Foods and Raw Materials. 2025;13(2)

ISSN 2308-4057 (Print)
ISSN 2310-9599 (Online)

Research Article
Open Access

Available online at http://jfrm.ru/en
https://doi.org/10.21603/2308-4057-2025-2-652
https://elibrary.ru/MNJCFZ

Autumn and winter diet of wood pigeon (*Columba palumbus*) in the Central Ciscaucasia

Anatoly P. Kaledin[1], Lyubov V. Malovichko[1,*], Alexander G. Rezanov[2], Lyudmila S. Drozdova[1], Botagoz A. Kentbaeva[3]

[1] Russian State Agrarian University – Moscow Timiryazev Agricultural Academy, Moscow, Russia
[2] Moscow City University, Moscow, Russia
[3] Kazakh National Agrarian Research University, Almaty, Kazakhstan

* e-mail: l-malovichko@yandex.ru

Received 28.03.2024; Revised 27.05.2024; Accepted 04.06.2024; Published online 02.11.2024

Abstract:
The wood pigeon (*Columba palumbus*) is the largest pigeon in Russia: an adult bird weighs max. 620 g. Its population in Central Ciscaucasia is quite numerous, which makes it a popular object of sports hunting. However, very little is known about its diet and feeding habits. This article describes the seasonal features of *C. palumbus* diet during the hunting season in the Stavropol Region, Russia.
The study relied on the analysis of foods extracted from 66 crops and stomachs of wood pigeons killed by hunters or hit by road vehicles in various biotopes in 25 districts of the Stavropol Region.
In the steppe areas, wood pigeons usually inhabit summer gardens, orchards, vineyards, and green belts along fields, roads, and railways. Wood pigeons are phytophages, which means they feed on plants. Their autumn diet includes sunflower seeds (17.98% occurrence rate, 19.68% total diet), corn grains (15.11 and 9.56%, respectively), wheat (14.39 and 9.98%), flax (6.47 and 10.4%), and millet (2.88 and 4.82%), as well as seeds of wild plants, e.g., wild vetch (7.19 and 3.14%), catchweed (5.75 and 6.25%), trailing bindweed (2.88 and 4.27%), etc.
The wood pigeon inhabits all districts of the Stavropol Region, which makes it a promising game bird species. In addition to cultivated plants, e.g., wheat, sunflower, peas, and corn, wood pigeons feed on a wide range of weeds. The research results contribute to scientific data on *C. palumbus* as a game bird and cast light upon some of its feeding patterns.

Keywords: Wood pigeon, *Columba palumbus*, Central Ciscaucasia, Stavropol Region, diet, gastroliths, distribution, biotope

Please cite this article in press as: Kaledin AP, Malovichko LV, Rezanov AG, Drozdova LS, Kentbaeva BA. Autumn and winter diet of wood pigeon (*Columba palumbus*) in the Central Ciscaucasia. Foods and Raw Materials. 2025;13(2):366–375. https://doi.org/10.21603/2308-4057-2025-2-652

INTRODUCTION

Wood pigeon (*Columba palumbus* Linnaeus, 1758) is a large bird species with a wide distribution [1]. The International Union for Conservation of Nature and Natural Resources classifies it as Least Concern [2]. In the Stavropol Region, Russia, wood pigeons are breeding migrants and a wintering species. Research data from 19th and the early 20th centuries give a rather heterogeneous picture of their population and habitat patterns in the Caucasus [3]. These days, wood pigeons are omnipresent in Ciscaucasia, with the exception of open steppes. They entered the Stavropol Region in the 1970s–1980s. Over the next decades, they settled in its northern and central areas [4]. Early publications, however, scarcely mention them breeding in the Stavropol Region.

This publication is part of a series of articles on the diet of game birds in the Stavropol Region, Russia [5–7].

STUDY OBJECTS AND METHODS

The research material was collected in the Stavropol Region during the hunting seasons (August 25 – October 11) of 2018–2023. It involved the contents of 66 crops and stomachs of wood pigeons (*Columba palumbus*) caught by hunters or hit by vehicles in twelve administrative districts of the Stavropol Region (Fig. 1, Table 1).

The stomach contents were extracted and transferred to paper bags to dry. After 1–2 days, we classified them

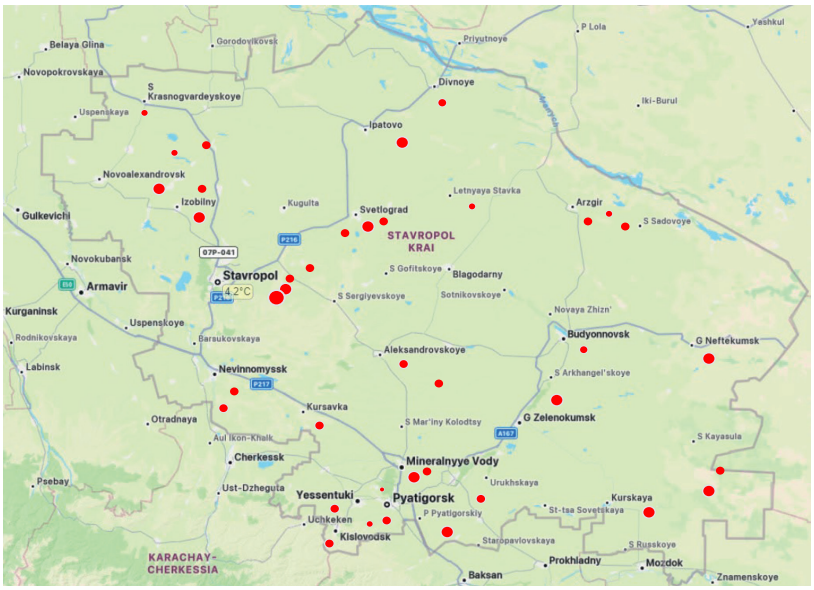

Figure 1 Sampling sites of *Columba palumbus* stomachs and crops in Central Ciscaucasia: Stavropol Region, Russia

Table 1 Sampling locations and dates for *Columba palumbus* stomachs and crops in Stavropol Region, Russia

Districts in Stavropol Region	*Columba palumbus* stomachs and crops, units	Sampling date
Arzgir	7	August 30, 2018 August 25, 2019
Levokumskoye	7	August 31, 2019 August 28, 2020
Grachevka	6	September 4, 2021
Kochubeyevskoye	6	October 11, 2023
Mineralnye Vody	6	September 30, 2022
Petrovsky	6	September 24, 2021
Stepnoye	6	September 27, 2023
Shpakovsky	6	September 29, 2022
Trunovsky	5	August 28, 2018
Izobilny	4	September 25, 2022
Turkmensky	4	August 29, 2019
Aleksandrovskoye	3	September 29, 2021
Total	66	August 25 – October 11

into gastroliths and seeds. The statistical processing followed State Standard ISO 5725-6-2003. The results were presented as mean value (X), standard error (SE), limit in the mean (lim.), and standard deviation (SD), with differences considered statistically significant at $p < 0.05$.

To classify stomach and crop contents, we appealed to the classification developed by Prekopov [8]. According to this classification, a food item belonged to primary if it is registered in ≥ 5% cases. Secondary foods occur in 1–5% while random foods are registered in ≤ 1% cases.

These materials update available scientific information about the diet of *C. palumbus* in the Stavropol Region.

RESULTS AND DISCUSSION

Wood pigeons (*Columba palumbus*) are distributed irregularly all over the Stavropol Region and inhabit both crop-farming areas and livestock pastures (Fig. 2). In the cattle-farming areas, their population growth is constrained by the lack of trees on arid pastures. In the urban areas and villages, their distribution is also irregular as it depends on nesting sites available and manin-duced impact on biotopes [9].

The current average annual population of wood pigeons is 2.58 ± 0.57 birds per 10 ha in 25 municipal districts of the Stavropol Region. The calculations took into account the maximal numbers for each region [9]. This count was higher than those reported in earlier studies [10].

The first number in Fig. 2 indicates the lowest count for the entire study period while the second figure represents the most relevant count, i.e., the number of birds in the last research year for that particular area. Single numbers marked with an asterisk* mean that only one count was conducted in this area.

The total population of *C. palumbus* in Fig. 2 is color-coded, with the Kirovsky District colored grey

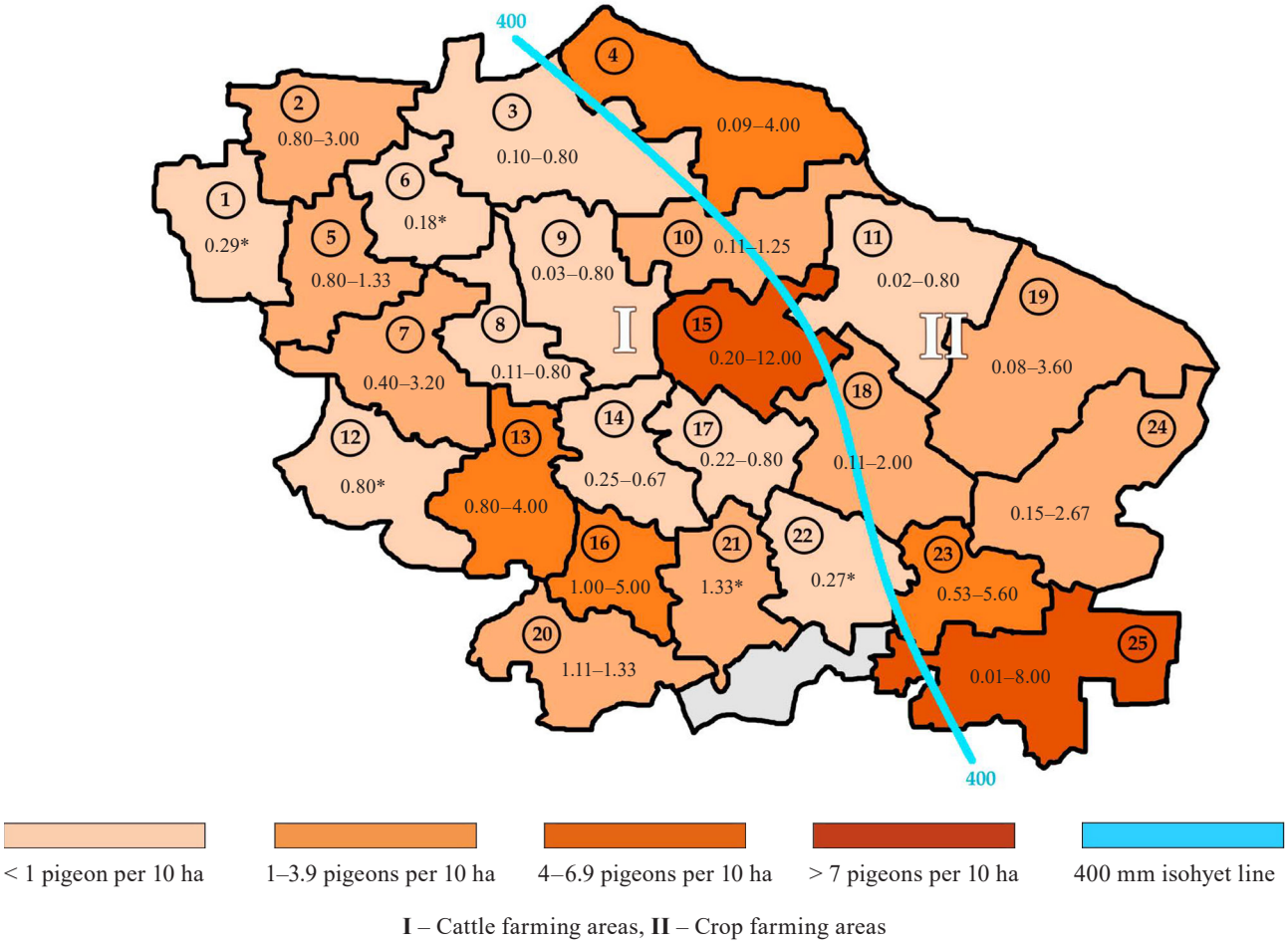

Figure 2 Total population of *Columba palumbus* in 25 districts of Stavropol Region, per 10 ha, 2006–2019:
1 – Novoalexandrovsk, 2 – Krasnogvardeyskoye, 3 – Ipatovo, 4 – Apanasenovsky, 5 – Izobilny, 6 – Trunovsky, 7 – Shpakovsky, 8 – Grachevka, 9 – Petrovsky, 10 – Turkmensky, 11 – Arzgir, 12 – Kochubeevskoye, 13 – Andropovsky, 14 – Aleksandrovskoye, 15 – Blagodarny, 16 – Mineralnye Vody, 17 – Novoselitskoye, 18 – Budennovsk, 19 – Levokumskoye, 20 – Predgorny, 21 – Georgievsk, 22 – Sovetsky, 23 – Stepnoye, 24 – Neftekumsky, 25 – Kurskaya

because no wood pigeon population counts were conducted there in 2006–2019.

The Stavropol Region produces 8–10% all Russia's grain, 4% sugar beets, and 5% sunflower seeds. The local agriculture shows the best results in crop farming, especially in grain production [11].

The Stavropol Region has few forests. The total forest area was 130 100 ha in 2018, with only 15 600 of them growing in urban areas or in rural settlements. Natural forests occupy 51 100 ha whereas man-planted forests make up 41 200 ha [12]. The local steppe afforestation project started in the late 19th century and remained unorganized up to the mid-20th century. The current protective forest belts were planted as part of the socalled Stalin's Plan for Transformation of Nature, adopted in 1948. A real boom in the local green belt policy started in the late 1960s, triggered by severe dust storms.

Wood pigeon diet. Wood pigeons feed on plant foods, i.e., grains, herbal seeds, berries, acorns, beech nuts, buds, and vegetative parts of plants [13–27]. In some areas, they eat foods of animal origin, e.g., terrestrial mollusks, worms, and insects [13, 23, 28–30]. In general, their diet and food type ration depend on the habitat and season to a large extant.

We discovered 22 species of seeds and grains in the crops and stomachs of *C. palumbus* inhabiting the Stavropol Region: 8 belonged to agricultural crops and 14 were from wild plants. The average number of seeds per crop/stomach was 49.67 ± 12.61 (lim.– 6–153; SD = 31.13; Med. = 37.5; $p = 0.001$; n = 66). These calculations were made for all plant species found in the crops and stomachs (Tables 2 and 3).

The statistics revealed an obvious correlation between the occurrence rate of various seeds in the crops and stomachs of wood pigeons and their share in the birds' diet (Figs. 3 and 4). The correlation was of direct nature, i.e., the higher the occurrence rate, the higher their proportion in the diet ($R = 0.8897$; $p < 0.001$).

Gastroliths. We found gastroliths of white, black, gray, dark gray, orange, and brown colors in the crops and stomachs (n = 66) of wood pigeons. The mean value for gastroliths of all colors was 9.17 ± 1.92 (lim. 3–21;

Table 2 Seeds in *Columba palumbus* crops and stomachs by plant species, mean value

Plant	Number of crops/stomachs with the seeds	Statistics				
		X ± SE	Lim.	SD	Med.	*p*
Sunflower (*Helianthus cultus*)	25	25.80 ± 7.38	9–49	11.21	24	0.001
Sugar corn (*Zea mays*)	21	16.48 ± 6.59	1–45	11.72	15	0.01
Wheat (*Triticum* sp.)	20	16.35 ± 6.78	3–34	9.21	14	0.001
Wild vetch (*Vicia cracca*)	10	10.30 ± 3.89	3–20	6.25	11	0.049
Cotton (*Linum usitatissimum*)	9	37.89 ± 13.44	11–56	15.66	40	0.01
Catchweed (*Galium aparine*)	8	25.63 ± 13.70	12–67	19.68	15	0.049
Ragweed (*Ambrosia artemisiifolia*)	6	42.33 ± 20.05	16–74	24.95	39	0.049
Garden pea (*Pisum sativum*)	6	14.17 ± 8.82	6–36	10.98	10.5	0.049
Trailing bindweed (*Convolvulus arvensis*)	4	35.00 ± 13.52	24–45	10.50	35.5	0.001
Knotweed (*Fallopia convolvulus)*	4	11.25 ± 5.17	4–16	5.25	12.5	0.049
White clover (*Trifolium repens*)	4	14.75 ± 12.86	5–34	13.07	10	0.049
Millet (*Panicum miliaceum*)	4	39.50 ± 11.52	29–43	7.00	43	0.001
Meadow pea (*Lathyrus pratensis*)	4	16.75 ± 11.41	9–34	11.59	12	0.049
Silverberry (*Elaeagnus commutata*)	3	29.33 ± 16.24	17–45	14.29	26	0.049
Lamb's quarter (*Chenopodium album*)	3	34.33 ± 1.48	34–35	0.58	34	0.00001
Amaranth (*Amaranthus hybridus*)	2	16.00 ± 6.74	6–26	14.14	16	0.5
Tare (*Vicia sativa*)	1	33	33	–	33	< 0.001
Meadow geranium (*Geranium pratense*)	1	21	21	–	21	< 0.001
Creeping buttercup (*Ranunculus repens*)	1	45	45	–	45	< 0.001
Oat (*Avena sativa*)	1	43	4	–	4	< 0.001
Black nightshade (*Solanum nigrum*)	1	100 (berries)	100	–	100	< 0.001
Field pennycress (*Thlaspi arvense*)	1	77	77	–	77	< 0.001

Table 3 Primary (> 5%), secondary (1–5%), and random (< 1%) foods in *Columba palumbus* diet

Foods	Total occurrences (n = 139)	Occurrences, % total samples (n = 139)
Primary		
Sunflower (*Helianthus cultus*)	25	17.98
Sugar corn (*Zea mays*)	21	15.11
Wheat (*Triticum* sp.)	20	14.39
Wild vetch (*Vicia cracca*)	10	7.19
Flax (*Linum usitatissimum*)	9	6.47
Catchweed (*Galium aparine*)	8	5.75
Secondary		
Ragweed (*Ambrosia artemisiifolia*)	6	4.32
Garden pea (*Pisum sativum*)	6	4.32
Trailing bindweed (*Convolvulus arvensis*)	4	2.88
Knotweed (*Fallopia convolvulus*)	4	2.88
White clover (*Trifolium repens*)	4	2.88
Millet (*Panicum miliaceum*)	4	2.88
Meadow pea (*Lathyrus pratensis*)	4	2.88
Silverberry (*Elaeagnus commutata*)	3	2.16
Lamb's quarter (*Chenopodium album*)	3	2.16
Amaranth (*Amaranthus hybridus*)	2	1.44
Random		
Meadow geranium (*Geranium pratense*)	1	0.72
Tare (*Vicia sativa*)	1	0.72
Creeping buttercup (*Ranunculus repens*)	1	0.72
Black nightshade (*Solanum nigrum*)	1	0.72
Oat (*Avena sativa*)	1	0.72
Field pennycress (*Thlaspi arvense*)	1	0.72
Total	**139**	**100.00**

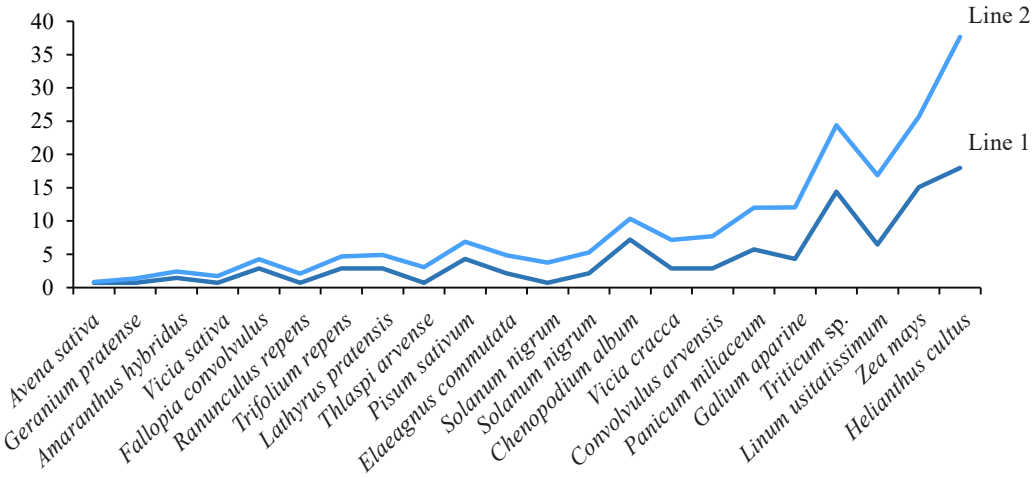

Figure 3 Occurrence rates of various seeds (Line 1) in *Columba palumbus* crops and stomachs vs. their share in *Columba palumbus* diet (Line 2)

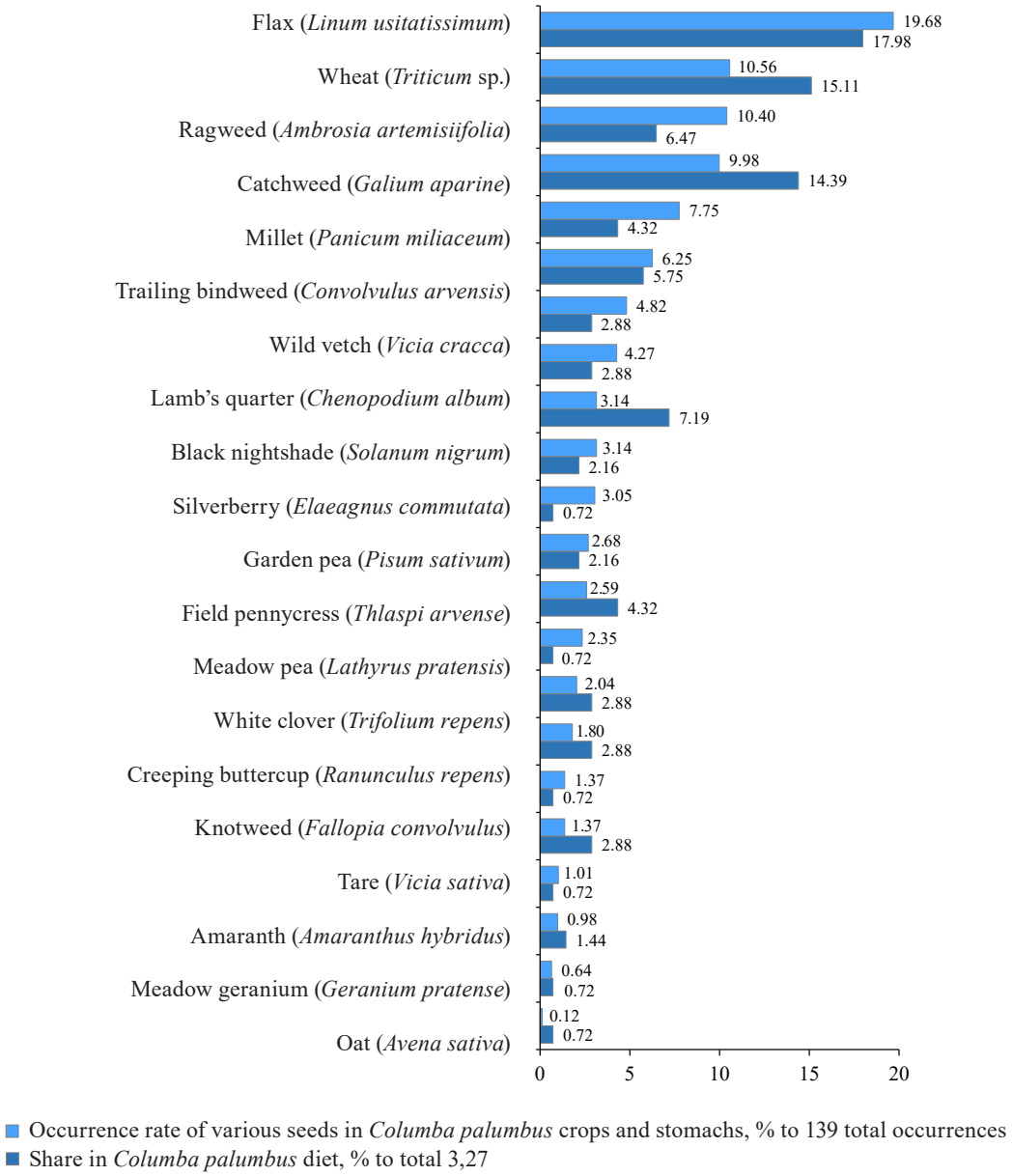

Figure 4 Occurrence rate of seeds in crops and stomachs of *Columba palumbus* vs. their share in *Columba palumbus* diet

SD = 4.74; Med = 8.5; $p = 0.001$; n = 66). In 1985, Cramp reported an average of 104 gastroliths per 128 wood pigeon stomachs [29].

Table 4 shows differentiated calculations for gastroliths of each color.

Differences in the number of colored gastroliths in crops and stomachs were not statistically significant ($t_d < 1.7$). We found that the crops and stomachs of wood pigeons from all surveyed areas in the Stavropol Region contained white and black gastroliths. We could not make any assumptions about the pigeons' preference for gastroliths of particular color (Fig. 5) since we had no data on the colors of stones and their ratio in the pigeon feeding areas under analysis.

The average diameter of gastroliths was 1.68–2.16 mm, most being 2 mm across (Table 5).

Gastroliths of different colors demonstrated different patterns in the relationship between their number and diameter. White gastroliths showed a statistically insignificant decrease in number that corresponded with an increase in diameter (Fig. 6). As black gastroliths grew in diameter and reached 2 mm, their number went first up and then down (Fig. 7). We used a polynomial trend for complex distribution. Orange gastroliths demonstrated an opposite trend (Fig. 8). Grey gastroliths increased in size as they grew in number (Fig. 9). Brown and orange gastroliths demonstrated a similar trend (Fig. 10).

Feeding patterns. In avian studies, feeding patterns are as important as diet. Feeding patterns involve the methods that birds use to obtain food. Wood pigeons are known to feed not only on the ground, but also on trees and shrubs [13, 20, 21]. However, a number of recent publications reported rock pigeons (*Columba livia* var. *urbana*) feeding on trees [31–37]. Rock pigeons seem to have acquired this feeding habit all over Russia, e.g., in the Moscow Region, in Arkhangelsk, in the Crimea, in the Rostov Region, in the Altai mountains, etc.

In the Stavropol Regions, wood pigeons preferred to feed on the ground in the summer and autumn (Fig. 11). In some cases, pigeons flew to sunflower fields and sat on the plants to peck seeds from the anthodium (Fig. 12). We found no evidence of such behavior described in the literature reviewed.

We used our own observations and scientific data from other publications, which we processed by digital coding, to identify the feeding patterns [27, 37].

Table 4 Gastroliths in crops and stomachs of *Columba palumbus*, by color

Color	Crops and stomachs with gastroliths	Total gastroliths	Statistics				
			X ± SE	Lim	SD	Med.	*p*
White	57	251	4.40 ± 0.89	1–11	2.04	4	0.001
Black	46	117	2.54 ± 0.81	1–8	1.67	2	0.001
Brown	24	66	2.75 ± 0.82	1–6	1.22	3	0.001
Orange	21	92	4.38 ± 1.93	1–10	2.69	4	0.001
Grey	20	79	3.95 ± 1.61	2–11	2.19	3	0.001

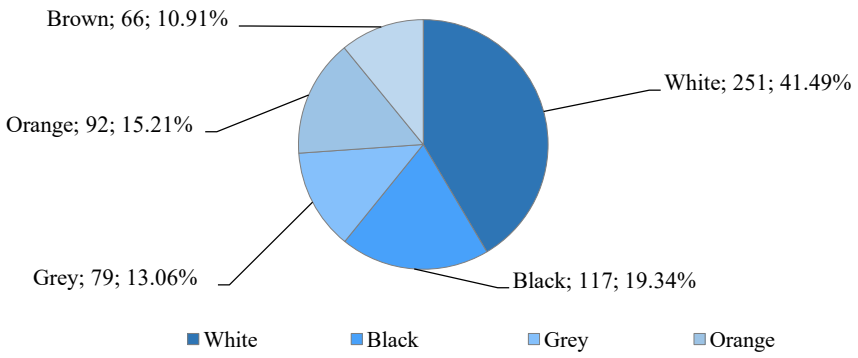

Figure 5 Number and share of gastroliths (n = 605) of different colors in crops and stomachs of *Columba palumbus* (n = 66)

Table 5 Diameter (mm) of gastroliths in crops and stomachs of *Columba palumbus*, by color

Color	Total gastroliths	Statistics				
		X ± SE	Lim	SD	Med.	*p*
White	251	2.16 ± 0.23	0.7–6	1.13	2	0.001
Black	117	1.79 ± 0.34	0.7–8	1.11	2	0.001
Orange	92	1.98 ± 0.34	1–4	0.99	2	0.001
Grey	79	2.14 ± 0.37	1–4	1.01	2	0.001
Brown	66	1.68 ± 0.29	1–3	0.71	2	0.001

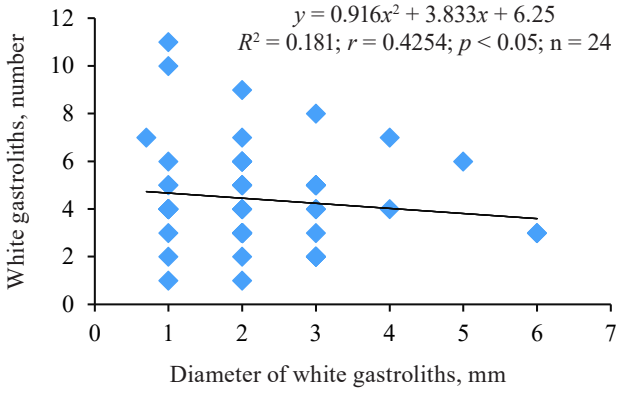

Figure 6 White gastroliths in crops and stomachs of *Columba palumbus*: diameter vs. number

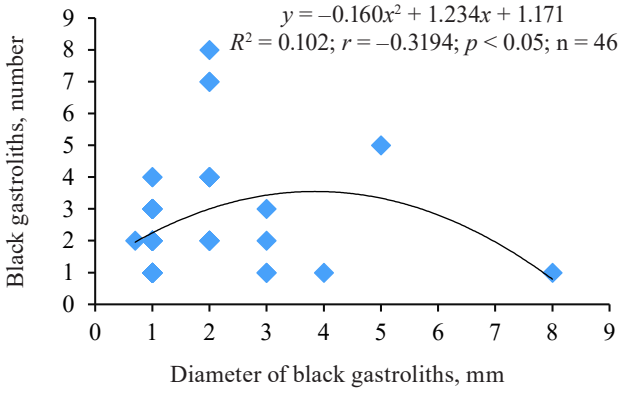

Figure 7 Black gastroliths in crops and stomachs of *Columba palumbus*: diameter vs. number

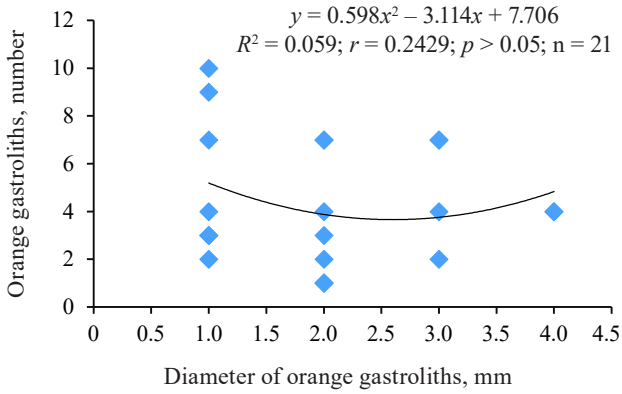

Figure 8 Orange gastroliths in crops and stomachs of *Columba palumbus*: diameter vs. number

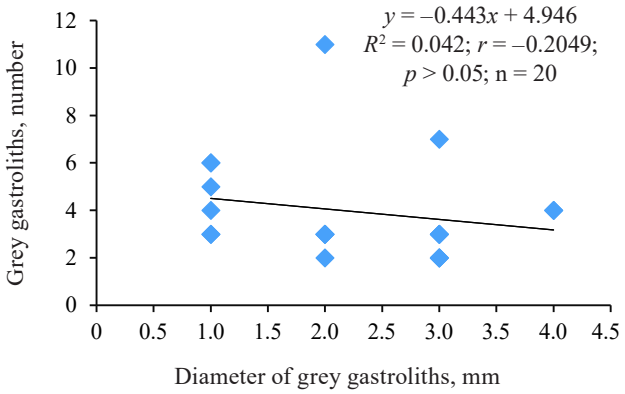

Figure 9 Grey gastroliths in crops and stomachs of *Columba palumbus*: diameter vs. number

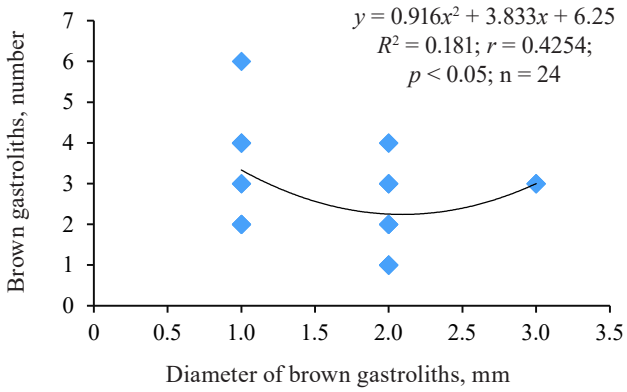

Figure 10 Brown gastroliths in crops and stomachs of *Columba palumbus*: diameter vs. number

Foraging on the ground:

1. Pigeons pick up static seeds, grains, fruits, and terrestrial mollusks from the ground; we collected no information about their behavior while catching moving objects, e.g., insects;
2. They pecked seeds from inflorescences that were close to the ground; and
3. They plucked leaves from herbs while on the ground.

Foraging in tree and bush foliage:

1. Pigeons pecked berries from the bush; and
2. They pecked berries and leave buds on the trees.

Foraging in tall herbal plants:

1. Pigeons pecked sunflower seeds directly from the anthodium while seating on the plant itself, of which nothing was mentioned in scientific literature.

Figure 11 Wood pigeons feeding in a harvested field, July 12, 2021, Mineralnye Vody District, Stavropol Region (photo by L.V. Malovichko)

Figure 12 Wood pigeons feeding on sunflower anthodia, August 27, 2021, Kochubeyevskoye District, Stavropol Region (photo by L.V. Malovichko)

CONCLUSION

During the agricultural crisis of the 1990s, Stavropol fields grew with weeds as the chemical pollution went down. Most fields were not plowed in the autumn, and entire fields of Sudan grass, corn, and sunflowers often stood unharvested. Protective green belts remained uncultivated. These changes were very beneficial for wood pigeons.

These days, agricultural mechanization simplifies the structure of agrocenoses: fields are getting larger; as a result, monoculture areas are growing in size; harvesting and plowing take much less time than before.

Agricultural crops, such as wheat, sunflower and corn, are not the only type of food that attracts wood pigeons (*Columba palumbus*). They prefer weeds, e.g., wild vetch, meadow pea, white clover, creeping buttercup, lamb's quarters, etc. To support these game birds, agrotechnical practices should alternate crop rotation patterns to increase the mosaic nature of the agricultural landscape.

CONTRIBUTION

All authors have contributed equally to the study and are equally responsible for the information published in this article.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

REFERENCES

1. Stepanyan LS. Conspectus of the ornithological fauna of Russia and adjacent territories (within the borders of the USSR as a historic region). Moscow: Academkniga; 2003. 808 p. (In Russ.).
2. *Columba palumbus*. The IUCN Red List of Threatened Species 2018. https://doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22690103A131924602.en
3. Bostanzhoglo VN. Ornithological fauna of the Aral-Caspian steppes. Moscow: Moscow Society of Nature Explorers; 1911. 410 p. (In Russ.).
4. Khokhlov AN. Increase in wood pigeons breeding in the Stavropol Region. Proceedings of the All-union scientific and methodological meeting of zoologists of pedagogical universities. Makhachkala; 1990. P. 242–244. (In Russ.).
5. Kaledin AP, Malovichko LV, Rezanov AG, Drozdova LS. Autumn and winter diet of *Phasianus colchicus* in the Central Ciscaucasia. Food Processing: Techniques and Technology. 2022;52(1):133–143. (In Russ.). https://doi.org/10.21603/2074-9414-2022-1-133-143; https://www.elibrary.ru/KJONRX
6. Kaledin AP, Malovichko LV, Rezanov AG, Drozdova LS. Diet of the gray partridge (*Perdix perdix* L.) in the Central Ciscaucasia. Food Processing: Techniques and Technology. 2022;52(2):334–343. (In Russ.). https://doi.org/10.21603/2074-9414-2022-2-2367; https://www.elibrary.ru/SGTLSY
7. Kaledin AP, Malovichko LV, Rezanov AG, Drozdova LS, Serikbayeva AT. Quails of Stavropol Region: Autumn food habits. Food Processing: Techniques and Technology. 2024;54(1):71–81. (In Russ.). https://doi.org/10.21603/2074-9414-2024-1-2489; https://www.elibrary.ru/KXVHQT
8. Prekopov AN. The golden bee-eater in Ciscaucasia. Proceedings of the Voroshilov State Pedagogical Institute. 1940;3(2):240–442. (In Russ.).

9. Malovichko LV, Yufereva VV, Tel'pov VA, Yuferev DP. The distribution and dynamics of synanthropisation of the common wood pigeon in the Stavropol region. South of Russia: Ecology, Development. 2021;16(3):33–46. (In Russ.). https://doi.org/10.18470/1992-1098-2021-3-33-46; https://www.elibrary.ru/XNACZW
10. Bobenko OA, Khokhlov AN, Il′yukh MP. Timing and features of nesting of pigeons in the Stavropol Region. Caucasian Ornithological Bulletin. 2011;(23):9–14. (In Russ.). https://www.elibrary.ru/XHANVZ
11. Agriculture [Internet]. [cited 2024 Feb 23]. Available from: https://stavregion.ru/stat/economics/agriculture
12. Report on the state of the environment and natural resource management in the Stavropol Region in 2018. Stavropol, 2019. 140 p. (In Russ.).
13. Meklenburtsev RN. Pigeons *Columbae*, or *Columbiformes*. In: Dement′ev GP, Gladkov NA, editors. Birds of the Soviet Union. Vol. II. Moscow: Sovetskaya nauka; 1951. pp. 3–70. (In Russ.).
14. Meklenburtsev RN. Pigeon, family Columbidae. In: Matchanov NM, Sagitov AK. Birds of Uzbekistan. Vol. 2. Tashkent: Fan; 1990. pp. 182–206. (In Russ.).
15. Dolgushin IA. Order Pigeons, Columbae. In: Gavrin VF, Dolgushin IA, editors. Birds of Kazakhstan. Vol. 2. Alma-Ata: Nauka; 1962. pp. 328–369. (In Russ.).
16. Ptushenko ES, Inozemtsev AA. Biology and economic importance of birds in the Moscow region and adjacent territories. Moscow: Lomonosov Moscow State University; 1968. 462 p. (In Russ.).
17. Ivanov AI. Birds of the Pamir Alai. Leningrad: Nauka; 1969. 448 p. (In Russ.).
18. Kostin YuV. Birds of Crimea. Moscow: Nauka; 1983. 241 p. (In Russ.).
19. Malchevsky AS, Pukinsky YuB. Birds of the Leningrad Region and adjacent territories. Vol. 1. Leningrad: Leningrad University Publishing House; 1983. 480 p. (In Russ.).
20. Cramp S. Handbook of the birds of Europe, the Middle East and North Africa: The birds of the Western Palearctic. Vol. IV: Terns to woodpeckers. Oxford: Oxford University Press; 1986. 960 p.
21. Kotov AA. Pigeonides. In: Gavrilov EhI, Ivanchev VP, Kotov AA. Birds of Russia and adjacent regions: Pteroclididae, Columbiformes, Cuculiformes, and Strigiformes. Moscow: Nauka; 1993. P. 47–181. (In Russ.).
22. O'Huallachain D, Dunne J. Seasonal variation in the diet and food preference of the Woodpigeon *Columba palumbus* in Ireland. Bird Study. 2013;60(3):417–422. https://doi.org/10.1080/00063657.2013.798259
23. Astafieva TV. Characteristics of food of the wood pigeon *Columba palumbus* in the Kaliningrad oblast. The Russian Journal of Ornithology. 2015;24(1158):2231–2234. (In Russ.). https://www.elibrary.ru/TXOPLH
24. Gutiérrez-Galán A, González CA, de Mercado JM. Woodpigeon *Columba palumbus* diet composition in mediterranean Southern Spain. Ardeola. 2017;64(1):17–30. https://doi.org/10.13157//arla.64.1.2017.ra2
25. Kaouachi A, Menaa M, Rebbah AC, Maazi MC. Diet of wood pigeon (*Columba palumbus*) in forest areas of souk Ahras region (North-Eastern Algeria): Management implications. Pakistan Journal of Zoology. 2021;53(5):1919–1927. https://doi.org/10.17582//journal.pjz//20190708150749
26. Berezovikov NN, Kazenas VL. The Turkestan wood pigeon *Columba palumbus casiotis* feeds on the fruits of the bird cherry *Cerasus avium* in the gardens of Almaty. Russian Journal of Ornithology. 2021;30(2103):3912–3914. (In Russ.). https://www.elibrary.ru/EJQSKC
27. Fazekas I. First observation in Hungary: the *Columba palumbus* (Linnaeus, 1758) feeding on cherries (Aves). e-Acta Naturalia Pannonica. 2023;25:55–61. https://doi.org/10.5281//zenodo.8056404
28. Gorshkov PK. Columbiformes. In: Popov VA, editor. Birds of the Volga-Kama region. Non-passerines. Moscow: Nauka; 1977. P. 221–233. (In Russ.).
29. Gulay VI. Wood pigeon *Columba palumbus* (*Columbiformes*, *Columbidae*) in the anthropogenic landscape of the western forest-steppe of Ukraine. Zoological Journal. 1991;70(5):75–83. (In Russ.).
30. Prokofjeva IV. To breeding ecology of the wood pigeon *Columba palumbus*. Russian Journal of Ornithology. 2003;12(242):1245–1249. (In Russ.). https://www.elibrary.ru/ICHXGN
31. Rezanov AA, Rezanov AG. Rock pigeons *Columba livia* feed on berries of *Padus maackii*. Russian Journal of Ornithology. 2004;13(249):18–20. (In Russ.). https://www.elibrary.ru/IBZCWL
32. Rezanov AG. Feeding behavior of birds: Digital coding method and database analysis. Moscow: Izdat-shkola; 2000. 223 p. (In Russ.).
33. Andreev VA. Rock pigeons *Columba livia* eat juicy fruits of woody plants in the Arkhangelsk. Russian Journal of Ornithology. 2014;23(1063):3344–3347. (In Russ.). https://www.elibrary.ru/SXKOGN
34. Ladygin SI. Rock pigeons *Columba livia* eating apples of the Siberian crabapple *Malus baccata* in Gorno-Altaisk in winter. Russian Journal of Ornithology. 2014;23(966):408–409. (In Russ.). https://www.elibrary.ru/RTYKLD

35. Berezovikov NN, Rozenberg GV. The rock pigeon *Columba livia* eating fruits of the bird cherry *Padus avium* in Altai. Russian Journal of Ornithology. 2019;28(1819):4191–4193. (In Russ.). https://www.elibrary.ru/WTQSIW
36. Zabashta AV, Zabashta MV. Feeding of rock pigeons *Columba livia* with fruits of the common hackberry *Celtis occidentalis* in Simferopol and Rostov oblast. Russian Journal of Ornithology. 2019;29(2012):5947–5950. (In Russ.). https://www.elibrary.ru/KIGQDH
37. Rezanov AG. Feeding behavior of birds: Generalized method of description and ecological and geographical features. Dr. Sci. Biol. diss. Moscow; 2000. 417 p. (In Russ.).

ORCID IDs
Anatoly P. Kaledin https://orcid.org/0000-0002-5744-1363
Lyubov V. Malovichko https://orcid.org/0000-0003-1040-2890
Alexander G. Rezanov https://orcid.org/0009-0002-3433-7624
Lyudmila S. Drozdova https://orcid.org/0000-0003-1150-0134
Botagoz A. Kentbaeva https://orcid.org/0000-0003-0969-9754