

UNIVERSITY OF SOPRON
FACULTY OF FORESTRY

Thesis of doctoral (PhD) dissertation

Nutritional Biology and Wildlife Health Study of the
Hungarian Common Wood Pigeon (*Columba palumbus*)
Population

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2026

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1. Introduction

The Common Wood Pigeon (*Columba palumbus*) has become increasingly widespread in both agricultural landscapes and urban environments in Hungary over recent decades, while its national population has also increased considerably. In parallel with the species' ongoing expansion, its hunting bag data have also shown a marked increase. Within the total number of harvested individuals, off-season culling authorized by the competent authorities to mitigate agricultural damage has become increasingly important. These culls are primarily carried out in spring to protect damage-sensitive crops, particularly sunflower (*Helianthus annuus*) and green pea (*Pisum sativum*). All this clearly indicates that the ecological, economic, and game management significance of the species has increased.

A detailed understanding of the species' feeding ecology is essential for interpreting its population growth and agricultural damage; however, relatively little information is available for Hungary. This justifies feeding ecology research on the Common Wood Pigeon under Hungarian conditions. The species' increasing population size and urbanization also raise animal and public health concerns, warranting a One Health-oriented investigation, particularly regarding the occurrence, maintenance and potential spread of antibiotic-resistant bacterial strains.

In my dissertation, I first analysed the temporal and spatial patterns of the species' hunting bag data between 1995 and 2024. Subsequently, I evaluated the diet composition of Common Wood Pigeons harvested both outside the hunting season (April–June: 521 individuals) and during the hunting season (September: 155 individuals) using large-sample crop content analyses. Finally, I conducted bacteriological investigations on samples collected from individuals originating from two study areas with different habitat characteristics and assessed the antibiotic susceptibility of the isolated bacterial strains.

By jointly evaluating hunting bag data, feeding ecology results, and bacteriological findings, my work may contribute not only to a more accurate understanding of the ecological role, agricultural significance, and wildlife health aspects of the Common Wood Pigeon, but may also support science-based game management decisions related to the management and sustainable utilization of the species.

2. Objectives

At the beginning of the study, I defined the following objectives:

1. Based on the data of the National Game Management Database, my objective was to conduct a long-term analysis of Common Wood Pigeon hunting bag data in Hungary and to reveal the temporal dynamics and trends in the utilization of the species. In addition, using the data from the derogation reports, I examined the emergence and changes of off-season Common Wood Pigeon culling in Hungary.
2. I analysed the spatial patterns of Common Wood Pigeon hunting bag data in Hungary at the county level, with particular emphasis on the extent to which the geographical centres of off-season culling and hunting bags recorded during the regular hunting season overlap.
3. To examine whether the sex and age of individuals influence the diet selection of Common Wood Pigeons in Hungary.
4. To conduct a detailed, component-level quantitative analysis of the crop contents of Common Wood Pigeons harvested during the regular hunting season in Hungary, and to determine the proportions of plant, animal and mineral food components in the diet of the species. An additional objective was to evaluate the extent to which the results support the justification for concentrating hunting efforts on sunflower fields vulnerable to crop damage.
5. To examine the diet composition of Common Wood Pigeons harvested outside the regular hunting season in Hungary, with particular emphasis on damage-sensitive agricultural crops, and to assess whether the results support the justification for off-season culling.
6. To conduct bacteriological investigations of Common Wood Pigeons and determine the antibiotic susceptibility of the isolated bacterial strains within a One Health framework, in order to assess the potential role of urbanizing populations in the maintenance and spread of antibiotic-resistant bacteria.

2. Materials and methods

2.1. Analysis of Hungarian hunting bag data

The analysis of hunting bag data was based on the records summarized in the National Game Management Database (hereafter: OVA). Between 1995 and 2024, I evaluated Common Wood Pigeon hunting bag data annually and at the county level; these data included the number of Common Wood Pigeons harvested in each game management year. In addition, based on the derogation reports, I also summarized the data on off-season culling in Hungary. These data were available from 2004 to 2024 and were also available at the county level. Together, these datasets enabled evaluation of the spatial and temporal patterns of both regular-season and off-season harvests. The relationship between the two standardized datasets was assessed using linear correlation analysis for the period between 2018 and 2024.

A detailed, game management unit-level analysis was conducted in Jász-Nagykun-Szolnok County. For this purpose, the Department of Agricultural Affairs of the Jász-Nagykun-Szolnok County Government Office provided, for research purposes, data on off-season culling by the game management unit for the period between 2019 and 2023.

Maps showing annual hunting bags and off-season culling were prepared at the county level. In addition, the off-season culling data for Jász-Nagykun-Szolnok County were also mapped at a finer spatial scale, by game management unit. The spatial visualization was carried out using ArcGIS 10.3 software.

2.2. Feeding Ecology Investigations

2.2.1. Methodology of Crop Content Analysis

To develop a standardized research methodology, I collected and analysed the most important Hungarian and international literature on the feeding ecology of the Common Wood Pigeon, as well as the methodological approaches described in these studies. Based on these works, I developed a feeding ecology research protocol applicable to the Hungarian population of the Common Wood Pigeon, which I also used in my own research. The elements of this research protocol were as follows:

- For each individual, the sampling location and exact date were recorded, and the samples were assigned a unique identification code accordingly.
- The body mass of the collected pigeons was measured and recorded to the nearest 0.1 g, and additional biometric data, including body length, wing length and tail length, were measured and recorded to the nearest millimetre.
- The age class of each individual was recorded as juvenile or adult, based on the degree of moult and plumage characteristics.
- The sex of each individual was recorded as female ♀ or male ♂, and was determined by a destructive method through examination of the gonads.
- The entire crop, together with its contents, was removed from each bird and stored frozen at –20 °C until processing.
- Individuals with damaged or empty crops were excluded from the analysis.
- Crop contents were processed in Petri dishes labelled with unique sample codes.
- Crop contents were dried at 105 °C to constant weight, then weighed to the nearest 0.01 g.
- The different components were separated, and the dry matter mass of each component was measured separately, also on an analytical balance to the nearest 0.01 g.
- The components were identified macroscopically on the basis of their morphological characteristics, allowing the taxonomic classification of the plant- and animal-derived food items examined.
- The components identified in the crop contents were assigned to main categories, namely: (I) plant components, (II) animal components, (III) mineral components and (IV) other components.
- The resulting dataset included sex and age data for all sampled individuals, as well as mass data for the dry food components. All quantitative variables were treated as continuous measurements in grams (g), while the categorical variables — age (juvenile or adult) and sex (female ♀ or male ♂) — were recorded as factors for comparative analyses.

2.2.2. Feeding Ecology Studies of Off-Season Harvested Individuals (April–June)

A total of 521 Common Wood Pigeons (juvenile ♀: 15, juvenile ♂: 22, adult ♀: 232, adult ♂: 252) were examined during my off-season feeding ecology study. Of these individuals, 68 were collected in Hungary in 2022 (18 April – 28 May), 330 in 2023 (14 April – 29 June), and 123 in 2024 (27 April – 31 May). The samples originated from Common Wood Pigeons harvested during off-season hunting activities. These hunts were carried out independently of my study. During sample processing and analysis, I applied the research protocol described earlier (see Section 2.2.1.).

The majority of the samples collected during extraordinary culling events (85.2%) originated from the hunting areas of two licensed game management units in Jász-Nagykun-Szolnok County, in the Jászberény region (16-750350-309; 16-750450-309). In addition, evaluable crop content samples were also obtained from one game management unit in Pest County, in the Tököl region (7.7%), and from one in Csongrád-Csanád County, in the Rösztke region (7.1%) (13-574360-301; 06-802150-305).

The statistical analyses were performed using RStudio 2024.12.0 Build 467. The psych, dplyr, ranger and randomForest R packages were used for the analyses.

2.2.3. Feeding Ecology Studies During the Regular Hunting Season (September)

A total of 155 Common Wood Pigeons (juvenile ♀: 44, juvenile ♂: 45, adult ♀: 25, adult ♂: 41) were examined during our feeding ecology study conducted within the regular hunting season. Sampling was carried out each year between 11 and 13 September (12 September 2021: 50 individuals; 11 September 2022: 16 individuals; and 13 September 2023: 89 individuals). The samples consisted of Common Wood Pigeons harvested during hunting activities that were conducted independently of this study.

Sampling was carried out in the hunting area coded 16-750450-309, located near the town of Jászberény. For the duration of the study, the sampling point was fixed 800 m northwest of the boundary of

Jászberény, measured in a straight line (GPS: 47°31'08.6"N 19°53'22.8"E). Sampling was conducted within a 150 m radius of this point, and only pigeons harvested in the late afternoon while flying in from feeding areas were collected for the analyses. During sample processing and analysis, I applied the research protocol described earlier (see Section 2.2.1.).

The statistical analysis was performed using the R statistical software environment, version 4.5.2, applying the “adonis2” function. A Gower distance matrix was calculated using the “cluster::daisy” function and then implemented using “vegan::adonis2”. Due to the high proportion of structural zeros (66.41%), a Bray–Curtis-based PERMANOVA was applied.

2.2.4. Bacteriological Investigations

Samples required for the bacteriological investigations were collected in the surroundings of the town of Jászberény during off-season hunting activities (April–June). Two sampling sites were designated within the catchment area of the town. The first site, referred to as “Jászberény”, was located northeast of the town, while the second site, referred to as “Jászfelsőszentgyörgy”, was located west of the town.

Sampling targeted individuals flying out from the direction of the town towards feeding areas. At both sampling sites, 16 individuals were sampled. After individual identification of the harvested birds, cloacal samples were collected using sterile swabs. Each swab was immediately placed into a sterile transport tube containing transport medium and stored refrigerated until processing.

The swab samples were subjected to bacteriological laboratory processing. The first step was enrichment, for which 5 ml of buffered peptone water was used. Incubation was carried out for 24 hours at 37 °C to ensure bacterial reactivation. Subsequently, the samples were spread onto PCA (plate count agar), followed by a further 48-hour incubation at 37 °C.

Identification and antibiogram determination were performed using a VITEK 2 Compact semi-automated system. Gram staining was carried out on pure cultures using the Gram-Nicolle Kit in order to distinguish Gram-positive (GP) and Gram-negative (GN) bacteria.

Identification was based on the biochemical characteristics of the examined strains.

During the assessment of antibiotic resistance, bacterial replication was analysed in the respective suspensions. Antibiotic susceptibility testing of GP bacteria was performed using AST-P592 cards, which allowed the simultaneous assessment of susceptibility to 17 antibiotics. The susceptibility of GN bacteria to antibiotics was evaluated using AST-N331 cards, which enabled the simultaneous testing of 16 antibiotics.

Basic statistical analyses and the corresponding boxplot and violin plot visualizations were prepared using PAST 5.0 statistical software. Differences in species composition between samples from the two habitats were analysed using ANOSIM, based on a Sørensen–Dice similarity matrix. The comparison was visualized using non-metric multidimensional scaling (NMDS). The quantitative characteristics and diversity of the identified bacterial species were assessed using the Shannon–Wiener index (H'). Calculation of the index was based on the occurrence of species in the samples. To enable bootstrap-based confidence interval estimation, the analysis was performed using integer values, treated as pseudo-abundance data. Diversity indices and their corresponding 95% confidence intervals were calculated using 10,000 bootstrap iterations and percentile confidence intervals. The diversity of the two sampling sites was compared using Hutcheson's t-test.

3. Results

3.1. Analysis of Hungarian hunting bag data

Based on the analysis of hunting bag data in Hungary, it can be clearly demonstrated that the significance of the Common Wood Pigeon has increased considerably. According to the data of the National Game Management Database for the period between 1995 and 2024, the hunting bag of the species increased from 2,747 individuals to more than six times this number in less than thirty years, reaching the highest value recorded to date in 2023, with 19,461 harvested individuals. However, this quantity represented an utilization rate of only 2.8% when compared with the minimum estimated Hungarian breeding population of 350,000 pairs in 2023, corresponding to at least 700,000 adult individuals.

Throughout the study period, the geographical centre of the hunting bag was associated with the Great Plain and central Hungarian regions. Already in 1995, Pest, Jász-Nagykun-Szolnok, Bács-Kiskun, Békés and Csongrád-Csanád counties were dominant, together accounting for 67.4% of the national hunting bag. This spatial concentration did not shift substantially in the 2020s either; in 2024, the same five counties accounted for 78.2% of the national hunting bag. Thus, the quantitative increase in the species' hunting bag was not accompanied by a major spatial redistribution, but rather intensified primarily in the agricultural regions that had already been important earlier.

From the perspective of assessing the species' significance, the increasing number and proportion of off-season culls are particularly important findings. Although only a few individuals were harvested outside the regular hunting season in 2014, this number exceeded 100 by 2018, surpassed 1,000 in 2022, and increased to 3,081 individuals by 2024, accounting for 17.2% of the annual hunting bag. The geographical centre of off-season culling corresponded to the regular-season harvests, which were also concentrated in the central part of the country. The increase in off-season culling was particularly pronounced in Jász-Nagykun-Szolnok County, where the off-season hunting bag rose from 37 individuals in 2019 to 1,592 individuals in 2023. This change indicates not only an increase in local crop damage, but also that hunting-based damage prevention plays a key role during the critical

spring period in certain agricultural crops, particularly sunflower and pea. The number of off-season culls showed a strong relationship with the trend in regular-season harvests ($R^2 = 0.92$); however, from 2022 onwards, its rate of increase proportionally exceeded that of regular-season harvests.

3.2 Results of the Feeding Ecology Studies

3.2.1 Results of the Feeding Ecology Studies of Individuals Harvested Outside the Regular Hunting Season (April–June)

Based on my results, the vast majority of the crop contents collected during off-season hunting activities (April–June), 98.0% (2,637.64 g), consisted of plant-derived main components. The additional food components detected in the crop contents – animal-derived components (16.26 g), mineral components (26.03 g) and other components (11.70 g) – together accounted for only 2.0%.

Within the animal-derived food group, the highest proportion was represented by woodlice (*Isopoda*) (54.61%), within which only the common pill woodlouse (*Armadillidium vulgare*) was found and identified. Insects (*Insecta*) were the second most abundant taxon (25.89%), while gastropods (*Gastropoda*) were also detected (19.5%).

The mineral food components consisted mainly of gastroliths and sand.

When examining the dry mass distribution of plant-derived subcomponents, I found that cultivated crops accounted for the largest proportion of the samples (83.38%), followed by weed seeds (12.53%). Based on the marked dominance of these two components and the low proportion of fruits and other parts of woody plants (3.43%), my results indicate that, in the studied areas and periods, the Common Wood Pigeon is primarily associated with agricultural areas in terms of feeding, particularly with arable crops.

By evaluating 11 identical sampling periods between April and June, I detected temporal changes in the dominance of food components. Cultivated crops dominated throughout the entire study period; in some periods, they accounted for almost the entire amount of consumed food. Weed species that produce large quantities of seeds and often occur together also played an important role. From May onwards,

animal-derived food components were continuously present in the diet of Common Wood Pigeons, although only in negligible proportions and with low taxonomic diversity.

When examining changes in the dry mass of the most important cultivated crops, it was observed that the dominance of individual components varied considerably over time. The importance of cereals, particularly wheat and barley, increased during their ripening period, while sunflower and green pea also played a key role and, when sown over large areas, their consumption could become almost exclusive. In the second and third weeks of May, the pigeons consumed maize seed, which at that time accounted for more than 80% of the crop-derived food. Another important finding was that the dry mass of treated sunflower, pea and maize seeds accounted for 47.68% of all food components during the first seven weeks of the study, indicating their particular importance during the sowing period. Ripening pea was one of the main food sources of the Common Wood Pigeon in June (64.82–93.88%). In addition, ripe barley and wheat also represented a substantial proportion in June (22.70–35.18%).

3.2.2 Results of the Feeding Ecology Studies of Individuals Harvested During the Regular Hunting Season (September)

The results of the feeding ecology investigations of Common Wood Pigeons collected during the regular hunting season in September showed that the vast majority of the crop contents, 99.57% (925.35 g), consisted of plant-derived components. All other food components detected in the crop contents were of animal (1.46 g) or mineral origin (2.48 g), with the latter accounting for only 0.27%.

The importance of animal-derived components was negligible; among these, woodlice (*Oniscidea*) and small terrestrial gastropods (*Gastropoda*) were detected.

The mineral food components consisted mainly of gastroliths and, to a lesser extent, sand.

When examining the dry mass distribution of plant-derived subcomponents, I confirmed that cultivated crops dominated, representing 97.63% of the plant components. These were followed by weed seeds, although their proportion barely exceeded 1% (1.24%).

The consumption of fruits of woody plants was also detected, but only in a low proportion (0.56%).

Among the cultivated crops, sunflower represented the highest proportion (92.62%), while wheat and barley (7.19%), as well as maize in a negligible proportion (0.19%), were also present. My results indicate that, in the studied areas and periods, the Common Wood Pigeon was primarily associated with agricultural areas and the cultivated crops found there, based on its food preference.

When evaluating the age- and sex-related variability of food components consumed by Common Wood Pigeons sampled during regular-season harvests in September, I found that dispersion did not differ significantly either between sexes or between age groups.

3.3 Bacteriological Investigations

During my study, Gram-positive (GP) bacteria were detected in 16 individuals, corresponding to an occurrence frequency of 50% of the total sample size. In the case of Gram-negative (GN) bacteria, this occurrence rate was 62.5% (20 individuals).

When occurrence frequency was examined by sampling site and Gram group, the occurrence rate of Gram-positive bacteria was 56.3% at the Jászberény (JB) sampling site ($n = 9$), while it was 43.8% at the Jászfelsőszentgyörgy (JFGY) sampling site ($n = 7$). For Gram-negative bacteria, the occurrence rate was 50.0% at the JB site ($n = 8$), whereas it was 75.0% at the JFGY site ($n = 12$).

Altogether, 23 bacterial species were identified from the two sampling sites, with marked differences between the areas. From the samples originating from the JB site, a total of 27 isolates were separated, of which 21 were identified to species level. In the case of samples from the JFGY site, 30 isolates were obtained, of which 17 were identified to species level. According to the ANOSIM results, the species composition of the bacteria isolated and identified from the two sites showed a significant difference; however, the magnitude of this difference was not substantial. A moderate overlap was observed between the JB and JFGY sites ($r = 0.1859$, $p = 0.0001$).

Differences between the two sites were observed not only in the composition of the identified species, but also in species diversity, as indicated by the Shannon H-index. Lower diversity was observed at the

JB sampling site ($H = 1.82$; 95% CI: 1.21–2.05), while substantially higher diversity was recorded at the JFGY site ($H = 3.00$; 95% CI: 2.70–3.03). The difference between the two sites was statistically confirmed by Hutcheson's diversity t-test ($t = -4.29$; $df = 35.77$; $p = 0.0001$).

Among the isolated Gram-positive bacteria, antibiotic susceptibility testing against different antibiotics was successfully performed for 12 isolates. Of the samples included in the analysis, 75% (9 isolates) were susceptible to all tested antibiotics, whereas antibiotic multidrug resistance was confirmed in three isolates.

In the case of Gram-negative bacteria, susceptibility testing was successfully performed for a total of 19 isolates. Resistance to at least one antibiotic was observed in 12 isolates, among which multidrug resistance was also detected in three cases. Differences were also observed between the two sites in the proportion of bacteria affected by antibiotic resistance. The proportion of resistant samples was 57.9% at the JFGY site and 41.7% at the JB site, while the proportion of multidrug-resistant bacteria was around 16% at both sites (JB: 16.7%; JFGY: 15.8%).

Of the 33 antibiotics tested, resistance was confirmed against a total of 15. Resistance to colistin (COL) should be highlighted, as it was detected in 7 cases (36.84%).

4. New Scientific Results

1. Based on the data from the study period (1995–2024), the Hungarian hunting bag data of the Common Wood Pigeon showed an increase of 653.8%, meaning that the national hunting bag of the species increased more than sixfold in less than thirty years. The evaluation of hunting bag data also confirmed that, from 2014 onwards, off-season culling of the Common Wood Pigeon (5 individuals, 0.1%) represented a markedly increasing proportion of the species' annual hunting bag in Hungary. In 2024, this already amounted to 3,081 individuals out of the total annual hunting bag of 17,961 individuals (17.2%). By examining the trends in regular-season and off-season hunting bag data from 2018 onwards, I confirmed that the number of off-season culls showed a strong relationship with the trend in regular-season harvests ($R^2 = 0.92$). However, from 2022 onwards, the rate of increase in off-season culling proportionally exceeded that of regular-season harvests. Furthermore, I demonstrated that even the highest hunting bag recorded to date, 19,461 individuals in 2023, represented a utilization rate of only 2.8% when compared with the Hungarian breeding population estimated at a minimum of 350,000 Common Wood Pigeon breeding pairs in the same year, corresponding to at least 700,000 adult individuals.
2. During the evaluation of the spatial pattern of Common Wood Pigeon harvest data in Hungary, I confirmed that the county-level centre of off-season culling coincided with the centre of hunting bags recorded during the regular hunting season (Pest, Jász-Nagykun-Szolnok, Bács-Kiskun, Csongrád-Csanád and Békés counties). These counties indicate the national distribution of the agricultural areas most affected by damage caused by the species.
3. Based on the crop content analysis of the large-sample Common Wood Pigeon material collected in Hungary outside the regular hunting season (April–June: 521 individuals) and during the regular hunting season (September: 155

individuals), I found that there was no statistically detectable difference in diet selection according to either sex or age in the consumption of the most important food component category, cultivated crops, using the applied statistical methods (Random Forest, Mann–Whitney test and PERMANOVA).

4. By examining the component-level dry mass dominance patterns of the crop contents of a large sample of Common Wood Pigeons collected in Hungary (676 individuals), I found that plant components represented the dominant mass proportion in both study periods (April–June: 98.00%; September: 99.57%). In contrast, the low dry mass proportions of animal-derived components (April–June: 0.60%; September: 0.16%) and mineral components (April–June: 0.97%; September: 0.27%) indicate the additive role of these components in the diet.
5. Among the plant components recorded in the crop contents of Common Wood Pigeons collected outside the regular hunting season in Hungary (April–June; 521 individuals), cultivated agricultural crops were absolutely dominant in terms of dry matter proportion (83.38%). Among these crops, damage-sensitive sunflower (*Helianthus annuus*) and green pea (*Pisum sativum*) played a particularly important role. The dominance patterns detected in my samples for the seeds and seedlings of these two damage-sensitive crops, as well as for green pea yield in early summer, further confirm the significance of agricultural damage caused by the species and the justification for off-season culling.
6. Among the components recorded in the crop contents of Common Wood Pigeons collected during regular season harvests in September in Hungary (155 individuals), cultivated agricultural crops were dominant (97.63%). Sunflower yield, which was ripening during the study period and is also vulnerable to damage, represented the largest proportion of the cultivated crops consumed (92.62%). The consumption of sunflower yield to this extent confirms the agricultural significance of the species and supports the justification for concentrating hunting efforts on damage-sensitive areas.

7. In the crop contents of Common Wood Pigeons collected in Hungary (676 individuals), I detected the flowers and fruits of black locust (*Robinia pseudoacacia*), as well as the common pill woodlouse (*Armadillidium vulgare*). These species had not previously been reported in the literature as food items consumed by the Common Wood Pigeon and confirmed by bromatological investigations.
8. During the bacteriological investigation of Common Wood Pigeons collected outside the regular hunting season in Hungary (April–June; 32 individuals), antibiotic susceptibility testing against different antibiotics was successfully performed for 12 isolates among the isolated Gram-positive bacteria, of which three showed antibiotic multidrug resistance. In the case of Gram-negative bacteria, susceptibility testing was successfully performed for a total of 19 isolates, of which 12 showed resistance to at least one antibiotic, and multidrug resistance was also detected in three cases. Based on these findings, it can be assumed that the urbanizing Common Wood Pigeon may act as a reservoir in the maintenance and spread of antibiotic-resistant strains. In addition, my results confirmed that, among huntable species, the Common Wood Pigeon can be effectively used as a bioindicator in One Health-oriented investigations.

5. List of Publications Related to the Topic

Q1–Q4 Journal Publications

SÁRKÖZY, Á., NAGY, E., BENDE, A., CSIVINCSIK, Á., BÓTA, B., NAGY, G., KOVÁCS, M. & TARI, T. (2026): Common Wood Pigeon (*Columba palumbus*): An Avian Bioindicator of Antimicrobial Resistance at the Human-Wildlife Interface. *Environments* **13**(4): 205 (Q1)

SÁRKÖZY, Á., FEKETE, I., JÁNOSKA, F., SÁNDOR, GY. & BENDE, A. (2026): Dietary biology research of the Common Wood Pigeon (*Columba palumbus*) in a Hungarian agricultural area during the sunflower ripening period. 18 p. (Q3, accepted)

Conference Paper – Full Text, Peer-Reviewed

SÁRKÖZY, Á., JÁNOSKA, F., SÁNDOR, GY. & BENDE, A. (2024): *Az orvos galamb (Columba palumbus L.) terítékadatainak elemzése [Analysis of Hunting Bag Data of Common Wood Pigeon (Columba palumbus L.)]*. In: CZIMBER, K., VÁGVÖLGYI, A., KOVÁCS, G. (eds.): Erdészeti Tudományos Konferencia Kiadványa. Sopron, Hungary. Soproni Egyetem Kiadó. pp. 284–290. (in Hungarian)

SÁRKÖZY, Á., JÁNOSKA, F., SÁNDOR, GY. & BENDE, A. (2023): Analysis of Hunting Bag Data of Woodpigeon (*Columba palumbus* L.) in Hungary. *Magyar Ápróvad Közlemények* **15**: 127–135.

SÁRKÖZY, Á., JÁNOSKA, F., SÁNDOR, GY. & BENDE, A. (2022): *Az orvos galamb (Columba palumbus L.) táplálkozásbiológiai vizsgálatainak összehasonlítása [Comparison of Feeding Ecology Studies of the Common Wood Pigeon (Columba palumbus L.)]*. In: CZIMBER, K., HEIL, B. (eds.): Az Erdőmérnöki Kar Tudományos Kiadványa. Sopron, Hungary. Soproni Egyetem Kiadó. pp. 232–239. (in Hungarian)

Conference Abstract

SÁRKÖZY, Á., JÁNOSKA, F., SÁNDOR, GY. & BENDE, A. (2024): *Az orvos galamb (Columba palumbus L.) terítékadatainak elemzése Magyarországon [Comparison of Feeding Ecology Studies of the Common Wood Pigeon (Columba palumbus L.)]*. In: CZIMBER, KORNÉL (eds.): Scientific Conference on Forestry, Sopron, 5–6 February 2024. Book of Abstracts. Sopron, Hungary: Faculty of Forestry, University of Sopron. p. 65. (in Hungarian)

Other – Full Text, Not Peer-Reviewed

SÁRKÖZY, Á., JÁNOSKA, F., SÁNDOR, GY. & BENDE, A. (2024): Örvös galamb szabta új feladatok: Napjaink vadgazdálkodásának egyik sürgető kihívása [New Challenges Posed by the Common Wood Pigeon: One of Today's Urgent Challenges in Game Management]. *NIMRÓD* 112: 10–13. (in Hungarian)

SÁRKÖZY, Á. (2023): *Örvös galambok lépten nyomon [Common Wood Pigeons All Around Us]*. website of the Faculty of Forestry, University of Sopron, 1 p. – <https://emk.uni-sopron.hu/orvos-galambok-lepten-nyomon> (in Hungarian)

SÁRKÖZY, Á. (2023): Új hódító madaraink [Our New Avian Conquerors]. *MI ERDŐNK* 13: 14–15. (in Hungarian)

Conference and Presentation Materials

SÁRKÖZY, Á., JÁNOSKA, F., SÁNDOR, GY. & BENDE, A. (2024): *Az örvös galamb (Columba palumbus L.) terítékadatainak elemzése Magyarországon [Comparison of Feeding Ecology Studies of the Common Wood Pigeon (Columba palumbus L.)]*. Forestry Scientific Conference. Sopron, 6 February 2024 (in Hungarian)

SÁRKÖZY, Á. (2023): *A hazai örvös galamb állomány növekedése és annak következményei [Population Growth of the Common Wood Pigeon in Hungary and Its Consequences]*. TAEK Tanulmányi Erdőgazdaság Zrt. Game Management Symposium and Training Course. Sopron, 15 May 2023 (in Hungarian)

SÁRKÖZY, Á. (2023): *Örvös galambok a városban [Common Wood Pigeons in the City]*. University of Sopron Pecha-Kucha. Sopron, 26 April 2023 (in Hungarian)