



Updated list of bumblebees (Hymenoptera: Apidae) from the Spanish Pyrenees with notes on their decline and conservation status

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Abstract

The Pyrenees, where Euro-Siberian, Mediterranean and alpine faunas join together, have a large biodiversity of bumblebees. We compiled historical literature records of bumblebee species from the Spanish Pyrenees, and then compared these to contemporary surveys to assess trends in elevational distribution. Twenty-eight species (including thirty-five subspecies) were found in the contemporary survey. Nine species and two subspecies previously present were not detected, some included on the Spanish Red List. With the exception of a few species, a reduction of the altitudinal range and an orophilous tendency was observed at both upper and lower elevational levels, suggesting an upward trend towards better-preserved high areas. Our results reinforce the need to develop new protection programs and more restrictive conservation measures for bumblebee populations, species and their habitats.

Key words: Biodiversity, *Bombus*, decline, habitat loss, pollinators, Spain

Introduction

The species richness of flower visiting insects has declined in past decades, and the ecosystem services they provide by pollinating crops and wild plants is threatened (Patiny *et al.* 2009, Potts *et al.* 2010, Bomarco *et al.* 2012). Bumblebees are vitally important pollinators, and play a key role in natural and agricultural ecosystems. The current drastic decreases in bumblebee communities, mainly due to anthropogenic actions, have been detected in some North American, Asian and European regions with potential consequences for the stability of these ecosystems and crop yields (García *et al.* 2004, Edwards & Williams 2004, Rasmont *et al.* 2006, Brown & Paxton 2009, Cameron *et al.* 2007, 2011, Patiny *et al.* 2009, Quintero *et al.* 2009, Williams & Osborne 2009, Potts *et al.* 2010, Ornosá 2011, Ornosá & Torres 2009a, 2009b, 2011, Bomarco *et al.* 2012, Goulson *et al.* 2008a, 2008b, Goulson, 2009, 2010, Ornosá & Ortiz-Sánchez 2011, Dupont *et al.* 2011, Colla *et al.* 2012, Ploquin *et al.* 2013, Herrera *et al.* 2014, Rasmont *et al.* 2015, Kerr *et al.* 2015, Miller-Struttman, *et al.* 2015, Pike *et al.* 2016).

Several factors have influenced the persistence, abundance or decline of bumblebee populations (Cameron *et al.* 2007, 2011, Rasmont *et al.* 2015, Goulson *et al.* 2015). According to Goulson *et al.* (2015), the decline in abundance and diversity of flowers, the simultaneous and chronic exposure to cocktails of agrochemicals and novel parasites accidentally spread by humans and climate change, are likely to exacerbate this situation in the future. The spill over of pathogens from commercial honeybee (and even bumblebee) colonies into wild populations has been implicated recently (Meeus *et al.* 2011, Mathew *et al.* 2013, Fürst *et al.* 2014, Potts *et al.* 2016) in the decline of native pollinators, since commercial colonies may have high pathogen loads, and are potentially likely to establish in the wild native bumblebee populations. Despite these recent human impacts, climatic fluctuations during recent glacial events should also be taken into account to explain present extinction rates and reduced