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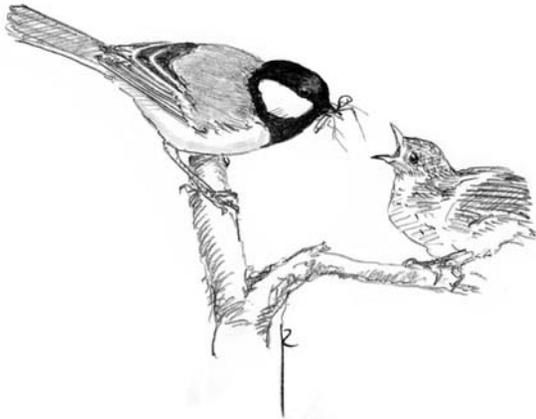
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A case of a three species mixed brood after two interspecific nest takeovers

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Mixed interspecific broods in hole nesting passerines occasionally occur as a by-product of competitive interactions for nest sites. Here, we report a rare case where such interactions led to a three species brood of Pied Flycatcher *Ficedula hypoleuca*, Blue Tit *Cyanistes caeruleus* and Great Tit *Parus major* nestlings that was successfully raised by a Great Tit pair. This occurred in an environment of relatively high temporal overlap in interspecific breeding. We suggest that such overlap may intensify interspecific competition between resident and migrant passerines that rely on similar resources.

Key words: interspecific interference competition, mixed broods, passerines, phenology

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During the breeding season, insectivorous hole nesting passerines compete for nest sites (Minot & Perrins 1986). Two species mixed broods resulting from these interactions have been reported occasionally (MacKenzie 1950, Arn 1955, Campbell 1968, Merilä 1994, Petrassi *et al.* 1998, Dolenc 2002, Borgström 2005, Suzuki & Tsuchiya 2010). Here we describe the special case of a three species mixed brood, where one nest box was sequentially occupied by a Pied Flycatcher *Ficedula hypoleuca*, a Blue Tit *Cyanistes caeruleus* and a Great Tit *Parus major*, all of which laid eggs. The eggs were incubated by the final, Great Tit, female. Subsequently, six Great Tits, one Blue Tit and two Pied Flycatcher chicks were raised to fledging. As far as we know the raising of three species in one nest has not been reported before.

The Pied Flycatcher is a migratory Palearctic passerine that winters in West Africa and breeds in Russia and temperate Europe (Cramp & Perrins 1993). On arrival at their breeding grounds, Pied Flycatchers have little time to decide on their breeding site. Therefore, part of flycatchers' habitat selection strategy is to use cues of resident species with considerable niche overlap, such as Blue and Great Tits (Seppänen & Forsman 2007). Pied Flycatchers not only utilize information of residents for their own breeding decisions (Seppänen & Forsman 2007), but they are also notorious for taking over nests from tits, sometimes with deadly conse-

quences for the flycatchers (Tompa 1967, Slagsvold 1975, Ahola *et al.* 2007; in Collared Flycatchers *Ficedula albicollis*: Merilä & Wiggins 1995). Taking over nests from resident tits is commonly described as a behavioural trait that is typical for Pied Flycatchers.

The spring of 2013 was unusually cold: data from De Bilt (NL) meteorological station show it was the 5th coldest pre-breeding period (15 March – 14 April) since the start of measurements in 1901. This cold period resulted in delayed nest building by resident Blue and Great Tits. Laying date in all species was the latest since the start of the study in 2007 in our study areas Dwingelderveld (52°49'04"N, 6°26'21"E, 400 nest boxes), Drents-Friese Wold (52°54'43"N, 6°19'16"E, 550 nest boxes) and Boswachterij Ruinen (52°43'34"N, 6°23'56"E, 100 nest boxes) National parks. Interestingly, Pied Flycatcher laying date was much less delayed by the cold weather than in the tits (Pied Flycatcher 3.2 d later, Great Tit 12.5 d later, Blue Tit 13.4 d later compared to 2007–2012; Figure 1). This resulted in the shortest laying date interval between tits and flycatchers within this study (2013: mean laying date interval between Blue Tit and Pied Flycatcher 6.7 d, between Great Tit and Pied Flycatcher 5.7 d; 2007–2012: mean laying date interval between Blue Tit and Pied Flycatcher 16.9 d, between Great tit and Pied Flycatcher 15.1 d).

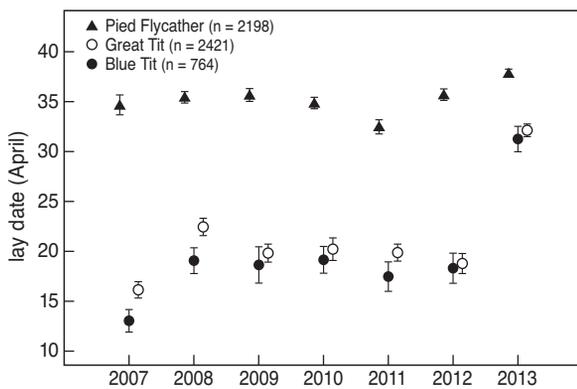


Figure 1. Mean first brood laying dates and confidence intervals of three common hole nesting passerines in the populations Dwingelderveld (400 nest boxes), Drents-Friese Wold (550 nest boxes), and Boswachterij Ruinen (100 nest boxes) National parks. Note the large laying date shift in Blue and Great Tits (13.4 d and 12.8 d respectively) compared to the smaller shift of Pied Flycatchers (3.2 d).

In concert with this late phenology, a highly peaked flycatcher arrival resulted in increased competition for nest boxes, especially in one of the oak dominated study sites (52°49'08"N, 6°23'11"E, 50 nest boxes) with high densities of Great and Blue Tits. This competition continued well into the egg laying phase, and takeovers not only went from flycatchers to tits, but also the other way around. Of 45 nests in this area, nine were takeovers, four of which went from Pied Flycatcher to Blue Tit, three from Great Tit to Pied Flycatcher, one from Pied Flycatcher to Great Tit and one from Blue Tit to Great Tit. Of these takeovers however, only one resulted in a mixed brood.

On 21 April, a Pied Flycatcher male had arrived at an unoccupied nest box in the aforementioned oak dominated study area and started singing. A female initiated nest building on 24 April, after which the nest was completed on 29 April, and the first egg appeared on 7 May. However, during a routine nest box check on 9 May, we found a Blue Tit nest made of moss and feathers with two flycatcher eggs and one Blue Tit egg. One day later (10 May), we found two more eggs apparently laid on the same day, one of a Great Tit and the other of a Blue Tit (Figure 2, left), but with no change to the nest material. The clutch was completed on 16 May, now containing two Pied Flycatcher eggs, two Blue Tit eggs and seven Great Tit eggs. These were incubated by a female Great Tit and all eggs except one (Great Tit) hatched between 28–30 May. In the course of the following three weeks, one Blue Tit chick died, but the remaining nine chicks (Figure 2, right) had fledged on 17 June.

The Great Tits did not seem to differentiate between chick types in the nest, because the two flycatcher young appeared to be fed normally, although one was underweight on day 12 (9.5 and 13.5 g; average of day-12 Pied Flycatcher chicks in 2013 was 13.9 g). Unfortunately, the Blue and Great Tit young were not weighed. Indiscriminant feeding was also observed in an interspecific cross-fostering experiment (Turtumøygard & Slagsvold 2010). As far as we know, the Great Tits were the only parents feeding the chicks, as they were the only ones alarming on frequent nest visits. Given that investing in offspring that are not your own is costly, why did the Great Tits not discriminate between their own and foreign young? It can be argued that the behaviour of covering up competitor eggs with nest material is usually sufficient to avoid their hatching, and selection on kin recognition in the nest may be weak, as mixed broods are rare. Moreover, even if interspecific eggs hatch, the young rarely fledge: in a previous study of mixed broods with Pied Flycatchers and Great and Blue Tits, fledging success of interspecifically cross-fostered flycatcher young was three times lower than that of young in control broods (Slagsvold 2004).

Pied Flycatchers are typically viewed as the 'parasite' in nest takeovers, whereby the tits aggressively respond to intrusions (Slagsvold 1975, Merilä & Wiggins 1995, Ahola *et al.* 2007). However, this case shows that Blue Tits and Great Tits are also capable of taking over nesting sites. We hypothesize that the propensity to take over nests is not merely a behavioural trait of flycatchers, but may be a more common phenomenon among hole nesting passerines. The explanation for rarely observing this in tits is that their breeding timing usually precedes that of flycatchers such that it rarely leads to interference competition for nest sites. We suggest that overlap in reproductive timing between resident and migrant passerines may intensify their interspecific competition during the breeding season.

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Figure 2. Left panel: two Pied Flycatcher eggs (left), two Blue Tit eggs (middle) and a Great Tit egg (right) after the second takeover. Right panel: a Blue Tit, two Pied Flycatcher and six Great Tit chicks three days before fledging.

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Samenvatting

Gemengde broedsels van soorten komen incidenteel voor bij hollenbroeders als bijproduct van concurrentie om nestholtes. Hier beschrijven wij een zeldzaam geval waarin zulke concurrentie heeft geleid tot een broedsel van drie vogelsoorten: twee jongen van Bonte Vliegenvangers *Ficedula hypoleuca*, twee van Pimpelmezen *Cyanistes caeruleus* en acht van Koolmezen *Parus major*. Hoewel twee jongen (één van beide mezensoorten) het niet hebben gered tot uitvliegen, zijn de overige jongen succesvol opgevoed door het Koolmezenpaar. Dit geval vond plaats in een koud voorjaar, waarin het broedseizoen tussen soorten een stuk meer overlapt dan gebruikelijk. We veronderstellen dat een dergelijke overlapping de interspecificke competitie tussen standvogels en trekvogels met een vergelijkbare niche kan intensiveren.

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