

**THE SEX AND AGE DISTRIBUTION AS WELL  
AS THE MAJOR ANATOMO—MORPHOLOGICAL  
CHARACTERISTICS OF THE POPULATION OF  
COLLARED DOVES (STREPTOPELIA  
DECAOCTO FRIV.)**

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The present work is a continuation of research on the population dynamics of Collared Doves (*Streptopelia decaocto* Friv.) in Debrecen. In previous papers (Bozsko-Juhász, 1979, 1981) data concerning the size, density and territorial distribution of population as well as their changes through seasons and over a number of years were published. As in doves visible external sex differences are absent the sex as well as the age structure of population can be established only by means of dissection of birds. Dissection was used also in order to reveal the major morphological characteristics of the population and their dynamics over the year.

#### **Materials and methods**

The birds were obtained from the University of Agriculture in Debrecen. From autumn to late spring one part the population feeds outside the town on the territory of mixing plant of University Farm. In summer the experimental sowing provide good base for a numerous flock. The samples were taken in May, July and October 1980 resp. in January and March 1981. In all, 182 birds were examined. For comparison the data of 62 doves from granary of Nyíregyháza were processed, too (37 birds in March and 25 birds in November 1980). The doves were shot without selection, thus the samples can be regarded as representative.

For the heart examination 15 Pigeons (*Columba livia* ssp. *domestica*) were used as comparative material.

The sex, age, body weight, bill size, the heart and gonads well as moulting were established, their major indexes calculated and statistically evaluated. The data of seasonal changes of gonads as well as moulting will be published in separate paper.

The body weight was determined without the crop content that ranged in our material between 0.5 and 26.5 g.

#### **Discussion of material**

##### **1. The sex structure of population**

The sex structure of the population studied is shown in Table 1. Strikingly the proportion of two sexes varied through the year in our material. With the exception of March and July, when the birds hatched, females prevailed. This

Table 1.

Sex distribution of the population of Collared Doves in Debrecen  
*A balkánigerle-populáció ivari megoszlása Debrecenben*

Date	n	Males		Females	
		abs.	%	abs.	%
15. V. 1980	24	11	45.83	13	54.17
7. VII. 1980	29	20	68.96	9	31.04
9. X. 1980	25	9	36.00	16	64.00
23. I. 1981	50	22	44.00	28	56.00
26. III. 1981	54	29	53.70	25	46.30
In all	182	91	50.00	91	50.00

Table 2.

Sex distribution of Collared Doves per months in other towns and regions  
*A balkáni gerle havonkénti ivari megoszlása más városokban és vidéken*

Place	Date	n	Males		Females		Note
			abs.	%	abs.	%	
Nyíregyháza	3.1980	37	16	43.24	21	56.76	Author's data
	11.1980	25	15	60.00	10	40.00	
In all		62	31	50.00	31	50.50	
Bácsalmás	8.1972	234	107	45.73	127	54.27	<i>J. Rékási (1973)</i> <i>J. Rékási, pers.</i> <i>communication</i>
Bácsalmás	8-9.1976	94	63	67.03	31	32.97	
	8-9.1977	76	55	72.37	21	27.63	
	4-5.1978	33	14	42.42	19	57.58	
	8-9.1978	100	39	39.00	61	61.00	
	8-9.1979	106	24	22.64	82	77.36	
	4-5.1980	28	16	57.14	12	42.86	
	8-9.1980	63	28	44.44	35	55.56	
In all		734	356	48.50	378	51.50	
Nord-Dobrogea Rumania	1970-1980						<i>I. B. Kiss</i> <i>J. Rékási, pers.</i> <i>communication</i>
	1.	63	29	46.03	34	53.97	
	2.	82	46	56.10	36	43.90	
	3.	62	35	56.45	27	43.55	
	4.	6	3	50.00	3	50.00	
	5.	8	4	50.00	4	50.00	
	6.	6	4	66.67	2	33.33	
	8.	54	26	48.15	28	51.85	
	9.	130	64	49.23	66	50.77	
	10.	85	33	38.82	52	61.17	
	11.	23	13	56.52	10	43.48	
	12.	34	10	29.41	24	70.59	
In all		553	267	48.28	286	51.72	

fact seems to suggest that the sex ratio be shifted in favour of females. Nevertheless on the whole – on the basis of the 182 birds studied – the sex ratio was exactly a half-to-half, i. e. to 50%. The samples from Nyíregyháza showed a completely identical distribution (Table 2). Unfortunately data on the sex structure of population in this species are lacking in literature. Certain observations, however, urge further research into this question. My own notes in the field showed that occasionally some males have mated with strange females, too (Bozsko, 1978). On a greater series of birds dissected (unpublished data of Rékási and Kiss) it has been observed any change in the sex ratio toward the females predominance (Table 2). This question requires further study on a larger material by means of examination of sex ratio and determination of differentive mortality in both sexes.

## 2. The age structure of population

In case of Collared Doves it is extremely difficult to define age groups. Therefore it was necessary to take into account such morphological and anatomical features as plumage, moulting stage, body weight, size of gonads. Even so, only three age groups were distinguishable: the juvenile, subadult and adult ones.

The juvenile group included specimens that did not yet have a black stripe at the neck, their plumage was still partly in sheaths and the body weight was around 150–160 g.

The specimens classed into the subadult group had very small immature, but differentiated gonads, their plumage still bore traces of post-juvenile moulting, the body weight was generally smaller than that of adults. The determining of this group requires great circumspection in early spring when sexually immature birds from late autumn breeds still occur side-of-side with the adults which have pre-nuptial moulting and their gonads are still in refractory phase in this time.

All sexually mature and bred specimens in summer as well as fully developed ones with adult plumage and large body weight in winter were classed into adult group.

The reproductive cycle of Collared Doves in Hungary lasts from February till November, but some birds nest sporadically in winter, too. Thus the juvenile and subadult birds could be present in samples an all periods. In our material most juveniles occurred in July and early October (Table 3). The young constituted 8% in January and were wholly absent in March because of winter nesting succeeded only exceptionally. Their number was rather small in May too, when the Collared Doves suffer the most losses in breeds from Jackdaws (*Coloeus monedula*) on the territory of Debrecen (Bozsko, 1978).

The number of subadult birds did not exceed 16% from July to January and later it was reduced to null. Their low proportion can be explained partly by the settling of youngs in new places and partly by rapid sexual maturation of the remained specimens, which take place at the age of 5–6 months (Kotov, 1979).

The greater part of the population consists of adult birds. Their proportion exceeded 50% even in early autumn, but later it gradually increased and reach-

Table 3.

Age distribution of the population of Collared Doves in Debrecen  
*A balkánigerle-populáció kormegoszlása Debrecenben*

Date	n	Ad.	Subad.	Juv.
15. 5. 1980	24	11	—	—
♂ ♀		11	1	1
In all, %	100.0	91.6	4.2	4.2
7. 7. 1980	29	11	3	6
♂ ♀		6	1	2
In all, %	100.0	58.6	13.8	27.6
9. 10. 1980	25	4	—	5
♂ ♀		10	2	4
In all, %	100.0	56.00	8.0	36.0
23. 1. 1981	50	18	3	1
♂ ♀		20	5	3
In all, %	100.0	76.0	16.0	8.0
26. 3. 1981.	54	29	—	—
♂ ♀		24	1	—
In all, %	100.0	98.1	1.9	—
In all	182	144	16	22
♂	91	73	6	12
♀	91	71	10	10
%	100.0	79.1	8.8	12.1

ed 76–98% in the winter and spring months. The great degree of sexual maturity of the population promotes, in all probability, the high reproduction rate of Collared Doves.

### 3. Body weight

The data of body weight given pertain only to adult and subadult groups. As these two groups cannot be unambiguously separated from each other, we examined them together. The juvenile birds were not evaluated statistically for their small number.

The average body weight values and their seasonal dynamics are shown in Table 4. In males the lowest body weight was registered in May. Towards autumn it grew rapidly to higher values. Even minimum means in October exceeded the averages of spring and summer. In January and March the mean weight decreased somewhat (205 and 204 g respectively), but even then it remained considerably greater than in May and July. An increase of mean body weight in winter has been attested in a number of other bird species as well, like house sparrow, greenfinch, blackbird and songthrush (relying on *O'Connor*, 1975). The causes of this phenomenon are not yet clarified, but it can be associa-

Table 4.

Monthly statistics of Collared Doves weights, gramm  
*A balkáni gerle testtömegének havonkénti mutatói grammokban*

Date	<i>n</i>	$\bar{x}(g)$	$\overline{sx}$	<i>s</i>	<i>s</i> <sup>2</sup>	<i>V</i> <sub>min</sub> - <i>V</i> <sub>max</sub>
<i>Males (♂)</i>						
05. 1980	11	195.86	2.901	9.623	92.608	177.0-208.5
07. 1980	14	197.86	3.402	12.799	162.016	176.0-218.0
10. 1980	4	217.09	7.598	15.184	230.542	198.0-235.0
01. 1981	21	204.93	3.014	13.811	190.751	183.0-232.0
03. 1981	29	203.89	2.233	12.026	144.632	188.0-232.0
<i>Females (♀)</i>						
05. 1980	12	190.09	2.771	9.189	84.441	170.0-196.0
07. 1980	7	194.00	3.854	10.198	104.000	178.0-203.0
10. 1980	12	199.90	2.806	9.720	94.472	181.2-212.0
01. 1981	25	195.64	2.461	12.303	151.356	172.0-224.0
03. 1981	25	202.67	2.485	11.916	141.988	177.3-223.0

ted primarily with increasing moulting. In Collared Doves, a change of food causes also weight uprising. From autumn on, after green food the Doves switch over to dry maize full of energy. In this time the flocks of birds cluster around granaries. In Debrecen their food basis is so good that even in the coldest months Collared Doves do not suffer from hunger. The birds dissected showed no signs of weight loss or illness.

Nearly the same body weight dynamics can be observed in females. The difference between the two sexes was conspicuous only in March, when – in comparison with January – the weight of males decreased by 1 g in average, while that of the females reached the maximum and approached that of males (Table 4). The weight increase of females in spring is usually explained by the development of the ovary and the appearance of eggs in it (O'Connor, 1975). To prove this we compared the difference of mean ovary weight and those of the average body weight from January to March. During the two months the average weight of ovaries increased in our material to the 5,5-fold and its minimum exceeded considerably the mean value for January, but in absolute terms this gain amounted only to 0,5 g in average. In the maximum variant (*V*<sub>max</sub>), when there was formed egg yolk the weight of the ovary amounted to 2 g only (Table 5). Thus the increase of the mean body weight in our sample by 7 g

Table 5.

The weight of ovaries in Collared Doves from January to March  
*A balkáni gerle ováriumtömege januárban és márciusban*

Month	<i>n</i>	$\bar{x}(g)$	$\overline{sx}$	<i>s</i>	<i>V</i> <sub>min</sub> - <i>V</i> <sub>max</sub>
27. 01. 1981	28	0.101	0.006	0.032	0.029-0.150
23. 04. 1981	21	0.548	0.092	0.423	0.231-2.002

seems to be caused not so much by the presence of ripe eggs in the ovarius, but in a greater degree by the accumulation of substances necessary for the ripening of eggs. Recent literature data confirm this conclusion (*Murton-Westwood, 1977*).

The seasonal differences in mean body weight proved to be statistically significant (*t*-test) in males between May and January, in females between May and October as well as May and March.

Sexual differences in body weight, which have been observed in every sample, are worth mentioning, too (Table 4). In the material as a whole these differences (males 200,38 g, females 197,77 g, *t*-test = 1,66) are less striking.

#### 4. The bill

The outer appearance of the bill serves often as an indicator of sexual dimorphism. As known the bill size changes throughout life: it grows some time but in old specimens the wear may modify its average size.

In the present study adult specimens were exclusively used ( $n = 49:23 \text{ ♀}$  and  $26 \text{ ♂}$ ). One of the chief aim of the study was to reveal the sexual differences in the form of the bill. The length and width of the bill and their ratio were established. The bill ratio related to the mass of body forme the bill index. The index so received was examined in each body weight category. The results summarized in Table 6. show that the lenght of bill is virtually the same in both sexes without significant differences. The bill width in males and females differ even less. Therefore, bill size does not show sexual dimorphism. Similarly, no differences were observed in the length/width ratio between the two sexes. The only difference was that the maximum values of bill length and bill width generally occurred in males, while those closer to the minimum values were more characteristic of females.

Table 6.

*Bill parameters of Collared Doves  
A balkáni gerle csörméreteinek jellemzői*

Parameters	<i>n</i>	$\bar{x}$	$\overline{sx}$	<i>s</i>	$V_{\min}-V_{\max}$
Bill length, mm ♂ ♀	26	16.29	0.158	0.807	14.5–18.6
	23	16.36	0.132	0.634	15.4–18.0
Bill width, mm ♂ ♀	26	6.22	0.106	0.543	4.7– 7.0
	23	6.23	0.124	0.595	5.0– 7.0
Bill length/ width relatio ♂ ♀	26	2.634	0.059	0.305	2.28–3.95
	23	2.649	0.072	0.348	2.2 –3.6
Bill index ♂ ♀	26	1.312	0.035	0.180	1.00–2.005
	23	1.321	0.043	0.210	1.083–1.914

Table 7.

Bill characteristics of Collared Doves according to body weight categories  
*A balkáni gerle csőrjellemezői testtömeg-kategóriánként*

Body weight categories		Mean bill width, mm		Mean bill length, mm		Mean bill ratio		Mean bill index	
		♂	♀	♂	♀	♂	♀	♂	♀
Below 180 g	<i>n</i>	1							
	$\bar{x}$	6.8		16.5		2.42		1.45	
	<i>s<sub>x</sub></i>								
180–200 g	<i>n</i>	11	9	11	9	11	9	11	9
	$\bar{x}$	6.07	6.03	16.28	16.52	2.72	2.77	1.42	1.40
	<i>s<sub>x</sub></i>	0.21	0.21	0.33	0.21	0.13	0.12	0.06	0.06
	<i>s</i>	0.687	0.638	1.076	0.628	0.436	0.403	0.210	0.166
200–220 g	<i>n</i>	11	12	11	12	11	12	11	12
	$\bar{x}$	6.23	6.36	16.37	16.18	2.63	2.57	1.27	1.24
	<i>s<sub>x</sub></i>	0.12	0.16	0.20	0.19	0.04	0.09	0.02	0.05
	<i>s</i>	0.374	0.575	0.649	0.650	0.121	0.320	0.076	0.156
Above 220 g	<i>n</i>	3	2	3	2	3	3	3	2
	$\bar{x}$	6.57	6.45	15.96	16.75	2.63	2.57	1.07	1.17
	<i>s<sub>x</sub></i>	0.23	0.35	0.09	0.25	0.08	0.10	0.04	0.04
	<i>s</i>	0.404	0.495	0.153	0.353	0.134	0.141	0.068	0.054

In relation to body mass the width of bill increases linearly with weight. A maximum width occurs in males, in accordance with the maximum value of weight in them.

Within the body category of 190–220 g bill length shows a change in a positive direction, but in males above 220 g a decrease of bill length could be observed. This may be probably indicative of the bill wear, although it cannot be unambiguously proved ( $n = 3$ ).

The length/width ratio of bill present a picture about shape of the bill. It was interesting to compare this parameter with the size of body. This index did not differ significantly by sex (Table 7). The changes of bill index according to body weight were followings. The highest value was found in the category of under 180 g. With further weight increasing the values of index became more and more reduced and the lowest one was found in the category of above 220 g. Thus, the bill size in adult birds is in inverse linear ratio to body mass.

## 5. The heart

The size of heart is species-specific feature whose absolute and relative means are modified in course of the ontogenesis, differently in nidifugous and insessorial birds (Shwarc, 1949, 1956). The weight of heart in adult birds does not change as a function of the nourishment or the season. Within one species, however, there are population differences in heart index (Hesse, 1924; Shwarc, 1949, 1956, 1958).

Until now data concerning the heart of Collared Doves are lacking. Our study extended over a sample from January 1981 ( $n = 39:18$  ♂ and 21 ♀) and one

Table 8.

*Heart mass and heart index of Collared Doves in the Debrecen population*  
*A balkáni gerle szívtömege és szívindexe a debreceni populációban*

Sex	Date	Weight of heart mass					Heart index			
		<i>n</i>	$\bar{x}$	$s\bar{x}$	<i>s</i>	$V_{\min}-V_{\max}$	$\bar{x}$	$V_{\min}-V_{\max}$	$C_v$	<i>t</i>
♂	0.1 1981	18	2.424	0.070	0.296	2.006-2.945	1.20	1.09-1.39	12.2	3.47
	03. 1981	20	2.652	0.047	0.209	2.247-3.008	1.31	1.11-1.49	7.8	
	Average	38	2.570	0.044	0.269	2.006-3.008	1.25	1.03-1.49	27.4	
♀	01. 1981	21	2.263	0.051	0.233	1.779-2.866	1.18	0.99-1.32	10.3	6.26
	03. 1981	17	2.838	0.058	0.259	2.239-3.085	1.43	1.28-1.60	8.4	
	Average	38	2.520	0.060	0.371	1.779-3.085	1.32	0.99-1.60	32.1	

from March ( $n = 36$ : 19 ♂ and 17 ♀), 75 specimens in all. The statistical means of heart weight, the heart index and its variation coefficients were determined and analysed by *t*-test (Table 8).

The heart weight of Collared Doves ranged between 2.0-3.0 g in both sexes. Values lower than 2.0 g occurred only in three cases and exclusively in females. The mean heart weight of both sexes are nearly the same (Table 8) what is in accordance with the statement of *Shwarc* (1949). The individual variability ( $C_v$ ) of heart reached 7.8-12.3% in males and 8.4-10.3% in females, what means 0.15-0.30 g in reality.

The relative weight of heart - the heart index - amounted to 1.26% and 1.32% in males and females respectively, what is surprisingly low in comparison with other birds, even of similar body size where it ranges between 6-16%, but in *Vanellus vanellus* and *Fulica atra* it reaches 23.4% and 26.9% respectively (*Shwarc*, 1949).

The heart index of Collared Doves is almost identical with that of Domestic Pigeon, what reached 1.29% in our material ( $n = 15$ ) and ranged between 1.11 and 1.55%. The lowest index was observed in immature specimens. The variability of the heart index of Pigeons published (*Simous*, 1960; *Sturkie*, 1972) varied between 1.02 and 1.38% and was probably connected with the age or body mass differences of various genetical stocks measured. But the great similarity between the heart indexes of Collared Doves and Pigeons assumes that a heart index around 1.0-1.5% is characteristic of several genera of Columbidae firmes and is probably also an order-specific anatomical feature.

A notifiable deviation in the heart weight was registered in our material in March. The heart weight average of males were then by about 10% higher than in January. The value of heart index rose significantly too ( $t = 4.69$ ), and its variability ( $C_v$ ) decreased to 7.8% proving its authenticity (Table 8). Even greater changes were found in females, where the heart index increased more than 25%. The heart index differences were also highly significant ( $t = 6.26$ ) and its variability was 8.4%. It cannot be asserted that the rise of heart index followed body weight gain as in this month average body weight decreased by 1 g in males and increased by 7 g in females. Besides this it is proved that the heart weight does not fluctuate with body weight changes. Not any case of heart obesity was found during the dissections. The increase of the mean body weight in March can be partly explained by maturation of subadult birds which, to so-

me extent, makes the higher values of heart weight more understandable. On the other hand, it is not excluded that strange migrating birds with different habit may got into the sample. This question requires further study.

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### A balkáni gerle (*Streptopelia decaocto* Friv.) populáció ivar- és koreloszlása, valamint fontosabb anatómo-morfológiai jellemzői

*Dr. Bozsko Szvetlana*

Jelen munka Debrecen balkáni gerle populációdinamikai kutatásának (*Bozsko–Juhász, 1979, 1981*) a folytatása. 1980. V. és 1981. III. között öt alkalommal, összesen 182 madarat vizsgáltunk meg.

1. A populáció ivarmegoszlása az év folyamán változó volt (1. táblázat), de az összességben 50–50%-osnak bizonyult.

2. Kor szerint csak juvenilis, szubadult és adult csoportok voltak elkülöníthetők. A legtöbb juvenilis madár nyár közepén és ősz elején fordult elő, télen arányuk jelentősen csökkent, márciusban pedig már hiányoztak a mintából, ami gyors ivarérésükkel áll kapcsolatban. A májusi kis számuk (3. táblázat) a városi csókák fészekről tevékenységével magyarázható, ami általános jelenség Debrecenben. A populáció nagyobbik része adult példányokból áll, arányuk nyáron 50%, de téli és tavaszi hónapokban eléri a 76, ill. 98%-ot. Ez a balkáni gerle gyors ivarérését és részben a fiatalok elvándorlását tükrözi.

3. A testtömeg megállapítása begyártalom nélkül történt. Csak adult és szubadult madarak adatai kerültek közlésre.

A testtömeg átlagaiban jellegzetes évszaki dinamika mutatkozott (4. táblázat). A hímek és a tojók testtömege májusban volt a legkisebb, októberben pedig kiugróan nagy lett, ami ennél a fajnál nem csak a vedlésnek, hanem az őszi táplálékváltásnak is köszönhető. A zöld táp után őszi elején a balkáni gerle áttér a száraz, energiadús kukoricamagra, amelyet bőségesen szedhet a magtáraknál. A tavaszi és az őszi testtömeg-differenciák szignifikánsnak bizonyultak (*t*-próba pozitív). Márciusban a tojók átlagosan 7 grammal súlyosabbak voltak, mint januárban, testtömegük megközelítette a hímekét. Ez a gyarapodás nem magyarázható pusztán a tojás megjelenésével, mivel az ovárium átlagtömege két hónap között csak 0,5 grammal nőtt (5. táblázat). A tojók tavaszi testtömegátlagainak emelkedését az adott mintában inkább a tojáséréshez szükséges anyagok felhalmozódása okozhatta. A testtömeg ivari különbségei minden egyes mintában jól érzékelhetők (4. táblázat), de összesített anyagban ezek kevésbé feltűnőek (hímek 200,38 g, tojók 197,77 g, *t*-próba 1,66).

4. A balkáni gerle csőrhosszúsága, ill. -szélessége, valamint ezek aránya nem mutatott biztos ivardifferenciát. Egyedül az állapítható meg, hogy a maximális értékek általában hímeknél fordulnak elő, a minimális pedig a tojóknál (6. táblázat). A csőr szélessége a test gyarapodásával lineárisan nő, a csőrhossz 180–220 g-os kategórián belül pozitív irányú változást mutatott, de a 220 g feletti hímeknél a csőrhossz csökkent. A csőrméretek aránya a testtömeghez viszonyítva a csőrindexet képezi. A csőrindex sem mutatott szignifikáns ivarkülönbségeket. A legnagyobb értékek a 180 g alatti kategóriában figyelhetők meg. További testnövekedéssel az index értéke csökken, és legkisebb a 220 g feletti csoportban (7. táblázat). Az adult madaraknál a csőrméret relatív értéke fordított lineáris arányban van a testtömeggel.

5. A balkáni gerle szívtömege mindkét nemnél 2–3 g között van (8. táblázat). A szívindex átlagai 1,26% a hímeknél, 1,32% a tojóknál. A balkáni gerle relatív szívtömege nagyon kicsi más madárfajokhoz képest, de majdnem azonos, mint a házi galambé (*Columba livia* ssp. *domestica*). Méréseink szerint a házi galamb szívindex-középpatlaga 1,29 (*n* = 15). Elképzelhető, hogy a szívindex 1,0–1,5 közötti értéke a *Columbidae* rend specifikus bélyege. A balkáni gerle debreceni populációjában lényeges szív-tömeg- és szívindex-átlageltérések mutatkoztak március hónapban (8. táblázat). A hímek szív-tömege átlagosan 10,0%-kal, a tojóké 25,0%-kal növekedett a januárhoz viszonyítva. Erősen szignifikáns változás történt a két nem szívindexmutatójában is (*t*-próba: hímeknél 4,69, tojóknál 6,26). A szívmutatók változása nem függött lineárisan a testtömeg növekedésétől. Feltételezhető, hogy az észlelt jelenség részben a sub-adult példányokérésével állt kapcsolatban, de nincs kizárva, hogy más habitust mutató vonuló madarak kerültek a mintába.

Ez a jelenség további ellenőrzést kíván.

\*

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