**INTRODUCTION**

The complex *Carthamus-Carduncellus* (Cardueae, Compositae) is formed by approximately 60 taxa widely distributed throughout the Mediterranean basin and western Asia. Genera delineation in the complex has been always controversial. The three main taxonomical proposals are: (1) the complex is formed by a single genus *Carthamus*, as suggested by Greuter (2003), (2) by two genera, *Carduncellus* and *Carthamus*, as proposed by López-González (2012); and (3) by four genera, *Carduncellus*, *Carthamus*, *Femeniasia* and *Phonus*, by Vilaterrana et al. (2005). (Fig. 2: Hypothesis H3, H2, and H4 respectively).

**AIMS**

Our aim is to provide a robust and comprehensive systematic proposal for the complex *Carthamus-Carduncellus* with the following specific goals: (1) to build a nuclear phylogeny encompassing most of the richness of all the putative genera; (2) to propose and test the genera delimitation of the complex and; (3) to infer the biogeographic history of the complex by estimating divergence times and ancestral distribution areas and lineages.

**RESULTS AND DISCUSSION**

- The *Carthamus Carduncellus* complex is polyphyletic. However, *Carthamus* and *Carduncellus s.l.* (*Carduncellus + Phonus + Femeniasia*) are monophyletic lineages (Fig. 1).
- Genus delimitation analyses strongly support (Bayes factor 2lnBF > 10) at least three different genera: *Carthamus*, *Carduncellus* and *Phonus*. The recognition of *Femeniasia* remains ambiguous (Fig. 2: H3 and H4).
- We propose 4 genera: *Carthamus*, *Carduncellus*, *Phonus*, and *Femeniasia* on the basis of the genera delimitation analyses plus clear-cut morphological and chorological features. *Femeniasia* comprises one single species restricted to Minorca (Balearic Islands) whereas *Phonus* species occur in North Africa and Iberian Peninsula and differ in seed morphology and plant biotype.
- The complex emerged in the Middle Miocene and diversified into the major lineages throughout the Middle and Late Miocene including the Messinian event. The onset of the Mediterranean climate triggered radiation processes within the genera *Carduncellus*, *Carthamus*, and *Phonus* (Fig. 1).
- The main lineages originated in different regions (Fig. 1). The ancestor of *Carduncellus s.l.* evolved in North Africa and later on colonized North Eastern Africa (Libya and Egypt), the Balearic Islands, and the Iberian Peninsula from which expanded to the rest of Europe. *Carthamus* emerged in The Eastern Mediterranean (Israel, Palestine) and radiated toward two different large areas: 1) Turkey and western Asia; and 2) North Eastern Africa (Libya and Egypt) and Greece.

![Fig. 1. A: Molecular dating and biogeographic analysis. Maximum clad credibility tree from the relaxed molecular clock analysis of concatenated rDNA sequences. Secondary calibration follows Barnes et al. (2013). Ancestral area reconstruction follows DEC+ model. B: Map of ancestral areas.](image1)

![Fig. 2. Diagram of the four genera delimitation hypothesis tested](image2)

**MATERIAL AND METHODS**

- Phylogeny: Two nuclear regions, ITS and 2ETS, Bayesian inference.
- Genus delimitation: four hypothesis (Fig. 2) tested by using the BEAST tool implemented in Beast (v1.8.3) and Bayes Factor Delimitation following the framework proposed by Grimmer et al. (2014) and Hotaling et al. (2016). 2lnBF [H4-H1] >10 is considered strong support.
- Biogeographic analysis: BEAST (v1.8.3) and BioGeoBears (Matzke, 2013).

**REFERENCES**