

Identification of Mediterranean Flycatcher

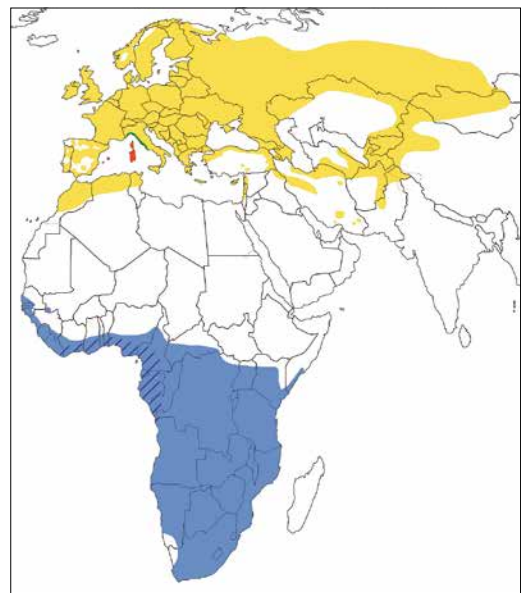
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Some of the most interesting taxonomic studies of the last 15 years in Europe were carried out in the western Mediterranean, particularly in Sardinia, Corsica and the Balearic Islands. This biogeographical area is characterized by a unique fauna, which remained isolated and evolved separately from the rest of the European fauna as a result of glacial cycles (Kvist et al 2004, Weiss & Ferrand 2007, van der Geer et al 2010). Examples of such studies are those in Moltoni's Warbler *Sylvia subalpina* (Brambilla et al 2008ab, Svensson 2013), Marmora's Warbler *S sarda* and Balearic Warbler *S balearica* (Shirihai et al 2001), and Citril Finch *Carduelis citrinella* and Corsican Finch *C corsicana* (Förschler & Kalko 2007, Förschler et al 2009), which analysed morphological, vocal, and genetic differences between these taxa to provide a picture of their systematics as complete as possible. The *Muscicapa* flycatchers in the western Mediterranean are among the most recent objects of study. So far, studies have dealt with morphology (Gargallo 1993, Viganò & Corso 2015, Olioso et al 2019), genetics (Pons et al 2016) and, more recently, vocalizations (Viganò 2015, Comolet-Tirman 2017, 2018, Wroza 2019). Here, we will report our most recent studies on vocalizations, relevant to field identification and crucial for assessing systematic relationships. Sounds are especially important in European *Muscicapa* species, with their drab plumage and extensive use of songs and calls, especially during courtship and reproduction (Viganò 2015). Sufficient evidence has now been mustered to confirm the recognition of insular Tyrrhenian populations from continental ones as a separate species according to the Phylogenetic Species Concept (Cracraft 1983, 1997): Mediterranean Flycatcher *M tyrrhenica*. Morphological comparisons of *M t tyrrhenica* (hereafter nominate *tyrrhenica*) and *M t balearica* (hereafter *balearica*) versus Spotted Flycatcher *M striata* (hereafter *striata*) showed significant differences, several of which allowing certain identification both in the field and in the hand (Gargallo 1993, Viganò & Corso 2015, Viganò et al 2016). Additionally, the recent publications and our results of bioacoustic analyses reported here confirm differences in vocalizations (especially song) be-

tween *tyrrhenica* sensu lato and *striata*, and their usefulness as a diagnostic character, both in the field and through analysis of sonagrams.

Genetic studies have shown constant differences in mitochondrial (about 3.5% in the CO1 region) and nuclear DNA between 'insular' (Corsica, Sardinia, Balearics, Tyrrhenian coast of Toscana) and continental populations (Pons et al 2016). Additional genetic studies of birds from Elba, in the Tuscan archipelago, and Sardinia, led to identical results of 3.5% different bases in the CO1 region of mitochondrial DNA (mtDNA) between nominate *tyrrhenica* and *striata* (Andrea Galimberti & Michele Viganò unpublished data). These populations can thus be considered two separate entities: the *tyrrhenica* group and the *stri-*

FIGURE 1 Distribution of Spotted Flycatcher *Muscicapa striata* (yellow: breeding; blue: wintering) and Mediterranean Flycatcher *M tyrrhenica* sensu lato (red: breeding; green: breeding range along Tyrrhenian coast of Italy in contact with or very close to that of Spotted; hatched blue: area of very few known winter records of *M t balearica*).



ata group, which separated about 1.1 million years ago, while *balearica*, though clearly grouped in *tyrrhenica* lineage, started differentiating from nominate *tyrrhenica* about 0.5 million years ago and shows a CO1 mtDNA distance from *tyrrhenica* of 1.7%, thus possibly acting as an incipient new species (Pons et al 2016). For decades, Mediterranean Flycatcher was almost completely neglected, with little if anything mentioned about its identification in the main field guides. Western Palearctic (WP) handbooks contain brief, vague, and often mistaken information. This is also the case for Shirihaï & Svensson (2018), where the only photograph of a presumed *tyrrhenica* is indeed most probably a *striata* due to cold greyish upperparts, heavy streaking on head, clear demarcation between ear-coverts and underparts and heavy, clear streaking on breast. In the text, they argue against the recognition of Mediterranean Flycatcher as a separated species based on two points: **1** morphological distinction of nominate *tyrrhenica* from Italian *striata* is poor and not comprehensively studied; and **2** genetically, nominate *tyrrhenica* seems to bridge *striata* and *balearica* rather than group with the latter. In our opinion point **1** is confuted by our past studies as well as the evidence shown here (but we agree that further study is needed in the contact zones), while point **2** is evidently a misreading of the data presented by Pons et al (2016) (see also Olivos et al 2019).

Our knowledge of migration routes and timing, wintering areas, and stop-over sites of *tyrrhenica* sensu lato is still very limited. Therefore, we summarize the available studies to provide a clear, concise and thorough framework for its identification. This paper mainly focuses on adult plumages of *striata*, nominate *tyrrhenica* and *balearica*; juvenile and first-winter plumages are more briefly analysed due to a lack in knowledge. In this paper, we use terms for *striata* such as 'the European Spotted Flycatchers' or 'Spotted Flycatchers of the European population', as we refer to populations breeding in Europe, or anyway within WP borders, rather than far eastern populations. By the same token, we use *tyrrhenica* sensu lato for Mediterranean Flycatcher as a whole, and nominate *tyrrhenica* and *balearica* for its two subspecies. Additionally, field identification of North African populations (and in part Iberian ones) should be investigated as well, since they likely concern an undescribed subspecies (Pons et al 2016; all authors' pers obs). However, the data at our disposal for North Africa are still incomplete and are only briefly mentioned here.

Materials and methods

We have studied the *Muscicapa* species groups in the field over the last decade in Balearic Islands (Mallorca and Menorca; Spain), Crete (Greece), Corsica (France), Cyprus, Georgia, Germany, Italy (including Sardinia and the Tuscan islands of Elba and Capraia), Switzerland and Turkey. We have also examined photographs from all taxa. Morphometric data were obtained using a stopped ruler (to the nearest 0.5 mm), callipers (to the nearest 0.1 mm) and a thin strip of graph paper (to the nearest 0.5 mm). On these birds we also measured the intensity of streaking on head and breast using the same categories used in Viganò & Corso (2015) (in the present study we added two additional ones for head streaking to include the heavier head pattern of *balearica*); after an initial evaluation of all specimens, we established categories that could represent in sufficient detail the variability. We scored breast streaking on a 0 to 6 scale (0 indicating the least streaked birds and 6 the most streaked ones) and head streaking on a 0 to 7 scale.

Collections visited for this research are: Natural History Museum, Tring, England (NHMUK); Museo Zoologico ISPRA, Ozzano dell'Emilia, Italy (MZI); Museo Civico di Storia Naturale di Milano, Milan, Italy (MSNM); Museo Civico di Zoologia di Roma, Roma, Italy (MCZR); Museo di Scienze Naturali in Forlì, Forlì, Italy (MSNF); Museu de Ciències Naturals de Barcelona, Barcelona, Spain (MCNB); and Muséum National d'Histoire Naturelle, Paris, France (MNHN). A total of c 300 skins were examined to study plumage characters and variability; morphometric measurements were also taken for 87 of these, whose geographic origin can be found in table 1. The recordings used to analyse songs (92 individuals) were obtained with a portable recorder and a parabolic microphone (table 2).

General information

Mediterranean Flycatcher – nominate M t tyrrhenica

Described in German (translated here) as 'Tyrrhenischer Grauer Fliegenfänger' by Guido Schiebel (1910). One of the syntypes is stored at Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany (ZFMK). The female is registered as ZFMK 57.1307, collected at Aitone near Evisa, Corsica, France, on 18 May 1910 (van den Elzen & Rheinwald 1984). Type description: '*Muscicapa striata tyrrhenica* subsp. nova. Tyrrhenian Flycatcher. Easily distinguished from a series of *M. s. striata* from Austria since the streaking on the underparts is very blurry and does not contrast strong-

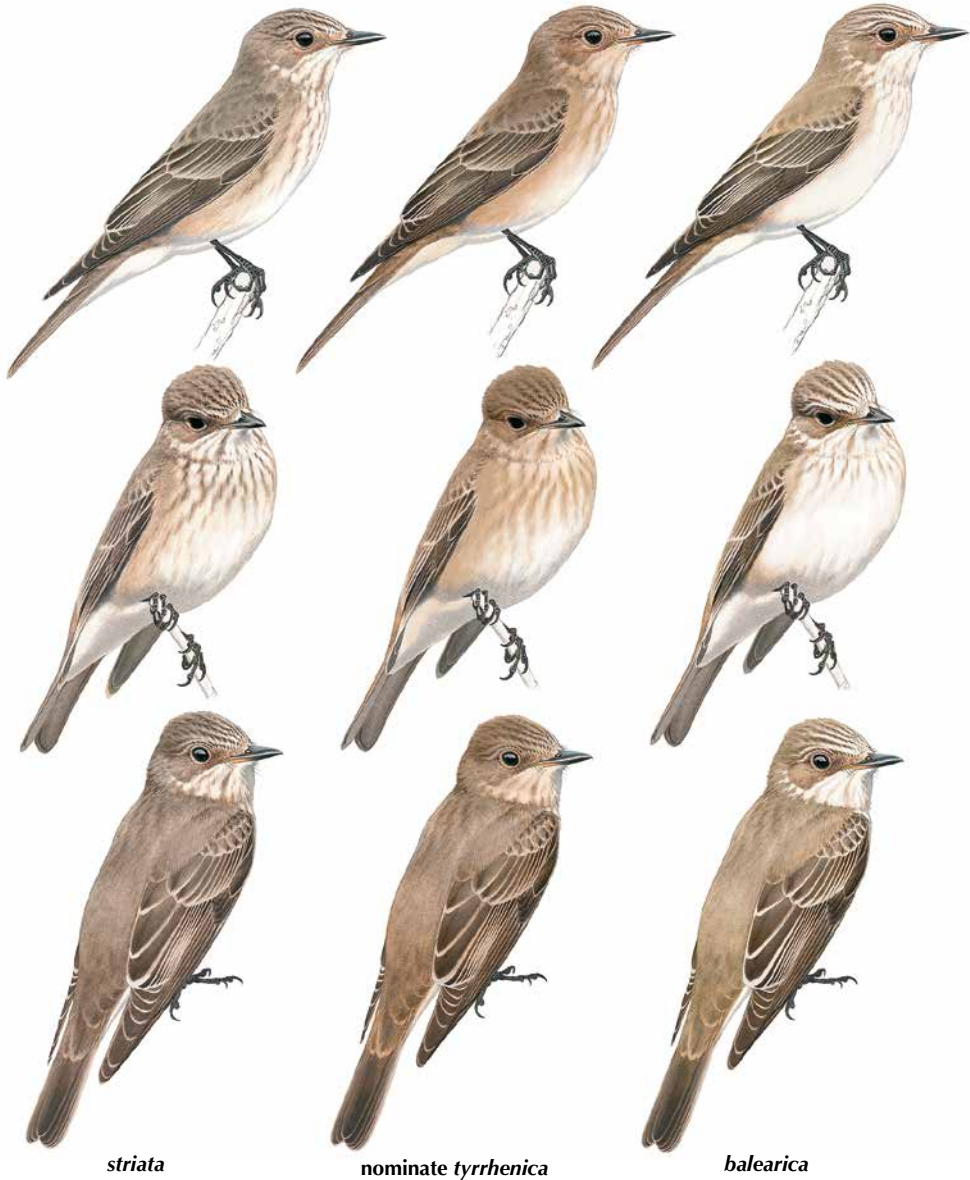


FIGURE 2 Spotted Flycatcher / Grauwe Vliegenvanger *Muscicapa striata* (left), Tyrrhenian Flycatcher / Tyrreense Vliegenvanger *M tyrrhenica tyrrhenica* (centre) and Balearic Flycatcher / Balearische Vliegenvanger *M tyrrhenica balearica* (right) (Lorenzo Starnini). For nominate *tyrrhenica* note especially: short wing not projecting beyond tail-coverts and with primary projection shorter than tertials length, rusty tones to plumage, weak contrast between upperparts and underparts, weak head streaking, diffuse streaking on underparts, creamy tinge to throat and lack of clear demarcation between ear-coverts and throat. For *balearica* note: same short wing as nominate *tyrrhenica*, warm but paler tones to plumage (more creamy/beige), clear contrast between upperparts and underparts, very pale underparts with almost immaculate flanks, very pale (whitish) base to head feathers making the head streaking even more evident than in *striata*, few, pale and thin streaking on throat and breast, rusty ear-coverts appear as mask due to contrast with pale crown, throat and some white neck feathers.

TABLE 1 Numbers and geographic origin of studied *Muscicapa* specimens

***Muscicapa striata* (53)**

M s striata (40) – Britain (5 NHMUK); France (1 NHMUK); Italy (29, from throughout continental Italy: 9 MSNM, 9 MCZR, 3 MSNF, 8 MZI); Netherlands (1 NHMUK); Poland (2 NHMUK); Sweden (2 NHMUK).

M s neumanni (4) – Crete, Greece (1 NHMUK); Iran (2 NHMUK); Palestine (1 NHMUK).

M s ssp (9) – Morocco (5: 2 NHMUK, 3 MCNB); Spain (3 MCNB); Tunisia (1 NHMUK).

***Muscicapa tyrrhenica* (34)**

M t tyrrhenica (17) – Corsica, France (1 NHMUK); Sardinia, Italy (16: 6 MSNM, 6 MCZR, 4 MSNF).

M t balearica (17) – Balearic Islands, Spain (15 NHMUK); Cameroon (2: 1 in spring (23 April 1921) and 1 in autumn (28 October 1907), NHMUK).

TABLE 2 Numbers and geographic origin of analyzed songs of *Muscicapa* taxa

***Muscicapa striata* (31)**

M s striata (31) – Britain (1 Martin Sutherland/xeno-canto.org XC256403); France (5 Julien Rochefort); Italy (13 this study); Poland (1 Krzysztof Deoniziak/xeno-canto.org XC101385); Sweden (1 Mats Rellmar/xeno-canto.org XC139372); Switzerland (10: 9 this study, 1 Thomas Luthi/xeno-canto.org XC247757).

***Muscicapa tyrrhenica* (61)**

M t tyrrhenica (37) – Corsica, France (24: 20 this study, 4 Arnoud van den Berg/The Sound Approach); Italy (13: 4 from Sardinia, 1 from Livorno (coast of Toscana), 7 from Capraia (Tuscan archipelago), 1 from Montecristo (Tuscan archipelago) – all for this study except the one from Montecristo by Giuseppe Gazzoni (in Brichetti & Fracasso 2008).

M t balearica (24) – Balearic Islands, Spain (21 from Mallorca: 19 this study, 2 Mark Constantine/The Sound Approach; 3 from Menorca, this study).

ly with the other feathers. One individual from Sardinia (donated by Crown Prince Rudolph, Hofmuseum, Vienna) resembles the Corsican birds. Range: Corsica and Sardinia. Types: male, 19 May 1910; female, 19 May 1910; pair.'

BREEDING RANGE The published breeding range comprises Sardinia, Corsica, the Tuscan archipelago (nominate *tyrrhenica*) and the Balearic Islands (*balearica*) (Viganò & Corso 2015) (figure 1). In much of its range, this taxon is exceptionally common and prefers less arboreal habitats than *striata*, favouring rocky and sometimes highly urbanized areas (Brichetti & Fracasso 2008, Viganò & Corso 2015; MV pers obs). In some publications, nominate *tyrrhenica* is also reported as breeding along a narrow coastal strip on the western – ie, Tyrrhenian – coast of Italy (Tellini et al 1997, Brichetti & Fracasso 2008). This has recently been confirmed by our personal observations: **1** in May 2015, we observed and sound-recorded singing individuals at Livorno (Tuscan coast); **2** in July 2016, several presumably breeding birds were photographed along the Entella river at Lavagna along the Ligurian coast (Daniele Papi and Andrea Simoncini in litt; the most northerly population currently known); **3** in June–July 2016, breeding birds were observed along the Tiber river at Rome, syntopically with several breeding pairs of *striata* (Andrea Corso & Justin Jansen pers obs). Its presence along the Tyrrhenian coast of Toscana is confirmed by the presence of individuals identified genetically as nominate *tyrrhenica* from the city of Livorno (Pons et al 2016). The presence of nomi-

nate *tyrrhenica* as far inland as Firenze, the locality of the wrongly identified photograph in Shirihai & Svensson (2018), has never been confirmed so far. We have the following data from small islands in the Tyrrhenian Sea, ie, away from its published range in the Tuscan archipelago: **4** in June 2012, several pairs on Marettimo, Egadi islands, Sicily (Giuseppe Speranza in litt); **5** in June 2017, several apparently breeding pairs on Ustica, c 50 km north of Palermo, Sicily (Giuseppe Speranza in litt); **6** in July 2016, several pairs on Ponza, Pontine archipelago, Latium (Giovanni Radaelli in litt); and **7** in June 2018, some possibly breeding birds on Ischia, Campania (Rosario Balestrieri in litt).

MIGRATION At least three were found on migration on 12 September 2015 on Salina, Aeolian islands, Sicily (Davide De Marchi in litt); two on 11 October 2015 on Lampedusa, Pelagie islands, Sicily (pers obs, MISC – Malati di Isolitudine allo Stadio Cronico); and numerous individuals (both adults and juveniles) in mid- to late September 2013–16 on Favignana, Egadi islands, Sicily (AC pers obs). It would be interesting to verify whether, as we suspect, Mediterranean Flycatcher also breeds on Salina and the Egadi islands. The wintering area is still unknown (Viganò & Corso 2015, Pons et al 2016, Viganò et al 2016).

VERNACULAR NAME The English name chosen by the IOC World Bird List is Mediterranean Flycatcher (Gill & Donsker 2019). Since Dutch Birding follows the IOC list for vernacular names, it is also the name used in this paper (Redactie Dutch

Birding 2016). When Mediterranean Flycatcher becomes the name of *tyrrhenica* sensu lato, Tyrrhenian Flycatcher can be used for nominate *M t tyrrhenica* and Balearic Flycatcher for *M t balearica*.

Balearic Flycatcher – M t balearica

Described in German (translated here) by Karl von Jordans (1913). The holotype is stored in ZFMK. The male was collected at Valldemosa, Mallorca, on 19 May 1913 (ZFMK 654) (van den Elzen & Rheinwald 1984). Type description: ‘*Muscicapa striata balearica* subsp. n. Bird surprisingly pale. Upperhead feathers with broad white edges. Back and underside very bright. Very similar to *M. str. Neumanni* Poche, but brighter, especially the upperhead, remarkably short wings. Wing length male 79,5-81,5, female 76-80 mm (*M. str. striata* 85-89, *M. str. neumanni* 86-90,5 mm). Type in my collection.’

BREEDING RANGE This taxon is only found breeding in the Balearic Islands, where it is very common and often found close to buildings (Gargallo 1993).

MIGRATION Recently, several sightings have been reported for French and Spanish Mediterranean coasts which reveal a regular passage, with a peak in early May (Peignot & le CHR-LR 2011, Gil et al 2016). There are five records outside the Balearic Islands: **1** one ringed in Merzouga, south-eastern Morocco, on 27 April 2013, the first record for Morocco (Bergier et al 2015); **2** one ringed in Malta on 26 April 2011 (Galea & Viganò 2011); **3** one ringed on Antikythera, Greece, on 5 May 2011 and recaptured afterwards on Menorca, Balearic Islands (Garcia-Febrero & Barboutis 2012); **4** 12 individuals trapped on Sardinia between late April and early May, five in Mal di Ventri (from May 1997) and seven from Asinara (May 2013, May 2014, May 2018 and four between late April and early May 2019) (Fozzi et al 2019); **5** one presumed bird photographed near Tagoundaft, 22 km north-east of Tizi n’Test pass, High Atlas, Morocco, on 13 April 2019 (Luca Mazzini et al). Winter range: specimens have been collected in western and south-western Africa (del Hoyo et al 2006). Two collected in Cameroon: see table 1.

VERNACULAR NAME When Mediterranean Flycatcher becomes the name of *tyrrhenica* sensu lato, Tyrrhenian Flycatcher can be used for nominate *M t tyrrhenica* and Balearic Flycatcher for *M t balearica*.

Spotted Flycatcher – various subspecies
Gill & Donsker (2019) list the following subspecies of *striata*:

M s striata, breeds from Europe east across the Ural mountains to western Siberia (Irtysh river), and in north-western Africa from northern Morocco east to northern Tunisia; winters in western, eastern and southern Africa.

M s inexpectata, breeds in Crimea; winters in Africa.

M s neumanni, breeds from islands in the Aegean Sea east to the Caucasus and northern and western Iran, and south to Cyprus and Levant, also in central Siberia (from Irtysh river east to western Transbaikalia); winters in eastern and southern Africa.

M s sarudnyi, breeds from eastern Iran and Turkmenistan east to Tien Shan, Pamirs and northern and western Pakistan; winters probably in eastern and southern Africa.

M s mongola, breeds from south-eastern Altai east to south-eastern Transbaikalia and northern Mongolia; winters probably in eastern and southern Africa.

The same genetic distance measured between the two subspecies of Mediterranean Flycatcher was found between European individuals of Spotted Flycatcher, including *M s neumanni*, and six individuals from Spain and Tunisia (Pons et al 2016). Additional studies are underway to shed light on the taxonomic situation of other populations of Spotted Flycatcher, especially those from Iberia and North Africa which, on the basis of genetic, structural, and plumage differences, may be subspecifically distinct (Jean-Marc Pons & José Luis Copete in litt). Nevertheless, in the absence of data on vocalizations, which proved essential for the other taxa, any further speculation on the systematic relationships of Iberian and North African populations is premature.

Plumage sequences

Interestingly, *Muscicapa* flycatchers have a moult sequence unique among European birds, with primaries moulting ascendantly, from the outermost (p1) to the innermost (p10) (Svensson 1992, Jenni & Winkler 1994, Blasco-Zumeta & Heinze 2015, Demongin 2016). Additionally, moult takes place mostly on the wintering grounds, and primary moult hardly ever in Europe, with very rare exceptions (Jenni & Winkler 1994). Therefore, birds can look very abraded and featureless in summer (plate 402). There is no information available in the literature on moult in Mediterranean Flycatcher, but two adult nominate *tyrrhenica* photographed by



402 Tyrrhenian Flycatcher / Tyrrhense Vliegenvanger *Muscicapa tyrrhenica tyrrhenica*, Sardinia, Italy, 7 August 2012 (*Helge Sørensen*). This very abraded and faded individual lost most of its warm rusty-drab or beige tinge to both underparts and upperparts; however, note almost invisible streaking and typical structure with shorter primary projection compared with Spotted Flycatcher *M striata*, with impression of longer tail. Abraded birds appear more two-toned than fresh ones, but still look duller overall and more uniform than Spotted. **403** Tyrrhenian Flycatcher / Tyrrhense Vliegenvanger *Muscicapa tyrrhenica tyrrhenica*, Salina, Eolie Islands, Sicily, Italy, 12 September 2015 (*Davide de Marchi*). On this bird many typical features of nominate *tyrrhenica* are visible: warm brownish colours, weak streaking on head and breast, creamy tinge on throat and weak contrast with ear-coverts, primary projection shorter than tertials length. There is an almost complete lack of information about moult timing of Tyrrhenian but this adult bird seems more advanced in his post-breeding moult than is usually the case in Spotted Flycatcher *M striata*, with newly replaced greater and median coverts, three tertials and, apparently, four inner primaries.

Davide de Marchi on Salina, Sicily, on 12 September 2015 (plate 403) showed quite an unusual moult for a European *Muscicapa*, being very advanced – including nearly all greater coverts, tertials, and four primaries – and because the moulted primaries were the inner ones as opposed to the outer ones, as would normally be the case in European *Muscicapa*. Additional studies are sorely needed to shed more light on the moult strategy of the two subspecies of Mediterranean Flycatcher.

Identification

General appearance

Tyrrhenica sensu lato is slightly smaller than *striata*, with a different structure. The wings are shorter and the tail appears longer in the field due to the shorter maximum chord and primary projection. The head looks somewhat larger, as in many Asian flycatchers. The two subspecies can be distinguished on plumage. Nominate *tyrrhenica* gives a rather dark overall impression (especially wings and tail), ‘dirty’, and lacking contrast (plate 404). This is due to lower contrast between the upperparts and underparts, the less-defined streaking on the underparts compared with *striata* and the warmer flanks, often with a buffy hue. The plumage of *balearica* is very pale and clean, both above

and below; the underparts in particular can appear almost pure white from a distance (plate 406). The upperparts are paler than in other taxa in nominate *tyrrhenica* and *striata*, with a beige tint, while the head’s whitish background colour sets off streaking that is better defined and often more ‘orderly’ than in *striata* and especially nominate *tyrrhenica*.

Structure

Table 3 gives the main biometric measurements from our studies of museum skins. Both subspecies of Mediterranean Flycatcher are smaller and more delicate than *striata*: the average maximum chord measured for nominate *tyrrhenica* was 81.6 mm (79-84) and for *balearica* 78.9 mm (76-82), while for 47 *striata* from throughout the WP (but excluding North Africa, see below) the average is 85.5 mm (83-90). We compared our museum measurements with measurements taken on ringed birds in the Balearic Islands (212 *striata*, 229 *balearica*) and can confirm that there is no statistical difference in the mean wing chord length of live birds and museum specimens (t-test for *balearica* gave $t=0.4666$ and $p=0.6412$, for *striata* $t=0.6295$ and $p=0.7878$). In the field, the shorter wing of *tyrrhenica sensu lato* can be detected by looking at primary projection (in relation to tertial length) and the wing-tip/tail-tip ratio. In *tyrrhenica sensu lato*, tertial length

TABLE 3 Important morphometric (mean and range in mm, followed by number of specimens) and plumage measurements derived from museum specimens for the three *Muscicapa* taxa discussed. Values for p2-5 indicate distance (in mm) between second and fifth primary (numbered from outside); positive values indicate that p2 is longer than p5, negative values the opposite. Same for third and fourth primary (p3-4), where p3 is almost always wing-tip in *striata*, while in *tyrrhenica* sensu lato p3 is very often bunched with p4. Plumage streaking intensity was measured for both breast (on scale from 0 to 5, where 0 is least and 5 most streaked) and head (on scale from 0 to 7); see main text under Materials and methods for further details.

	<i>striata</i>	nominate <i>tyrrhenica</i>	<i>balearica</i>
wing chord	85.84 (83-90; 44)	81.59 (79-84; 17)	78.82 (76-82; 17)
tail	55.60 (50-60; 15)	56.36 (54-61; 14)	56.00 (51-58; 17)
p2-5	2.57 (0/5; 44)	-0.59 (-2/1; 14)	-1.94 (-4/0; 17)
p3-4	1.25 (0/3; 44)	0.06 (-1/1; 17)	-0.18 (-1/0; 17)
bill width	4.37 (3.5-4.5; 28)	4.35 (3.5-5; 15)	4.39 (3.5-4.5; 8)
breast streaking	4.04 (3/5; 28)	1.6 (0/3; 15)	0.53 (0/2; 17)
head streaking	3.62 (2/5; 28)	1.33 (0/3; 15)	5.59 (4/7; 17)

is always longer, or at most equal to primary projection (plate 406, 411), while in *striata* the tertial length is always shorter, or at most equal to primary projection (plate 410). When perched and with the wings closed, the wing-tip of *tyrrhenica* sensu lato reaches the base of the tail or c one third of the way down, while in *striata* it reaches at least halfway down the tail. The wing formula also differs between the two: in *tyrrhenica* sensu lato, the wing is rounder with p2 shorter than p5 (numbered from the outside) (plate 407, 409), while the reverse is usually true in *striata* (plate 408). As a consequence, in *tyrrhenica* sensu lato p2 is also clearly shorter than p3 (which forms the wing point), while this difference is less evident in *striata*. Nevertheless, we feel that the p2/p5 ratio is more reliable: this character is easy to use in the hand and on museum skins but can also be seen in the field under ideal conditions or on good photographs (cf plate 410, 413). The best conditions for evaluating this character and obtaining useful images are with birds at eye level or above, and slightly backlit: the primaries will appear translucent, making it easier to assess the position of p2 in relation to p5 (plate 412). Some Iberian breeding individuals from Catalunya measured in the field have p2 equal to p5 in length, or even shorter. The number of studied birds is small (n=25) and mostly they showed p2 longer than p5. Furthermore, from our data there seems to be a slight gradient, with birds from northern, north-eastern and western Europe (Denmark, France, Netherlands, Poland, Sweden) showing a larger distance between p2 and p5 (p2 much longer than p5, mean 3.91 mm, n=8), while birds from central/southern Italy have a less pronounced distance (mean 2.14 mm, so p2 closer to p5 but still longer, n=7); anyway, birds from as south as the Puglia and Calabria regions of Italy (thus breeding south of many Mediterranean

Flycatchers) still show p2 longer than p5, the reverse of most *tyrrhenica* sensu lato. This highlights the need of combining different features for a correct identification. Average tail length is the same in the two species but in light of the wing-tip/tail-tip ratio, *tyrrhenica* sensu lato appears to have a narrower and longer tail compared with *striata*, both in the field and in the hand. We did not find any other meaningful structural differences. In this regard, it is interesting to note that Parrot (1910) reported differences in bill structure for nominate *tyrrhenica*, which he considered to be flatter at the base and more elongated, based on six specimens from Corsica. We have been unable to confirm these differences in bill structure – our measurements from a large series of specimens were similar for all three taxa discussed here – but measurements taken from live birds may shed a different light on the assessment of this character.

Plumage colour

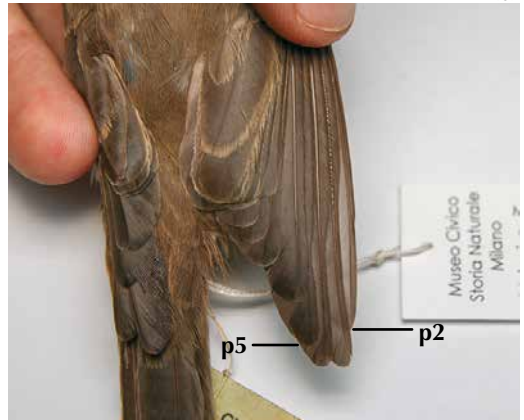
The mantle of *striata* from continental Europe is rather cold brownish-grey, lacking warm tones (plate 405). The rump appears concolorous with the back, or at most slightly warmer. Wings and tail are essentially the same colour, with rather evident pale edges, which wear rapidly and may be nearly invisible as early as May, more commonly mid/late June (wing and tail moult takes place on the wintering grounds in Africa). The underparts are rather pale with evident streaking and contrast visibly with the upperparts. Nominate *tyrrhenica* have clearly warmer plumage tones, brown with a rufous hue (cf plate 404). Although the mantle appears slightly paler in the field, the wings, tail, and head are darker, and this together with darker, less contrasting edgings to the tail and flight-feathers, give nominate *tyrrhenica* a darker overall appearance compared with *striata*; the edges to the wing-



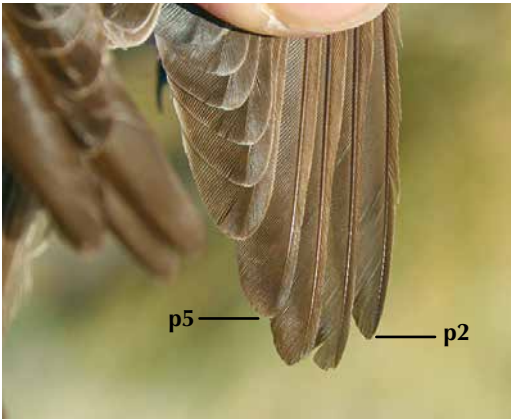
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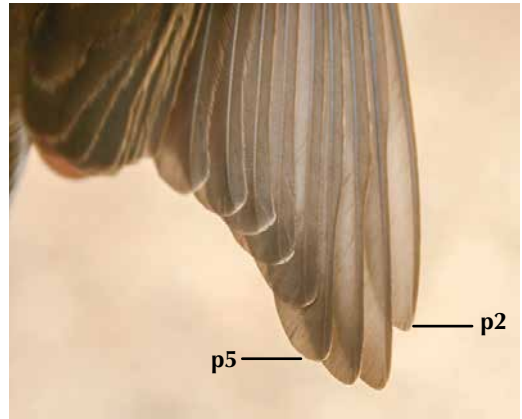
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404 Tyrrhenian Flycatcher / Tyrrhene Vliegenvanger *Muscicapa tyrrenica tyrrenica*, adult, Corsica, France, 6 June 2015 (Michele Viganò). Under field conditions, general impression of individuals from Sardinia, Corsica and Tyrrhenian islands and coasts, Italy, is that of warmer-toned birds than Spotted Flycatcher *M striata*, more uniformly coloured overall, with shorter wings, longer tail and bigger looking head and much less defined streaking on both head and underparts. **405** Spotted Flycatcher / Grauwe Vliegenvanger *Muscicapa striata*, adult, Pantelleria, Sicily, Italy, 15 May 2013 (Michele Viganò). During migration in Mediterranean basin, especially on small islands, it is possible to observe Spotted and Mediterranean Flycatcher *M tyrrenica* together: on side-by-side comparison, it is possible to note longer wings/primary projection of Spotted (wing-tip longer than longest undertail-covert), with primary projection being longer than tertials' length, proportionally shorter tail projection, colder and greyer plumage tone overall, more distinctly streaked underparts and crown, with better defined and well demarked streaks. **406** Balearic Flycatcher / Balearische Vliegenvanger *Muscicapa tyrrenica balearica*, adult, Mallorca, Balearic Islands, Spain, 11 June 2015 (Alex Bos). On Balearic Islands, this subspecies of Mediterranean Flycatcher is very common and widespread, breeding also in urban landscape. Its structure is very similar to that in Tyrrhenian Flycatcher *M t tyrrenica* but plumage is visibly paler, slightly colder, cleaner overall, with stronger contrast between darker upperparts and paler underparts, these being almost clean white. Crown has whiter ground colour than any other of related flycatcher taxa. Compared with Spotted Flycatcher *M striata*, primary projection is shorter (shorter than tertials' length), reaching 1/3 of tail (not 2/3) and in line with longest uppertail-coverts (and often shorter than undertail-coverts), appearing longer tailed; plumage is cleaner, paler, with narrower streaking on breast and crown, often barely visible. **407** Tyrrhenian Flycatcher / Tyrrhene Vliegenvanger *Muscicapa tyrrenica tyrrenica*, adult (collected on Tavolara, Sardinia, Italy, 14 May 1966), Museo Civico di Storia Naturale di Milano, Italy, 20 November 2012 (Michele Viganò). All over distribution range of Mediterranean Flycatcher (ie, both subspecies), wing is shorter than in Spotted Flycatcher *M striata*, with shorter second primary (p2) shorter or equal to p5. Furthermore, p3 and p4 appear closer to each other, being in most cases of same length.



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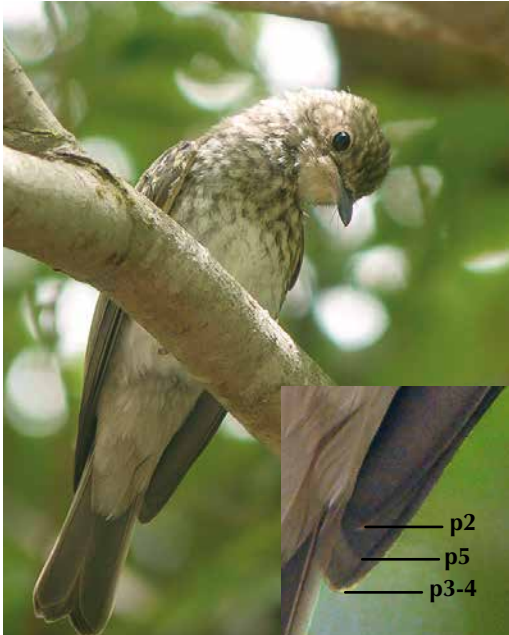


408 Spotted Flycatcher / Grauwe Vliegenvanger *Muscicapa striata*, adult, Falsterbo, Skåne, Sweden, 22 August 2015 (*Marc Illa*). In *striata*, p2 is (almost) always longer than p5. **409** Balearic Flycatcher / Balearische Vliegenvanger *Muscicapa tyrrhenica balearica*, adult, Illa de l'Aire, Menorca, Balearic Islands, Spain, 5 May 2015 (*Marc Illa*). Wing formula in *balearica* is similar to that in Tyrrhenian Flycatcher *M t tyrrhenica*, or sometimes with even shorter p2. **410** Spotted Flycatcher / Grauwe Vliegenvanger *Muscicapa striata*, adult, Ventotene island, Lazio, Italy, 24 April 2011 (*Michele Viganò*). Note extremely long primary projection, longer than tertials, and uppertail-coverts, reaching more than 2/3 of tail. In rare opportunity like this, when p2 is displaced, longer length compared with Mediterranean Flycatcher *M tyrrhenica* is obvious. **411** Tyrrhenian Flycatcher / Tyrreense Vliegenvanger *Muscicapa tyrrhenica tyrrhenica*, adult, Sardinia, Italy, 20 May 2012 (*Francesco Deluca*). Streaking on breast (and often belly) is weak and often appearing as dull spotting/marbling (almost as in Thrush Nightingale *Luscinia luscinia*), less well marked and obvious than in Spotted Flycatcher *M striata*. Head is overall dull with rather dull ground colour, streaking consequentially being barely visible. Throat is tinged creamy or tawny-drab, almost concolorous with ear-coverts (unlike Balearic Flycatcher *M t balearica*). Often, it is throat where dark markings are more visible. Flanks are in most birds tinged creamy or drab-tawny as well, more often than in Spotted (and of course than in Balearic).

coverts are also more fulvous and therefore less contrasting. In nominate *tyrrhenica*, the rump shows the warmest, rustiest tones of the entire body and slightly contrasts with the mantle and the tail (plate 411). The underparts look rather dirty, including the flanks and underwing, and contrast with the upperparts is limited. Additionally, the underparts, especially the throat and upper chest,

show a pale cream wash that is lacking in the other taxa (plate 417). *Balearica* share with nominate *tyrrhenica* the warm tones on the mantle, wings and tail but the ground colour is visibly paler and less reddish than in nominate *tyrrhenica*; sandy tones prevail over reddish ones (plate 406, 415). Additionally, some individuals may have a greyer and colder plumage, with reduced warm tones

Identification of Mediterranean Flycatcher



412 Tyrrhenian Flycatcher / Tyrreense Vliegenvanger *Muscicapa tyrrhenica tyrrhenica*, juvenile, Sardinia, Italy, 29 July 2013 (Claudio Crespi). All flycatchers, when perched, often have wings slightly open: in such position, it is possible to study wing-formula in detailed and close up photographs – note rather short p2, ‘bunched’ p3-p4 and shadow of p5, longer than p2.

413 Balearic Flycatcher / Balearische Vliegenvanger *Muscicapa tyrrhenica balearica*, adult, Mallorca, Balearic Islands, Spain, 24 May 2016 (Michele Viganò). When preening, it may be possible to ‘read’ wing formula: look for rather short p2 with much longer p5 (in Spotted Flycatcher *M striata* this would have almost equal length of p5 or shorter and not visible). Note also typically clean white underwing-coverts of *balearica*, and almost unmarked white underparts, including breast. Crown is very pale with ‘ghostly’ streaking. Throat is very white, contrasting strikingly with ear-coverts, more than in Spotted and Tyrrhenian Flycatcher *M t tyrrhenica*.





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414 Spotted Flycatcher / Grauwe Vliegenvanger *Muscicapa striata*, adult, Losone, Ticino, Switzerland, 12 June 2014 (*Riccardo Caretoni*). Streaking on both underparts and head more pronounced, visible and regularly defined compared with Mediterranean Flycatcher *M tyrrhenica*; furthermore, border between dark ear-coverts and pale throat is more abrupt than in Mediterranean, which usually shows creamy tinge in throat, lowering contrast between upper- and underparts. **415** Balearic Flycatcher / Balearische Vliegenvanger *Muscicapa tyrrhenica balearica*, adult, Mallorca, Balearic Islands, Spain, 5 May 2015 (*Juan Sagardía*). Plumage of *balearica* is surely most characteristic among related Western Palearctic *Muscicapa* flycatchers: underparts are almost unmarked white (sometimes only barely tinged creamy), fine, pencil-like dark streaking barely detectable, ground colour of crown is rather whitish, with darker streaking showing off pretty well, upperparts are drab-tawny, rusty ear-coverts often appear as isolated patch (surrounded by pale). **416** Balearic Flycatcher / Balearische Vliegenvanger *Muscicapa tyrrhenica balearica*, adult (left) and Spotted Flycatcher / Grauwe Vliegenvanger *M striata* (right), Illa de l'Aire, Menorca, Balearic Islands, Spain, 8 May 2012 (*Marc Illa*). When compared directly, whiter ground colour of crown of *balearica* is strikingly visible. In Tyrrhenian Flycatcher *M t tyrrhenica*, colour would be pretty similar to *striata*, but dark streaking much less well marked. **417** Tyrrhenian Flycatcher / Tyrrhense Vliegenvanger *Muscicapa tyrrhenica tyrrhenica*, adult (left) and Spotted Flycatcher / Grauwe Vliegenvanger *M striata* (right), Sardinia, Italy, 22 May 2018 (*Ilaria Fozzi*). When directly compared, it is easy to note differences in colours and contrasts between them: right bird has more numerous, clearer and browner streaks on underparts, while left bird shows fainter streaking and distinctive creamy wash to throat.



418 Spotted Flycatcher / Grauwe Vliegenvanger *Muscicapa striata*, adult, Falsterbo, Skåne, Sweden, 22 August 2015 (*Marc Illa*). Note cold plumage tone in this post-breeding adult, with very well marked dark streaking on crown and throat/breast, and very long wing and primary projection. **419** Balearic Flycatcher / Balearische Vliegenvanger *Muscicapa tyrrenica balearica*, adult, Illa de l'Aire, Menorca, Balearic Islands, Spain, 5 May 2015 (*Marc Illa*). Being easiest Mediterranean Flycatcher *M tyrrenica* to identify, *balearica* shows most characteristic plumage pattern: almost white ground colour of crown with well visible streaking, pencil-like streaking over breast, white throat which is often unmarked, isolated rusty ear-coverts patch, clean and bright underparts, uniformly tawny-drab or 'beige' upperparts, and often rather pale rump. In hand examination will reveal biometrical characters that are diagnostic for Mediterranean (ie, both nominate *tyrrenica* and *balearica*).



(caused by wear and individual, seasonal and age-related variation). The underparts are quite clean, almost pure white; the flanks are white, at most with a slight brownish wash, and the underwing is milky-white with a very slight hint of pale fulvous or cinnamon, which is often altogether lacking. When assessing field records of *balearica* in a vagrancy context, and especially when the documentation is poor, photographs of the underwing might be highly relevant to ensure the identification.

Chest and head streaking

As already noted by Schiebel (1910), underpart streaking is different in *striata* and *tyrrhenica* sensu lato. In *striata*, streaking is an evident plumage feature (plate 414, 418), hence its scientific name. Streaking is heavy and dense on the chest and neck sides, and quite well defined, contrasting strongly with the whitish ground colour of the underparts; streaking is more diffuse on flanks and axillaries. Some *striata*, especially breeding birds

in southern Europe (eg, several birds in north-eastern Spain) can show reduced chest streaking and white background, resembling *balearica* to some extent, but still have brown underwing and flanks. In *tyrrhenica* sensu lato, the underparts are visibly less marked, with some individuals showing virtually no real streaking: markings on the underparts are much less well defined and extensive than in *striata*, and they are rather warm in coloration (plate 411); in some individuals, especially from a distance, it is hard to discern any sort of patterns on the underparts except for a warm wash on the chest. Underpart streaking in *balearica* is limited, very fine, and of a warm yet quite pale colour (plate 415). Important differences from an identification standpoint can also be seen in head streaking (especially crown and forehead). Nominote *tyrrhenica* is the least marked of all, and since the ground colour of the head feathers is darker and warmer compared with the other taxa, the head streaking is less evident. In *balearica*, the ground colour of the head feathers, especially the fore-

TABLE 4 Summary of identification criteria for the three *Muscicapa* taxa discussed

	<i>striata</i>	nominate <i>tyrrhenica</i>	<i>balearica</i>
general structure	slender and elongated	short wings, long tail, large head	short wings, long tail, large head
general appearance	contrast between upperparts and underparts	dark and dirty, rather uniform	pale and clean, contrast between upperparts and underparts
primary projection	longer than tertials	shorter than tertials	shorter than tertials
wing formula	p2>p5 p3>p4	p2<p5 p3≈p4	p2<p5 p3≈p4
general colour	brownish-grey, generally cold plumage tones	dark brown with evident warm plumage tones	pale brown with evident warm plumage tones
rump	same colour as back	warmer than back	warmer than back
chest	strongly streaked	spotted or marbled, often indistinct as in Thrush Nightingale <i>Luscinia luscinia</i>	thin, well-defined streaking, sometimes nearly invisible
flank and underwing	dark	dark or dirty	pale and clean
head streaking	well-defined	poorly defined (dark ground colour of head)	very well-defined (ground colour of head very pale, often milky white)
ear-coverts	well demarcated from underparts but not from upperparts	blending with spotting on underparts	appearing isolated from rest of face (masked appearance)
song	maximum frequency 2 kHz, almost always below 10/11 kHz	electric tones in song, maximum frequency 18-20 kHz	electric tones in song, to human ear sounds very similar to <i>tyrrhenica</i> , but lower maximum frequency (13-15kHz)

Identification of Mediterranean Flycatcher



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420 From left to right: two Balearic Flycatchers / Balearische Vliegenvangers *Muscicapa tyrrenica balearica*, adults, Ibiza, Balearic Islands, Spain, 11 May 1930; one Tyrrhenian Flycatcher / Tyrreense Vliegenvanger *M t tyrrenica*, adult, Strait of Bonifacio, Sardinia, Italy, 1 April 1899; two Spotted Flycatchers / Grauwe Vliegenvangers *M striata*, adults, Uppsala, Sweden, 17 June 1950 and Texel, Netherlands, 5 June 1930, respectively; two flycatchers / vliegenvangers *Muscicapa*, Moyen Atlas, Morocco, 28 and 9 July 1919, respectively; Natural History Museum Tring, England, 21 March 2016 (*Michele Viganò*). Same specimens as in plate 421. Note differences in plumage tone and pattern between Tyrrhenian, Balearic and Spotted Flycatchers: warmer and darker in *tyrrenica*, warm but paler in *balearica*, and colder in *striata* (with certain amount of variability). Crown weakly streaked in *tyrrenica*, visibly streaked and contrasting in *balearica*, and well streaked in *striata*. Right specimen of *striata* represents warmest and rustiest extreme of coloration spectrum, while left one is typical example. North African specimens appear as in-between link or mix among both species in plumage colour/pattern and measurements, though closer to Tyrrhenian.

421 From left to right: two Balearic Flycatchers / Balearische Vliegenvangers *Muscicapa tyrrenica balearica*, adults, Ibiza, Balearic Islands, Spain, 11 May 1930; one Tyrrhenian Flycatcher / Tyrreense Vliegenvanger *M t tyrrenica*, adult, Strait of Bonifacio, Sardinia, Italy, 1 April 1899; two Spotted Flycatchers / Grauwe Vliegenvangers *M striata*, adults, Uppsala, Uppsala län, Sweden, 17 June 1950 and Texel, Noord-Holland, Netherlands, 5 June 1930, respectively; two flycatchers / vliegenvangers *Muscicapa*, Moyen Atlas, Morocco, 28 and 9 July 1919, respectively; Natural History Museum Tring, England, 21 March 2016 (*Michele Viganò*). Same specimens as in plate 420. Note that *balearica* is cleanest and least patterned; nominate *tyrrenica* is pretty dull below (rusty-drab or dull beige tinged) with pretty dull and marked throat and almost spotted pattern; *striata* shows clean throat with well-marked streaks on malar area, breast with obvious and defined dark streaking. North African birds appearing as taxon with mixed features, though closer to Tyrrhenian.

head, is extremely pale, almost whitish, which clearly and strongly contrasts with the dark streaking (plate 416). In *striata*, this pattern is intermediate, more contrasting than in nominate *tyrrenica* but never as well defined as in *balearica* (table 4). In summer (July-August), the contour feathers, which by this time are 7-8 months old, are quite worn, and the pale margins that make the head of *balearica* look so contrasting, can wear off to the point that the head looks more uniform, while the underpart streaking in *striata* can look much thinner and subtle differences in plumage contrasts can easily disappear due to wear in nominate *tyrrenica* too (plate 402).

Face pattern

In combination with underparts and chest streaking, the face pattern is of great use in identifying flycatchers in the Mediterranean basin. Once again, the face pattern in nominate *tyrrenica* is the least well defined of all three taxa in question. In particular, the streaking/spotting on the chest and chin is so poorly-defined and blurry as to blend in with the ear-coverts; in most individuals, there is no clear demarcation between ear-coverts and the underparts, the ground colour of which is closer to cream than to white (plate 417). In *striata*, instead, the streaking on the underparts is not only thin and well-defined, it is also less messy than in nominate *tyrrenica*, and running parallel to the malar stripes. This implies that a pale area is present between the dark malar stripe and the dark ear-coverts on *striata*, so that the ear-coverts are always clearly set off from the underparts. This is

true in *balearica* as well, although it is not quite as obvious due to the paler ground colour of ear-coverts. Nevertheless, *balearica* shows another important characteristic as a result of the sum of all the field marks listed above. The ear-coverts, together with the lores, look like an isolated dark mask surrounded by paler areas. In most individuals, the pale areas on the sides of the neck are so extensive that it almost looks like a half-collar that reaches all the way around the ear-coverts, further setting off the dark ear-coverts mask (plate 415, 419).

Vocalizations

In late spring and summer 2015, we carried out a study of *Muscicapa* songs. Our aim was to compare the songs of *striata* from continental Europe with those of nominate *tyrrenica* from throughout their range: Corsica, Sardinia, the Tuscan archipelago and the Tyrrhenian coast. Our results showed that these two species could always be told apart by their songs, both in the field and through analysis of spectrograms, so that the song is a diagnostic identification character. The overall structure of the song of nominate *tyrrenica* (figure 3) is very similar to that of *striata* (figure 5) but there is one character that allows for the immediate identification of these two species: nominate *tyrrenica* emits some notes of extremely high frequency, much higher than the 6-8 kHz of their normal notes. They give the song a very distinctive tone, unique among European passerines (although at times Common Nightingale *Luscinia megarhynchos* and Lesser Whitethroat *S curruca* can give brief snatches of song that sound some-

Identification of Mediterranean Flycatcher



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422 Flycatchers / vliegenvangers *Muscicapa*, adults, Museu de Ciències Naturals de Barcelona, Spain, 18 May 2016 (Michele Viganò). Four left birds: Hauta Kasdir, north-western Morocco, 7-18 July 1932; three right birds: Cubelles, Catalunya, Spain, 6 June 1952. Same specimens as in plate 423. Note that four skins to left appear much rustier and warmer than three right ones. Ibero-maghreb population deserves more study: genetically (see Pons et al 2016), they should represent compact group well differentiated from European Spotted Flycatchers *M striata*; looking at specimens and birds in field it would be hard to think that they belong to same 'population' or taxon. Study of vocalizations will surely help in better understanding of this conundrum. Nearest breeding area of Tyrrhenian Flycatcher *M t tyrrhenica* to Tunisian populations is no more than 150 km, raising question whether it could also be nesting in North Africa.

423 Flycatchers / vliegenvangers *Muscicapa*, adults, Museu de Ciències Naturals de Barcelona, Spain, 18 May 2016 (Michele Viganò). Four left birds: Hauta Kasdir, north-western Morocco, 7-18 July 1932; three right birds: Cubelles, Catalunya, Spain, 6 June 1952. Same specimens as in plate 422. Note that underparts colour and markings in North African specimens are similar to those in Mediterranean Flycatcher *M tyrrhenica*, while these are more like Spotted Flycatcher *M striata* in Iberian ones.

what similar), which might be described as 'electric' due to the very brief notes emitted in a rapid sequence, and their dry, strident, and high-pitched tone falling between 12 and 19 kHz. A practical way to describe this tone would be to liken it to a rusty bicycle wheel or to the sounds that can sometimes be heard near power lines. On a sonagram (figure 3), the shape of these high-frequency notes is very distinctive and visible, since they occupy a portion of the sonagram—above 12 kHz—that no other European bird exploits. The notes look like a thin, well-defined, uninterrupted line that begins at about 16 kHz then rises to 18-19 kHz—the highest frequency reached by the song—then drops precipitously to c 10-11 kHz or lower in the space of 0.02 seconds (Viganò 2015); similar results were recently found by Comolet-Tirman (2017). It should be stressed that these diagnostic high-pitched notes are very conspicuous and numerous in highly excited songs (eg, during interactions within the members of a couple—fast song, figure 3A and 3B), while in less excited song (eg, on a lazy session of territorial song from a high elevated perch—slow song, figure 3C) they can be much less frequent and thus the song sounds more similar to *striata*. In our experience anyway, even in the slowest song, some diagnostic high-pitched notes are always uttered.

In spring 2016, we recorded numerous individuals of *balearica* on Mallorca and Menorca, allowing us to present some general remarks on the song of this taxon: in the field, the general structure sounds extremely similar to that of the song of nominate *tyrrhenica*, including the diagnostic high-pitched elements that give it its distinctive electric tone. Looking at sonagrams (figure 4), it is evident that the maximum frequency reached by *balearica* is not quite as high as in nominate *tyr-*

rhenica, generally remaining below 15 kHz. We disagree with Comolet-Tirman (2018) about some recordings of *balearica* he analysed in his paper: he obtained similar results to ours but concludes that, even though generally higher pitched, the song of *balearica* does not have the short, strident, high-pitched notes of nominate *tyrrhenica*. Even though high-pitched notes of *balearica* have a maximum frequency usually between 12 and 15 kHz, they share the same structure and strident tone with the ones of nominate *tyrrhenica* and to our ears they sound extremely similar, just a tad less extreme and electric. The same considerations about the different number of high-pitched notes given for nominate *tyrrhenica* applies for fast (figure 4A) and slow songs (figure 4B and 4C) of *balearica*. In light of the above, it should be possible to differentiate between the songs of *striata* and *tyrrhenica* sensu lato by ear in the field at all times, and to distinguish the two subspecies of Mediterranean Flycatcher using sonagrams.

The song of *striata* and *tyrrhenica* sensu lato falls into the category of 'endless songs', namely vocalizations that are not organized into strophes repeated at regular intervals, but rather comprise improvised notes with no discernible pattern, uttered for a variable length of time. The notes included in these songs are very disparate: from low-frequency warbled notes reminiscent of certain parts of the song of Common Blackbird *Turdus merula* to very high-frequency notes around 10 kHz, which only a very few European species—such as Common Firecrest *Regulus ignicapilla*—reach; as stated, in *tyrrhenica* sensu lato, the highest frequency reached is even higher. The volume is always quite low, making it one of the least conspicuous European passerine songs.

Identification of Mediterranean Flycatcher

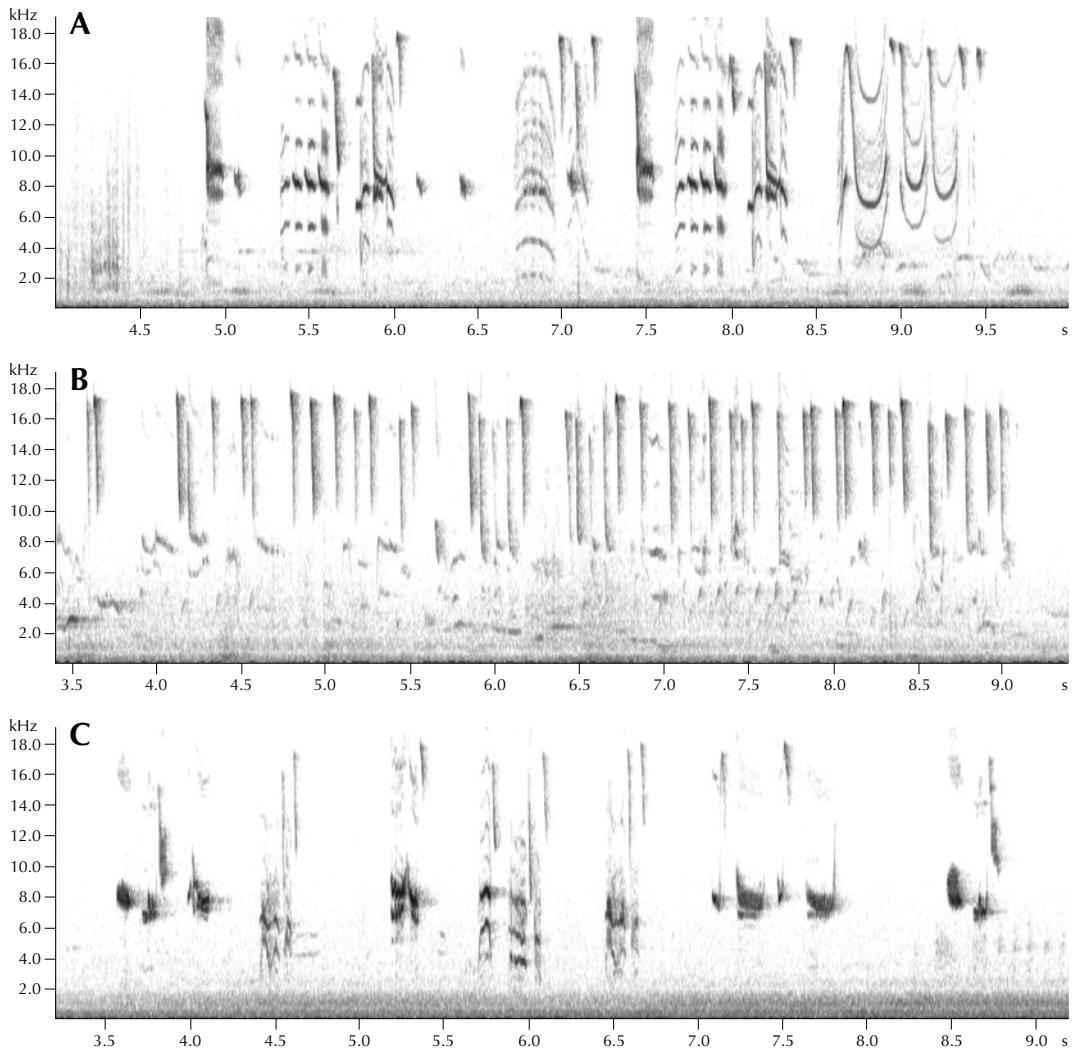


FIGURE 3 Tyrrhenian Flycatcher / Tyrrhense Vliegenvanger *Muscicapa tyrrhenica tyrrhenica*, song. **A** Sardinia, Italy, 8 June 2015; **B** Corsica, France, 5 June 2015; **C** Capraia Island, Tuscan archipelago, Italy, 28 May 2015 (*Michele Viganò*). Song is, in all European *Muscicapa*, without fixed scheme and uttered erratically and suddenly; however, some differences can be seen in sonagrams (and by ear once learned): both nominate *tyrrhenica* and Balearic Flycatcher *M t balearica* always include some notes of very high frequencies, unique among European passerines, giving song rather 'electric' quality (vertical lines on upper part of sonagram). In nominate *tyrrhenica*, these reach 17-19 kHz.

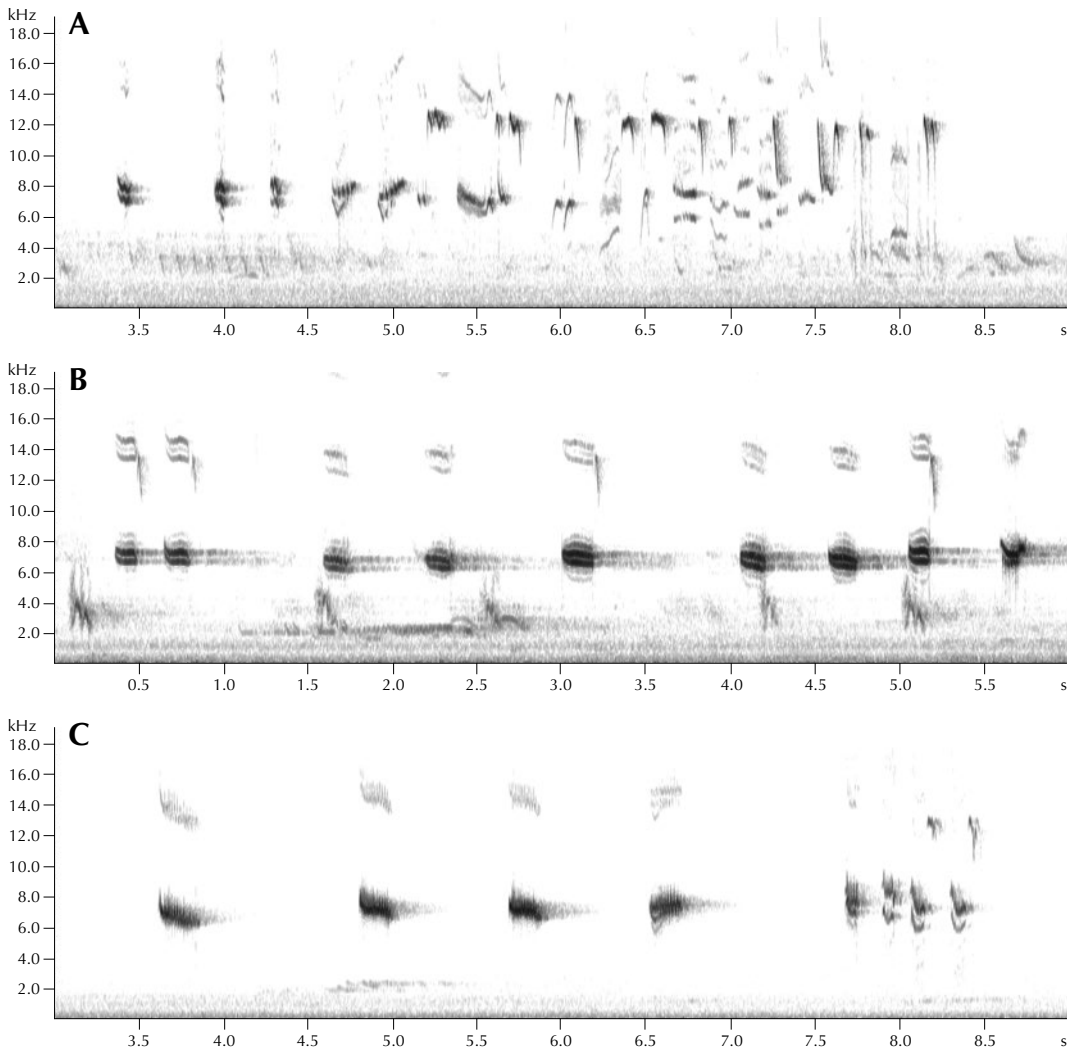


FIGURE 4 Balearic Flycatcher / Balearische Vliegenvanger *Muscicapa tyrrenica balearica*, song. **A** Mallorca, Balearic Islands, Spain, 24 May 2016; **B** Mallorca, Balearic Islands, Spain, 27 May 2016; **C** Menorca, Balearic Islands, Spain, 28 May 2016 (Michele Viganò). ‘Electric’ quality and notes typical of Tyrrhenian Flycatcher *M t tyrrenica* can be heard also in *balearica*, although highest frequencies are slightly lower in *balearica*, being around 13/14 kHz (still much higher than in Spotted Flycatcher *M striata*, and sounding very differently). In slower songs (B and C), the diagnostic high-pitched notes are less frequent than in faster songs (A).

Identification of Mediterranean Flycatcher

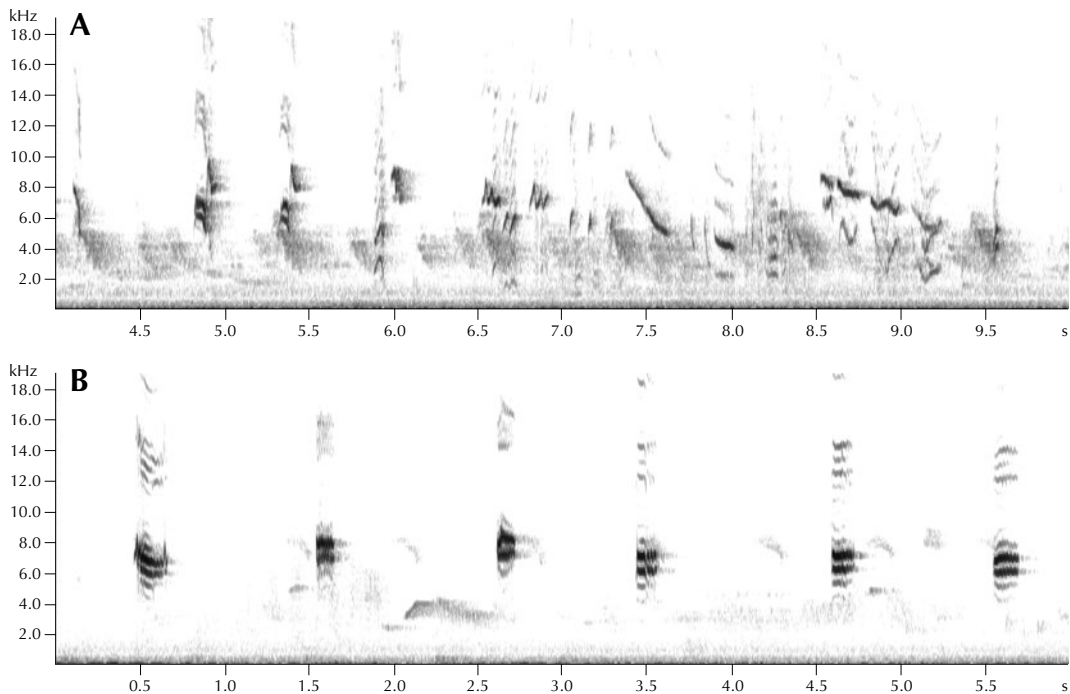


FIGURE 5 Spotted Flycatcher / Grauwe Vliegenvanger *Muscicapa striata*, song. **A** Sarigo, Varese, northern Italy, 18 May 2015; **B** Cadero-Veddasca, northern Italy, 26 May 2015 (*Michele Viganò*). Song of Spotted is always very subdued and continuously improvised, heard mostly around sunrise and sunset: it alternates some slow-pace parts (B) with other much faster ones (A); during latter, it is easier to hear typical difference between this species and Mediterranean Flycatcher *M tyrrhenica*. As can be seen in these sonagrams, ‘electric’ high-pitched notes are missing in Spotted.

Conclusions and further research

Striata has a very large breeding range, and our studies did not comprehensively sample all populations. For instance, the easternmost taxa *sarudnyi* and *mongola* are not well represented in European museum collections. Nevertheless, the specimens we were able to analyse convinced us that further studies are needed: given their plumage characteristics and morphometrics, these eastern taxa may prove to be identifiable in the field in a European context, where autumn vagrancy is possible. While *neumannii* does not appear to be much different from *striata*, taxa from further east (*inexpectata*, *sarudnyi*, *mongola*) generally appear paler and less well-marked than European birds, with a variable degree of streaking on the underparts and crown, and plumage patterns that can sometimes be very similar to those of *balearica* or even nominate *tyrrhenica*. Some individuals seem to have an overall brownish wash, and in some cases the ground colour of the crown is whitish. Primary projection is

generally longer than in nominate *tyrrhenica* and *balearica*, with a wing-tip/tail-tip ratio as in nominate *striata*, although p2 in *sarudnyi* can be shorter than or equal to p5. Crown streaking is generally heavy and well defined. Vocalizations are in need of further study.

The populations that require, however, the most urgent study are undoubtedly those from Iberia and North Africa. According to genetic analyses of Spanish and Tunisian individuals, they form a distinct group that is genetically different from all other *striata* analysed (from Europe and central Russia), and differentiated from them at about the same time as the split between the two subspecies of Mediterranean Flycatcher (Pons et al 2016). Once again, few specimens exist in museum collections but the ones we were able to study suggest that the situation is even more complicated. The Barcelona museum collection is of particular interest, as it provides the possibility to directly compare specimens taken during the breeding season

(June-July) in Spain and Morocco. Clear plumage and structural differences exist between specimens from these two countries: it is hard to believe that the individuals in plate 422-423 belong to the same taxon. In terms of biometrics, some – but not all! – of these North African individuals look very similar to *tyrrhenica* sensu lato. North Africa is as ecologically varied as the rest of the Mediterranean basin, and it could well host more than one taxon from the *striata* complex, as is the case with the Italian peninsula, where nominate *tyrrhenica* has recently been found along the Tyrrhenian coast of central Italy and on small islands off Sicily less than 150 km from the Tunisian coast. Studies on the Iberian-North African populations will shed more light on the evolutionary history of the *striata* complex in the Mediterranean, and we suspect that once again vocalizations will prove to be of crucial importance. For all taxa it would also be worthwhile to investigate more vocalizations than only song, such as contact calls (which are of more use for identifying out-of-range individuals). Mediterranean Flycatchers (especially *balearica*) are seen with some regularity along the Mediterranean coast of France and Spain in spring, probably due to overshooting. Therefore, spring is probably the best time to look for vagrants in central and northern Europe, a pattern matched by other species that share a similar breeding distribution, such as Moltoni's Warbler and Balearic Woodchat Shrike *Lanius senator badius*. Any putative claims of Mediterranean Flycatcher from central and northern Europe should be scrutinized very closely and ideally be assessed on the basis of: **1** very high-quality photographs showing the wing formula; **2** sound recordings; **3** primary projection and wing/tail ratio; and **4** precise plumage observations. In particular, in the absence of **1** and **2**, reports of vagrants should not be accepted far away from the breeding range.

In the next years, the distribution of *striata* and nominate *tyrrhenica* in continental Italy will be studied to assess sympatry. When contact areas are found, it will be possible to study the interactions between these taxa.

As said before, until recently information on identification of these *Muscicapa* taxa was treated in only a few publications (Gargallo 1993, van Duivendijk 2011, Viganò & Corso 2015), and at first differences between nominate *tyrrhenica* and *balearica* were not shown. That explains why all extralimital Mediterranean Flycatchers are from recent dates.

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Samenvatting

HERKENNING VAN BALEARISCHE Vliegenvanger Recent onderzoek naar *Muscicapa*-populaties in het centrale Middellandse Zeegebied laat zien dat deze de status van soort verdienen, Balearische Vliegenvanger *M tyrrhenica*. Na onderzoek aan morfologie en morfometrie kwamen er studies aan vocalisaties en genetica. Er bleken constante verschillen te zijn in zang en in nucleair en mitochondriaal DNA tussen continentale Grauwe Vliegenvanger *M striata* en de eilandpopulaties van Balearische. Twee ondersoorten van Balearische worden momenteel erkend: nominaat *M t tyrrhenica* broedt in Sardinië, Corsica, de Toscaanse archipel en delen van de Tyrrheense kust in Italië; de ondersoort *M t balearica* broedt op de Balearen. Voor beide ondersoorten is zeer weinig informatie over migratieroutes of overwinteringsgebieden beschikbaar. Structureel zijn beide onderling

vergelijkbaar en ze verschillen van Grauwe in kortere vleugellengte (*striata*: 85,5 mm, nominaat *tyrrhenica*: 81,6 mm, *balearica*: 78,9 mm). Anders dan bij Grauwe is daardoor de handpenprojectie van Balearische korter dan de lengte van de tertials. De vleugelvorm van Balearische is meer afgerond (p2 is gelijk of korter dan p5; handpennen van buiten naar binnen geteld). Hoewel de staart van Balearische even lang is als die van Grauwe, lijkt deze door de kortere vleugels in verhouding langer. De twee ondersoorten van Balearische verschillen onderling in verenkleed. Nominaat *tyrrhenica* heeft meestal een warme kleur van het verenkleed (bijna roodachtig), minder contrast tussen boven- en onderdelen, minder kruinstreping, uitgebreide maar slecht gedefinieerde streping op de onderdelen, goed gemarkeerde flanken en ondervleugels, en een subtiele maar karakteristieke roomkleurige tint op de keel. *Balearica* vertoont meer beige bovendien, een sterk contrast tussen boven- en onderdelen, zeer goed gemarkeerde kruinstreping (zelfs meer dan bij *striata*), en zuiver witte onderdelen, flanken en ondervleugel met zeer kleine, dunne, en bleke streping beperkt tot bovenborst en keel. De algemene structuur van de zang van Balearische is vergelijkbaar met die van Grauwe: een schijnbaar willekeurige mix van lage en hoge tonen op laag volume en gedurende een variabele tijdsduur. De zang van Balearische verschilt echter van die van Grauwe door de aanwezigheid van veel hogere tonen (18-20 kHz in nominale *tyrrhenica*, 13-15 kHz in *balearica*). Deze zijn zowel in het veld als in sonogrammen detecteerbaar en diagnostisch. De zang van Balearische heeft daardoor een elektrische en schelle kwaliteit. De kennis over deze *Muscicapa*-soorten dient nog verder te worden onderzocht, met name op het Iberisch Schiereiland en in Noord-Afrika.

References

- Bergier, P, Franchimont, J & the CHM 2015. Les oiseaux rares du Maroc. Rapport de la Commission d'Homologation Marocaine numéro 20 (2014). Go-South Bull 12: 1-23.
- Blasco-Zumeta, J & Heinze, G-M 2015. Identification atlas of birds of Aragon – Spotted Flycatcher. Website: <https://tinyurl.com/yxe3qbfx>. [Accessed 17 May 2018.]
- Brambilla, M, Janni, O, Guidali, F & Sorace, A 2008a. Song perception among incipient species as a mechanism for reproductive isolation. *J Evol Biol* 21: 651-657.
- Brambilla, M, Vitulano, S, Spina, F, Baccetti, N, Gargallo, G, Fabbri, E & Randi, E 2008b. A molecular phylogeny of the *Sylvia cantillans* complex: cryptic species within the Mediterranean basin. *Mol Phylogenet Evol* 48: 461-472.
- Brichetti, P & Fracasso, G 2008. Ornitologia italiana 5 – Turdidae-Cisticolidae. Bologna.
- Comolet-Tirman, J 2017. Les vocalisations du Gobe-mouche gris *Muscicapa striata tyrrhenica* en Corse: perspectives pour les décisions relatives à son statut taxonomique. *Alauda* 85: 295-306.
- Comolet-Tirman, J 2018. Note sur le chant nuptial du Gobe-mouche des Baléares *Muscicapa tyrrhenica balearica* à Majorque. *Alauda* 86: 235-236.
- Cracraft, J 1983. Species concepts and speciation analysis. In: Johnston, R F (editor), *Current Ornithology* 1, Boston, p 159-187.
- Cracraft, J 1997. Species concepts in systematics and conservation biology: an ornithological viewpoint. In: Claridge, M F, Dawah, H A & Wilson, M R (editors), *Species, the units of biodiversity*, Systematics Association special volume 54, London, p 325-339.
- Demongin, L 2016. Identification guide to birds in the hand. Beauregard-Vendon.
- van Duivendijk, N 2011. *Advanced bird ID handbook – the Western Palearctic*. London.
- van den Elzen, R & Rheinwald, G 1984. Die Wirbeltiersammlungen des Museums Alexander Koenig. II. Vögel. *Bonn Zool Monogr* 19: 49-150.
- Förschler, M I & Kalko, E K 2007. Geographical differentiation, acoustic adaptation and species boundaries in mainland citril finches and insular Corsican finches, superspecies *Carduelis [citrinella]*. *J Biogeogr* 34: 1591-1600.
- Förschler, M I, Senar, J C, Perret, P & Björklund, M 2009. The species status of the Corsican finch *Carduelis corsicana* assessed by three genetic markers with different rates of evolution. *Mol Phylogenet Evol* 52: 234-240.
- Fozzi, I, Pisu, D, Piras, S, Carta, P, Zucca, C & Nissardi, S 2019. Prime segnalazioni di Pigiamaosche *Muscicapa striata balearica* in Italia attraverso dati di inanellamento scientifico. Poster, XX CIO 2019, Napoli.
- Galea, R & Viganò, M 2011. Segnalazioni da Malta. *Quad di Birdwatching* XIII (6): 40-41.
- Garcia-Febrero, O & Barboutis, C 2012. Primera cita de Menjamosques Balear (*Muscicapa striata balearica*) (Jordans, 1913) a l'illa d'Anticitera (Illes Jòniques, Grècia). *An Ornitol de Les Balears* 2012 (27): 43-48.
- Gargallo, G 1993. Identificació de la subspècie balear de Menjamosques (*Muscicapa striata balearica*). *An Ornitol de Les Balears* 1993: 21-30.
- van der Geer, A, Lyras, G, de Vos, J & Dermitzakis, M 2010. Evolution of island mammals. Malaysia.
- Gil, M, Burgas, A, García, M, Illa, M, Larruy, X, Ollé, À & Franch, M 2016. Ocells rars a Catalunya. Informe del Comitè Avifaunístic de Catalunya 2012, 2013 i 2014. *Butl del CAC* 1: 32-43.
- Gill, F & Donsker, D (editors) 2019. IOC world bird list (version 9.2). Website: www.worldbirdnames.org.
- del Hoyo, J, Elliott, A & Christie, D A (editors) 2006. *Handbook of the birds of the world* 11. Barcelona.
- Jenni, L & Winkler, R 1994. *Moult and ageing of European passerines*. London.
- von Jordans, K 1913. Vorläufige kurze Beschreibung neuer Formen von den Balearen. *Falco* 3: 43-44.
- Kvist, L, Viiri, K, Dias, P C, Rytkönen, S & Orell, M 2004. Glacial history and colonization of Europe by the blue tit *Parus caeruleus*. *J Avian Biol* 35: 352-359.
- Olioso, J, Thibault, J-C, Piacentini, J & Pons, J-M 2019. Le Gobe-mouche tyrrhénien: nouvel endémique des îles de Méditerranée occidentale. *Ornithos* 26: 67-77.
- Parrot, C 1910. Neue Vogelformen aus dem mediterranen Gebiet. *Ornithol Monatsber* 18: 153-156.
- Peignot, C & le CHN-LR 2011. Les oiseaux rares en Languedoc Roussillon en 2010. 3e rapport du Comité

- d'Homologation Régional du Languedoc-Roussillon. Website: <https://tinyurl.com/y36jabxk>. [Accessed 17 May 2018.]
- Pons, J-M, Thibault, J-C, Aymí, R, Grussu, M, Muntaner, J, Olioso, G, Sunyer, J R, Touirhi, M & Fuchs, J 2016. The role of western Mediterranean islands in the evolutionary diversification of the Spotted Flycatcher (*Muscicapa striata*). *J Avian Biol* 46: 1-13.
- Redactie Dutch Birding 2016. Naamgeving van taxa in Dutch Birding. *Dutch Birding* 38: 97-101.
- Schiebel, G 1910. Neue Vogelformen aus Corsica. *Ornithol Jahresber* 21: 102-103.
- Shirihai, H, Gargallo, G, Helbig, A J, Harris, A & Cottridge, D 2001. *Sylvia* warblers. Identification, taxonomy and phylogeny of the genus *Sylvia*. London.
- Shirihai, H & Svensson, L 2018. Handbook of Western Palearctic birds 2 – Passerines: flycatchers to buntings. London.
- Svensson, L 1992. Identification guide to European passerines. Fourth edition. Stockholm.
- Svensson, L 2013. A taxonomic revision of the Subalpine Warbler *Sylvia cantillans*. *Bull Br Ornithol Club* 133: 240-248.
- Tellini, F G, Baccetti, N, Arcamone, E, Meschini, A & Sposimo, P 1997. Atlante degli uccelli nidificanti e svernanti in Toscana (1982-1992). Provincia di Livorno e Centro Ornitologico Italiano. Quaderni del Museo Provinciale di Storia Naturale di Livorno. Monografie 1.
- Viganò, M 2015. Indagini genetiche e bioacustiche sui Pigliamosche (*Muscicapa striata*) del bacino del Mediterraneo. Thesis Pavia University. Pavia.
- Viganò, M & Corso, A 2015. Morphological differences between two subspecies of Spotted Flycatcher *Muscicapa striata* (Pallas, 1764) (Passeriformes, Muscicapidae). *Biodiv J* 6: 271-284.
- Viganò, M, Corso, A & Janni, O (MISC) 2016. Identificazione del Pigliamosche tirrenico. *Quaderni di Birdwatching* 20: 58-70.
- Weiss, S & Ferrand, N 2007. Phylogeography of southern European refugia. Dordrecht.
- Wroza, S 2019. Le Gobemouche tyrrhénien *M. tyrrhenica*: un exemple de vocalisation extrême. *Ornithos* 26: 78-82.

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