
Factors affecting population density of *Colletes floralis* (Hymenoptera: Apidae) on Islay, Hebrides

Cathy Fiedler

BTCV Scotland, Hunterian Museum (Zoology), Graham Kerr Building, University of Glasgow, Glasgow, G12 8QQ.

E-mail: catedl@ceh.ac.uk

Colletes floralis (Fig. 1) is a northerly distributed solitary mining bee associated with coastal habitats (Michener, 2000). It is a BAP species, classified as Rare and RDB3 listed (UK BAP Plan, 2004). It is polylectic, visiting a variety of plant species (Westrich, 2001) to collect pollen and nectar as provisions for its offspring, and to feed. As well as being a species of conservation interest in its own right, it is also an important food source for chough, *Pyrhocorax pyrrhocorax* (amber list bird of conservation concern) on Islay. Machair grassland is a highly specialised and complex sand dune system, confined worldwide to the northwest coasts of Ireland and Scotland (Gaynor, 2006). It is an important habitat for *C. floralis* on Islay, providing a rich diversity of floral resources and semi-fixed dune substrate for nesting.



Fig. 1. *Colletes floralis* female (above) and male (below).

The population density of *C. floralis* at two sites on Islay, Ardnave (NR 2973) and Killinallan (NR 3072) was determined, focusing on five nest sites at each - all in grey dunes and southerly-facing. The amount of bare sand and floral resources were investigated as

factors that could affect female nesting density. At each nesting site, a 50 x 50cm quadrat was thrown randomly between 5 and 10 times (depending upon the size of the site) and all *C. floralis* burrows within it counted. The average number of burrows was multiplied by the size of the nesting area (estimated in m²) to calculate burrow density. At the same time, the percentage area of bare sand at the nest site was estimated. Nine 100 metre transects were conducted at both Ardnave and Killinallan; the floral abundance, species richness and number of inflorescences were recorded. Pollen samples were taken from 30 females at Killinallan for analysis.

A greater number of nesting females were found at Killinallan than at Ardnave ($F_{6, 75} = 17.364$, $p < 0.001$), at an average of 27 per m² and 13 per m² respectively. Burrow density increased significantly with increasing size of the nest site ($F_{6, 75} = 7.361$, $p < 0.001$). Burrow density was not significantly influenced by the amount of bare sand ($t = 0.297$, $df = 72$, $p = 0.767$). *C. floralis* was found nesting in the mobile fore-dune and in grey dunes, and were nesting in various aspects. Both sites were floristically rich with 27 and 25 species of flowering plant at Ardnave and Killinallan respectively. The number of inflorescences did not differ significantly between sites (ANOVA, $F_{1, 180} = 0.922$, $p = 0.339$), but the species composition was significantly different (ANOVA, $F_{46, 180} = 45.362$, $p < 0.001$). Pollen analysis results will be published in an article for the Bees Wasps and Ants Recording Society newsletter in the near future.

Population density is greater at Killinallan than Ardnave. There is less nesting habitat available at Ardnave so this may be a limiting factor. Forage may not be a limiting factor since the number of flowers, their abundance and the species richness is similar between sites. Floral composition may be important however. *C. floralis* may provide important pollination services to the machair habitat, since *Bombus* species were the only other bees observed. Population density increases with increasing size of the nest site, supporting findings that *C. floralis* nests in aggregations, attracted by the strongly scented pheromone, linalool (Albans *et al.*, 1980). *C. floralis* was found nesting in mobile fore-dune and grey dune areas, which suggests that sand that has been stabilised by vegetation is favoured. Within this habitat, aspect and the amount of bare sand are not primary factors in nest site choice, suggesting *C. floralis* can exhibit plasticity in its site choice.

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