

More than a collection: the scientific value of woodpecker specimens in the Šariš museum in Bardejov (Slovakia)

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More than a collection: the scientific value of woodpecker specimens in the Šariš museum in Bardejov (Slovakia). – Acta Mus. Siles. Sci. Natur. 74: 99–122, 2025.

Abstract: We present a summary of woodpecker (Piciformes, Picidae) specimens deposited in the collection of the Šariš Museum in Bardejov (SMB), Slovakia. This work builds on previous studies highlighting the importance of the SMB collections, both regionally and globally. In total, data on 303 individuals belonging to 10 species from 58 localities were evaluated. The specimens were collected between 1952 and 1977. The significance of this work also lies in the cataloguing process, which provides valuable data on regional museum collections – data that can be important not only at a local level but also in the context of global biodiversity research. In addition, the SMB exhibition includes 8 specimens from 5 exotic Piciformes species – *Dryocopus lineatus* (Linnaeus, 1766), *Melanerpes flavifrons* (Vieillot, 1818), *M. superciliaris* (Temminck, 1827), *Sphyrapicus varius* (Linnaeus, 1766), and *Xiphidiopicus percussus* (Temminck, 1826) – originating from Argentina and Cuba.

Keywords: museum collections, specimen cataloguing avian diversity, historical records, exotic species

Introduction

Hromada (2015a) and Hromada et al. (2015) reported that the Natural History Department of the Šariš Museum in Bardejov (hereafter SMB) houses approximately 693,000 specimens and objects of both living and non-living nature, the majority of which were collected by Tibor Weisz. The significance of the SMB collections is further emphasized by more than 60 scientific publications (as of 2015) based on material acquired by the former curator, Tibor Weisz (Hromada 2015b).

The museum's bird collection contains specimens representing 251 bird species occurring in Slovakia. Additionally, the exotic bird collection, comprising around 600 specimens, forms an important part of the holdings (Hromada et al. 2015, Mikula et al. 2018).

Specimens are preserved as skins (approx. 6,000), sternal bones (over 3,500), egg sets (about 800), ectoparasites in ethanol, and various other preparations. Each sample is accompanied by supplementary data, including measurements such as weight, body length, bill length, wingspan, general condition, and gonad size. Further biological materials, such as stomach contents, parasites, and nests, are often preserved as well (e.g., Hromada et al. 2003, Hromada & Klimovičová 2015).

Gorman (2014) noted that woodpeckers (239 species) are highly specialized for an arboreal lifestyle, with only a few species evolving toward ground-dwelling habits. The family ranges from the diminutive piculets of tropical forests to the now-extinct Imperial Woodpecker of Mexico. Between these extremes lies substantial species diversity, with all members sharing broadly similar morphology and occupying forests and woodlands worldwide – except in Australasia and Antarctica.

The aim of this study is to catalogue and analyse the Picidae specimens deposited

in the SMB collections, presenting data on locality, date of acquisition, sex, and age structure. Such cataloguing provides a foundation for more detailed future analyses of individual specimens.

Material and Methods

Specimen overview

In total, the ornithological collection of the Šariš Museum in Bardejov (SMB) includes 303 specimens of woodpeckers (*Picidae*), representing 10 species native to Slovakia. These specimens were collected primarily by the museum's former chief curator, PhDr. Tibor Weisz, between 1952 and 1977, from 58 localities across the country (Tab. 1).

The cataloguing effort focused on data such as collection locality, date, sex, and age structure, which are crucial for supporting future biodiversity research, long-term ecological studies, and faunistic comparisons.

Species composition

The full species list and number of specimens per species are provided below for clarity and consistency.

- Eurasian Wryneck, *Jynx torquilla* (Linnaeus, 1785) – 8 specimens
- European Green Woodpecker, *Picus viridis* Linnaeus, 1785 – 10 specimens
- Grey-headed Woodpecker, *Picus canus* Gmelin, 1788 – 40 specimens
- Black Woodpecker, *Dryocopus martius* (Linnaeus, 1785) – 9 specimens
- Eurasian Three-toed Woodpecker, *Picoides tridactylus* Linnaeus, 1785 – 5 specimens
- Middle Spotted Woodpecker, *Dendrocoptes medius* Linnaeus, 1785 – 10 specimens
- Syrian Woodpecker, *Dendrocoptes syriacus* Hemprich & Ehrenberg, 1833 – 26 specimens
- Great Spotted Woodpecker, *D. major* Linnaeus, 1785 – 120 specimens
- White-backed Woodpecker, *D. leucotos* (Bechstein, 1802) – 51 specimens
- Lesser Spotted Woodpecker, *Dryobates minor* (Linnaeus, 1785) – 24 specimens

Collection methods and preservation

Specimens were acquired using standard ornithological collection methods of the mid-20th century, most commonly by shooting. They were preserved in several forms, including:

- **Study skins**
- **Taxidermy mounts**
- **Sternal bones**
- **Other voucher materials** – including partial skeletal elements, feathers, or oological collections

The use of multiple preservation methods reflects different research purposes: morphological analysis, osteological studies, and future possibilities for genetic or parasitological research. In addition, stomach contents and ectoparasites preserved in ethanol were collected from some individuals.

Data recording and protocol cards

Each specimen is associated with a protocol card containing essential information such as collection locality, date, morphometric measurements (e.g., body mass, total length, bill length, wingspan), general condition, and gonad size. These records form the basis of this study. For some individuals, additional biological material was preserved (e.g., stomach content, parasites, or nests).

However, in many cases, sex and age of the specimens were not originally recorded. Therefore, each specimen was re-examined individually, and where possible, these characteristics were determined using the identification key of Svensson et al. (2004).

Georeferencing

All specimens with sufficiently precise locality data were georeferenced using a combination of:

- Original museum records and field notes
- Contemporary digital mapping tools (e.g., Google Maps, Mapy.cz)
- Historical topographic maps, in cases where place names had changed or disappeared

A total of 58 localities were successfully georeferenced and are listed in Tab. 2. For 15 individuals, the locality was not recorded or was too vague to assign coordinates and is therefore listed as “unknown.”

Sex and age determination

Sex and age of specimens were determined either directly during collection or subsequently during curatorial processing, based on morphological characteristics (plumage, gonads, skull ossification). Where this was not possible, individuals were marked as “sex unknown” or “age unknown.”

Tab. 1: Overview of woodpecker localities deposited in the SMB collection.

Locality, GPS coordinates	N	%	Locality, GPS coordinates	N	%
Andrejová, 49°20'03"N, 21°19'59"E	2	0.7	Kříže, 49°14'34"N, 21°08'58"E	17	5.6
Bacău, ^a 46°34'05"N, 26°54'53"E	2	0.7	Kružlovská Huta, 49°18'56"N, 21°07'47"E	2	0.7
Bardejov, 49°17'40"N, 21°16'40"E	87	28.7	Kurimka / Šarišské Čierne, ^d 49°19'59"N, 21°24'26"E	1	0.3
Bartošovce, 49°11'45"N, 21°16'35"E	2	0.7	Kurov, 49°20'35"N, 21°08'06"E	15	5.0
Becherov, 48°25'11"N, 21°18'37"E	1	0.3	Lenartov, 49°18'35"N, 21°01'12"E	1	0.3
Branisko, 48°59'58"N, 20°53'24"E	3	1.0	Livov, 49°15'02"N, 21°05'16"E	1	0.3
Breznica, 49°09'41"N, 21°39'41"E	1	0.3	Lukavica, 49°15'48"N, 21°19'09"E	1	0.3
Brno, ^b 49°11'35"N, 16°36'25"E	1	0.3	Lukov, 49°17'30"N, 21°04'53"E	2	0.7
Cígeľka, 49°24'23"N, 21°08'53"E	9	3.0	Malcov, 49°18'21"N, 21°03'50"E	1	0.3
Dubinné, 49°14'49"N, 21°26'23"E	2	0.7	Marhaň, 49°10'09"N, 21°27'00"E	1	0.3
Frička 49°24'09"N, 21°05'13"E	2	0.7	Mediaș (Medgyes), ^a 46°34'05"N, 26°54'53"E	2	0.7
Gaboltoť, 49°21'54"N, 21°08'33"E	5	1.7	Miňovce, 49°08'07"N, 21°39'03"E	1	0.3
Gerlachov, 49°05'54"N, 20°12'23"E	3	1.0	Mokroluh, 49°18'28"N, 21°12'52"E	3	1.0
Haniska pri Prešove 48°57'27"N, 21°14'28"E	6	2.0	Nemira lake, ^a 46°12'19"N, 26°27'13"E	2	0.7
Hankovce, 49°01'43"N, 21°56'46"E	1	0.3	Nižný Tvarožec, 49°21'49"N, 21°11'14"E	1	0.3
Harghita, ^a 46°29'33"N, 25°38'44"E	1	0.3	Nižná Voľa, 49°13'20"N, 21°22'21"E	1	0.3
Hertník, 49°12'26"N, 21°14'32"E	3	10.3	Petrová, 49°23'15"N, 21°07'08"E	2	0.7
Hrabovec, 49°16'26"N, 21°22'39"E	5	1.7	Poliakovce, 49°15'14"N, 21°24'16"E	3	1.0

Locality, GPS coordinates	N	%	Locality, GPS coordinates	N	%
Kisnána, ^c 47°51'04"N, 20°08'43"E	1	0.3	Prešov, 48°59'46"N, 21°14'41"E	2	0.7
Kľušov, 49°14'40"N, 21°15'35"E	2	0.7	Rejdová, 48°47'23"N, 20°17'10"E	1	0.3
Kolbovce / Korunková, ^d 49°11'22"N, 21°44'11"E	1	0.3	Rešov, 49°14'19"N, 21°19'51"E	2	0.7
Komárov, 49°16'52"N, 21°21'04"E	5	1.7	Rokytov, 49°19'02"N, 21°11'23"E	1	0.3
Koprivnica, 49°09'27"N, 21°23'52"E	1	0.3	Senné, 48°39'52"N, 22°01'53"E	10	3.3
Smolkov, ^b 49°54'07"N, 18°04'24"E	1	0.3	Turany and Ondavou, 49°06'01"N, 21°39'13"E	3	1.0
Stropkov, 49°12'06"N, 21°39'08"E	1	0.3	Valkov, 49°03'46"N, 21°39'09"E	9	3.0
Sveržov, 49°20'07"N, 21°09'28"E	2	0.7	Vyšná Voľa, 49°14'58"N, 21°21'40"E	2	0.7
Šiba, 49°13'27"N, 21°14'23"E	12	4.0	Vyšný Tvarožec, 49°23'07"N, 21°11'40"E	2	0.7
Tínovul Mare, ^a 47°17'24"N, 25°06'24"E	1	0.3	Želmanovce, 49°07'08"N, 21°25'28"E	3	1.0
Traian Romania, ^a 47°17'24"N, 25°06'24"E	4	1.3	Unknown	15	5.0
Trepec, 49°02'32"N, 21°41'39"E	1	0.3			

^aLocalities are in Romania; ^bLocalities are in Czech Republic; ^cLocality is in Hungary; ^dLocality probably on the border of the two catastral territories of municipalities (it was not possible to unambiguously determine based on the attached documentation).

Results and discussion

The woodpecker specimens housed in the museum include individuals of both sexes, although their proportions differ. The individuals are divided into two age categories: subadults and adults. For various reasons, information on sex, collection locality, age, or morphometric data is frequently missing (see Tabs 2–12). Additionally, several sternal bones were found to be damaged, either during preparation or because of long-term storage in the museum.

Tab. 2: Overview of woodpecker's voucher materials deposited in the SMB collection.

Species	N	Skin	Sternum	Taxidermy mounts	Stomach contents	Parasites
<i>Jynx torquilla</i>	8	-	8	2	4	3
<i>Picus viridis</i>	10	9	5	1	2	-
<i>Picus canus</i>	40	36	14	2	13	1
<i>Dryocopus martius</i>	9	8	4	1	1	1
<i>Picoides tridactylus</i>	5	4	1	1	-	-
<i>Dendrocoptes medius</i>	10	8	5	2	2	-
<i>Dendrocopos syriacus</i>	26	24	13	1	6	1
<i>Dendrocopos major</i>	120	110	96	1	34	4
<i>Dendrocopos leucotos</i>	51	42	42	3	15	4
<i>Dryobates minor</i>	24	19	17	3	9	1
Total	303	260	205	17	86	15

Order: Piciformes, **Family:** Picidae, **Subfamily:** Jynaginae, **Genus:** *Jynx*

Collection of the Eurasian Wryneck (*Jynx torquilla*)

The collection of the Eurasian Wryneck (*Jynx torquilla*) consists of eight specimens (see Tab. 3), with a higher number of males. The individuals were collected over four years (1958, 1959, 1962, and 1963; see Graph 1). Most specimens were obtained in the vicinity of Bardejov, particularly during the month of April (see Graphs 2 and 3). The collection includes two taxidermy mounts, which are currently on public display in the exhibition (Fig. 1).

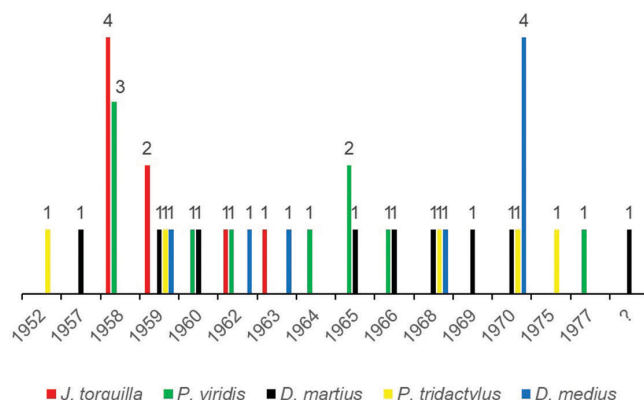
Study skins are not present in the collection; only sternal bones were preserved (see Tab. 2).



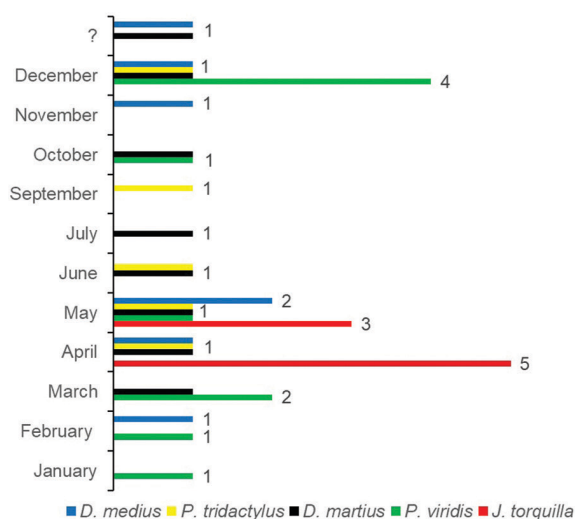
Fig. 1: Taxidermy mounts of the Eurasian Wryneck (*Jynx torquilla*) displayed in the exhibition of the SMB.

Tab. 3: Overview of the Eurasian Wryneck (*Jynx torquilla*) specimens deposited in the SMB collection.

<i>Jynx torquilla</i>	N	%
Sample size	8	100
Sample of males	4	50.0
Sample of females	2	25.0
The number of localities information	8	100
The number of date information	8	100
The number of age information	8	100
The number of sex information	6	75.0
The number of missing localities information	-	-
The number of missing date information	-	-
The number of missing age information	-	-
The number of missing sex information	2	25.0



Graph 1: Number of specimens of the Eurasian Wryneck (*Jynx torquilla*), European Green Woodpecker (*Picus viridis*), Black Woodpecker (*Dryocopus martius*), Eurasian Three-toed Woodpecker (*Picoides tridactylus*), and Middle Spotted Woodpecker (*Dendrocoptes medius*) deposited in the SMB collection, divided by year of collection.



Graph 2: Number of specimens of the Eurasian Wryneck (*Jynx torquilla*), European Green Woodpecker (*Picus viridis*), Black Woodpecker (*Dryocopus martius*), Eurasian Three-toed Woodpecker (*Picoides tridactylus*), and Middle Spotted Woodpecker (*Dendrocoptes medius*) deposited in the SMB collection, divided by month of collection.

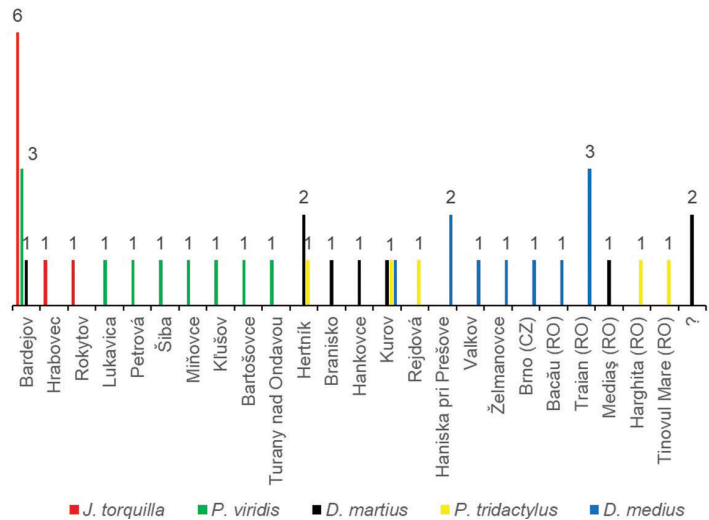
Distribution, Ecology, and Conservation status

The Eurasian Wryneck (*Jynx torquilla*) is widespread across lowland Europe and less common in mountainous areas (Tucker and Heath 1994). It mainly breeds in countries like Russia, Belarus, Ukraine, Poland, Italy, Romania, and Spain, preferring a range of forest types but avoiding dense forests (Tucker and Heath 1994). The species favours dry, sandy soils and often roosts along sunny forest edges or in disturbed habitats.

In Slovakia, it breeds throughout most of the country except in high mountains, mainly in lowlands and foothills, avoiding mixed and coniferous forests, and usually occurs up to 1000 m a.s.l. (Pavlik 2002a). As a territorial bird, it nests from May to June in natural cavities, old woodpecker holes, or artificial nest boxes, laying typically

7–12 eggs (Winkler et al. 2020a). Its diet consists mainly of ant larvae and pupae, but also includes other insects, spiders, tadpoles, and berries in poor conditions (Tucker and Heath 1994, Winkler and Christie 2002).

The Wryneck is migratory, wintering mostly south of the Sahara and occasionally in the Mediterranean (Hagemeijer and Blair 1997). Although it was assessed as Least Concern by the IUCN in 2020 due to its wide range and stable population in Europe and Slovakia (Demko et al. 2013, 2014, BirdLife International 2021a), declines have been observed. These are mainly due to climate change (increased rainfall during breeding), habitat loss from reduced orchards and meadows, forest changes, agricultural expansion, and pesticide use that reduces ant abundance (Tucker and Heath 1994, Winkler and Christie 2002).



Graph 3: Collection of the Eurasian Wryneck (*Jynx torquilla*), European Green Woodpecker (*Picus viridis*), Black Woodpecker (*Dryocopus martius*), Eurasian Three-toed Woodpecker (*Picoides tridactylus*), and Middle Spotted Woodpecker (*Dendrocopetes medius*) deposited in the SMB collection, divided by locality.

Order: Piciformes, **Family:** Picidae, **Subfamily:** Picinae, **Tribe:** Picini, **Genus:** *Picus*
Collection of the European Green Woodpecker (*Picus viridis*)

The abundance of specimens of the European Green Woodpecker (*Picus viridis*) in the collection is limited (Tabs 2, 4; Fig. 2). The first two specimens were collected in 1958, and the most recent specimen dates from 1977 (Graph 1). In total, the collection includes ten specimens, mainly obtained during the autumn and winter months (Graph 2). These individuals originated from eight different localities (Graph 3).

Tab. 4: Overview of the European Green Woodpecker (*Picus viridis*) specimens in the SMB collection.

<i>Picus viridis</i>	N	%
Sample size	10	100
Sample of males	8	80.0
Sample of females	2	20.0
The number of localities information	10	100
The number of date information	10	100
The number of age information	10	100
The number of sex information	10	100
The number of missing localities information	-	-
The number of missing date information	-	-
The number of missing age information	-	-
The number of missing sex information	-	-



Fig. 2: Skins of the European Green Woodpecker (*Picus viridis*, left) and the Grey-headed Woodpecker (*Picus canus*, right) deposited in the SMB collection.

Distribution, Ecology, and Conservation status

Most of the global population of the Eurasian Green Woodpecker (*Picus viridis*) is found in Europe, particularly in France, Romania, Italy, Germany, and the UK (BirdLife International 2021b). In Slovakia, it breeds widely in lowlands and hilly areas up to 700–800 m, although it is less common in the north (Pavlik 2002b).

The species prefers semi-open habitats such as forest edges, clearings, parks, orchards, and residential areas, often near mature deciduous trees or conifers in higher elevations. Nesting takes place from April to June, with 5 to 8 eggs laid in cavities excavated in dead or soft wood. Its diet is mainly composed of ants, especially larger species, but also includes earthworms, snails, reptiles, fruits, and seeds (Winkler and Christie 2002, 2020a).

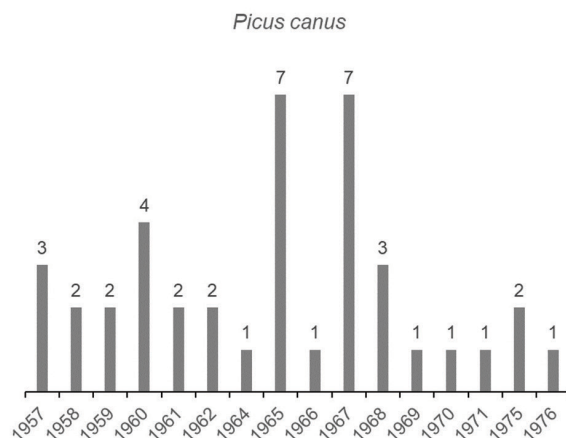
The Eurasian Green Woodpecker is mostly a resident species, though it may show some local winter movements. It is currently assessed as Least Concern by the IUCN, with a stable European population (Demko et al. 2013, 2014, BirdLife International 2021b). However, threats such as agricultural and forestry intensification, habitat loss, and the reduction of ant populations due to land-use changes affect its numbers. In addition, harsh winters can lead to significant mortality, sometimes over several years (Tucker and Heath 1994, Hagemerijer and Blair 1997).

Collection of the Grey-headed Woodpecker (*Picus canus*)

The collection of this species in the SMB is relatively large (Tabs 2, 5), with sex and age data available for all individuals. Only three specimens lack location data, and two lack collection dates. Males outnumber females (Tab. 5). Specimens were collected between 1957 and 1976, with peaks in 1965 and 1968, while in some years, no specimens were added (Graph 4). One specimen was missing from the collection at the time of data processing.

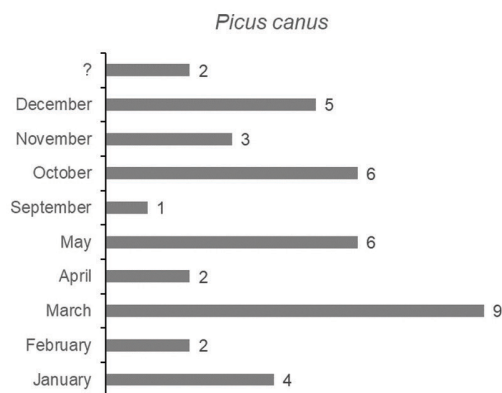
Tab. 5: Overview of the Grey-headed Woodpecker (*Picus canus*) specimens in the SMB collection.

<i>Picus canus</i>	N	%
Sample size	40	100
Sample of males	24	60.0
Sample of females	16	40.0
The number of localities information	37	92.5
The number of date information	38	95.0
The number of age information	40	100
The number of sex information	40	100
The number of missing localities information	3	7.5
The number of missing date information	2	5.0
The number of missing age information	-	-
The number of missing sex information	-	-



Graph 4: Number of *Picus canus* specimens in the SMB collection, shown by year of collection.

Most specimens were collected during the autumn–winter period (Graph 5). A total of 18 localities are known, including two from abroad (Hungary and Romania), while three specimens lack precise locality data (Graph 6).



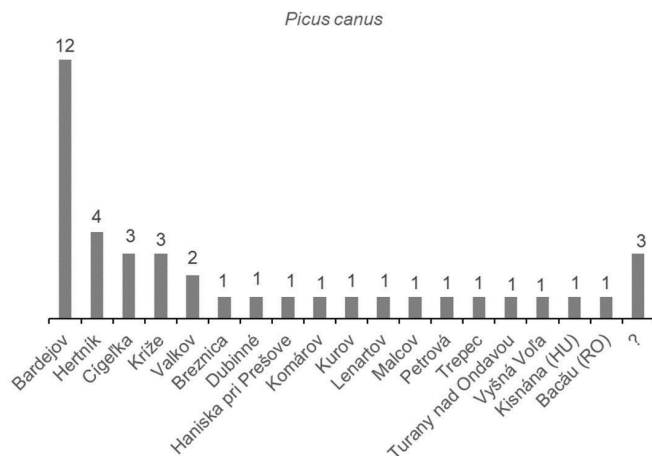
Graph 5: Monthly distribution of Grey-headed Woodpecker (*Picus canus*) specimens in the SMB collection.

Distribution, ecology, and conservation status

In Europe, the Grey-headed Woodpecker (*Picus canus*) breeds mainly in Russia, with notable populations in Romania and Ukraine. In Slovakia, it is one of the most widespread woodpecker species, favoring old deciduous and mixed forests near grasslands, though it is less common in the west and tends to avoid floodplain forests (Kropil 2002a). The presence of beech trees is important for its occurrence, with local population densities ranging from 0.21 to 0.67 pairs per square kilometer. Like the European Green Woodpecker (*P. viridis*), it occupies a variety of habitats including open areas with vegetation, parks, orchards, gardens, and different types of forests.

It is mainly associated with deciduous trees but can also occur in pine-oak or larch (*Larix* spp.) mountain forests. The species breeds from lowlands up to 1,700 m and has been observed up to 2,000 m during the non-breeding season. Nesting occurs from late April to early June, typically in cavities excavated in dead or decaying hardwood trees. Clutches contain 4–10 eggs. Its diet is dominated by ants (*Myrmica*, *Lasius* spp.) and termites, which can make up more than 90% of its food, though it also eats insects, spiders, bird eggs, fruits, seeds, nuts, and nectar (Winkler and Christie 2002, del Hoyo et al. 2020a).

The species is mostly resident with some post-breeding dispersal and is classified as Least Concern by the IUCN thanks to its broad distribution and large population (Demko et al. 2013, 2014, BirdLife International 2021c).



Graph 6: Locality-based distribution of Grey-headed Woodpecker (*Picus canus*) specimens in the SMB collection.

Order: Piciformes, Family: Picidae, Subfamily: Picinae, Tribe: Picini, Genus: *Dryocopus*
Collection of the Black Woodpecker (*Dryocopus martius*)

The collection of this species consists of nine specimens (Tabs 2, 6; Fig. 3), with an equal number of males and females (Tab. 6). Specimens were collected between 1957 and 1970 (Graph 1), across several months (Graph 2). They originate from six known localities, while two specimens lack precise locality data (cf. Graph 3).



Fig. 3: Skins of the Black Woodpecker (*Dryocopus martius*) deposited in the SMB collection.

Tab. 6: Overview of the Black Woodpecker (*Dryocopus martius*) specimens deposited in the SMB collection.

<i>Dryocopus martius</i>	N	%
Sample size	9	100
Sample of males	5	55.6
Sample of females	4	44.4
The number of localities information	7	77.8
The number of date information	8	88.9
The number of age information	9	100
The number of sex information	9	100
The number of missing localities information	2	22.2
The number of missing date information	1	1.1
The number of missing age information	-	-
The number of missing sex information	-	-

Distribution, ecology and conservation status

The Black Woodpecker (*Dryocopus martius*) breeds mainly in Russia, with smaller populations across much of Europe, except for westernmost regions such as Portugal, the UK, the Faroe Islands, Iceland, and Greenland. In Slovakia, it is one of the most widespread woodpecker species, occupying old deciduous, mixed, and large coniferous forests from lowlands up to 1,500 m, with a preference for poplar floodplain forests in lowland areas (Kropil 2002b).

Due to its large territory size and specific habitat needs, its population density remains relatively low. The species inhabits various mature forests that are not too dense, including forest edges, and is present in a range of forest types across Europe, from riparian to subalpine zones. Nesting usually takes place between mid-March and mid-May, though courtship can begin in January, with nest cavities excavated in tall living trees. Clutches generally contain three to five eggs. Its diet is based mostly on ants (*Camponotus*, *Formica*, *Lasius*) and their larvae, but also includes wood-destroying beetles (Cerambycidae, Elateridae), other arthropods, snails, fruits, berries, and occasionally even beehives (Winkler and Christie 2002, 2020b).

The species is mostly resident, with some partial migration in northern populations (BirdLife International 2021d). It was assessed as Least Concern by the IUCN in 2020, due to its very large range and population size, which do not meet the criteria for a threatened category (Demko et al. 2013, 2014, BirdLife International 2021d). While not currently considered at risk, localized threats from logging and forestry may impact some populations (Garmendia et al. 2006, Zhelezov 2010).

Order: Piciformes, **Family:** Picidae, **Subfamily:** Picinae, **Tribe:** Melanerpini, **Genus:** *Picoides*

Collection of the Eurasian Three-toed Woodpecker (*Picoides tridactylus*)

The collection of this species consists of five specimens (Tabs 2, 7, Fig. 4), with males predominating (Tab. 7). The specimens were collected between 1952 and 1975 (Graph 1), mostly during the spring months (Graph 2). They originate from five known localities, including two specimens from Romania (Graph 3). One specimen is missing and had not been located at the time of data processing.

Distribution, ecology and conservation status

The Eurasian Three-toed Woodpecker (*Picoides tridactylus*) breeds mainly in Russia and Finland, and in Slovakia, it inhabits mountain forests between 400 and 1800 meters, especially in spruce, spruce-fir, and fir-beech forests from the Javorníky Mountains to the Eastern Carpathians (Pačénovský 2002). Although locally common, its overall population density is low, with breeding mostly along mountain ridges.

The species prefers mature coniferous forests, particularly spruce (*Picea* spp.), and benefits from forest disturbances like fires that trigger insect outbreaks (Winkler et al. 1995). Courtship begins in late March, and nesting occurs from mid-May to June, sometimes extending into July. Nests are typically excavated 2 to 10 meters high in dead conifer trees or dead sections of living trees affected by heart-rot, though other species like poplar, birch, and alder are occasionally used (Winkler and Christie 2002, del Hoyo et al. 2020b). Its diet consists mainly of bark beetles (*Ips* and *Polygraphus* spp.), wood-boring beetles, and other invertebrates (Gorman 2014). While mountain populations are mostly resident, they may move locally after breeding, and northern populations sometimes undergo eruptive migrations (Winkler and Christie 2002, del Hoyo et al. 2020b).

The species is currently listed as Least Concern by the IUCN due to its large range and population size exceeding 10,000 mature individuals, although the exact trend is unknown (BirdLife International 2021e, Demko et al. 2013, 2014). Major threats include commercial logging, fire suppression, removal of dead trees, and pesticide use, which reduce available food and nesting habitats (Tucker and Heath 1994, Winkler and Christie 2002, del Hoyo et al. 2020b). While spruce and fir die-offs from acid rain may offer short-term benefits, they pose a possible long-term threat to the species (Tucker and Heath 1994).



Fig. 4: Skins of the Eurasian Three-toed Woodpecker (*Picoides tridactylus*) deposited in the SMB collection.

Tab. 7: Overview of the Eurasian Three-toed Woodpecker (*Picoides tridactylus*) specimens deposited in the SMB collection.

<i>Picoides tridactylus</i>	N	%
Sample size	5	100
Sample of males	3	60
Sample of females	1	20
The number of localities information	5	100
The number of date information	5	100
The number of age information	5	100
The number of sex information	4	100
The number of missing localities information	-	-
The number of missing date information	-	-
The number of missing age information	-	-
The number of missing sex information	1	20

Order: Piciformes, **Family:** Picidae, **Subfamily:** Picinae, **Tribe:** Melanerpini, **Genus:** *Dendrocoptes*

Collection of the Middle Spotted Woodpecker (*Dendrocoptes medius*)

The SMB collection includes ten specimens of *Dendrocoptes medius* (Tab. 8, Fig. 5), collected over five years (Graph 1). All individuals are known adults with recorded sex and age (Tab. 8). Specimens were collected during both autumn-winter and spring-summer seasons (Graph 2) from seven known localities (Graph 3).



Fig. 5: Skins of the Middle Spotted Woodpecker (*Dendrocoptes medius*) deposited in the SMB collection.

Tab. 8: Overview of the Middle Spotted Woodpecker (*Dendrocoptes medius*) specimens in the SMB collection.

<i>Dendrocoptes medius</i>	N	%
Sample size	10	100
Sample of males	6	60.0
Sample of females	4	40.0
The number of localities information	10	100
The number of date information	9	90.0
The number of age information	10	100
The number of sex information	10	100
The number of missing localities information	-	-
The number of missing date information	1	10.0
The number of missing age information	-	-
The number of missing sex information	-	-

Distribution, Ecology, and Conservation status

Most of the global population of the Middle Spotted Woodpecker (*Dendrocoptes medius*) occurs in Europe, particularly in Romania, France, Germany, Turkey, and Poland (BirdLife International 2021f). In Slovakia, it mainly inhabits oak forests in lowland and hilly regions, including floodplain and field forests, up to 700–950 meters above sea level (Pavlik 2002c).

The species shows a strong preference for thermophilous old oak forests and floodplain oak stands.

It is currently listed as Least Concern by the IUCN in both Europe and Slovakia (Demko et al. 2013, 2014, BirdLife International 2021f). The European breeding population is estimated between 401,000 and 695,000 pairs, with an overall increasing trend and stable numbers within the EU28. However, declines have occurred in some regions due to forestry practices that fragment habitats, remove old trees, or replace broad-leaved forests with conifers. Additional threats include air pollution, climate change, and extreme weather events (Hagemeyer and Blair 1997, Winkler and Christie 2002, Winkler et al. 2020b). Despite these pressures, the species continues to benefit from its relatively wide distribution and habitat specificity to older oak forests.

Order: Piciformes, **Family:** Picidae, **Subfamily:** Picinae, **Tribe:** Melanerpini, **Genus:** *Dendrocopos*



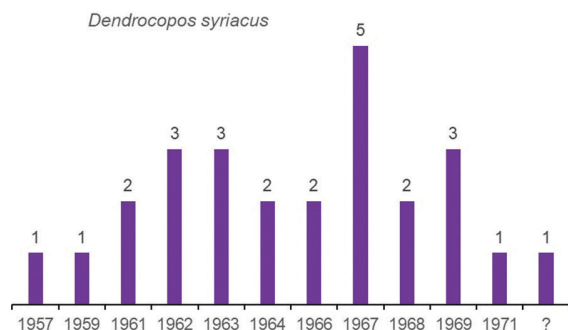
Fig. 6: Skins of the Syrian Woodpecker (*Dendrocopos syriacus*) deposited in the SMB collection.

Collection of the Syrian Woodpecker (*Dendrocopos syriacus*)

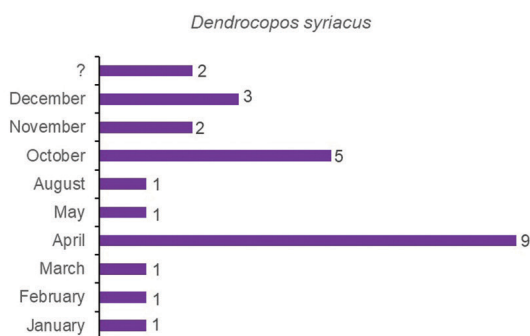
The SMB collection contains 26 specimens of *Dendrocopos syriacus* (Tab. 9, Fig. 6), collected between 1957 and 1971, with some years missing (Graph 7). Sex and age were identified for all specimens (Tab. 9). Collection dates span the entire year, with peaks in April and October (Graph 8). Specimens originate from eleven known localities (Graph 9). One specimen was missing at the time of data processing.

Tab. 9: Overview of the Syrian Woodpecker (*Dendrocopos syriacus*) collection in the SMB.

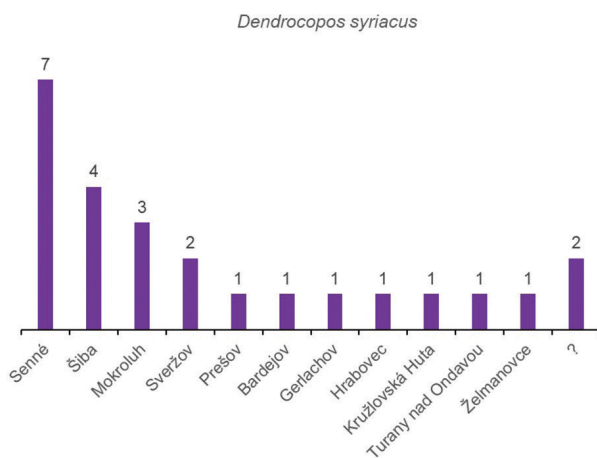
<i>Dendrocopos syriacus</i>	N	%
Sample size	26	100
Sample of males	16	61.5
Sample of females	10	38.5
The number of localities information	24	92.3
The number of date information	24	92.3
The number of age information	26	100
The number of sex information	26	100
The number of missing localities information	2	7.7
The number of missing date information	2	7.7
The number of missing age information	-	-
The number of missing sex information	-	-



Graph 7: Number of Syrian Woodpecker (*Dendrocopos syriacus*) specimens in the SMB collection, shown by year of collection.



Graph 8: Monthly distribution of Syrian Woodpecker (*Dendrocopos syriacus*) specimens in the SMB collection.



Graph 9: Distribution of Syrian Woodpecker (*Dendrocopos syriacus*) specimens in the SMB collection by locality.

Distribution, Ecology, and Conservation status

The Syrian Woodpecker (*Dendrocopos syriacus*) breeds mainly in Turkey, Romania, Ukraine, and Hungary, and was first recorded in Slovakia in 1949, mainly in the east, south, and southwest (Winkler et al. 2020c, BirdLife International 2021g, Pavlík 2002d).

It prefers towns, gardens, orchards, and open countryside with scattered trees, nesting from mid-April to June in tree trunks, branches, or man-made structures, laying 3–7 eggs. The species feeds on insects, snails, fruits, sap, nuts, and seeds (Gorman 2014, Winkler and Christie 2002) and is mostly resident but sometimes disperses locally. Its population density in Slovakia is low, and it is gradually being replaced by the Great Spotted Woodpecker (*D. major*) in urban areas.

The Syrian Woodpecker is listed as Least Concern by the IUCN (Demko et al. 2013, 2014, BirdLife International 2021g). A potential threat is hybridization with the Great Spotted Woodpecker (Hagemeijer and Blair 1997).

Collection of the Great Spotted Woodpecker (*Dendrocopos major*)

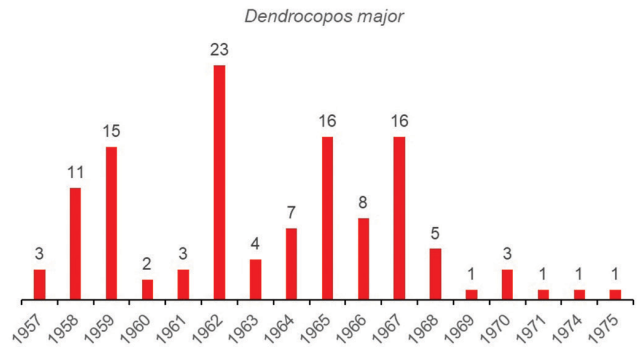


Fig. 7: Skins of the Great Spotted Woodpecker (*Dendrocopos major*) deposited in the SMB collection.

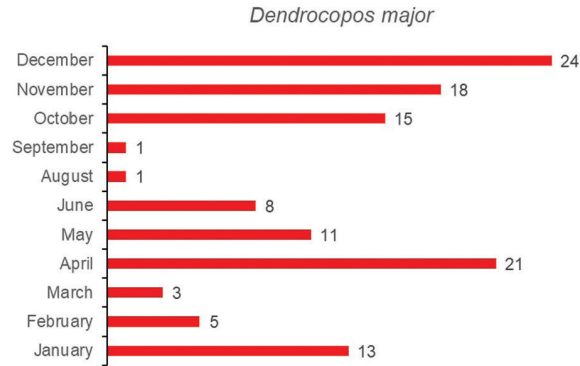
The SMB collection contains 12 specimens of the Great Spotted Woodpecker (*Dendrocopos major*), making it the most abundant woodpecker species in the collection (Tabs 2, 10., Fig. 7). These specimens were collected over a 17-year period (1957–1975, see Graph 10), with some years lacking records. Sex and age were identified for almost all individuals ($n = 119$; see Tab. 10). Specimens were collected throughout the year, predominantly during the autumn–winter months (Graph 11), from 23 known localities (Tab. 8, Graph 12), with a strong concentration near the city of Bardejov ($n = 52$). Two individuals originated from Romania. One specimen was missing at the time of data processing.

Tab. 10: Overview and basic information on the Great Spotted Woodpecker (*Dendrocopos major*) specimens deposited in the SMB collection.

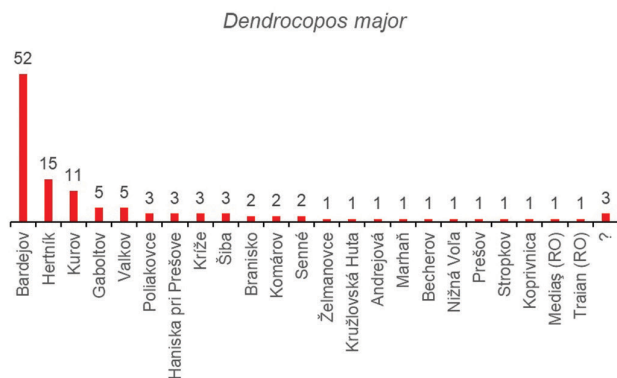
<i>Dendrocopos major</i>	N	%
Sample size	120	100
Sample of males	68	56.7
Sample of females	51	42.5
The number of localities information	117	97.5
The number of date information	120	100
The number of age information	119	99.2
The number of sex information	119	99.2
The number of missing localities information	3	2.5
The number of missing date information	-	-
The number of missing age information	1	0.8
The number of missing sex information	1	0.8



Graph 10: Collection of the Great Spotted Woodpecker (*Dendrocopos major*) specimens in the SMB collection, shown by year of acquisition.



Graph 11: Collection of the Great Spotted Woodpecker (*Dendrocopos major*) specimens in the SMB collection, divided by months of collection.



Graph 12: Collection of the Great Spotted Woodpecker (*Dendrocopos major*) specimens in the SMB collection, divided by localities.

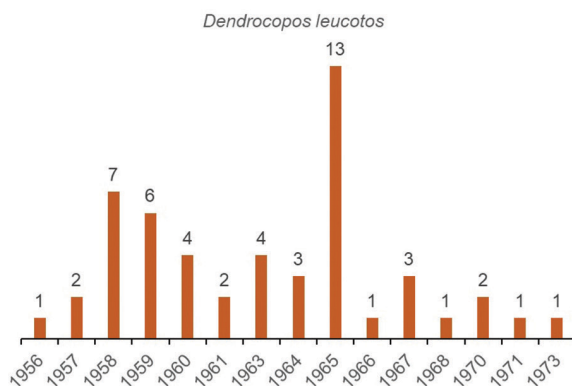
Distribution, Ecology, and Conservation status

The species breeds mainly in Russia, Germany, and Poland, with smaller populations throughout Europe, and nests regularly across Slovakia up to 1000 m in various forest types, parks, and cemeteries (BirdLife International 2021h, Pavlík 2002e).

It inhabits trans-Palearctic coniferous and deciduous forests, as well as parks and gardens, with courtship starting in December and nesting from mid-April to June (Hagemeijer and Blair 1997, Winkler et al. 2020d). Both sexes excavate new nest holes annually in dead or living trees, sometimes using poles or nest boxes, with clutches of 4–8 eggs (Winkler et al. 2020d). Its diet is varied, mainly invertebrates, but also includes seeds, nuts, berries, sap, and occasionally eggs and young of other birds (Winkler and Christie 2002, Winkler et al. 2020d). The species is mostly resident but can disperse or migrate eruptively in northern areas.

It is classified as Least Concern due to its large range and population, though severe winters and habitat fragmentation may cause local declines; subspecies on the Canary Islands are more vulnerable due to forest threats (Demko et al. 2013, 2014, BirdLife International 2021h, Winkler and Christie 2002). Air pollution causing forest die-off in Central and Eastern Europe likely has mixed effects: severe damage reduces nesting opportunities, food supply, and food quality, leading to woodpecker declines, though the exact impact remains unknown. Hybridization with Syrian Woodpeckers (*D. syriacus*) may also pose a threat (Hagemeijer and Blair 1997, Winkler and Christie 2002).

Collection of the White-backed Woodpecker (*Dendrocopos leucotos*)



Graph 13: Collection of White-backed Woodpecker (*Dendrocopos leucotos*) specimens deposited in the SMB collection, divided by years.



Fig. 8: Skins of the White-backed Woodpecker (*Dendrocopos leucotos*) deposited in the SMB collection.

There are 51 specimens of *Dendrocopos leucotos* in the SMB collection, making it the second most numerous species after *Dendrocopos major* (Tabs 2, 11, Fig. 8). The specimens were collected between 1956 and 1973 (see Graph 13). Sex and age were identified for all individuals (Tab. 11). Specimens were collected in all months except July, with a predominance in May, April, and November (Graph 14), from 18 known localities (Graph 15). Two individuals originated from Romania.

Tab. 11: Overview of the White-backed Woodpecker (*Dendrocopos leucotos*) deposited in the SMB collection.

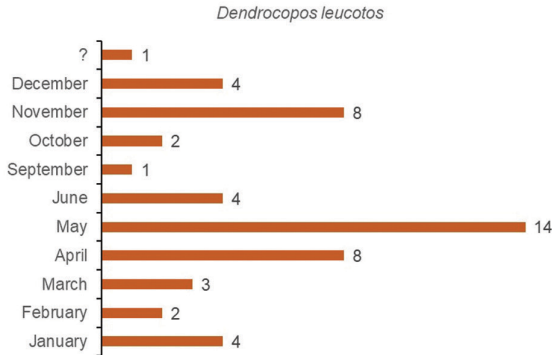
<i>Dendrocopos leucotos</i>	N	%
Sample size	51	100
Sample of males	24	47.0
Sample of females	27	53.0
The number of localities information	49	96.1
The number of date information	50	98.0
The number of age information	51	100
The number of sex information	51	100
The number of missing localities information	2	3.9
The number of missing date information	1	2.0
The number of missing age information	-	-
The number of missing sex information	-	-

Distribution, Ecology, and Conservation status

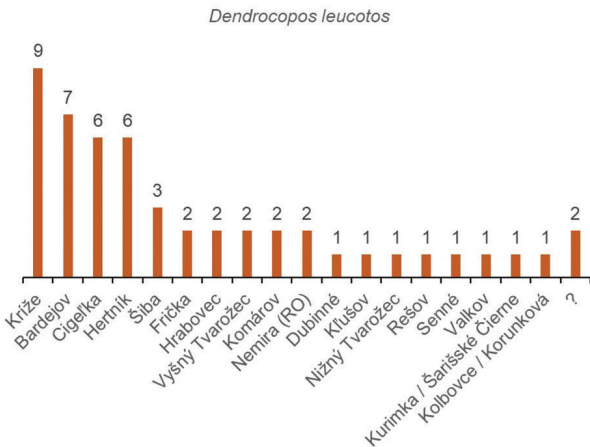
The White-backed Woodpecker (*Dendrocopos leucotos*) breeds mainly in Russia and Romania, and in Slovakia it nests mostly in beech, fir-beech, and spruce-fir-beech forests between 330 and 1300 meters, avoiding lowlands and generally not favouring spruce forests (Kropil 2002c).

It inhabits deciduous forests that vary regionally, preferring beech, hornbeam, and oak in central and southern Europe, and birch and aspen in northern and eastern Europe (Hagemeijer and Blair 1997). Courtship starts in February, with nesting from late April to June, both sexes excavating nests in dead or decaying wood or sometimes utility poles, laying three to five eggs (Winkler and Christie 2002). The species is mainly insectivorous, specializing in larvae of wood-boring beetles, but also eating flies, whiteflies, and carpenter ants (Gorman 2014), and generally remains resident with only local movements (Winkler and Christie 2002).

It is listed as Least Concern by the IUCN due to its large range and population, though the population is declining by about 16% over 11 years, mainly due to intensive forest management reducing dead wood and the spread of conifer plantations (Demko et al. 2013, 2014, BirdLife International 2021i, Winkler and Christie 2002, Håpnes 2003). The estimated European breeding population is 210,000–411,000 pairs (BirdLife International 2021i).



Graph 14: Collection of the White-backed Woodpecker (*Dendrocopos leucotos*) deposited in SMB collection divided by months.



Graph 15: Collection of the White-backed Woodpecker (*Dendrocopos leucotos*) deposited in the SMB collection, divided by localities.

Order: Piciformes, **Family:** Picidae, **Subfamily:** Picinae, **Tribe:** Melanerpini, **Genus:** *Dryobates*

Collection of the Lesser Spotted Woodpecker (*Dryobates minor*)

There are 24 specimens of the Lesser Spotted Woodpecker (*Dendrocopos minor*) in the SMB collection (Tabs 2, 12, Fig. 9), collected between 1957 and 1975 (see Graph 16). Sex was determined for 23 individuals, while age was identified for 22 (Tab. 12). Specimens were collected throughout several months, with a predominance during

the winter season (Graph 17). The material originates from 14 known localities (Graph 18), including one specimen from the Czech Republic. Three specimens are currently missing from the collection and had not been located by the time of data processing.



Fig. 9: Skins of the Lesser Spotted Woodpecker (*Dryobates minor*) deposited in the SMB collection.

Tab. 12: Overview of the Lesser Spotted Woodpecker (*Dryobates minor*) specimens deposited in the SMB collection.

<i>Dryobates minor</i>	N	%
Sample size	24	100
Sample of males	13	54.1
Sample of females	10	41.7
The number of localities information	22	91.7
The number of date information	22	91.7
The number of age information	22	91.7
The number of sex information	23	95.8
The number of missing localities information	2	8.3
The number of missing date information	2	8.3
The number of missing age information	2	8.3
The number of missing sex information	1	4.2

Distribution, Ecology, and Conservation status

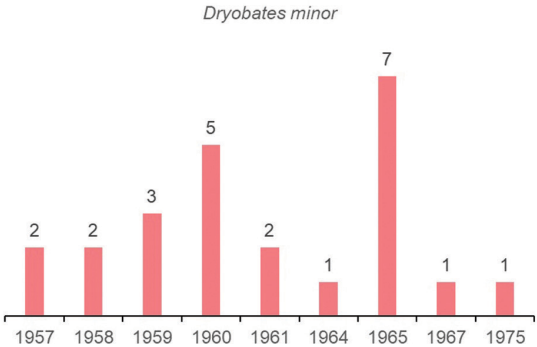
The Lesser Spotted Woodpecker (*Dryobates minor*) breeds mainly in Russia, with smaller populations across most of Europe, including Slovakia where it occurs throughout but at low densities, favouring older deciduous forests in lowlands, hills, and foothills up to 600–800 m, and avoiding large continuous forests (Pavlík 2002f).

It inhabits temperate and boreal deciduous forests, often near lakes or rivers, and uses forest edges, parks, orchards, and gardens with many thin snags for nesting. Courtship begins in February, with egg-laying from April to May or June; both sexes excavate nests in dead or decaying wood (Winkler and Christie 2002, 2020c).

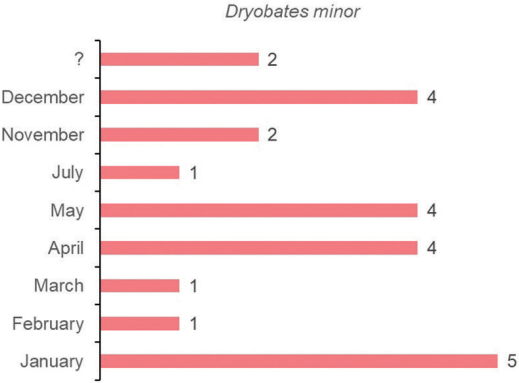
The species is listed as Least Concern by the IUCN due to its large range and population size, which is estimated at 757,000–1,510,000 breeding pairs in Europe, with stable or increasing trends (Demko et al. 2013,

2014, BirdLife International 2021g). However, declines have occurred due to habitat loss from reduction of deciduous habitats like riparian forests and old orchards, and the spread of conifers in mixed forests, as well as sensitivity to forest fragmentation because of its large home range (Winkler and Christie 2002, Hagemeyer and Blair 1997). The species often forms long-term monogamous pairs and nests in soft dead wood or branch undersides (Winkler and Christie 2002, 2020c).

Notes: The SMB collection exhibition also includes 8 specimens of 5 exotic Piciformes species – *Dryocopus lineatus* (Linnaeus, 1766), *Melanerpes flavifrons* (Vieillot, 1818), *M. superciliaris* (Temminck, 1827), *Sphyrapicus varius* (Linnaeus, 1766), and *Xiphidiopicus percussus* (Temminck, 1826) – originating from Argentina and Cuba (cf. Mikula et al. 2018).



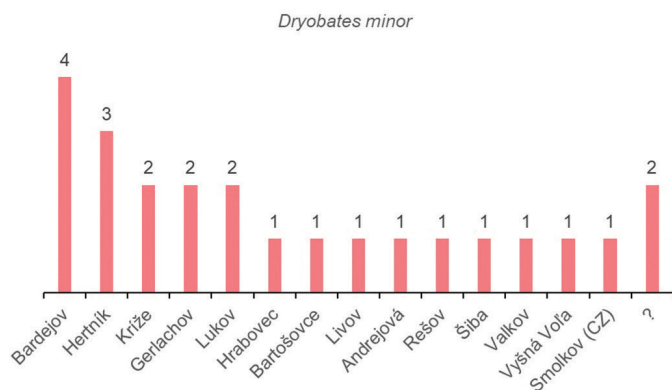
Graph 16: Collection of the Lesser Spotted Woodpecker (*Dryobates minor*) deposited in the SMB collection, divided by years.



Graph 17: Collection of the Lesser Spotted Woodpecker (*Dryobates minor*) deposited in the SMB collection, divided by months.

Conclusions

In this study, we focused on woodpeckers (Piciformes, Picidae) deposited in the SMB collection. Our summary confirmed that the collection contains 303 specimens representing 10 species (Tabs 1–12), primarily collected in north-eastern Slovakia between 1952 and 1977. Many acquisitions occurred in 1965 ($n = 48$, 15.8%), followed by 1959 and 1967 ($n = 32$, 10.6% each), and 1962 ($n = 31$, 10.2%). Both sexes and various age groups (adults and juveniles) are represented, with morphometric data recorded for most individuals. Several mounted specimens are also displayed in the museum’s public exhibition, and the collection includes eight individuals of five exotic Piciformes species.



Graph 18: Collection of the Lesser Spotted Woodpecker (*Dryobates minor*) deposited in the SMB collection divided by localities.

Our results confirm previous knowledge regarding the occurrence and diversity of woodpecker species in the region, while emphasizing the unique scientific value of the SMB collection. By publishing this catalogue, we provide accessible data for the wider research community and the public, offering a foundation for future ornithological studies, comparative analyses, and conservation planning.

Acknowledgement: This work was supported by grants, GaPU10/2024.

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