

The mysterious bird outbreak of 1779 in southeastern Iberian peninsula: a massive irruption of the Spanish sparrow *Passer hispaniolensis* from Africa?

J. J. Ferrero–García, L. M. Torres–Vila, P. P. Bueno

Ferrero–García, J. J., Torres–Vila, L. M., Bueno, P. P., 2018. The mysterious bird outbreak of 1779 in southeastern Iberian peninsula: a massive irruption of the Spanish sparrow *Passer hispaniolensis* from Africa? *Animal Biodiversity and Conservation*, 41.2: 365–377.

Abstract

*The mysterious bird outbreak of 1779 in southeastern Iberian peninsula: a massive irruption of the Spanish sparrow *Passer hispaniolensis* from Africa?* Several current and past bibliographical references mention the sudden pest outbreak of a mysterious sparrow–like bird in the southeastern Iberian peninsula in 1779. Based on these references, we investigated unpublished documentary sources from various historical archives that reflected the actions carried out by public authorities against the bird pest. Some narratives come from direct witnesses who sometimes provided relevant data on the origin and biology of the birds involved. From the analysis and interpretation of these data, it was clear that the bird outbreak was caused by an unusual passerine in southeastern Iberia. In May 1779, birds irrupted in large numbers into several localities in the current provinces of Alicante, Murcia and Almería, probably coming from North Africa. Damage caused to cereal crops was meaningful and the extraordinary alarm generated in the people motivated the intervention of both local authorities and government institutions. The birds formed large arboreal colonies, building multiple nests per tree. We discuss different hypotheses related to the taxonomic position of these birds within the Ploceidae and Passeridae families. The bird species whose distribution, morphology, life characteristics and behaviour agrees best with the testimonies analysed is the Spanish sparrow *Passer hispaniolensis*. We propose that this sparrow could be the protagonist of this historic bird pest outbreak.

Key words: Bird pests, Passerines, 18th century, Historical archives, North Africa, Southeastern Spain

Resumen

*La misteriosa plaga de aves de 1779 en el sureste de la península ibérica: ¿una irrupción masiva del gorrión moruno *Passer hispaniolensis* desde África?* Algunas referencias bibliográficas, actuales y pasadas, señalan la abrupta llegada de una misteriosa plaga de aves, parecidas a los gorriones, al sureste de la península ibérica en 1779. Partiendo de dichas referencias, en este estudio hemos investigado en fuentes documentales inéditas de distintos archivos históricos, donde se recogen las medidas que adoptaron contra esta plaga diferentes autoridades. Algunos de estos relatos provienen de testigos directos, que a veces aportaron datos de interés sobre la biología de las aves y de su procedencia. Del análisis de esos datos se desprende que esta plaga fue provocada por un passeriforme no habitual en el sureste de la península ibérica. Las aves irrumpieron en gran número en mayo de 1779 en algunas localidades de las actuales provincias de Alicante, Murcia y Almería, probablemente procedentes del norte de África. Los daños causados en los cultivos de cereal debieron ser significativos y la extraordinaria alarma que suscitó en la población motivó la intervención tanto de autoridades locales como de instituciones estatales. Las aves formaron grandes colonias en árboles y construyeron muchos nidos por árbol. Planteamos diferentes hipótesis en relación con la identificación taxonómica de estas aves, dentro de las familias Ploceidae y Passeridae. Finalmente sugerimos que la especie cuya distribución, morfología, características y comportamiento concuerda mejor con los testimonios analizados es el gorrión moruno *Passer hispaniolensis*, por lo que creemos que pudo ser el protagonista de esta plaga histórica.

Palabras clave: Plagas de aves, Paseriformes, Siglo XVIII, Archivos históricos, Norte de África, Sureste de España

Received: 6 IX 17; Conditional acceptance: 19 XII 17; Final acceptance: 22 I 18

Juan J. Ferrero–García, Servicio de Calidad Agropecuaria y Alimentaria, Consejería de Medio Ambiente y Rural PAyT, Junta de Extremadura. Avda. Luis Ramallo s/n, 06800 Mérida, Spain.– Luis M. Torres–Vila, Pedro P. Bueno, Servicio de Sanidad Vegetal, Consejería de Medio Ambiente y Rural PAyT, Junta de Extremadura. Avda. Luis Ramallo s/n, 06800 Mérida, Spain.

Corresponding author: Juan J. Ferrero–García. E–mail: juanjose.ferrerog@juntaex.es

Introduction

It is well-known that some bird species can cause extensive damage to agricultural crops, as reported from many parts of the world (Jones, 1972; Pinowski and Kendeigh, 1977; De Gracio, 1978; Wright et al., 1980; Bruggers and Ruelle, 1981; Bellatreche, 1986; Dhindsa and Saini, 1994; Huber et al., 2002; Contreras et al., 2003; Tracey et al., 2007; Behidj-Benyounes et al., 2011; De Melo and Cheschini, 2012; De Mey et al., 2012; Canavelli et al., 2014; Codesido et al., 2015; De Rijk, 2015; Loza-Del Carpio et al., 2016). Based on records of historical archives, we recently investigated the incidence and spatio-temporal variation of bird pests in the region of Extremadura (southwestern Spain) over four centuries (1501–1900) (Torres-Vila et al., 2009; Ferrero-García et al., 2014, 2016; Torres-Vila et al., 2015). Our research showed that passerines, particularly sparrows (house sparrow *Passer domesticus* and/or Spanish sparrow *Passer hispaniolensis*), were the birds that caused most harm to Spanish agriculture in the past. Our results provided a historical perspective of both the impact of the birds and the changing human perception towards them. Currently, the house sparrow is widely distributed in the Iberian peninsula, while the Spanish sparrow occurs mainly in southwestern Iberia (Bernis, 1989; Tellería et al., 1999; SEO/BirdLife, 2012; De Juana and Garcia, 2015). The past distribution of these two species has been known with relative precision since the 19th century and was broadly similar to the current distribution (De Juana and Garcia, 2015). In Spain, the house sparrow is basically sedentary and nests in rocks, trees and buildings, while the Spanish sparrow is partially migratory and mostly breeds in trees and shrubs, sometimes forming large colonies (Bernis, 1989; Tellería et al., 1999; De Juana and Garcia, 2015).

In one of the above-cited works (Ferrero-García et al., 2014) we found that several municipalities in Extremadura echoed an Order of the Council of Castile, dated 19 October 1779, concerning a plague of 'overseas' birds that had arrived in Spain that same year. The Order mentioned that these birds had irrupted into southeastern Spain (provinces of Almería and Murcia) in May 1779. We hypothesized that it was likely the same bird species that, also in May 1779, struck Totana (Murcia), a crucial matter about which the Count of Floridablanca (probably the most relevant statesman in those years) wrote to Pedro Franco Dávila, Director of the Royal Cabinet of Natural History. Ferrero-García et al. (2014) stressed that the bird outbreak had such repercussion that its occurrence was announced in the *Gaceta de Madrid* (1779), the official Spanish bulletin of the epoch, where the birds were described as similar to sparrows ('pájaros como especie de gorriones'). However, the study focused on the region of Extremadura and did not investigate further into the reports or into the species of birds involved.

Previous references discussed this mysterious bird outbreak, but none included strictly scientific background. García-Hourcade (1996) mentioned that in 1779 there was a plague of 'African sparrows' in

Cartagena (Murcia), referring to an older reference mentioning the devastation produced that year in Cartagena by the same 'African sparrows' (Díaz, 1895). García-Abellán (1975) quoted the plague of sparrows of 1779 as one of the most remarkable in the region of Murcia in the 18th century. In a specific paper published in a local magazine (in which the Order of 19 October 1779 is reproduced) Grima (1990) remarked: 1) that the denomination of these birds as 'overseas' itself suggests that they came from the other side of the sea; 2) that birds settled initially in Cartagena (Murcia), from where they moved to Lorca (Murcia) and then to Vera (Almería); and 3) that the birds were the size of a sparrow. Unfortunately, Grima (1990) did not conduct an in-depth study and did not reach any conclusion about the birds that starred in the pest outbreak of 1779.

In this paper we aimed to perform a more rigorous analysis of the available documentary sources (especially of the unpublished documents from different historical archives) in relation to the bird outbreak of 1779. Our objectives were: 1) to systematically collect and analyse the available information; 2) to find out if the described bird pest was caused by a rare or occasional species (in the sense of 'rarities'; see e.g., De Juana, 2006) of unusual presence in southeastern Spain; 3) to specify the territorial scope that birds came to encompass as well as to infer the lasting time; 4) to assess whether birds had a major impact on agricultural crops; and 5) to infer the taxonomic position of these birds. In short, we aimed to investigate a bird outbreak that had a notable social impact, not only in the affected localities, but also in other places in Spain. Such an historical event has been mentioned by several authors over the years, and in varied contexts, although always in a collateral, marginal or anecdotal manner, and often within studies with objectives other than wildlife research.

Material and methods

We consulted the historical and municipal archives in the cities and towns mentioned in the bibliographical references we found on the bird plague of 1779, as well as those archives in the localities suspected of having been affected. Documents were in paper format but digital reproductions were also used when available (e.g., AHRM, 2017). Target documents were read in full searching for and collecting all information relevant to the goals of this study.

To assess the importance of the testimonies contained in the studied documents, it is important to note that several Spanish authorities from the period (during the reign of Carlos III) of different rank/status are named. The most relevant authorities (Gómez, 2006) were: 1) the Corregidor, the representative of the king in a municipality at that time, responsible for judicial and police matters; 2) the Major Mayor, a lawyer appointed by the monarch and the highest authority in municipalities that did not have a Corregidor or a Corregidor's legal assistant; 3) the Governor of a city, a Corregidor to whom the military

government was entrusted; and 4) the Regidor, the Trustee ('Procurador Síndico') and the Deputy of the Common, other local authorities.

The historical archives consulted and their corresponding documents are as follows:

The Books of Agreements (Municipal Archives)

A large part of the documentary sources studied included the Books of Agreements (BAs thereafter) from several municipal archives. The BAs contain the agreements (organized per session) adopted by municipalities regarding matters within their legislative, executive and judicial jurisdiction (Torres–Vila et al., 2015). BAs constitute the most relevant documentary series that the Spanish municipalities have produced, and they date back to the Late Middle Ages (García–Ruipérez, 2008). As emphasized in previous researches (Ferrero–García et al., 2014, 2016; Torres–Vila et al., 2015), aspects reflected in the BAs include matters related to agricultural pests (including birds), and the human (and divine) actions taken to combat these. We consulted the BAs of Vera (Almería) and Lorca (Murcia) where the bird pest occurred according to the Order of 19 October 1779. In this Order it is also stated that birds colonised Mojácar and Turre (Almería), but BAs of these municipalities before the 19th century are not preserved. We also consulted the BAs of Totana (Murcia) where the bird pest was referred to both in its time (Gaceta de Madrid, 1779) and today (Calatayud, 1987; Velasco–Pérez, 2012). Lastly, we checked the BAs of Cartagena (Murcia), where the occurrence of the bird pest in 1779 is referred by several authors (Díaz, 1895; García–Hourcade, 1996). This research sometimes motivated the consultation of further BAs from other municipalities, which were mentioned in the sources investigated. This was the case of Orihuela (Alicante) and city of Murcia. In short, we searched the archives in six municipalities now belonging to three provinces. Note that the current provincial distribution in Spain dates from 1833. In the Results section we show the findings: Document 1 (BA of Orihuela), Document 2 (BA of Murcia), Document 3 (BA of Cartagena) and Document 4 (BA of Lorca).

File 558 (Archive of the *Museo Nacional de Ciencias Naturales* [MNCN] of Madrid)

The existence of File 558 of the Document Catalogue from the Royal Cabinet of Natural History (1752–1786) has been cited previously (Calatayud, 1987; Velasco–Pérez, 2012) but these papers did not deepen in their content. File 558 consists of several documents, beginning with an official dispatch dated 15 May 1779 from the Royal site of Aranjuez (Madrid) by the Count of Floridablanca, and addressed to Pedro Franco Dávila. Both men were important figures: Floridablanca had the full confidence of King Carlos III from 1766 to 1788, and he held the position of Secretary of State from 1776 to 1792 (Hernández, 2009). Dávila in turn was the founder and first director of the Royal Cabinet of Natural History of Madrid, currently the National Museum of Natural Sciences (*Museo*

Nacional de Ciencias Naturales, MNCN) (Calatayud, 1987; Velasco–Pérez, 2012). On 17 May 1779, Dávila acknowledged the receipt of the official dispatch to Floridablanca, and returned a copy of the documents that accompanied it. These documents, which deal with the studied bird pest, are the following:

Document 5: letter dated 11 May 1779 written in Murcia by Marcos Mayoral and addressed to his superior, Miguel Múzquiz Goyeneche. The former was the General Intendant of Murcia, who at that time was the head of the Public Finance in the province, adjunct to the Ministry of Finance (Lillo and Lisón, 2002). The latter was a Minister of Carlos III, specifically the Secretary of the Treasury (Escobedo, 2007).

Document 6: letter dated 10 May 1779 written in Totana by Bartolomé Fontana and addressed to Marcos Mayoral. According to the letter, Fontana was an employee of Spain's 'Renta del Tabaco' (Tobacco Income), an important institution managed by Spanish Public Finance in the 18th century, and whose employees had extensive privileges (Escobedo, 2007).

Document 7: letter–testimony also dated 10 May 1779 written in Pozo Estrecho (Cartagena) by Lucas Josef de Valera (including the testimonies of Francisco Meseguer, Fulgencio Saura and Miguel Sancho) and addressed to Marcos Mayoral. According to this letter, Valera, Meseguer and Sancho were employees of the Tobacco Income, whereas Saura was Deputy of the Common of Pozo Estrecho.

File 472–019 (Municipal Archive of Vera, Almería)

This File 472–019 'on the birds discovered in these surroundings' was formed, as specified in its beginning, by direct Order of the Governor of the Council of Castile. 'Governor of the Council' was a position of the highest status within the institutional framework of the Old Regime in Spain, as it was the maximum representative of the king (Granda, 2011). The main documents the file contains relevant to this work are:

Document 8: it consists of four letters written in Madrid in early June 1779 and addressed to Manuel Serrano Cilleros, Major Mayor of Vera, as stated in the same document. At the beginning of the 19th century, the Mayor's Office of Vera still consisted of four mayoralties including those of Vera and Mojácar (Almería), the latter in turn including the village of Turre (Morales, 1998). The first letter, dated 1 June 1779, is signed by Manuel Ventura Figueroa, Governor of the Council of Castile from 1773 to 1783 (Martínez, 2010). The second letter, dated 4 June 1779 is written by Antonio Martínez Salazar, notary of the Council of Castile and King's Secretary (De Sancha, 1780). The other two letters are dated 6 and 9 June 1779 and are signed again by Manuel Ventura Figueroa.

Document 9: Judicial Order ('Auto') dated 11 June 1779 written in Vera by Manuel Serrano Cilleros, and road letters (i.e., 'veredas', a type of mail notification to nearby areas) by the same author dated on the same day and addressed to several villages.

Document 10: letter dated 29 June 1779 written in Vera by Manuel Serrano Cilleros and addressed to Manuel Ventura Figueroa.

Document 11: letter dated 19 October 1779 written in Madrid by Antonio Martínez Salazar and addressed to the authorities of Vera.

Document 12: Judicial Order dated 10 November 1779 written in Vera by Ginés Antonio García, and road letters by the same author dated on the same day addressed to several villages. Ginés Antonio García, as indicated in the same document, was a lawyer of the Royal Councils and a regent of the Major Mayor of Vera.

Results

We summarise the contents of the main documentary sources (all written in the Spanish of that time) that refer to events regarding the bird irruption (table 1). The eight (current) municipalities unequivocally affected by the outbreak (according to these sources) were: Vera, Mojácar and Turre (Almería); Cartagena, Lorca, Murcia and Totana (Murcia); and Orihuela (Alicante) (table 1). We developed a graph of the approximate spatial distribution of the bird irruption in Spain, which extended at least over the three (current) provinces indicated (fig. 1). We have superimposed municipalities for which there were indications of the birds but no solid documentary evidence (fig. 1). The most relevant information extracted from the documentary sources studied is assembled below:

Document 1: on 8 May 1779, it was commented that for two days, large flocks of harmful birds called sparrows had arrived in Orihuela and quickly built nests and started laying. An order was issued requiring all inhabitants of La Huerta to 'eliminate' native sparrows and 'harmful aliens' (table 1), each neighbour having to contribute twelve 'heads of birds'. Several people were also selected to bring down the nests and kill the birds.

Document 2: on 8 May 1779 it was commented in the city of Murcia that 'over a few days' birds similar to sparrows had been detected in great numbers and in the breeding stage at a place named El Campo (table 1). It was noticed that birds were destroying cereal crops, and that there were reports that there was a plague of the same bird in Cartagena and Orihuela. It was agreed to appoint an inspector to inform the Corregidor of Murcia. On 18 May 1779, the Deputy of the Common of Cañada Hermosa (Murcia) reported the occurrence of large numbers of strange birds resembling sparrows (table 1) eating the crops and causing great damage. Some men were sent to shoot the birds. In addition, a report dated 17 May 1779 detailed the results of the bird inspections carried out by Ginés Buitrago in certain parts of the municipality of Murcia (La Zarza, Barqueros, El Campo and Cañada Hermosa). It was certified that on the date of the report, birds remained only in some places, such as La Zarza, that birds bred and built their nests in olive trees, that there were eggs and sometimes nestlings in their nests, that birds were sparrows from other lands (table 1), and that in their place of origin either there were no available crops or crops were delayed with respect to their usual harvesting date. It

was noticed that the greatest damage had occurred in early barley crops, that a plague 'of the same species' had occurred even more intensely 40 years previously, and that control actions had consisted of 'spells, gunpowder and nest removal'.

Document 3: on 4 May 1779, Francisco Subiela, Deputy of the Common of Cartagena, noticed a plague of Barbary sparrows ('gorriones de Berbería') in 'Levante' and San Ginés (table 1). Sparrows appeared in great numbers, building numerous nests and causing great damage. It was said that such a plague had never been seen and it was agreed to inform the Governor of Cartagena. On 7 May 1779 the Governor replied that he had ordered the Regidor and the Deputy of the Common of Cartagena to perform inspections, and that subsequently he had been informed that the birds had vanished, as only ten or twelve individuals were seen. The inspectors verified the presence of many nests in trees, however, and orders were given for these to be knocked down.

Document 4: on 17 April 1779, a mandatory imposition ('repartimiento') was agreed in Lorca to kill the birds, but no exceptional circumstances were reported. In contrast, on 4 May 1779, the Trustee of Lorca requested that measures be taken given the abundance of another bird species (table 1). It was agreed to continue with the measures adopted on 17 April.

Document 5: Marcos Mayoral stated that a plague of birds had appeared between Murcia and Totana, causing great damage. He sent two inspectors from the Tobacco Income (Bartolomé Fontana and Francisco Meseguer) to various places for information. Mayoral attached the two writings by the inspectors to his report dated 11 May 1779, stating he had sent to Miguel Múzquiz two birds (collected by Fontana) and one egg; he added he was not including a nest as he considered they were not special in any way. Mayoral explains that the birds arrived dead, that he was forwarding them conserved in 'wine spirit' (i.e. alcohol), that one bird seemed to be an old adult because it had a white feather as a necktie, and that the other bird looked like a female or nestling, having no white feather.

Document 6: on 10 May 1779, Bartolomé Fontana wrote that he had gone with some assistants to the field on 4 May, as he was informed that numerous small birds resembling sparrows had been observed in the previous days (table 1), nesting in the trees and causing great damage to crops in 'El Paretón' (Totana) and Alcanara (Lorca), and also in groves along the Sangonera River. He stated that: 1) he saw birds, especially in 'El Paretón'; 2) they nested in olive trees and sometimes in black poplars; 3) clutch size ranged from 3 to 7 eggs; 4) some nests had two parts (each one with its eggs inside) but a single conduit to enter and exit; 5) in many olive trees there were between 100 and 250 nests; 6) they chased the birds away with daily repetition of gun shots; this did not get rid of them but it avoided their breeding; 7) each day they killed many birds; and to conclude, 8) the birds were a serious pest. In addition, Fontana informed Mayoral that he sent him four live birds captured with birdlime, and two nests.

Document 7: Lucas Josef de Valera began his writing on 10 May 1779 stating that he left the city of Murcia on the same day in the morning, along with Francisco Meseguer, to whom he was helping. At first they did not find the birds, so they continued to Pozo Estrecho (Cartagena), where they were joined by Fulgencio Saura and Miguel Sancho. These latter informed them that, in the orchards of the Convent of San Ginés de la Jara (Cartagena), large numbers of birds with the size, feathers, beak and general look of sparrows (table 1) were damaging trees and crops. Saura and Sancho informed Valera that they had notified the authorities of Cartagena, who had sent large numbers of people to eliminate the birds. In fact, on 8 May, when Saura and Sancho were in command of 150 men, they found no birds, although villagers told them that there had been a lot of birds, that when the birds arrived they remained quite still but that in less than twelve hours they had built innumerable nests in trees, and that when men fired shots, the birds flew away towards Orihuela, and perhaps some of them also flew towards Lorca and Totana. These sources report that the bird damage was not too high because of the rapidity with which control actions were undertaken. It was also reported that one bird was captured alive and was sent to the Governor of Cartagena. He ordered the bird to be recognized by a Maghrebian from the Military Arsenal, who said that plagues of this bird had occurred many years in his land (table 1), that the birds were very harmful, and that Maghrebians cooked wheat with poison and spread the mixture in the fields to kill the birds.

Document 8: on 1 June 1779 Manuel Ventura commented on a letter from Manuel Serrano dated 25 May informing about the appearance in Vera (Almería) of a new species of bird similar to sparrows (table 1) which was damaging wheat fields. Ventura stated that he already had heard about this bird pest from the Corregidor of Murcia and that he agreed with the measures taken by Serrano: prizes to collaborator villagers, mandatory impositions ('repartimientos') and the use of birdlime as hunting method applied on rods, canes and esparto plants ('en varetas, cañas y espartos'). In the other three letters written in Madrid, first Antonio Martínez —at the suggestion of the Council of Castile— and then Ventura, informed to Serrano in early June 1779 that they continue with the measures adopted to extinguish the bird pest. All four letters issued from Madrid are answers to successive Serrano's writings (which are not kept in the file). In one of them, apparently dated 1 June 1779, Serrano specified that bird damages were centered on Vera, Mojácar and Turre (and such data are reproduced in the letter from Ventura dated 9 June 1779).

Document 9: on 11 June 1779, Manuel Serrano transmitted a Judicial Order through road letters addressed to those towns and villages infested by the pest or at risk of being affected, but at no time he did distinguish between both situations. The complete list of localities to which road letters were addressed has not been able to be identified completely, although there is evidence that they were received in about thirty villages (almost all within the present province

of Almería, but also seven villages in the province of Granada). Road letters communicated, among other things, that the best way to exterminate the birds was by knocking down their nests.

Document 10: Manuel Serrano writes on 29 June 1779 to Manuel Ventura informing about the diligences practiced in order to eradicate the bird pest.

Document 11: Antonio Martínez writes on 19 October 1779, recalling how in the month of May of that year a great number of unknown birds arrived into Vera, Mojácar and Turre (table 1), reason why the Council of Castile gives the instructions summarised in the Martínez's letter dated 4 June 1779. Appropriate measures are now dictated to defray the costs of gunpowder used trying to eliminate the pest of 'overseas' birds (table 1), and the affected towns are ordered to pay those costs to the Corregidor [Major Mayor] of Vera. In addition, he informs that the Council of Castile has agreed an Order warning local authorities in case the same bird pest returns next year.

Document 12: in addition to recall the bird pest that took place in the spring of 1779, Ginés A. García comments on 10 November 1779 the damage that were causing to the olive harvest the 'innumerable flocks and clouds of foreign birds that now have come upon', in the Almanzora River and Cabrera Mountain Range, in the province of Almería. Therefore, he recommends to the authorities of the affected villages to shoot the birds at night in the places where they go to congregate and rest (letters were issued to half a hundred localities).

Discussion

Unconventional expressions were used in at least one dozen texts written in 1779 to refer to the birds involved in the pest outbreak occurring that year in Spain (table 1). The texts used the Spanish vernacular names 'gorrión' (sparrow) and, more often, 'pájaro' (bird). The latter word is used to name any passerine, any small bird, and also any bird in general, a peculiar trait of the Spanish language (Bernis, 1995). In most old texts, these names do not differ from the customary use and, in fact, they are the most abundant denominations for birds we have found in previous studies (Ferrero–García et al., 2014, 2016). However, the texts from 1779 all reflect the underlying doubts people had about the taxonomic ascription of the birds, or the conviction that the birds involved in the pest outbreak belonged to a species that today we would qualify as rare or unusual in the southeastern Iberian peninsula. Birds were described with epithets such as 'strange birds', 'unknown birds', 'foreign birds', 'sparrow-like birds', 'sparrow-shaped birds', 'sparrows from other lands', 'overseas birds' and 'Barbary sparrows'.

In Document 3, the alleged provenance of birds is even indicated with relative precision ('Barbary sparrows'), providing valuable zoogeographical information regarding the target bird species. 'Barbary' ('Berberia') is an old European word that remained in use until the second half of the 19th century, roughly defining the current region of the Maghreb and, by extension, the

whole of North Africa (De Bunes, 1989). This report, provided by an authority of Cartagena, increases its credibility because it coincides with the testimonies from other report by an authority of Pozo Estrecho, and also with those of three employees from the Tobacco Income (Document 7) who narrated how a Moor working in the Military Arsenal of Cartagena had examined the birds and had recognised them 'as characteristic of his homeland'. Thousands of people worked in this military centre in the 18th century, including many Maghrebians as prisoners (Henares, 2010). It is likely that Díaz (1895) collected his testimonies when talking about the plague of 'African sparrows' in Cartagena, a city that is less than 200 km from the North African coast at its nearest point (Oran, Algeria). A key aspect of the documents in table 1 is that the protagonists were not usually in contact with one another, so they would not be mutually influenced. In any case, these two texts (Documents 3 and 7) are those that most accurately point to the geographical origin of the bird pest.

The documentary sources locate the bird pest with certainty in an array of eight municipalities (fig. 1). This does not mean that the whole of each municipality was occupied by birds, or that some lands within neighbouring municipalities were not partially populated. Indeed it is likely that the birds arrived in another thirty municipalities in the provinces of Almería and Granada (fig. 1, Document 9). The historical documents sometimes allow the birds to be placed in relatively definite places such as small villages that still exist today (Pozo Estrecho, La Zarza, Barqueros, Cañada Hermosa, El Paretón and Alcanara). Some natural areas are also mentioned as populated by birds. Examples include the 'Campo de Murcia', which currently corresponds to the southern half of the municipality of Murcia (Aliaga, 2008), the section of the Sangonera River between Lorca, Totana and Murcia, better known as the Guadalentín Valley (Ramírez and Baños, 1997), or the 'Huerta de Orihuela', which constitutes a well-defined territory around the Segura River (Ferrández and Diz, 2015). In one case it is even possible to locate the bird pest with complete accuracy (Document 7): it is the Convent of San Ginés de la Jara, located a few kilometers east of the city of Cartagena, with origins dating back to the 13th century, and whose building remains standing although in a ruinous state (Sánchez, 2012).

Regarding the dates the birds appeared we agree with Grima's (1990) version. Birds irrupted into the coast of Cartagena on the first days of May 1779 (Document 3), continuing to Lorca and Totana (Documents 4 and 6), and then to Murcia (Document 2) and Orihuela (Documents 1 and 2). No bibliographic source, as far as we know, has previously cited the bird pest in the latter municipality belonging to Alicante province. Testimonies indicate that around May 7, a few birds remained in Cartagena (Documents 3 and 7) but most of them disappeared during the second ten-day period of the month. An exception is found in the municipalities of Almería, where birds arrived from the Guadalentín Valley in the second half of May (Document 8) and probably persisted at least until some time in June (Documents 9 and 10). In

short, birds appeared suddenly and then completely vanished in just two months. One possible explanation for the massive bird arrival could be poor harvests in their homelands, which would have deprived them of trophic resources (Document 2) and set off a migratory process. Lack of food is a main ecological factor triggering migratory behaviour in birds, possibly leading to a large-scale massive irruption in the destination areas (Nelson, 1985; Berthold, 2001; Newton, 2006). In this regard, it should be noted that the period 1760–1800 was characterised in the western Mediterranean basin by a notorious climatic oscillation known as the Maldá anomaly, with extreme hydrometeorological episodes and major losses in agriculture (Barriendos and Llasat, 2003). In many areas of the Iberian peninsula, this anomaly provoked climatic events such as cold and heat waves, and floods and droughts (Oliva et al., 2018).

In relation to the municipalities of Almería, the judicial order and road letters issued on 10 November 1779 by the regent of Major Mayor of Vera (Document 12) were surprising. This figure, who had not intervened until then, documented a supposed return flight of the birds in November. However, what he seems to describe is the typical attack by wintering flocks of starlings (*Sturnus* spp.) and/or thrushes (*Turdus* spp.) that come to the Iberian peninsula to feed on mature olives, an occurrence documented both in the past (Ferrero-García et al., 2014) and today (Tellería et al., 1999; SEO/BirdLife, 2012; De Juana and Garcia, 2015). Such a surprising judicial action could have something to do with the fact that the Council of Castile had decided a few weeks earlier that a part of the expenses caused in the control of 'overseas' birds had to be paid to the authorities of Vera by the affected villages (Document 11).

It is of note that some documents written as of October 1779 include statements that are difficult to believe. As these documents were generated after a three-month parenthesis without any news regarding the bird plague, it is assumed they were probably written by people who were not direct witnesses of the events that occurred the previous spring. Thus, in the Order of 19 October 1779, bird nests were said to contain 28–30 eggs (Grima, 1990) in contrast with the 3–7 eggs mentioned in May by Bartolomé Fontana (Document 6), or the 5–6 eggs published in the Spanish official bulletin in the same month (Gaceta de Madrid, 1779). The latter clutch sizes appear to be much more reliable. Klom (1970) noted pheasants (8–15 eggs) and partridges (14–20 eggs) as examples of bird groups with a very large clutch size, neither of which are passerines. More recently, Jetz et al. (2008) analysed data from 5,290 bird species and calculated a mean clutch size of 2.8 eggs (mode = 2) with only six bird species having mean values higher than 14 eggs: *Rhea americana* (19.7), *Rhea pennata* (17.3), *Aepyodius arfakianus* (20.0), *Perdix perdix* (16.0), *Perdix dauurica* (19.0) and *Callipepla californica* (14.9). None of these six birds are passerines. In fact, in this latter study, only three passerines (out of almost three thousand analyzed) were found to laid more than 9 eggs, and never above

Table 1. Main textual references found in the unpublished documentation studied (written in the Spanish language of the 18th century) referring to birds causing the mysterious plague of 1779 in the Iberian peninsula. A free translation into the English language is given. The source document and the affected municipalities (as well as the corresponding current provinces) according to these documentary sources are also indicated.

Tabla 1. Principales referencias textuales encontradas en la documentación inédita estudiada (escritas en la lengua española del siglo XVIII) en las que se mencionan las aves que causaron la misteriosa plaga de 1779 en la península ibérica. Se da una traducción libre al idioma inglés. También se indican la fuente documental y los municipios afectados (y las provincias actuales correspondientes) según estas fuentes.

Municipality	Main textual references	Document
Orihuela (Alicante)	"a matar assi los gorriones del pais, como los extranjeros dañeros" [to kill both native sparrows and "harmful aliens"]	1
Murcia (Murcia)	"espezie de paxaros gorriones" [birds similar to sparrows]	2
	"multitud de paxaros extraños a forma de gorriones" [a multitude of strange birds resembling sparrows]	2
	"siendo cierto que son gorriones de otras tierras" [being true that they are sparrows from other lands]	2
Totana and Lorca (Murcia)	"abundancia de pájaros pequeños con similitud á los gorriones" [abundance of small birds resembling sparrows]	6
Lorca (Murcia)	"abundancia de otra especie" [abundance of another bird species]	4
Cartagena (Murcia)	"plaga de gorriones de Berbería" [plague of Barbary sparrows]	3
Cartagena (Murcia)	"muchedumbre de paxaros, su grandaria, pluma, pico, y todo él de gorrión" [swarm of birds, their body size, feathers, beak and a general sparrow appearance]	7
	"un moro manifestó que en su tierra la morisma muchos años se experimenta esta plaga" [a Moor stated that in his homeland, the Maghreb, this bird plague occurred over many years]	7
Vera (Almería)	"nueba especie de paxaros semejantes a gorriones" [new bird species similar to sparrows]	8
Vera, Mojácar and Turre (Almería)	"pájaros desconocidos" [unknown birds]	11
	"plaga de pájaros ultramarinos" [plague of overseas birds]	11

10: *Aegithalos caudatus* (9.8), *Regulus regulus* (9.9) and *Parus ater* (9.4).

Another relevant aspect to consider is whether the bird pest actually caused severe damage to agricultural crops. Most evidence indicates that they did, particularly to cereals, with wheat (Document 8) and

barley (Document 2) being expressly mentioned. It is unquestionable that people of that time was alarmed in an extraordinary way. Therefore, actions against birds were deployed, not only with the available means in each municipality (as it was usual in the case of 'normal' bird pests; Ferrero–García et al.,

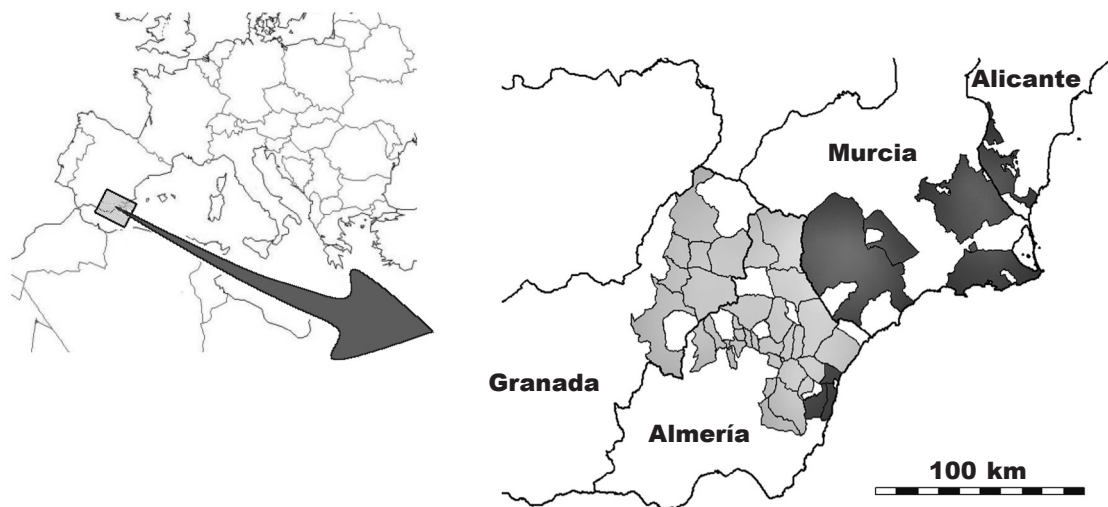


Fig. 1. Municipalities in the current provinces of Alicante, Murcia and Almería (southeastern Iberian peninsula) affected by the mysterious bird plague of 1779 (dark grey). Other possibly affected municipalities within the provinces of Almería and Granada are also shown (light grey, see text).

Fig. 1. Municipios de las actuales provincias de Alicante, Murcia y Almería (sureste de la península ibérica) afectados por la misteriosa plaga de pájaros de 1779 (gris oscuro). También se muestran otros municipios que pudieron verse afectados en las provincias de Almería y Granada (gris claro, véase el texto).

2014, 2016, Torres–Vila et al., 2015) but also with the intervention of major State institutions: the Tobacco Income in the province of Murcia, and the Council of Castile in the province of Almería. Indeed, even the highest authorities in the country, including two ministers of Carlos III (the Count of Floridablanca and Miguel Múzquiz Goyeneche) and the Governor of the Council of Castile (Manuel Ventura Figueroa), knew about the bird pest.

The last question to be dealt with is the most complex and transcendent: what bird, presumably alien to southeastern Iberia avifauna, could provoke such an unusual pest outbreak? We are looking for a bird with the size and appearance of a sparrow, that populates trees in huge colonies, builds multitude of nests per tree, has a clutch size of at least 6–7 eggs, eats mostly cereals or other small grains, and potentially causes severe damage to crops. These features agree with those summarized by the Spanish official bulletin of the epoch (Gaceta de Madrid, 1779). In Africa (the continent of origin that some testimonies pointed out) there are several candidate birds that fulfill the above features, at least in part. Within the Ploceidae family, we find some species accused of producing important plagues in sub-saharan Africa: the Red-billed Quelea *Quelea quelea* and the Village Weaver *Ploceus cucullatus* (Bernis, 1989; Craig, 2010). However, at least today, no Ploceidae species arrives as far north in its distribution as to the coasts of the Mediterranean Sea, and what is more, they do not venture into the Sahara desert (Craig, 2010;

Del Hoyo and Collar, 2016). In addition, clutch size in these species does not exceed four eggs and males have easily recognisable and conspicuous colours in some body parts (Craig, 2010). It should be noted that testimonies contained in our documents never mention any details regarding the colour of birds, which make us suspect that surely there was nothing to emphasize. Regarding the Passeridae, several species are able to form local concentrations and damage crops (Summers–Smith, 1988; Bernis, 1989). In Africa, damage caused by the Sudan Golden sparrow *Passer luteus* can be important (Bernis, 1989; Summers–Smith, 2009). This species, however, inhabits only a narrow strip from Mauritania to Sudan (Summers–Smith, 2009; Del Hoyo and Collar, 2016), has a clutch size of less than 5 eggs, and the male has a conspicuous golden colour on the head and belly (Summers–Smith, 2009). It follows that all the above mentioned passerine species are unlikely to be the cause of the 1779 pest outbreak. In contrast, there is another Passeridae that we must carefully consider: the Spanish sparrow, curiously called the 'Moorish sparrow' in Spanish 'gorrión moruno'.

The Spanish sparrow (sometimes considered conspecific with the house sparrow and the Italian sparrow *P. italiae*; Fulgione and Ripa, 2012; Del Hoyo and Collar, 2016) is currently distributed in some parts of Asia, eastern Europe and most of northern Africa, from Morocco to Libya (Summers–Smith, 1988; Bernis, 1989; Summers–Smith, 2009; Del Hoyo and Collar, 2016). Already in the 19th century a similar

distribution was mentioned, with great abundance in Algeria (Degland and Gerbe, 1867). The species also inhabits some areas in the Iberian peninsula, mainly in the southwestern sector, and its presence in the south east is marginal or occasional only (Alonso, 1997; Bernis, 1989; Tellería et al., 1999; Roviralta, 2003; SEO/BirdLife, 2012; De Juana and García, 2015; Calvo et al., 2017). Despite its English common name, for unknown reasons, the Spanish sparrow in Spain has undergone marked fluctuations in both population abundance and distribution since the second half of the 19th century, being prone to abandon colonies and establish new ones (De Juana and García, 2015). Neither Reyes' (1886) or Arévalo's (1887) decimononic recompilations mentioned the occurrence of the Spanish sparrow in any locality of the provinces of Almería, Murcia and Alicante (nor in those of the neighbouring provinces). In the 1960s–1980s, the species restricted its already scarce populations to certain areas of the Tajo and Guadiana basins, especially within the Extremadura region (Bernis, 1989; De Juana and García, 2015). However, by the late 20th century the species had greatly expanded its range and in Extremadura it even became a pest, with colonies of almost 30,000 nests and yield losses of up to 90 % in certain crops (Prieta, 2003), probably motivating its non-protected status in Spain after 1999 (Ferrero–García et al., 2014).

As above mentioned, the Spanish sparrow is not only characterised by its high population fluctuations, but also by its irregular and unpredictable movements, particularly those in North Africa. Both characteristics are closely related to interannual variations in the ecological conditions (Summers–Smith, 1988). In any case, in the Iberian peninsula the Spanish sparrow is a wandering species outside the breeding season and part of the population may overwinter in northern Africa (De Juana and García, 2015). Therefore, the explanation of the massive arrival of the birds in May 1779 (within the breeding season) would have to be sought in an exceptional situation, maybe related to the aforementioned Maldá anomaly.

The Spanish sparrow is known to provoke serious damages to cereal crops in North African countries such as Algeria (Metzmacher and Dubois, 1981; Bellatreche, 1986; Summers–Smith, 1988; Behidj–Benyounes et al., 2011; Belkacem et al., 2012). The species normally breeds in trees forming large colonies, with a number of nests reaching well over a hundred per tree (Bernis, 1989; Tellería et al., 1999; Roviralta, 2003; Belkacem et al., 2012), and a clutch size of up to seven eggs (Summers–Smith, 1988; Metzmacher, 1990; Tellería et al., 1999; Marques, 2002), so that it is widely considered the most gregarious sparrow in the Palaearctic (Summers–Smith, 1988). Bernis (1989) stated that the Spanish vernacular name of this species ('gorrión moruno' = Moorish sparrow) was influenced by the knowledge of the severe damage that these birds caused in Morocco, and the huge magnitude of some of their colonies there. At least in the 19th century, this vernacular denomination was used in Spain together with other common names (Arévalo, 1887). Summers–Smith (1988) mentions that

the main English vernacular name (Spanish sparrow) is rather unfortunate as it simply derives from the fact that the species was described based on some specimens from Spain that were sent from Gibraltar but captured in Algeciras, Cadiz (Temminck, 1820).

Spanish sparrow females have a coloration almost the same as that of house sparrow females. Males of the two species are somewhat more distinct, and more showy in spring in both cases (see De Juana and Varela, 2000; Summers–Smith, 1988, 2009; Del Hoyo and Collar, 2016). The house sparrow is widely distributed throughout Iberia, including the southeastern sector (Bernis, 1989; Tellería et al., 1999; Molina, 2003; SEO/BirdLife, 2012; De Juana and García, 2015; Calvo et al., 2017). This scenario was the same in the second half of the 19th century (Reyes, 1886; Arévalo, 1887) and we may infer that it was similar in the 18th century (see Ferrero–García et al., 2014). Therefore, if people of that century had to describe the Spanish sparrow (assuming that they had never seen it before, or at least they had not noticed it because its presence was sparse or occasional) in a geographical area where the house sparrow was well-known, surely the simplest and easy description would be to use expressions invoking the similarity of the first sparrow species with the second one. In the documents analysed, only Marcos Mayoral (Document 5) comments on a perceptible physical feature that apparently one of the birds exhibited (a male adult): a white feather. The Spanish sparrow male has notably very white cheeks (De Juana and Varela, 2000; Summers–Smith, 1988, 2009; Del Hoyo and Collar, 2016). However, it was a dead bird (Mayoral had never seen it alive) and perhaps somewhat deteriorated, as he defined the specimen as 'old'. The bird had in fact been caught by using birdlime, a hunting procedure that damages feathers (Murgui, 2014).

It is relevant to note that nest removal is mentioned as one of the most effective bird control methods in some of the documents studied. At present, this method is used *mutatis mutandis* for the control of the Spanish sparrow in some African countries such as Algeria (Belkacem et al., 2012). In Tunisia there was even a law of 1892 that required people to destroy the Spanish sparrow nests (Summers–Smith, 1988). Note also that during an anti-pest campaign carried out in Kyrgyzstan (Central Asia), almost two million Spanish sparrows were eliminated with poisoned wheat (Summers–Smith, 1988; Bernis, 1989). Thanks to Document 7, we know that this dangerous control method was also probably used in the Maghreb to control this species during the second half of the 18th century. It is also interesting to verify the use of birdlime in the provinces of Murcia (Document 6) and Almería (Document 8) in the same period, a non-selective hunting method whose use in other regions of Spain has been a source of conflict since the first half of the 20th century to the present (Ferrero–García, 2017a, 2017b).

In conclusion, we have the certainty that an extraordinary bird outbreak occurred in Spain in May 1779, damaging cereal crops in several municipalities in Alicante, Murcia and Almería, and lasting in the

latter province until June. The pest outbreak was probably caused by the irruption of a sparrow-sized passerine bird that formed large arboreal colonies with many nests per tree and whose presence was totally unusual in southeastern Iberian peninsula. Descriptions narrated by direct witnesses coincide regarding the biology and behavior of the (badly named) Spanish sparrow and are consistent with the distribution of the species in southern Iberia and the Maghreb, as well as with its morphology and other species-specific features. We thus hypothesize that the Spanish sparrow would be the protagonist of this historic bird pest.

Acknowledgements

We thank the staff at the municipal archives of Vera, Orihuela and Lorca for their kind collaboration and two anonymous referees for their comments and suggestions. This research was supported in part by the Servicio de Sanidad Vegetal (SSV), Junta de Extremadura.

References

- AHRM [Archivos Históricos de la Región de Murcia], 2017. Proyecto Carmesi <http://www.regmurcia.com/servlet/s.SI?METHOD=CUADROCLASIFICACION&sit=c,373,m,139,serv,Carmesi>.
- Aliaga, I., 2008. Nuevos desarrollos urbanísticos en el Campo de Murcia. Implicaciones territoriales y planeamiento territorial. *Papeles de Geografía*, 47–48: 5–24.
- Alonso, J. C., 1997. Gorrión moruno *Passer hispaniolensis*. In: *Atlas de las aves de España (1975–1995)*: 498–499 (F. J. Purroy, Ed.). Lynx Edicions, Barcelona.
- Arévalo, J., 1887. *Aves de España* (Memorias de la Real Academia de Ciencias Exactas, Físicas y Naturales, tomo XI). Imprenta de viuda e hijo de Aguado, Madrid.
- Barriendos, M., Llasat, M. C., 2003. The Case of the 'Maldá' Anomaly in the Western Mediterranean Basin (AD 1760–1800): An Example of a Strong Climatic Variability. *Climatic Change*, 61: 191–216.
- Behidj-Benyounes, N., Bissaad, F. Z., Behidj, K. K., Chebouti, N., Doumandji, S., 2011. Variations inter parcellaires des dommages dus au moineau hybride *Passer domesticus* x *P. hispaniolensis* sur céréales dans un milieu agricole de l'extrême partie orientale de la Mitidja (Algerie). *Sciences & Technologie*, C–34: 61–71.
- Belkacem, A. A., Sekour, M., Doumandji, S., 2012. Effectiveness of mesh netting and nest' destruction in protection of crops against attack by Spanish sparrow *Passer hispaniolensis*. *African Journal of Agricultural Research*, 7: 4575–4580.
- Bellatreche, M., 1986. Approche économique des dégâts aviaires en Algérie. *Ann. Inst. Natl. Agro., El Harrach*, 10: 181–195.
- Bernis, F., 1989. *Los gorriones. Con especial referencia a su distribución y eto-ecología en las mesetas españolas* (Comunicaciones INIA. Serie Recursos Naturales). Ministerio de Agricultura, Pesca y Alimentación, Madrid.
- 1995. *Diccionario de nombres vernáculos de aves*. Gredos, Madrid.
- Berthold, P., 2001. *Bird Migration: A General Survey*. Second edition. Oxford University Press, Oxford. [translated by Hans-Günther Bauer and Valerie Westhead]
- Bruggers, R., Ruelle, P., 1981. Economic impact of pest birds on ripening cereals in Senegal. *Protection Ecology*, 3: 7–16.
- Calatayud, M. Á., 1987. *Catálogo de documentos del Real Gabinete de Historia Natural (1752–1786)*. CSIC, Madrid.
- Calvo, J. F., Hernandez-Navarro, A. J., Robledano, F., Esteve, M. Á., Ballesteros, G., Fuentes, A., García-Castellanos, F. A., González-Revelles, C., Guardiola, Á., Hernández, V., Howard, R., Martínez, J. E., Zamora, A., Zamora, J. M., 2017. Catálogo de las aves de la Región de Murcia (España). *Anales de Biología*, 39: 7–33.
- Canavelli, S. B., Branch, L. C., Cavallero, P., González, C., Zaccagnini, M. E., 2014. Multi-level analysis of bird abundance and damage to crop field. *Agriculture Ecosystems & Environment*, 197: 128–136.
- Codesido, M., Zufiaurre, E., Bilenca, D. N., 2015. Relationship between pest-birds and landscape elements in the Pampas of central Argentina. *Emu*, 115: 80–84.
- Contreras, A. J., Tejeda, A. G., García, J. A., 2003. Las aves como plaga, controles y manejo. *Ciencia UANL*, 6: 93–98.
- Craig, A. J. F. K., 2010. Family Ploceidae (Weavers). In: *Handbook of the Birds of the World*, Vol. 15 (Weavers to New World Warblers): 74–197 (J. Del Hoyo, A. Elliott, D. A. Christie, Eds.). Lynx Edicions, Barcelona.
- De Bunes, M. A., 1989. *La imagen de los musulmanes y del norte de África en la España de los siglos XVI y XVII: Los caracteres de una hostilidad*. CSIC, Madrid.
- Degland, C. D., Gerbe, Z., 1867. *Ornithologie européenne ou Catalogue descriptif, analytique et raisonné des oiseaux observés en Europe*. Tome I. Deuxième édition. J. B. Baillière & fils, Paris.
- De Gracio, J. W., 1978. World bird damage problems. In: *Proceedings: Eighth Vertebrate Pest Conference*: 9–24 (W. E. Howard, Ed.). University of California, Sacramento.
- De Juana, E., 2006. *Aves raras de España. Un catálogo de las especies de presentación ocasional*. Lyns Edicions, Bellaterra, Barcelona.
- De Juana, E., Garcia, E., 2015. *The birds of the Iberian Peninsula*. Helm-Bloomsbury Publishing, London.
- De Juana, E., Varela, J. M., 2000. *Guía de las aves de España. Península, Baleares y Canarias*. Lynx Edicions, Barcelona.
- Del Hoyo, J., Collar, N. J. (Eds.), 2016. *HBW and BirdLife International Illustrated Checklist of the Birds of the World*. Volume 2: Passerines. Lynx

- Edicions, Barcelona.
- De Melo, C., Cheschini, J., 2012. Daños causados por las aves en sorgo (*Sorghum bicolor*) en Brasil central. *Bioagro*, 24: 33–38.
- De Mey, Y., Demont, M., Diagne, M., 2012. Estimating bird damage to rice in Africa: evidence from the Senegal River Valley. *Journal of Agricultural Economics*, 63: 175–200.
- De Rijk, J., 2015. Vogels en mensen in Nederland 1500–1920. Proefschrift Vrije Universiteit, Amsterdam.
- De Sancha, A., 1780. *Memorias de la Sociedad Económica*, Tomo II. Sociedad Económica de Madrid, Madrid.
- Dhindsa, M. S., Saini, H. K., 1994. Agricultural ornithology: an Indian perspective. *Journal of Biosciences*, 19: 391–402.
- Díaz, P., 1895. *Serie de los obispos de Cartagena: sus hechos y su tiempo*. Estab. Tip. de Fortanet, Madrid.
- Escobedo, R., 2007. Los empleados de la Renta del Tabaco durante los siglos XVII y XVIII: el imán del privilegio. *HISPANIA. Revista Española de Historia*, 67: 1025–1040.
- Ferrández, T., Diz, E. (Eds.), 2015. *Historia natural de la Huerta de Orihuela*. Ayuntamiento de Orihuela.
- Ferrero–García, J. J., 2017a. Hunting passerines with non–selective trapping methods was a source of conflict in Spain as far back as 1933. *Animal Biodiversity and Conservation*, 40: 1–6.
- 2017b. La lucha contra la liga y las redes pajareras en la Segunda República española. *Quercus*, 374: 50–56.
- Ferrero–García, J. J., Bueno, P. P., Mendiola, F. J., Torres–Vila, L. M., 2016. Aves y agricultura en la historia de Extremadura: del conflicto a la alianza. *Quercus*, 369: 34–41.
- Ferrero–García, J. J., Martín–Vertedor, D., Torres–Vila, L. M., 2014. Incidencia histórica de las plagas de aves en la agricultura de Extremadura, España (siglos XVI–XIX). *Boletín de la Real Sociedad Española de Historia Natural. Sección Biológica*, 108: 5–20.
- Fulgione, D., Ripa, D., 2012. The Tangle Evolution of Italian sparrow. *International Journal of Evolution*, 1: 2.
- Gaceta de Madrid, 1779. Totana, en el Reyno de Murcia, 9 de mayo. *Gaceta de Madrid*, 41 [21 V 1779]: 351.
- García–Abellán, J., 1975. *La otra Murcia del siglo XVIII*. Academia Alfonso X El Sabio, Murcia.
- García–Hourcade, J. J., 1996. *Beneficiencia y sanidad en el siglo XVIII: El hospital de San Juan de Dios de Murcia*. Servicio de publicaciones de la Universidad de Murcia.
- García–Ruipérez, M., 2008. Los libros de actas municipales en los siglos XIX y XX. In: *VII Jornadas científicas sobre documentación contemporánea (1868–2008)*: 233–271. Departamento de Ciencias y Técnicas Historiográficas, UCM, Madrid.
- Gómez, A., 2006. Cargos y oficios municipales en las ciudades de León, Zamora y Salamanca durante el reinado de Carlos III. *Estudios Humanísticos. Historia*, 5: 159–184.
- Granda, S., 2011. El Presidente del Consejo de Castilla y el Generalato de la Suprema. *Revista de la Inquisición (Intolerancia y Derechos Humanos)*, 15: 27–83.
- Grima, J., 1990. Estampas del pasado veratense (1): la invasión de pájaros ultramarinos sufrida en Vera en 1779. *Vera* 30, 2: 4–7.
- Henares, F., 2010. Cartagena–Argel: una redención de cautivos en 1713. Trinitarios y mercedarios en Berbería. *Carthaginensia*, 26: 107–131.
- Hernández, J., 2009. Pasado y presente de Florida–blanca como objeto de la Historia. *Mélanges de la Casa de Velázquez*, 39: 163–186.
- Huber, D. M., Hugh–Jones, M. E., Rust, M. K., Sheffield, S. R., Simberloff, D., Taylor, C. R., 2002. Invasive pest species: impacts on agriculture production, natural resources, and the environment. *Council for Agricultural Science and Technology*, 20: 1–18.
- Jetz, W., Sekercioglu, C. H., Böhnig–Gaese, K., 2008. The Worldwide Variation in Avian Clutch Size across Species and Space. *PLoS Biology*, 6: 2650–2657.
- Jones, E. L., 1972. The bird pests of British agriculture in recent centuries. *Agricultural History Review*, 20: 107–125.
- Klom, H., 1970. The Determination of Clutch–Size in Birds a Review. *Ardea*, 58: 1–124.
- Lillo, M., Lisón, L., 2002. *Naturaleza y patrimonio: La dimensión de los aprovechamientos termales en Fortuna*. Servicio de publicaciones de la Universidad de Murcia.
- Loza–Del Carpio, A., Clavitea, J., Delgado, P., 2016. Incidencia de aves granívoras y su importancia como plaga en el cultivo de quinua (*Chenopodium quinoa* Willd.) en el altiplano peruano. *Bioagro*, 28: 139–150.
- Marques, P. M., 2002. Breeding parameters of Spanish sparrow *Passer hispaniolensis* in southern Portugal. *International Studies on sparrows*, 29: 11–20.
- Martínez, C. A., 2010. *Carlos III y los bienes de los jesuitas: la gestión de la temporalidad por la Monarquía borbónica (1767–1815)*. Universidad de Alicante, San Vicente del Raspeig.
- Metzmacher, M., 1990. Climatic factors, activity budgets and breeding success of the Spanish sparrow [*Passer hispaniolensis* (Temm.)]. In: *Granivorous birds in the agricultural landscape* (Proceedings of General Meeting of the Working Group on Granivorous Birds, INTECOL): 151–168 (J. Pinowski, J. D. Summers–Smith, Eds.). Polish Scientific Publishers, Warszawa.
- Metzmacher, M., Dubois, D., 1981. Estimation des dégâts causés par les oiseaux aux céréales en Algérie. *Revue Écologie (Terre et Vie)*, 35: 581–595.
- Molina, B., 2003. Gorrión común *Passer domesticus*. In: *Atlas de las aves reproductoras de España*: 560–561 (R. Martí, J. C. Del Moral, Eds.). Dirección General de Conservación de la Naturaleza–Sociedad Española de Ornitología, Madrid.
- Morales, M. Á., 1998. *La Justicia Penal en la Almería de la primera mitad del siglo XIX*. Universidad de

- Almería.
- Murgui, E., 2014. When governments support poaching: a review of the illegal trapping of thrushes *Turdus* spp. in the parany of Comunidad Valenciana, Spain. *Bird Conservation International*, 24: 127–137.
- Nelson, I., 1985. Irruption. In: *A Dictionary of Birds*: 307–309 (B. Cambell, E. Lack, Eds.). T. & A. D. Poyser, London.
- Newton, I., 2006. Advances in in the study of irruptive migration. *Ardea*, 94: 433–460.
- Oliva, M., Ruiz–Fernández, J., Barriendos, M., Benito, G., Cuadrat, J. M., Domínguez–Castro, F., García–Ruiz, J. M., Giralt, S., Gómez–Ortiz, A., Hernández, A., López–Costas, O., López–Moreno, J. I., López–Sáez, J. A., Martínez–Cortizas, A., Moreno, A., Prohom, M., Saz, M. A., Serrano, E., Tejedor, E., Trigo, R., Valero–Garcés, B., Vicente–Serrano, S. M., 2018. The Little Ice Age in Iberian mountains. *Earth–Science Reviews*, 177: 175–208.
- Pinowski, J., Kendeigh, S. C. (Eds.), 1977. *Granivorous birds in ecosystems*. Cambridge University Press, Cambridge.
- Prieta, J. (Ed.), 2003. *Aves de Extremadura: Anuario ADENEX 1999–2000*, volumen 2. ADENEX, Mérida.
- Ramírez, J. A., Baños, J., 1997. La despoblación como fenómeno de frontera en el valle del Sangonera/ Guadalentín (Murcia) Siglos XII–XIV. In: *Actas del Congreso la Frontera Oriental Nazarí como Sujeto Histórico (s. XIII–XVI): Lorca–Vera, 22 a 24 de noviembre de 1994*: 373–379 (P. Segura, Ed.). Instituto de Estudios Almerienses, Almería.
- Reyes, V., 1886. Catálogo de las aves de España, Portugal é Islas Baleares. *Anales de la Sociedad Española de Historia Natural*, 15: 5–109.
- Roviralta, F., 2003. Gorrión moruno *Passer hispaniolensis*. In: *Atlas de las aves reproductoras de España*: 562–563 (R. Martí, J. C. Del Moral, Eds.). Dirección General de Conservación de la Naturaleza–Sociedad Española de Ornitología, Madrid.
- Sánchez, F. J., 2012. Evolución constructiva de San Ginés de la Jara y propuesta arquitectónica de recuperación. *Revista Murciana de Antropología*, 19: 55–70.
- SEO/BirdLife, 2012. *Atlas de las aves en invierno en España 2007–2010*. Ministerio de Agricultura, Alimentación y Medio Ambiente–SEO/BirdLife, Madrid.
- Summers–Smith, J. D., 1988. *The sparrows: a study of the genus Passer*. T & AD Poyser, Calton.
- 2009. Family Passeridae (Old World sparrows). In: *Handbook of the Birds of the World*, Vol. 14 (Bush–shrikes to Old World sparrows): 760–813 (J. Del Hoyo, A. Elliott, D. A. Christie, Eds.). Lynx edicions, Barcelona.
- Tellería, J. L., Asensio, B., Díaz, M., 1999. *Aves ibéricas II. Paseriformes*. J. M. Reyero Editor, Madrid.
- Temminck, C. J., 1820. *Manuel d’Ornithologie, ou Tableau Systématique des Oiseaux qui se trouvent en Europe*, Seconde édition, Première partie. Chez Gabriel Dufour, Paris.
- Torres–Vila, L. M., Ferrero–García, J. J., Martín–Vertedor, D., Moral–García, F. J., Bueno, P. P., Morillo–Barragán, J., Sánchez–González, Á., Mendiola, F. J., 2015. Sparrow plagues in Extremadura (western Spain) over four centuries (1501–1900): a spatio–temporal analysis of records from historical archives. *Ardeola*, 62: 19–33.
- Torres–Vila, L. M., Ferrero–García, J. J., Martín–Vertedor, D., Sánchez–González, Á., 2009. La sanidad vegetal en Extremadura en el siglo XIX. In: *Dioses, mitos y demonios: la agricultura extremeña en el siglo XIX* (Colección: historia agraria y rural): 97–114 (J. L. Mosquera, Ed.). Consejería de Agricultura y Desarrollo Rural, Junta de Extremadura, Badajoz.
- Tracey, J., Bomford, M., Hart, Q., Saunders, G., Sinclair, R., 2007. *Managing bird damage to fruit and other horticultural crops*. Bureau of Rural Sciences, Canberra.
- Velasco–Pérez, M. C., 2012. La colección de láminas del naturalista Johannes Le Francq van Berkheij y su llegada al Real Gabinete de Historia Natural. In: *Pedro Franco Dávila (1711–1786): De Guayaquil a la Royal Society*: 245–271 (J. I. Sánchez–Almazán, Ed.). CSIC, Madrid.
- Wright, E. N., Inglis, I. R., Feare, C. J. (Eds.), 1980. *Bird problems in agriculture*. BCPC Publications, Croydon.