

Research Article

Cities favour the recent establishment and current spread of the Eurasian collared dove *Streptopelia decaocto* (Frivaldszky, 1838) in Dominican Republic

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Abstract

The Eurasian collared dove *Streptopelia decaocto* (Frivaldszky, 1838) spread over the world in the last century. Its presence in America started in the Caribbean islands in the 1970s due to an accidental escape, but the establishment of this non-native species in Dominican Republic (La Hispaniola Island) remains unclear despite of the existence of recent records and its presence in nearby countries since decades ago. We combined citizen science data (compiled in eBird) together with a large-scale survey conducted in 2017 (travelling approximately 2,150 kilometers across the main habitats of the island) to ascertain the current invasion status of the species in Dominican Republic. Our results indicate that the species probably colonized -or was introduced into- the island in 2002, being now well established in cities distant up to 270 km far from the city where it was firstly recorded. The current spatial distribution and recent exponential increase in the number of individuals recorded suggest that the spread to more cities and even natural habitats is likely to occur in the near future. Further research is needed to assess its possible impacts on native biodiversity.

Key words: Caribbean, avian invasions, urban ecology, alien species, population dynamics

Introduction

The Eurasian collared dove *Streptopelia decaocto* is a granivorous, medium-sized (body length c. 32 cm, body mass 125–240 g) pigeon (Aves, Family Columbidae). It is a gregarious species that builds stick nests in trees, laying two eggs and usually producing three to four broods per year (Cramp 1985). This species is one of the best avian colonizers. Originally distributed in temperate and subtropical Asia, it expanded during the last century all over Europe, North Africa, China, Mongolia, North and South Korea, and Japan (Lever 2005). The colonization of America presumably began in 1974 with an unintentional escape of no more than 50 individuals in the Bahamas (Smith 1987). Moreover, the presence of this species in some islands of the Lesser Antilles was probably caused by another release at Guadalupe (Barré et al. 1997). By the early 1980s the species

was already recorded in Florida and Cuba (Hengeveld 1993), reaching in a few decades the west coast of the United States and spreading to Mexico, Belize, Costa Rica, the northern United States and the south of Canada (Romagosa 2002; Sullivan et al. 2009).

Although the Dominican Republic (in La Hispaniola Island) seems suitable for the invasion by Eurasian collared doves, the species was not recorded there until four decades after its introduction in the nearby Caribbean islands. At least one pair was recorded in Playa Bávaro in 2005, and 12 individuals (including one juvenile) were recorded in Punta Cana in 2006, both sited in the Eastern corner of Dominican Republic (Dhondt and Dhondt 2008). However, the three most recent books on the birds of Dominican Republic (Raffaele et al. 2003; Latta et al. 2006; Arlott 2010) did not mention the presence of this species in the country, thus making its establishment as a non-native species uncertain. Here, we tried to ascertain

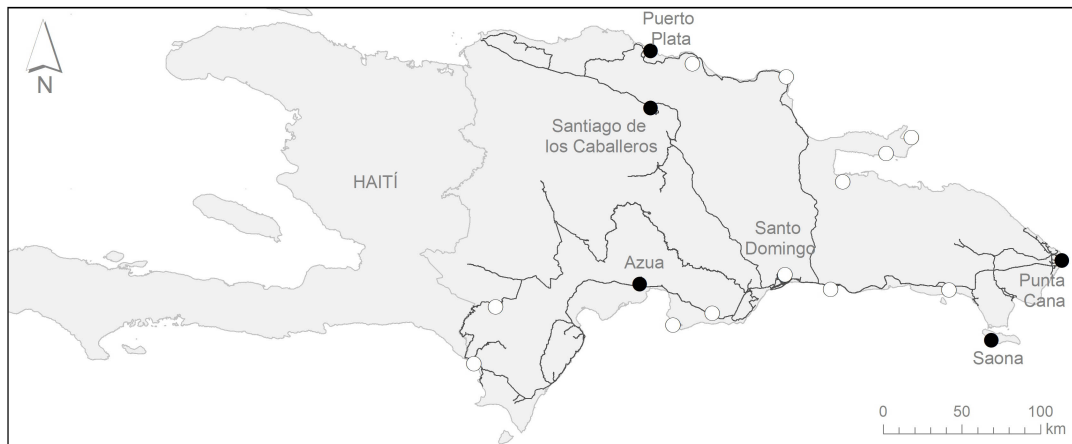


Figure 1. Map of the Dominican Republic including the roadside transects surveyed (black lines, totaling 2134.5 km), the records of Eurasian collared doves obtained by members of this expedition (black dots), and locations with records registered on eBird (white dots). eBird also provided records of the species for Puerto Plata, Santiago de los Caballeros, Azua and Punta Cana (marked with black dots).

the current invasion status of the Eurasian collared dove in Dominican Republic by combining citizen science with an expedition conducted in 2017 across the country.

Methods

Study area

Dominican Republic (17°36'–19°58'N; 68°19'–72°01'W) is located on the central area of the Caribbean Sea, covering two thirds of La Hispaniola Island. This country has the largest variety of ecosystems in the region, due in part to its mountainous relief. The distance to closest countries with Eurasian collared dove populations are 400 km East to Puerto Rico and 850 kilometers West to Cuba.

Records compilation

We combined citizen science with an exhaustive field survey to ascertain whether the Eurasian Collared dove is established on the island and where the species is located. We extracted from eBird (Sullivan et al. 2009) the information for all the sightings recorded on the island until June 2017. Information from citizens may be however biased towards the more touristic areas (especially coastal cities with residential areas and beaches) and a few birdwatching “hotspots” of the country. To avoid this potential caveat, which could mask the actual geographic distribution and use of habitats by the species, we conducted a large-scale roadside survey in June 2017. One of the authors (AL) travelled throughout the country in June 2016, gathering information on the distribution of habitats

across the island. Later on, we used recent satellite maps for selecting a network of secondary, mostly unpaved roads to survey both Eurasian collared doves and parrot species (Authors, in prep.). This road network tried to evenly cover natural habitats as well as agricultural land and urban areas throughout the country, and was plotted on paper maps and uploaded on a portable GPS.

We then conducted the field survey from June 6 to June 21, 2017, with 2,143.5 km surveyed (Figure 1). Surveys were conducted by 3–4 persons driving a car at low speed (10–25 km/h) in the morning and afternoon, avoiding the central hours of the day, when birds are less active, and bad weather. Roads were surveyed only once to avoid pseudoreplication. Habitats crossed through the roadside surveys were grouped into the main habitats of the island: 1) coniferous forests, 2) tropical rainforests, 3) tropical dry forests, 4) farmland, 5) towns and villages, and 6) large cities. We stopped every time the species was detected to record the number of individuals, habitat used, and geo-referencing the site. Eurasian collared doves are easily detectable, perching conspicuously on trees, poles and fences and flying in open spaces. Moreover, all the authors were much familiarized with this species since it is widespread and abundant in their country (Spain).

An index of the relative abundance of the species in each habitat was obtained as the number of individuals recorded divided by the number of km surveyed. This standard methodology and index of relative abundance have been used to survey a variety of medium- to large-sized bird species (e.g., Carrete et al. 2009; Tella et al. 2013, 2016).

Table 1. Relative abundance of Eurasian collared doves in each city and km surveyed in each of them.

City	km surveyed	Individuals	number of individuals / km	Coordinates
Azua	19.09	2	0.104	18.455877N -70.733849W
Punta Cana	86.36	2	0.023	18.566461N -68.354306W
Puerto Plata	22.38	41	1.832	19.792577N -70.692167W
Santiago	94.94	47	0.495	19.466620N -70.700407W

Results

Information extracted from eBird revealed 215 records of the species in 16 localities of Dominican Republic (Figure 1, Table S1). These records summed to a minimum of 549 individuals (some records did not provide the exact number of individuals observed, see Table S1). It is remarkable that one individual was recorded in Punta Cana in 2002 (Table S1), three years before the first record registered in the scientific literature. Most observations of the species (95% of the records and 96% of the individuals) were obtained in urban areas, mostly in coastal cities (Table S1, Figure 1).

Our large-scale survey confirmed the pattern suggested by eBird records. We only recorded the species in four cities (Figure 1), in addition to a previous record obtained by a member of our expedition in 2016 in an urban area of Saona Island (Figure 2). That was the first record of the species in this small 110-km² island with only 500 inhabitants, located to the south-east of the country. The highest relative abundances of the species were obtained in Puerto Plata and Santiago (Table 1), cities sited to the North of the island and about 270 km far from Punta Cana (Figure 1), where the first individuals were observed 15 years ago. During our expedition, we did not see any individual out of large cities, or even in other humanized areas that are considered as typical habitats for the Eurasian collared dove across its worldwide distribution, despite of the high and comparable survey effort devoted to all the main habitats present in the country (Table 2).

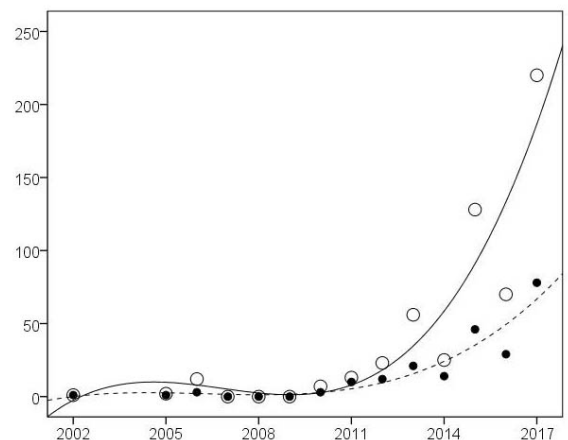
Data provided by eBird, which should be comparable across time, suggest an exponential increase of the population in recent years (Figure 3).

Discussion

Considering the nearly absent published information on the Eurasian collared dove in the Dominican Republic (Raffaele et al. 2003; Latta et al. 2006; Dhondt and Dhondt 2008;; Arlott 2010) and data compiled here, it seems highly probable that the species appeared on the island just about 16 years ago (in 2002). It is unknown, however, whether the

Table 2. Number of observations of Eurasian collared doves in each habitat and km surveyed in each one of them.

Habitat	km surveyed	individuals
farmland	375.39	0
city	370.34	92
coniferous forest	108.64	0
town and village	509.38	0
tropical rainforest	314.46	0
tropical dry forest	465.29	0
TOTAL	2143.5	92

**Figure 2.** Eurasian collared dove (*Streptopelia decaocto*) perched on a TV antenna in Saona Island (photograph taken by Alvaro Luna).**Figure 3.** Temporal trends in the number of records (black dots, discontinuous line) and number of observed individuals (white dots, continuous line) of Eurasian collared doves in Dominican Republic reported in eBird. Lines are cubic fits to data.

species was introduced by people or naturally colonized the Dominican Republic from the nearby islands or the continent. Our results also show that the species is currently well established in several localities and has spread far from the initial first record in Punta Cana.

Several Eurasian collared dove local populations seem to be mostly established in Dominican Republic cities. As for other non-native and native bird species, the colonization of cities and flourishing of large populations there may be favored by the scarcity of predators (Rebolo-Ifrán et al. 2017) and particular conditions (e.g., microclimate, Abellán et al. 2017) in urban habitats. However, it is worth noting we did not record the species in some of the localities where the species was previously recorded by citizens.

Detectability might have varied among habitats, but this does not seem to affect our main conclusion that the species is mostly established in large cities. Throughout our survey, we frequently observed seven out of the nine native doves and pigeons throughout the country (both in cities and natural habitats). The behavior and detectability of the Eurasian collared dove does not differ much from that of the native doves and pigeons, and we were quite familiarized with this species. Therefore, our absence of records in the natural habitats and some cities may be rather related to the low density of Eurasian collared doves in recently invaded areas, making difficult its detection until populations reach a certain size threshold (Myers et al. 2000; Hulme 2006) or, alternatively, to processes of local colonization/extinction during the invasion process. On the other hand, citizens provided a few records of the species in rural and even natural habitats. These records could reflect individuals dispersing among cities, but could also indicate an incipient colonization of non-urban habitats. The global expansion of the Eurasian collared dove has been well documented (Eraud et al. 2007; Bled et al. 2011), and the pattern of invasion of Dominican Republic could be similar to that observed in European countries (Gorski 1993; Rocha-Camarero and de Trucios 2002), North-African countries (Bendjoudi et al. 2015), and the United States (Fujisaki et al. 2010): first occupying urban areas and then spreading to other, mainly human-altered, habitats.

The Eurasian collared dove is one of the most successful invasive bird species worldwide (Lever 2005), and it could negatively affect native birds by the increase in disease transmission and because this invasive species could be behaviorally dominant (Romagosa and Labisky 2000; Rocha-Camarero and de Trucios 2002; Poling and Hayslette 2006; Schuler et al. 2012; Kasner and Pyeatt 2016). Although the

information about its impact on native birds in other Caribbean islands remains scarce, it has been suggested that the Eurasian collared dove could have an impact on their native pigeons (Monceau et al. 2009). This is a matter of concern, since the Dominican Republic holds nine species of native doves and pigeons, including three vulnerable species (*Geotrygon chrysie*, *Patagioenas inornata* and *Patagioenas leucocephala*) and one endangered species (*Geotrygon leucoetopia*) (Ministerio de Medio Ambiente y Recursos Naturales de la República Dominicana 2011).

In conclusion, we confirm here the successful establishment of the Eurasian collared dove in Dominican Republic and its incipient spread by colonizing distant cities across the island. The current spatial distribution of the species and its apparent exponential population growth in recent years constitute an early warning signal. Due to its ability to reach distant areas and its adaptability to a great variety of environmental conditions, it is expected that in coming years this species will continue spreading through the island, including Haití. Further research is needed to study this spread process and the possible interaction of Eurasian collared doves with native avifauna.

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Supplementary material

The following supplementary material is available for this article:

Table S1. Compilation of observations of Eurasian collared doves in Dominican Republic registered in eBird.

This material is available as part of online article from:

http://www.reabic.net/journals/bir/2018/Supplements/BIR_2018_Luna_et_al_Table_S1.xlsx