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## Catalogue of parasitoids and inquilines in cynipid oak galls in the West Palaearctic

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## Abstract

A quantitative catalogue of the parasitoids (almost exclusively Chalcidoidea) and inquiline Cynipidae recorded in the western Palaearctic from galls induced on *Quercus* by Cynipidae (Cynipini) is presented. Quantitative and national data are included with bibliographic references to almost all records published in 2011 and earlier. The catalogue is followed by two checklists, firstly one of the Chalcidoidea with numbers of each species recorded from each type of host gall (galls of the sexual and asexual generations of the host gall wasps are listed separately), and secondly one of inquiline Cynipidae with host galls. Compared to non-oak gall wasps, the Cynipini support a much larger parasitoid and especially inquiline fauna, and this fauna is very largely restricted at the species level to Cynipini galls. About one hundred chalcidoid species are recorded from galls of Cynipini, distributed over six families: Pteromalidae and Eulophidae (29 species each), Torymidae (21 species), Eurytomidae (10 species), Eupelmidae (8 species) and Ormyridae (at least 2 species). Polyphagy is usual in the chalcidoid parasitoids, most species having a broad host gall range, but quantitatively the fauna of each type of oak gall is rather characteristic and is strongly influenced by gall morphology, situation on the tree, season of growth and host tree species. These and other extrinsic factors restrict the full exploitation of the chalcidoids' potential host gall range.

**Key words:** Hymenoptera, Chalcidoidea, Cynipidae, Synergini, parasitoids, inquilines, west palaearctic

## Introduction

This catalogue complements an earlier one (Askew *et al.* 2006) in which are listed parasitoids and inquilines in galls of non-oak Cynipidae, formed by 'Aylacini' (probably polyphyletic) on herbaceous plants and *Rubus*, Diplolepidini on *Rosa*, and Pediaspidini on *Acer*. Here we consider the inhabitants of galls of Cynipini (Hymenoptera, Cynipidae) which, in the western Palaearctic, are formed on oak (*Quercus*) with an introduced species, the chestnut gall wasp *Dryocosmus kuriphilus*, on *Castanea*. Elsewhere other Fagaceae are attacked by Cynipini: *Notholithocarpus* and *Chrysolepis* in North America, and *Lithocarpus* and *Castanopsis* in Asia. Cynipini galls are in general more complex and varied in structure than galls induced by the other tribes of Cynipidae (Csóka *et al.* 2005). The large numbers of insect species associated with most oak galls, and the size and complexity of food webs that can be generated within oak galls (Askew 1961f; Schönrogge *et al.* 1995, 1996; Bailey *et al.* 2009), are a function of this diversity of oak gall form.

Oak gall communities comprise the gall-inducing Cynipini, many inquiline cynipids, and a diversity of chalcid parasitoids (Hymenoptera, Chalcidoidea) which attack the cynipids and each other. *Synergus* is a speciose genus of inquiline Cynipidae found only in oak galls. The species have lost the capability of inducing galls themselves, although they modify the host gall morphology to a greater or lesser extent. Species of *Synergus* feed as larvae on the tissues of galls induced by gall-forming Cynipini, and very occasionally Cecidomyiidae (Askew 1999a). Some species live in chambers in the peripheral tissue of the gall and seem to have little effect on the host gall wasp (non-lethal inquilines), but during the development of other *Synergus* species, the larval chamber of the host gall wasp is occluded and its occupant destroyed (lethal inquilines).

We present below a catalogue of inquiline Cynipidae and parasitic Hymenoptera recorded from western Palaearctic cynipid oak galls. Parasitoids certainly known to have developed upon inquiline Tortricidae (Lepidoptera) or other insects, such as aculeate Hymenoptera, Coleoptera and Neuroptera, which utilise oak galls, more or less facultatively, for food, shelter or as nesting sites, are excluded. Thus, for example, *Leucospis dorsigera* Fabricius, a large chalcid parasitoid of solitary bees of the subfamily Megachilinae (mainly *Anthidium* Fabricius and *Osmia* Panzer (Baur & Amiet 2000)), quite frequently emerges from old woody galls in southern Europe, but is omitted from the catalogue, as are species of Tetrastichinae which attack cocooned Neuroptera. It is sometimes unclear, however, whether or not a parasitoid species is a genuine but only occasional member of the oak gall community in its restricted sense. For instance, rearings of parasitoids normally associated with leaf-mines, such as *Closterocerus trifasciatus* Westwood, *Cirrospilus* and some species of *Pediobius*, are included in parenthesis in the catalogue when there is a probability that they had developed upon regular gall inhabitants.