

Notas Breves

BIRD POLLINATION IN MADEIRA ISLAND

POLINIZACIÓN POR AVES EN LA ISLA DE MADEIRA

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Outside Europe and temperate Asia, birds are well known as pollinators of flowering plants. They visit flowers for nectar, pollen and maybe insects. The main flower-visiting birds are hummingbirds (Trochilidae), sunbirds (Nectariniidae), white-eyes (Zosteropidae), honeyeaters (Meliphagidae), flower-peckers (Dicaeidae), Hawaiian honeycreepers (Drepanidinae), and lorikeets (Loriinae) (Proctor *et al.*, 1996). However, several other bird species visit flowers on a less regular basis (e.g. Grant & Grant, 1981; Cox, 1983; Vogel *et al.*, 1984; Olesen, 1985; Westerkamp, 1996; Olesen *et al.*, 1998). Some of these birds, e.g. the Blue Tit (*Parus caeruleus*), may occasionally pollinate European flowers (e.g. Búrquez, 1989). European warblers (Sylviidae) also visit flowers. Laursen *et al.* (1997) found that 2% of warblers caught in spring in Denmark carried «pollen horns» from Mediterranean plants (e.g. *Eucalyptus*, *Citrus*). In the Palearctic region except Israel, regular bird pollination is only known from the Canary Islands (Vogel *et al.*, 1984; Olesen, 1985). Here, birds like the Spectacled Warbler (*Sylvia conspicillata*), the Sardinian Warbler (*S. melanocephala*), the Blackcap (*S. atricapilla*), the Blue Tit, the Chiffchaff (*Phylloscopus collybita*), and the Canary (*Serinus canarius*) visit several native and introduced flowering plant species for nectar. The birds are regarded as very important to the reproduction and survival of several endemic plants (Olesen, 1985; Valido *et al.*, 2002). In addition, most of these plants have floral traits associated with bird pollination outside Europe and temperate Asia, e.g. red-yellow corolla colours, plenty of nectar, and no odour (Fægri & Pijl, 1971). Why do these insect- and fruit-ea-

ting birds include floral resources into their diet? Low species density on islands and thus a reduced interspecific competition may lead to very high abundance (i.e. density compensation, MacArthur *et al.*, 1972) in a subset of species such as the *Phylloscopus* and *Sylvia* species and this again may lead to intensified intraspecific competition and cause a widening of the niche of the birds to include floral resources (*unpubl. data*). Maybe a shortage of arthropod food on islands (Janzen, 1973) and in cold spring weather in temperate mainland regions (as in the case of the Blue Tit; Búrquez, 1989) also contributes to a niche widening or shift in some bird species. The same is observed in island lizards. They are important pollinators and fruit dispersers on many islands, and a similar causal background has been suggested here (Olesen & Valido, 2003).

If birds, generally, do density compensate and widen their food niche on islands one should expect to find bird pollination on other oceanic islands outside the traditional bird pollination regions, e.g. in the Azorean and Madeira archipelagos.

Here, we report the first instances of bird pollination from the island of Madeira. In August 2001, we observed the Blackcap to visit *Isoplexis sceptrum* (Scrophulariaceae) five times during one day and *Musschia wollastonii* (Campanulaceae) seven times during one day. In *I. sceptrum* the bird perched just under one of the inflorescences and in *M. wollastonii* it perched on the side branches of the 1-m tall inflorescence. We do not believe the birds search the flowers for insects, since we inspected many flowers but never found small insects, such as thrips, inside the flowers. Both plant

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species are endemic to Madeira. Our observations were made at Ribeiro Frio in the laurel forest where an individual of each species was kept under observation from 10 am to 3 pm. Four plants of *M. wollastonii* and nine of *I. sceptrum* were growing here. *Isoplexis sceptrum* had red-orange flowers and no scent, whereas *M. wollastonii* had a corolla colour dimorphism, i.e. some plants had yellow flowers and others purple flowers. Birds were only observed to visit an individual with purple flowers. Its flowers were also scentless.

We measured the amount of floral nectar with micro pipettes and sugar concentration of nectar as sucrose equivalents with a hand-held refractometer. Average standing crop of nectar in a flower of *I. sceptrum* was 37 ± 25 microliters and sugar concentration was $14.7 \pm 2.9\%$ ($n = 10$, ranges 9-81 microliters and 11-19%). Several individuals of *Bombus terrestris* ssp. *maderensis* (Hymenoptera: Apidae) approached the flowers of *I. sceptrum* and tried to enter the flowers but they never succeeded. They most often landed on the top of the flower on the outside of the corolla, sipping nectar from here. This nectar had been oozing out of flowers higher up in the inflorescence, making all flowers sticky on their outside.

Average standing crop of nectar in a flower of *M. wollastonii* was 95 ± 55 microliters and sugar concentration was $12.5 \pm 1.2\%$ ($n = 15$, ranges 11-149 microliters and 11-16%). Thus the large volume of nectar produced in both species made flower-visiting profitable to birds. Several insects also collected nectar and pollen from this species, e.g. Muscidae, Syrphidae and Vespidae spp. The stigma, however, is inaccessible to small insects because its margins are bordered by inulin-producing glands (pers. obs.). Therefore, we suspect the Blackcap could be important to the reproduction in these rare Maderian endemics.

As a consequence of their flower morphology (Fægri & Pijl, 1971), several other Madeiran plant species may candidate as being bird-pollinated, e.g. *Echium nervosum*, *E. porto-sanctense* (Boraginaceae), *Lotus argyroides*, *L. macranthus*, *L. loweanus*, *Vicia costae* (Fabaceae), *Teucrium betonicum*, and *T. abutiloides* (Lamiaceae).

Bird pollination is not known from the Azores. Lizard pollination, however, has been observed on both the Azores (the introduced li-

zard *Teira dugesii* visits the endemic plant *Azorella vidalii* (Campanulaceae); unpubl. data) and Madeira (*T. dugesii* visits several plant species; Elvers, 1978).

Finally, we hypothesize pollination of *I. sceptrum* and *M. wollastonii* by the very abundant Blackcap to be a consequence of density compensation and niche widening, a phenomenon observed in many island species (MacArthur *et al.*, 1972; Olesen & Valido, 2003).

RESUMEN.—*En este estudio se muestran las primeras evidencias que sugieren la polinización por parte de aves (Sylvia atricapilla) de dos especies de plantas endémicas en Madeira. Diversos insectos pueden alimentarse del néctar que estas plantas poseen en sus flores. Sin embargo, no pueden polinizar las flores, lo cual nos indica la importancia de algunas especies de aves como polinizadores de estas plantas endémicas de la Isla de Madeira.*

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