

Rapid Communication

Railway-facilitated dispersal of the Spanish Sparrow (*Passer hispaniolensis*) during its current range expansion in the Pannonian Basin

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Abstract

Sparrows (*Passer* spp.) have long been presumed to rely on railway traffic during their long-distance terrestrial dispersion. The currently ongoing range expansions of the Spanish Sparrow (*Passer hispaniolensis*) and the Red-rumped Swallow (*Hirundo daurica*) in Central Europe provide an opportunity to develop this idea into a testable hypothesis. Both species are small, synanthropic passerines but the latter one is highly aerial and mobile. Therefore, Red-rumped Swallows are not supposed to rely on railways for spatial dispersion so that their distance from railway lines is supposed to reflect observers' distribution, but not otherwise influenced by railway proximity. I have analyzed published data from Hungary and North Serbia (Vojvodina, except for its South Banat District) from 2000 onward. During this period, both species exhibited a slow northward range expansion on the Southern edge of the study area but have not yet established self-sustaining populations. Vagrant individuals of the Spanish Sparrow and its hybrid Italian Sparrow (*Passer italiae*) occurred significantly closer ($N = 8$, range = 0.01–3.36 km) to railway lines than vagrant Red-rumped Swallows ($N = 23$, range = 0.45–13.76 km). This constitutes an empirical evidence supporting the idea that sparrows tend to rely on railway traffic for long-distance dispersion.

Key words: human facilitated dispersal, freight trains, railway, Passeriformes, synanthropic birds

Introduction

Children's story books rarely provide a starting point for research. However, the tale on the "richest sparrow of the world" (Miler and Petiska 1963) prompts the question whether sparrows may get accidentally trapped into goods wagons and, thus, utilize freight train traffic for their spatial dispersion. Sparrows (*Passer* spp.) are highly sedentary birds, their lifetime dispersal capability is limited most often to 1–3, and rarely up to 5–10 km (Summers-Smith 1988). In some cases, the speed of their continent-wide range expansions may fit to this dispersal capability, e.g. the range of introduced Tree Sparrows (*Passer montanus* (Linnaeus, 1758)) currently exhibits a northward shift at a rate of 3.3 km/year in North America (Burnett et al. 2017). Contrarily, during its continent-scale invasions the House Sparrow (*Passer domesticus* (Linnaeus, 1758))

exhibited a much quicker range expansion in Mexico (Wagner 1959), North-America (Robbins 1973), Siberia (Summers-Smith 1988), and Africa (Schrey et al. 2014), especially along railway lines. Based on these observations and anecdotal evidence, several authors (Robbins 1973; Summers-Smith 1988; Schrey et al. 2014) suggested that sparrows may utilize cargo trains for their long-distance spatial dispersion. The purpose of this study is to develop this idea into a testable hypothesis and find support for or against it using formerly published data.

The geographic scope of this study is focused on the Pannonian Basin (aka. Carpathian Basin), in Central Europe. The South-Eastern edge of this area is neighbored by the Balkan Peninsula, that is inhabited by the Spanish Sparrow (*P. hispaniolensis hispaniolensis* (Temminck, 1820)). This species exhibits a North-West range expansion that already reached South Romania, South and East Serbia from 1950

onwards (Obratil 1985; Hadarics 2015). Contrarily, the Italian Peninsula, that neighbors the South-West edge of the Pannonian Basin, is inhabited by the Italian Sparrow, a stable hybrid between the House Sparrow and Spanish Sparrow. Some authors claim it is conspecific with the Spanish Sparrow (see e.g. Töpfer 2006), while others treat it as a separate species (*P. italiae* (Vieillot, 1817)) of recent hybrid origin (Hermansen et al. 2011). Whatever its taxonomic rank, it is a hybrid of Spanish and House Sparrows. A few vagrant individuals of Spanish and Italian Sparrows have already been observed in Northern Serbia and Hungary. Since female and juvenile individuals of Spanish and Italian Sparrows are indistinguishable from those of House Sparrows in the field, all but one (see below) observations used in the present study refer to adult males.

The nearest regular breeding ground of the Spanish Sparrow is in villages in Berliște, Caraș-Severin County, South-West Romania. The seven vagrant individuals described below occurred in a 130–450 km distance from this breeding area. The nearest breeding area of the Italian Sparrow is in Caorle, Italy (Trier et al. 2014), in a 420 km distance from the site of the single vagrant individual observed and captured in Hungary. Presuming that these pioneering vagrant individuals traveled by train, I hypothesize that the exact site of their observations should be nearer to railway lines than expected by chance. It is not easy, however, to quantify what distances should we expect by chance because observers themselves do not move randomly over the area. They may prefer to travel by train and, thus, their observation efforts could probably be also concentrated to the proximity of railway stations.

One possible solution for this problem would be to compare the mean distance of Spanish Sparrow observation sites from railway lines to the mean distance of all other rarities' observation sites from railway lines. This would be misleading, however, because most rarities are observed in undisturbed natural habitats relatively far from human activities. By definition, we would expect a synanthropic species—like the Spanish Sparrow—to occur more closely to human traffic, including railway lines, than other rarities. Therefore, to establish a base for a meaningful comparison, first I quantified the distance of the rare vagrant Red-rumped Swallow (*Hirundo daurica*) individuals from the nearest railway lines. This is a highly mobile, aerial insectivorous passerine species. It is also endemic to the Balkans, the Adriatic coast, and North Italy, and it is also slowly expanding its range to the North. Just like Spanish Sparrows, the Red-rumped Swallow is also loosely connected to human settlements, especially during the breeding

season. Being so highly aerial and mobile, Red-rumped Swallows are not presumed to rely on trains, cargo transportation, or any other means of human assistance during their spatial dispersion. Therefore, I argue that they can serve as a natural control, so as observations of dispersive Red-rumped Swallows should mirror the observers' typical distance from railway lines in the area when observing a rare vagrant individual of a synanthropic passerine. Second, I measured the distance of Spanish and Italian Sparrow observation sites from the nearest railway lines to test whether these sites are located more closely to railway lines than the Red-rumped Swallow observation sites.

Methods

All occurrence data (date, geographic coordinates of exact location, number of individuals) were obtained from Rare Birds of the Carpathian Basin (Sakertour 2018), an internet website devoted for the collection and share of data on the rare vagrant birds observed in the Pannonian basin. All of them refer to opportunistic observations by non-professional ornithologists, however, most of them were verified by several observers and documented by photographs. Only the observations since 2000 were considered, since the existence and functionality of railway lines cannot be verified for much earlier periods of time. Observations until 5 May 2018 were considered. I used Google Maps to identify the nearest railway line and to measure each bird's distance from that (with 0.01 km precision). Only standard-gauge railway lines were considered, because narrow-gauge railways serve only local transportation without direct long-distance connections. Mann-Whitney Tests were used for statistical comparisons.

I considered all observations from Hungary, and also all observations from the neighboring northern province of Serbia, Vojvodina, except for its South Banat District. This district was excluded for two reasons, first, the Spanish Sparrow has already been breeding here repeatedly (Vučanović 2012; Ružić and Rajković 2012), and second, it is neighboring the Berliște area of Caraș-Severin County, Romania, that already has a stabilized colony of Spanish Sparrow. Spanish Sparrows and Red-rumped Swallows do not occur North of the study area.

In Hungary, a single breeding pair of the Red-rumped Swallow was observed in 2017 (Bodor 2017). Although female Spanish Sparrows are practically inseparable from House Sparrows in the field and they often hybridize, Hadarics (2015) claimed that a pair of Spanish Sparrows bred in 2014–2015 in Bácsbokod, Southern Hungary. Since my present study focuses on rare vagrant individuals, I consider

Table 1. Data of Red-rumped Swallows, Spanish and Italian Sparrows from Hungary (HU) and the Serbian province Vojvodina except for South Banat (SRB) from 03. 2000 to 05. 2018. ID numbers refer to those of the source of data (Rare Birds of the Carpathian Basin 2018).

ID # at website	N	country	date	distance from railway (km)
Red-rumped Swallow				
7044	1	HU	28.04.2018	5.90
6799	1	HU	19.05.2017	2.51
6830 ^a	2	HU	05.05.2017–17.08.2017	0.57
6829	1	HU	16.04.2017.	2.77
6828	1	HU	16.04.2017	4.22
5863	1	HU	18.04.2015	0.45
4590	3	HU	16–17.05.2013	6.85
4513	1	HU	02.04.2013	1.26
3577	1	HU	06.05.2012	6.15
3565	2	SRB	29.04.2012	10.78
3174	1	SRB	16.05.2011	0.48
2296	1	HU	14.05.2011	7.77
2182	2	HU	06.05.2011	1.08
1005	1	HU	11.04.2009	3.38
1003	3	HU	10–12.05.2005	13.76
1001	1	HU	30.07.2002–14.08.2002	9.45
Spanish Sparrow				
6416	1	HU	20.05.2016	3.36
6163	1	HU	16.11.2015	0.09
5471 ^b	2	HU	13.06.2014–10.05.2015	1.66
4539	1	SRB	17.04.2013.	0.01
5829 ^c	2	SRB	12.04.2013	2.80
Italian Sparrow				
2683	1	HU	09.03.2008	0.31

^a Breeding pair, ID codes of subsequent observations of the same specimens: 8631, 8634, 8645.

^b allegedly a breeding pair, ID codes of subsequent observations of the same specimens: 5472, 5475, 5479, 5480, 5482, 5483, 5521, 5886, 5891.

^c ID code of subsequent observation of the same specimens: 4578.

the occurrence of these breeding pairs as 2 adult individuals each, and neglect their nestlings as non-vagrant individuals.

Most data on vagrant Red-rumped Swallows, Spanish and Italian Sparrows refer to singletons, however, a few co-occurring pairs and even triplets have also been observed. Since both species are highly sociable, such observations likely do not represent independent events, thus handling them as independent data points can be misleading. Therefore, I carried out two analyses; first, treating each adult individual as a statistically independent event, and second, lumping together the co-occurring individuals into single statistical events.

Results

Within the study period and area as outlined above, the data set refers to 23 Red-rumped Swallow, 7 Spanish Sparrow, and 1 Italian Sparrow individuals (Table 1). The distance of Red-rumped Swallows from the nearest railway lines (range = 0.45–13.76, mean = 5.70, SD = 4.60) was greater than that of

Spanish and Italian Sparrows (range = 0.01–3.36, mean = 1.59, SD = 1.33) (Figure 1A). The medians differed significantly between the two samples ($W = 41.0$, $p = 0.023$). Several observers verified that a pair of Spanish Sparrows bred in Southern Hungary, in 2014–2015 (Hadarics 2015). Since females are hardly separable from the House Sparrow in the field, and the two species readily hybridize, the female individual might have been a misidentified House Sparrow as well. However, deleting this single individual from the data set does not considerably affect these results (details not shown).

After lumping together the co-occurring individuals, a total of 16 Red-rumped Swallow, 5 Spanish Sparrow, and 1 Italian Sparrow observation events (whatever the number of individuals) were recorded. The distance of Red-rumped Swallow observations from the nearest railway lines (mean = 4.84, SD = 4.06) was greater than that of Spanish and Italian Sparrow observation events (mean = 1.37, SD = 1.46) (Figure 1B). Again, the medians differed significantly between the two samples ($W = 19.0$, $p = 0.036$).

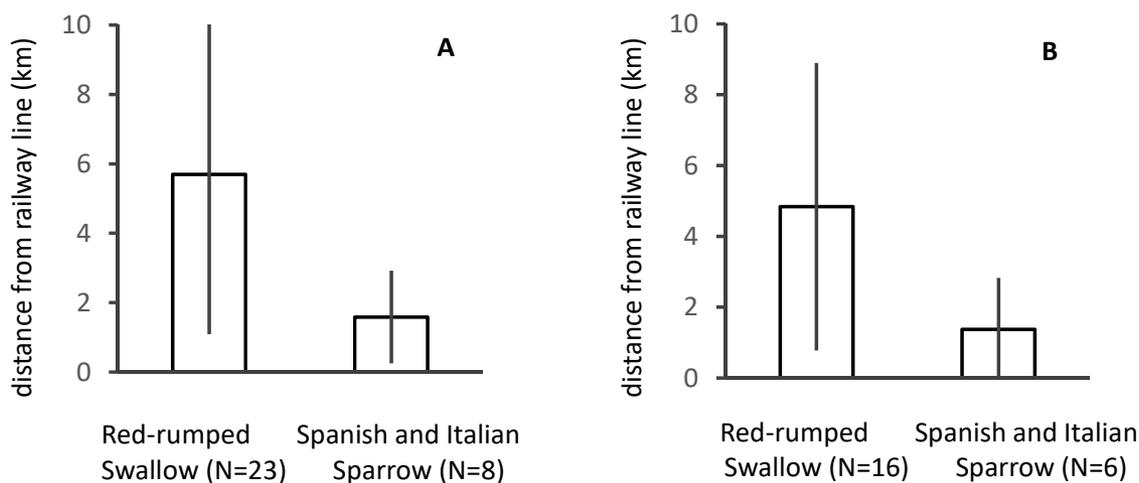


Figure 1. Distance (mean km, \pm SD) of vagrant Red-rumped Swallows versus Spanish and Italian Sparrows from the nearest railway lines in Hungary and Vojvodina, 2000–2018. A: taking the occurrence of each individual as a statistically independent event. B: lumping the data of co-occurring individuals together as single events.

Discussion

The idea that synanthropic Sparrows may utilize freight trains for long-distance dispersal is well known to children (Miler and Petiska 1963) as well as to experts (Summers-Smith 1988). It had already been supported by observations of House Sparrows' fast geographic range expansion (Wagner 1959; Robbins 1973; Summers-Smith 1988; Schrey et al. 2014) and by anecdotal information. To my best knowledge, however, this trivial idea has never been tested against data. Herein, I compared the spatial occurrence of rare, pioneering individuals of Red-rumped Swallows (serving as controls not expected to be transported by wagons) to that of Spanish Sparrows and their hybrid, the Italian Sparrow. During the study period, both species exhibited a Northward range expansion in the Pannonian Basin. Indeed, Sparrows occurred much closer to railway lines than Red-rumped Swallows.

Since this study is focused on scarce vagrant birds that were observed pioneering far (as compared to their dispersal capabilities) from their breeding grounds, sample sizes are inevitably low, considerably limiting the statistical power. Despite this shortcoming, the analysis of formerly published faunistic data indicates that long-distance pioneers of the Spanish and Italian Sparrow most probably disperse by means of railway traffic. This result constitutes an empirical evidence to support the suspicion that railway facilitated dispersal plays a major role in the range expansion of Sparrows.

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