*Die Vogelwarte 41, 2002: 231–239*

# Cohabitation and nest-site selection of Common Swift (*Apus apus*) and Pallid Swift (*A. pallidus*)

By Anton Antonov and Dimitrinka Atanasova

Abstract: ANTONOV, A., & D. ATANASOVA (2002): Cohabitation and nest-site selection of Common Swift *(Apus apus)* and Pallid Swift *(A. pallidus)*. Vogelwarte 41: 231–239.

This study explored colony pattern, interspecific association and nest-site selection of two closely related species of swift, Common Swift (*Apus apus*) and Pallid Swift (*A. pallidus*) in Sofia city, Bulgaria. The numbers and locations of nests were determined by the newly devised method of „excrement watching" but also supplemented with the classic „building mapping" method.

The Common Swift population (1147 pairs) was nearly 4 times larger than the Pallid Swift population (304 pairs). Common Swift colonies were of a wider range of sizes (3–34 pairs vs. 3–11 in Pallid Swift), but in both species small colonies predominated. Most pairs of both species bred in monospecific colonies, but a greater proportion of the Pallid Swift population nested in mixed colonies. In both species nest-site selection took place with preference for north and east facing situations. Most pairs in both species nested in the eaves of buildings but Pallid Swift was less specific in its choice of nest-sites, utilizing a wider range of heights, and occupying the whole range of recorded nest-cavity types. Pallid Swift was suggested to have colonized the city after Common Swift and initially associated more strongly with the latter.

Key words: Common Swift *(Apus apus)*, Pallid Swift *(Apus pallidus)*, nest-site selection, mixed colonies.

Address of the corresponding author (A.A): Kozloduy 3320, bl. 64, ent. A, ap. 14, Bulgaria. E-mail: tonyant_bg@yahoo.com

## 1. Introduction

Common Swifts (*Apus apus)* breed over most of the area of Europe, up to 70° N, thus having an unique range in the family Apodidae (CRAMP 1985). Pallid Swift (*Apus pallidus*), on the other hand, are confined to the southern parts of Europe, mainly in the Mediterranean region (HAGEMEIR & BLAIR 1997). The ranges of the two species overlap in the south of Europe. According to some authors, the Pallid Swift has shown a range extension northwards, but the difficulties in field identification may have concealed the real trend with some newly discovered colonies in fact being long established but previously confused with Common Swift (BOANO & CUCCO 1989). Hence, the current distribution of Pallid Swift is still imperfectly known (HAGEMEIR & BLAIR 1997).

Common Swift and Pallid Swift are often known to share the same breeding grounds and even the same buildings in the areas of range overlap (CRAMP 1985, CUCCO et. al. 1987, CUCCO & MALACARNE 1987). Data on nest-site selection by these closely related species are very useful for understanding their ecology better. Moreover, if Pallid Swift has recently begun colonizing new areas to the north, then it is interesting how it interacts with local long-established colonies of Common Swifts. Are they more prone to associate with Common Swifts or do they mostly prefer to settle apart from them? Difficulties in assessing swift populations (TOMBAL 1995) together with the identification problems account for the scarcity of such studies concerning Common Swift and Pallid Swift.

The current study explored breeding populations of Common and Pallid Swifts in the city of Sofia and tried to explain their spatial relationships. Here we applied a new method of counting breeding swifts and determined population sizes of the two species in the city. Our aims were: (1) to reveal the coloniality pattern and the degree of interspecific association of Common and Pallid Swifts; (2) to see how they differentiate in their nest-site selection as for cavity types, nest-height and exposition.

## 2. Methods

The present study was conducted between 1998 and 2000 in the city of Sofia (42°40' N, 23°20' E, altitude 580 m), Bulgaria, where both species breed. The approximate areas of the city, holding colonies of swifts, had been found before counting sessions commenced by regular walks in late afternoons and evenings when screaming parties circled intensely before roosting. The term colony in this paper is defined as a spatial aggregation of 3 or more pairs. In most cases a colony corresponded spatially to a building, but in the few cases where pairs nested in 2–3 adjacent buildings and the distances between their cavities were shorter than the distance to another building with nesting swifts, they were considered as one colony. Counting and recording of nest-sites were carried out by using two methods. We primarily used the „excrement watching" method which was probably applied for the first time in this study. This method is based on the following underlying facts:

1) Swift chicks show a marked tendency to eject the faeces away from the nest, which agrees well with the common tendency among hole-nesting species (O'Connor 1984).
2) Between the age of 20–30 days the young begin to walk around nests freely (Cramp 1985; Malacarne et al. 1994; own unpubl. data.); this tendency extends in ejecting the faeces not only outside the nest itself but also outside the nesting cavity if the possibility for doing so does exist (own unpubl. data).
3) The ejected faeces fall on the ground below the nest cavity and form a diffuse but yet discernible splash; such splashes usually have a marked centre of concentration (own unpubl. data).
4) The faeces of swifts are specific and clearly recognizable; the only confusion possible is with House Martins (*Delichon urbica*), but since the latter have exposed and visible nests, the problem of confusion virtually does not exist (own unpubl. data.).
5) In addition, nest entrances at almost all nests become clearly white-marked by continual ejecting of faeces (own unpubl. data.).

The combination of counting splashes of faeces on the ground at the time when most pairs have young > 20 days old, and looking at possible white-marked nest entrances proved a reliable method for registering the locations of swift nests. The method, however, is only practicable if the following assumptions are fulfilled:

- Cavities must lie at the same height and protrude from the walls, i.e. they must be in the eaves or moulders; cavities dispersed on vertical walls cannot be recorded in such a way at all.
- There must be a possibility for swifts to eject the faeces outside the nest cavities i.e. the entrance must be at the same or lower level as the nest (this is for instance the case in the eaves).
- There should not be any broad low-lying ledges or dense vegetation preventing the faeces from falling to the ground.
- The method does not work well on the busy streets where the faeces already fallen are either intensively swept or stamped away by pedestrians.
- Nest cavities should not be very high above the ground, so that the dispersion of faeces is not very large (3–5-storey buildings are best suited for this method).
- It is necessary to know the local and annual phenology of swift breeding on the base of accessible colonies in order to time counting sessions properly, i.e. to be aware of the average „after 20$^{th}$-day period" for a given year in the study area, since timing of breeding in swifts may differ between years (Cucco et al. 1992).
- In order not to miss possible late breeders it is essential to make a repeat check later.

The described method proved applicable for over 80 % and 61 % of Common Swift and Pallid Swift populations respectively in Sofia since the great majority of them nested in the eaves of 3–5 storey buildings, for which most of the assumptions are fullfilled (see Results). Given the occurrence of mixed colonies, some nests initially found by excrement watching were identified as „*Apus* spec.". Additional visits were made mainly in the evenings to resolve such uncertainties. As a very useful feature in distinguishing such nests we used the difference in voice of the two species (Cucco et al. 1987), which we consider very easy to distinguish. Birds are most active and vocal in the evenings before roosting (Malacarne et al. 1989); when birds enter the cavities they always utter screams to announce their sex to the partner (Kaiser 1997). By this, doubtful pairs could be identified for certain.

Wherever the „excrement watching" method could not be applied we used the „building mapping" method (Cucco & Malacarne 1987). The latter involves preparation of drawings of the buildings holding nesting swifts, with details of certain reference points or marks such as gutters, drain pipes, windows etc. Cavities are located and marked on the drawings by seeing incoming swifts during observation spells of at least 2 hours mainly in the evenings. We should note that nearly half the nests revealed by excrement watching were additionally „verified" by this method.

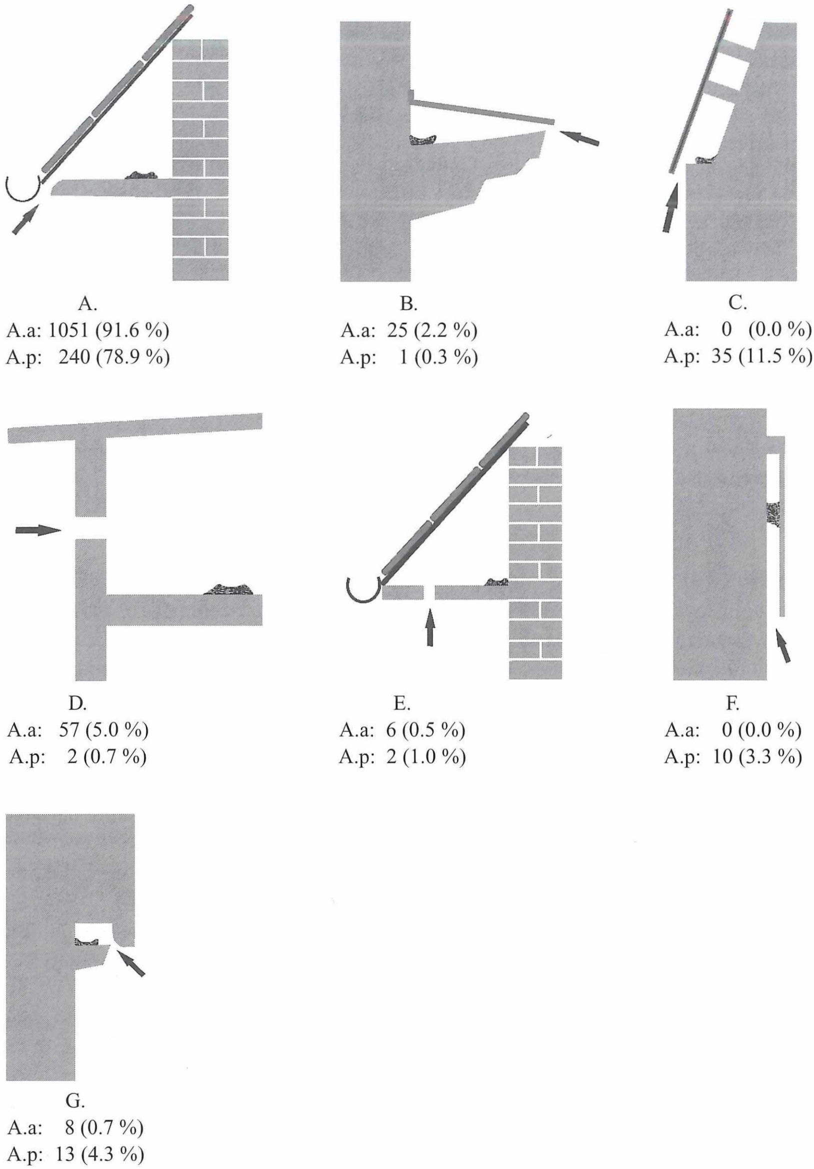


Fig. 1: Nest cavity types of Common Swift (n = 1147) and Pallid Swift (n = 304) in Sofia city.
A. Eaves with gutter, B. Inside a molder, C. beneath top iron bordering of tall structures, D. side-pointing round narrow ventilating apertures, E. down pointing ventilating apertures in the eaves, F. vertical cavities between facing tiles and the external wall, G. small cavities scattered in the walls of tall structures either above windows or apart from them.

Abb. 1: Typ der Nestspalten beim Fahlsegler und beim Mauersegler in Sofia.
A. Dachüberstand mit Dachrinne, B. innen im Dachgesims, C. unter der Blechverkleidung der Hochbauten, D. zur Seite weisende runde Belüftungsöffnungen, E. nach unten weisende Belüftungsöffnungen im Dachüberstand, F. Vertikalspalte zwischen Fassadenplatten und Außenwand, G. Kleine Spalte in Hochbauten über Fenster oder auch getrennt davon.

We distinguished 7 types of nest cavities characterized mainly by entrance features:

A. Eaves with gutter – narrow mainly longitudinal down-side-pointing entrance and nests are on level surface with plenty of space around (Fig. 1.A).
B. Inside a moulder (there is no gutter) – narrow longitudinal crevice, level surface, plenty of space (Fig. 1.B).
C. Cavities beneath top iron bordering of tall structures – down-pointing entrance, narrow space around nest, no gutter (Fig. 1.C).
D. Side-pointing round narrow (5 cm) ventilating apertures – nests are inside the loft and the entrance holes lie at a level higher than nests lie (Fig. 1.D).
E. Down-pointing round (5–8 cm) ventilating apertures in the eaves (Fig. 1.E).
F. Vertical cavities between facing tiles and the external wall – nests are glued between the two vertical surfaces without a substantial support from below (Fig. 1.F).
G. Small cavities scattered in the walls of tall structures either above windows or apart from them, with side- or down-pointing small entrances; very narrow space around the nest (Fig. 1.G).

Statistical procedures were performed with SPSS/WIN (SPSS Inc. 1999). Since data were not normally distributed, non-parametric tests were used and medians their interquartile ranges are reported. All tests are two-tailed.

Acknowledgements: We are very grateful to MICHAEL FRANKIS who improved the English of this paper. PAUL VINKE kindly translated the summary into German.

## 3. Results

The Common Swift was the more numerous of the two species, with a total of 1147 pairs distributed in 146 monospecific colonies (944 pairs), or as 1–2 pairs per building (117 pairs). Pallid Swift was far less abundant, with 304 pairs. Of these, 174 pairs formed 36 monospecific colonies and 64 pairs bred singly or two per building. The remaining 86 pairs of Common Swift and 43 Pallid Swift pairs formed 17 mixed colonies. The remaining 23 Pallid Swift pairs nested in two mixed colonies with Alpine Swifts (*Apus melba*).

A significantly greater proportion of Pallid Swift pairs nested singly or up to two pairs per building as compared to Common Swift ($\chi^2 = 35.11$, df = 1, $p < 0.0001$). In both species, small colonies were predominant (Fig. 2). Common Swifts bred at a wider range of colony sizes but 54.2 % (78 of 146) of them still held only five pairs or less.

Most pairs in both species bred monospecifically (Table 1). However, a significantly greater proportion of Common Swift pairs bred monospecifically than in Pallid Swift ($\chi^2 = 5.42$, df = 1, $p < 0.02$). The latter was more associated with mixed colonies. We found 17 mixed colonies of the two species. Of the 43 pairs of Pallid Swift nesting at the same buildings with Common Swifts only 13 (30 %) shared the same facade with the latter.

The median number of pairs per monospecific colony was significantly greater in the Common Swift (Table 1) as compared to the Pallid Swift (Mann-Whitney U-test, U = 2063.0, p = 0.041).

In both species, the median number of pairs per monospecific colony was significantly higher than the median number of pairs of the same species in mixed colonies (Mann-Whitney U-tests, Common Swift: U = 864.0, $p < 0.05$; Pallid Swift: U = 93.0, $p < 0.0001$). In mixed colonies, Common Swift had higher median number of pairs than Pallid Swift and the difference approached significance (Wilcoxon signed rank test, Z = –1.843, p = 0.065). Pallid Swift outnumbered Common Swift in only 4 of the 17 mixed colonies. In the two mixed colonies with Alpine Swift, Pallid Swift was the more numerous.

In both species the direction was a significant factor in the choice of nest cavities (Table 2). A marked preference for north and east and a clear avoidance of south situations was evident. In the Common Swift west situations were also preferred.

Vertical distribution of nest cavities of the two species showed a wider variety of heights used by the Pallid Swift (Fig. 3). It nested on average higher than Common Swift. Of Common Swift nest

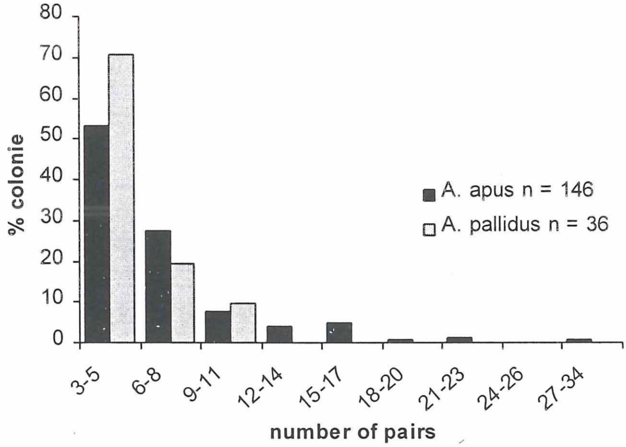


Fig. 2: Colony sizes in Common Swift and Pallid Swift.
Abb. 2: Koloniegröße bei Mauerseglern und Fahlseglern.

Table 1: Distribution of Common Swift and Pallid Swift pairs in monospecific and mixed colonies.
Tab. 1: Aufteilung der Mauersegler- und Fahlsegler-Paare in monospezifische und Mischkolonien.

| Parameters | Species | |
|---|---|---|
| | Common Swift | Pallid Swift [a] |
| Total number of pairs | 1147 | 304 |
| Number of pairs nesting monospecifically | 1061 (92.5 %) | 238 (78.3 %) |
| Total number of pairs nesting in mixed colonies | 86 (7.5 %) | 66 (21.7 %) |
| with *A. apus* | | 43 |
| with *A. pallidus* | 86 | |
| with *A. melba* | | 23 |
| Median number of pairs per monospecific colony | 5.0 (3.0 – 8.0) n = 146 | 4.0 (3.0 – 4.0) n = 36 |
| Median number of pairs per mixed colony | 4.0 (2.5 – 4.5) n = 17 | 2.0 (1.0 – 3.0) n = 17 |

Note: [a] Two mixed colonies of Pallid Swift with Alpine Swifts are not included considering the median number of pairs per colony.

Bemerkung: [a] Zwei Mischkolonien zwischen Fahlsegler und Alpensegler wurden nicht mit indie Berechnung des Medianwertes für Mischkolonien einbezogen.

cavities, 79.0 % were situated at 8–12 m, while only 48.3 % of Pallid Swift pairs bred at the same height interval ($\chi^2 = 31.23$, df = 1, $p < 0.0001$). Only 3.2 % of Common Swift nests were over 30 m height, these at 30–32 m. With Pallid Swift, 13.8% of the pairs nested over 30 m, the highest at 56 m.

Most pairs of the two species nested in the eaves (Fig. 1) with an entrance under the gutter. A greater proportion of Common Swift pairs occupied eaves as a nest site in comparison to Pallid Swift ($\chi^2 = 4.34$, df = 1, $p < 0.05$). Pallid Swift utilized a wider variety of nest sites and used the whole range of distinguished types (7). Two of the cavity types (C, F) that were used by Pallid Swift but not by Common Swifts, were the commonest nest-sites of Alpine Swifts in Sofia (own unpubl. data).

Table 2: Distribution of nest cavities in relation to exposure.
Tab. 2: Verteilung der Nestspalten bezüglich ihrer Exposition.

| | N | S | W | E | total | $\chi^2$ | df | P |
|---|---|---|---|---|---|---|---|---|
| Common Swift | 286 | 188 | 273 | 279 | 1026 | 24.72 | 3 | < 0.001 |
| Pallid Swift | 77 | 49 | 49 | 83 | 258 | 15.18 | 3 | < 0.01 |

Note: Cavities at intermediate situations (NW, NE, SW, SE) were not included (21 x *A. apus*, 13 x *A. pallidus*). The interaction of species and exposure was not significant ($\chi^2 = 6.91$, df = 3, p = 0.07).

Bemerkung: Nestspalten mit intermediärer Exposition (NW, NE, SW, SE) wurden nicht mit einbezogen (21 x *A. apus*, 13 x *A. pallidus*). Die beiden Arten unterscheiden sich in der Exposition nicht signifikant ($\chi^2 = 6.91$, df = 3, p = 0.07).

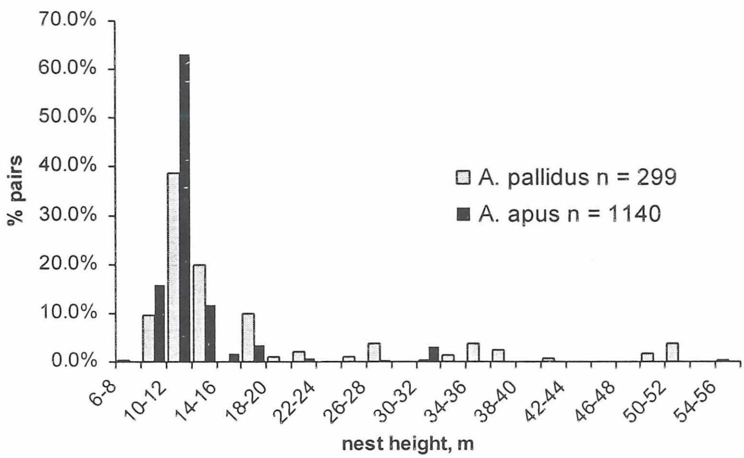


Fig. 3: Cavity height of Common Swift and Pallid Swift in Sofia city.
Abb. 3: Höhe der Nestspalten über dem Boden bei Mauerseglern und Fahlseglern in Sofia.

## 4. Discussion

Sofia city is considered as lying at the northern boundary of Pallid Swift's range in the Balkan Peninsula (Antonov & Atanasova 2001). The breeding population in Sofia (310 pairs) is relatively large as compared to that in Carmagnola (40 pairs) and Saluzzo (110 pairs) in Piedmont Italy (Boano & Cucco 1989), other points at the northern boundary of its range in Europe. Pallid Swift in Sofia was nearly 4 times less numerous than Common Swift. This might be due to its more recent settlement there and is in accordance with the presumed range extension northwards. Common Swifts also outnumbered Pallid Swifts in Piedmont (Boano & Cucco 1989).

Both species bred in small colonies but those of Common Swifts (3–34 pairs) were more variable in size and on average larger. Generally Common Swift colonies in Europe do not exceed 30–40 pairs, rarely up to 100 pairs (CRAMP 1985). The predominance of small colonies of Pallid Swift was also reported from Gibraltar where of 92 colonies, 47.8 % were less than 10 pairs (FINLAYSON 1979 in CRAMP 1985). Colonies in Piedmont Italy vary between 10 and 70 pairs (CUCCO et. al. 1992) and seem to be larger than those in Sofia (3–11 pairs). This species, however, may locally form very large colonies, as in Seville (Spain), where a single 23–storey building held about 8000 individuals (RODRIGUEZ DE LOS SANTOS & RUBIO GARCIA 1986).

The two species mostly bred separately and mixed colonies were not very common. In most of the mixed colonies, the Common Swift was the more numerous species. On the contrary, Pallid Swifts had predominance in mixed colonies in Piedmont Italy (CUCCO et al. 1987). Mixed colonies of Pallid Swifts and Alpine Swifts were also reported from the Mediterranean coast of Italy on cliffs (MAZZOTTO et al. 1996), where Pallid Swift was the more numerous species.

Interestingly, the distribution of nest cavities with respect to direction proved significantly different for the two species. Both showed avoidance of south situations and preference for north and east facades. It is unlikely that the availability of suitable holes would differ systematically with direction, hence the observed results should reflect a real preference. It is difficult to explain these results but the avoidance of south situations may reflect a tendency to avoid overheating. In a study on Common Swift in Pavia/Italy, COLOMBO & GALEOTTI (1993) found aspect to be a non-significant factor.

The typical nesting places of Common Swift were in the eaves at 8–12 m height, which were used by nearly half of the pairs. Nesting places higher than 30 m were rare. The Common Swift seemed to be more conservative in its nest-site preferences and did not use all the cavity types utilized by Pallid Swifts. Nesting places of both species seem to vary greatly at the various urban localities of their breeding range. Common Swifts in Pavia Italy nest between 9–14 m (COLOMBO & GALEOTTI 1993). In Nord department of France, all types of buildings were used by Common Swifts, yet the highest ones held only 33 % of the pairs. Most of them (52 %) nested in small worker dwellings (TOMBAL & TOMBAL 1995). In the town of Kozloduy/ Bulgaria, Common Swifts nest very high at 45–55 m and seem to ignore obviously suitable lower buildings (own unpubl. data). CUCCO & MALACARNE (1987) found that Pallid Swifts occupy lower nest situations than Common Swifts in Piedmont/Italy.

The wider range of nesting places used by Pallid Swift in this study as to both height and cavity type could have two explanations, which are not mutually exclusive. First, this may result from a greater plasticity in nest-site selection of this species as compared to Common Swift. In addition to eaves of lower buildings, typical of Common Swifts, Pallid Swift often used the same or similar nest cavities as Alpine Swift at higher situations. The second hypothesis assumes that when Pallid Swifts began to colonize the city, Common Swifts had already occupied most of the optimal cavity-rich buildings. It is thus likely that the first Pallid Swifts were attracted to areas where Common Swifts were already breeding. At first, there might have been unoccupied suitable buildings near Common Swift colonies where first Pallid Swift colonies formed. With the gradual occupation of these buildings and the increase in Pallid Swift population, more pairs were perhaps forced to choose alternative sites.

It is unclear at what point the formation of mixed colonies has taken place. A significantly greater proportion of Pallid Swift population bred in mixed colonies, and in most of them the Common Swift predominated, which suggests that the latter may have been the first species to settle. It is known that non-breeding birds in both species will try to persistently find nesting places at already occupied ones (CRAMP 1985, KAISER 1997). Pallid Swifts were also found to prefer certain parts of buildings where there is a higher concentration of pairs (CUCCO & MALACARNE 1987), which is considered an indicator of nest-site suitability in colonial birds (DANCHIN et al. 1998).

Thus, one hypothesis is that at the very beginning of Pallid Swift colonisation, when its numbers must have been rather low, the first pairs settled in the existing Common Swift colonies and later on, monospecific colonies started to predominate perhaps due to the limited availability of unoccupied holes in the long-established Common Swift colonies. On the other hand, it is possible that mixed colonies were not necessarily formed mostly at the beginning of Pallid Swift spreading. Rather, they may have arisen all the time together with new monospecific ones. Some traits of Pallid Swift might facilitate such a process. It usually arrives at the breeding grounds in spring slightly earlier than Common Swifts in both Piedmont (Boano & Cucco 1989) and Sofia (own unpubl. data). They thus have the opportunity to commandeer some Common Swift cavities (we have observed this twice, unpubl. data). Some pairs that change cavity before laying second clutches are also known to occupy nests of Common Swifts (Boano & Cucco 1989), since part of the latter have already departed at that time.

In conclusion, the study did find coexistence of Common Swifts and Pallid Swifts but it was rare and the two species nested largely separately. This could be attributed to the limited availability of holes within existing long-established colonies. Pallid Swift chose a wider array of nest-sites as compared to the Common Swift.

## 5. Zusammenfassung


Gemeinsames Brüten und Nistplatzwahl von Mauersegler (*Apus apus*) und Fahlsegler (*Apus pallidus*).

Ziel der Studie war es, Koloniestrukturen sowie interspezifisches Verhalten und Nistplatzwahlkriterien von zwei nah verwandten Seglerarten – Mauersegler (*Apus apus*) und Fahlsegler (*Apus pallidus*) – in einem städtischen Habitat zu untersuchen. Die Erhebungen wurden von 1998 – 2000 in der bulgarischen Hauptstadt Sofia durchgeführt. Anzahl und Lage der Nester wurden durch die registrierte Zahl bekoteter Einfluglöcher und durch übliche Nesterkartierung ermittelt. Der Bestand an Mauerseglern war annähernd viermal so groß wie jener der Fahlsegler (1147 Mauerseglerpaare gegenüber 304 Fahlseglerpaaren). Mauerseglerkolonien variierten stärker in der Anzahl der Brutpaare (Mauersegler: 3–34 Paare/Kolonie, Fahlsegler: 3–11 Paare/Kolonie), jedoch überwogen kleinere Kolonien bei beiden Arten. Die meisten Paare beider Arten brüteten in artreinen Kolonien. Es konnten 17 gemischte Kolonien festgestellt werden, in denen die Anzahl der Mauersegler überwog.

Ein Untersuchungsaspekt war die Erfassung relevanter Faktoren für die Nistplatzwahl beider Arten. Artübergreifend wurden Nord- und Ostlagen gegenüber Südlagen deutlich bevorzugt. Die meisten Paare beider Arten nisteten hinter Dachvorsprüngen. Fahlsegler brüteten durchschnittlich in größeren Höhen und in einem weiteren Höhenbereich verteilt als Mauersegler und belegten alle in der Studie aufgenommenen Nisthöhlentypen. Vermutlich haben Fahlsegler die Stadt später besiedelt als Mauersegler und sich von Beginn an stärker an deren Kolonien angegliedert.


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