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# **A study of feral pigeon *Columba livia* var. in urban and suburban areas in the city of Jena, Germany**

L. M. Ferman, H.–U. Peter & D. Montalti

Ferman, L. M., Peter, H.–U. & Montalti, D., 2010. A study of feral pigeon *Columba livia* var. in urban and suburban areas in the city of Jena, Germany. *Arxius de Miscel·lània Zoològica*, vol. 8: 1–8, <https://doi.org/10.32800/amz.2010.08.0001>

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## **Abstract**

*A study of feral pigeon Columba livia var. in urban and suburban areas in the city of Jena, Germany.*— A population of feral pigeons, *Columba livia* var. was conducted in the city of Jena, Germany, from July to December 2007. Daily censuses were conducted by walking ten transects in a selected area of the city, five transects in built up areas and five in the suburbs. Pigeon population density was higher in urban areas than in suburbs but differences were not significant. Main behavioural activities recorded were resting, preening, flying, eating, sunning and roosting. Regular locations of activities were rooftops and roof edges in urban areas, and rooftops, eaves on balconies in suburban areas. The plumage phenotype most frequently recorded in both areas was Blue bar.

Key words: *Columba livia* var., Feral pigeons, Urban birds, Jena city, Germany

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## **Resumen**

*Un estudio sobre la paloma doméstica Columba livia var. en la ciudad de Jena, Alemania.*— Se estudió una población de palomas domésticas, *Columba livia* var. en la ciudad de Jena, Alemania, entre julio y diciembre de 2007, mediante censos diarios en diez transectos de un sector de la ciudad, cinco en áreas urbanas y cinco en áreas suburbanas. La densidad poblacional de palomas en las zonas urbanas resultó mayor que en las zonas suburbanas, aunque no se encontraron diferencias significativas entre ambas áreas. Las actividades de comportamiento registradas por las palomas fueron de descanso, de mantenimiento del plumaje, de vuelo, alimentación, baños de sol y elección de lugares donde posarse. Las actividades se producen en lugares como tejados altos y aleros de edificios en zonas urbanas y tejados y aleros de balcones en zonas suburbanas. El fenotipo de plumaje más abundante para ambas áreas durante el periodo del censo fue Blue bar.

Palabras clave: *Columba livia* var., Paloma doméstica, Aves urbanas, Jena, Alemania

*Rebut: 11/01/2010; Acceptació condicional: 18/02/2010; Acceptació definitiva: 27/05/2010*

*Laura M. Ferman*<sup>(1)</sup> & *Diego Montalti*<sup>(2)</sup>, CONICET–UNLP, Ornithology Section, Fac. of Natural Sciences and Museum, Paseo del Bosque s/n., B1900FWA–La Plata, Buenos Aires, Argentina.– *Hans–Ulrich Peter*<sup>(3)</sup>, Polar & Bird Ecology Group, Friedrich–Schiller Univ., Jena, Germany.

<sup>(1)</sup>E–mail: [lauferman2002@yahoo.com.ar](mailto:lauferman2002@yahoo.com.ar)

<sup>(2)</sup> E–mail: [dmontalti@arnet.com.ar](mailto:dmontalti@arnet.com.ar)

<sup>(3)</sup>E–mail: [Hans–Ulrich.Peter@uni–jena.de](mailto:Hans-Ulrich.Peter@uni-jena.de)

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## Introduction

Pigeons were originally found wild in Mediterranean bordering countries, on coasts and cliffs of Europe, North Africa, and Western Asia. They were later introduced and colonized in North, Central and South America and all over Europe (Baptista et al., 1997) in both tropical and temperate regions (Gompertz, 1957; Goodwin, 1954, 1960). They are now distributed worldwide and live mainly in urban environments (Haag–Wackernagel, 1998, 2003) where they cause health problems for humans and domestic animals, carrying virus, bacteria, fungi, protozoa and parasites (Cena et al., 1989; Cerri et al., 1989; Baldaccini, 1991; Straff et al., 2001; Trovnick et al., 2002; Haag–Wackernagel & Spiewak, 2004), and damage buildings and monuments (Johnston & Janiga 1995, Haag–Wackernagel, 1998).

The species has a large range, with an estimated global occurrence of ten million km<sup>2</sup>. The European breeding population has been estimated at 17–28 million individuals (BirdLife International, 2004). Several studies have estimated city populations, with results showing, for example, 103,650 birds averaging 570 ind/km<sup>2</sup> in Milan (Sacchi et al., 2002), and 14,200 individuals averaging 44 birds x 10<sup>-1</sup> ha in Gdansk, Poland (Hetmanski & Jarosiewicz, 2008). A census for Barcelona city in 1990 reached 183,887 ± 14,914 and a density of 2,849 ± 231 ind/km<sup>2</sup> (Sol & Senar, 1995) but more recent research estimated 270,743 ± 36,815 (Senar et al., 2009).

This present work is the first study of *Columba livia* var. in the city of Jena, Germany, and it reports on a daily census of behavioral activities, plumage phenotypes and breeding data at urban and suburban areas.

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## Materials and methods

The study was carried out from July to December 2007 in Jena city, Germany (fig. 1) (50° 55' N, 11° 34' S). In an attempt to estimate the *Columba livia* population in the city, we chose a delimited area, including the built up centre and suburban areas. Five suburban east–west transects were defined and measured as followed: 1.28 km, 1.32 km, 0.46 km, 0.40 km, 0.39 km, with 0.25–0.35 km approximately between transects, occupying a total of 3.85 km<sup>2</sup> suburban area. Another five urban north–south transects were also measured: 1.02 km, 0.70 km, 0.80 km, 0.37 km, 0.40 km occupying a total area of 3.29 km<sup>2</sup>. Censuses were conducted using binoculars and digital camera four to five days per week. We recorded both stationary and moving birds in the transect dimension, two hours before and after midday following Uribe et al. (1984), Senar & Sol (1991), Montalti & Kopij (2001). Pigeon density (individuals per km<sup>2</sup>) was calculated from the census transects per area. Urban areas were characterized by high buildings, churches, cafés and food shops, buses and cars. Such buildings resemble rocky sea cliffs, an ideal synantropic environment for feral pigeon settlement. Suburban areas consisted of residential houses, few shops and little traffic.

Behavioural activities were recorded using binocular observation on daily census while walking on street transects. We registered resting, preening, sunning, eating, flying, nesting, roosting, drinking, sleeping, perching, and mating.

Plumage phenotypes were recorded using binoculars, camera and bird guides on daily census from July to December. These data were later classified per month and per area (Goodwin, 1970; Murton et al., 1973, 1974; Johnston & Janiga, 1995; Miller, 1997).

Breeding activity was measured monthly (seven visits) at the tower of Lobeda locality (50° 52' N, 11° 35' E), 7 km from Jena. The tower contained twenty experimental wooded nest boxes occupied by pigeons where we classified bird stages. At Jena, breeding was measured on transects by registering nesting on walking census in both areas.



Fig. 1. Location of the city of Jena, in Thuringia region, eastern Germany.  
 Fig. 1. Ubicación de la ciudad de Jena en la región de Turingia, Alemania.

## Results

Feral pigeons density during census was higher in urban transects,  $730 \text{ ind/km}^2 \pm 199$  with a total number of individuals of 2,377 (61%), than in suburban transects,  $392 \text{ ind/km}^2 \pm 205$ , with a total number of 1,510 (39%) pigeons. (fig. 2). However, differences between the two areas were not statistically significant ( $\alpha = 0.05$ ;  $F = 1.52$ ;  $p > 0.24$ ). A  $t$ -test, considering different variances analysis, showed no significant differences ( $p > 122$ ;  $t > 1.23$ ). Mean values of pigeons per transect were 396 in urban areas and 251 in suburban areas.

*Columba livia* behavioural activities were registered on transects in both areas. Comparison of pigeon activities showed no significant differences between urban and suburban areas in any month except December ( $\alpha = 0.05$ ;  $F = 7.33$ ) (table 1, fig. 3).

Plumage phenotypes were Blue bar (Bb,  $N = 542 \pm 44$ ), B Checker (Bche,  $N = 169 \pm 20$ ), T Checker (Tche,  $N = 91 \pm 8$ ) Blue Dark (Bdark,  $N = 29 \pm 6$ ) Brown bar (BBrown,  $N = 31 \pm 5$ ) and B Light (Blight,  $N = 16 \pm 2$ ) (fig. 4). Comparison of months to detect differences in coloration patterns revealed no significant differences using ANOVA analysis. The most abundant plumage phenotype was B bar: 56% in July, 71% in August, 60% in September, October and November, and 56% in December.

Breeding activities in both localities and areas were performed by checking presence of birds, nesting and mating (table 1) and registering number of adults  $N = 12 \pm 2$ , fledglings  $N = 10 \pm 1$ , small chicks  $N = 6 \pm 1$ , eggs  $N = 13 \pm 1$ , and number of active  $N = 25 \pm 2$  and non-active nests  $N = 13 \pm 2$ . Variance analysis showed no significant differences between these bird stages at the tower (fig. 5).

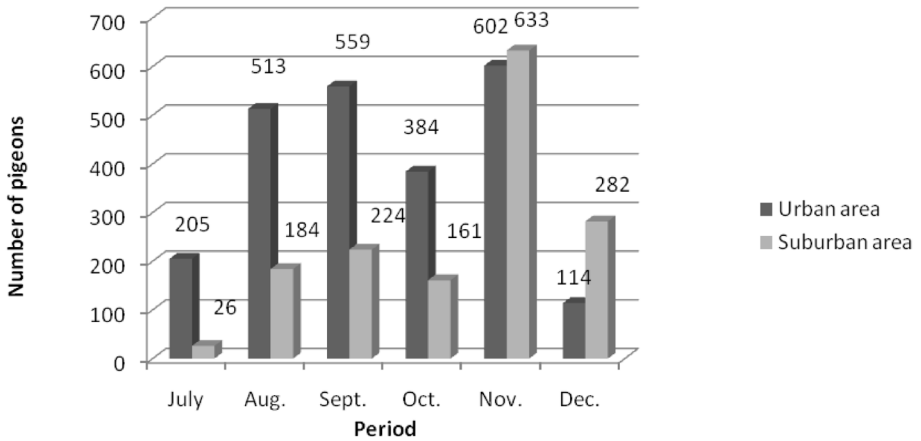


Fig. 2. *Columba livia* population during census period in urban and suburban areas, Jena 2007.

Fig. 2. Población de *Columba livia* durante el censo en zonas urbanas y suburbanas de Jena, 2007.

Table 1. Total pigeon number per area per activity from July to December 2007 in Jena city, Germany.

Tabla 1. Número total de palomas según la actividad o el área desde julio a diciembre en la ciudad de Jena, 2007, Alemania.

Activities	Urban areas		Suburban areas		Total
	Location	Location	Location	Location	
Resting	518	Roofs, buildings	154	House roofs, eaves	672
Preening	170	City roofs	80	House roofs	250
Flying	178	Over the city	71	Over suburban neighbourhood	249
Eating	224	Near cafés, food shops, fast food shops	19	in gardens, near Food industries	243
Sunning	160	Sunny side of buildings, roofs	48	Roofs, houses, gardens	208
Roosting	95	Roofs, building edges	47	In trees, on house eaves and ledges	142
Nesting	59	Attics, building edges, air-conditioning apparatus	19	House eaves and ledges	78
Perching	30	Buildings, balconies	19	House roofs, factory edges	49
Drinking	12	Water systems, drainage systems	7	Ponds, river banks	19
Sleeping	17	Building edges, on street poles	1	House eaves, ledges, balconies	18
Mating	1	On building edges	6	House roofs	7

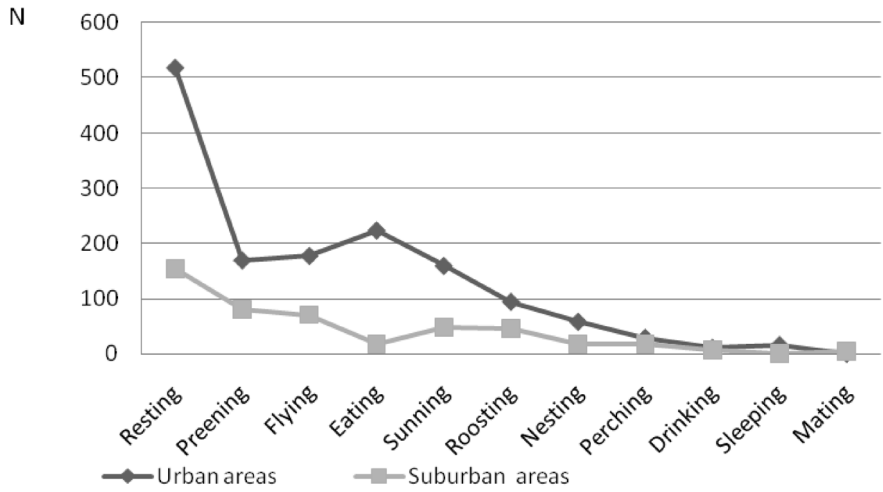


Fig. 3. Number of pigeons in urban and suburban areas discriminated by activities during census period, Jena, 2007, Germany.

Fig. 3. Número de palomas según las actividades de comportamiento en zonas urbanas y suburbanas, Jena, 2007, Alemania.

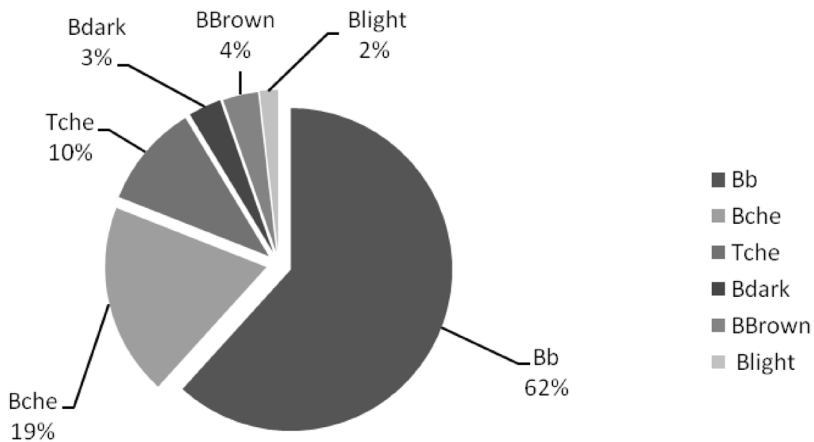


Fig. 4. *Columba livia* plumage phenotypes total values and percentages during total census in the study area, Jena, 2007.

Fig. 4. Porcentajes y valores totales de fenotipos de plumaje de *Columba livia* durante los censos en el área de estudio, Jena 2007.

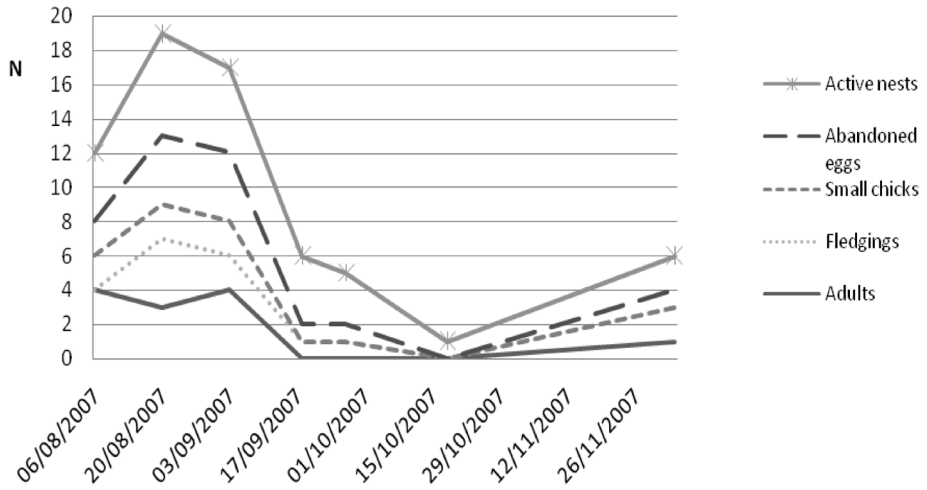


Fig. 5. *Columba livia* breeding stages displayed at the water tower (Lobeda).

Fig. 5. Estadios reproductivos de *Columba livia* registrados en la torre de agua (Lobeda).

## Discussion

Feral pigeon urban density was higher than suburban density but differences were not statistically significant. Urban areas were characterized by high buildings that were architectonically favourable for pigeon settlement: old, grey, abandoned, rocky-walled churches and some empty domes were favoured. In suburban areas they favoured greenish landscape, low houses. Differences in population density were expected between areas but lack of significant findings may be due to the boundaries chosen. Jena may not correspond structurally to a classical European gothic city. The city was largely rebuilt after World War II, leaving a mix of old centre patches in the middle of suburban neighbourhoods. To find differences between areas it could be interesting to conduct a study comparing the outer city with a suburban area.

Blue bar (62%) was the most abundant plumage followed by Checker (19%) and T Checker (10%). The study of a probable phenotype-dependent selection in an urban environment such as Vienna showed that natural distribution was 30% of Blue bar and 28% of Blue Checker. Bird activities were similar in both areas without significant changes.

## Acknowledgements

L. M. J. wishes to thank the supervisor at the Polar & Bird Ecology Group in Jena for educational and logistical material and for constant support during her DAAD grant stay. Thanks also to DAAD and the Spanish Ministry of Education, Science and Technology for fellowship support, and CONICET.

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