ESSIGELLA CALIFORNICA (APHIDOIDEA: APHIDIDAE), A PINE-FEEDING APHID NEW TO BRITAIN

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ABSTRACT

The aphid *Essigella californica* (Essig) is reported new to Britain following its discovery in November 2010, feeding on Scots Pine *Pinus sylvestris* and Bhutan Pine *Pinus wallichiana* at the Royal Botanic Gardens at Kew in London, and subsequent finds on Montezuma Pine *Pinus montezumae* in Kent.

INTRODUCTION

A small number of specimens of *Essigella californica* (Essig), the Monterey pine aphid, were found on samples of *Pinus* branches submitted to the Food and Environment Research Agency (Fera) by the Plant Health and Seeds Inspectorate (PHSI) for examination in November 2010 (Plate 9, Fig. 1). The branches originated from potted Scots Pine *Pinus sylvestris* L. and Bhutan Pine *Pinus wallichiana* Jackson grown outdoors at the Royal Botanic Gardens at Kew, which had been obtained four or five years previously for a temporary exhibition; the exact origin of the trees is unknown. Live viviparous apterae and a single nymphal viviparous alate were examined and identified by the first author. The potted *P. sylvestris* also harboured a large infestation of Smooth Pine Scale *Leucaspis pini* (Hartig), as reported by Malumphy & Redstone (2011) which was later destroyed.

In July 2012, the second and third authors found a small population of *E. californica* on Montezuma Pine *Pinus montezumae* Lamb. at Bedgebury National Pinetum, Kent. Upon re-sampling in September 2012 and August 2013, a small number of apterous viviparous specimens were sent to the Food and Environmental Research Agency for slide mounting and confirmation.

In 2013 Rothamstead Research identified a single alate *E. californica,* which was caught in the Whittle suction trap near Chelmsford, Essex on 03.xi.2009 (Mark Taylor, pers. comm.).

IDENTIFICATION

Essigella (Lachninae: Eulachnini) is a Nearctic pine feeding genus with 14 described species. They are all elongate spindle-shaped and have 5-segmented antennae and bifurcate tarsal claws which distinguishes them from the morphologically similar Palaearctic genus *Eulachnus.*

Thus far *E. californica* is the only species in the genus to have been recorded outside North America. Its viviparous apterae are 1.4–2.3mm long and have a grey-green thorax and a lime green abdomen, with or without brown dorsal spots. The legs are variably pigmented, often mainly pale but with the tibiae darker. The alatae have 2–4 secondary rhinaria on the third antennal segment (Blackman & Eastop, 1994). In Britain they could most easily be confused with *Eulachnus agilis* (Kaltenbach) which is common on *P. sylvestris*. *Essigella californica* move quickly when disturbed and are often overlooked, hence their biology is little known.

Essigella californica can be separated from other *Pinus* feeding lachnids known to occur in Britain using Blackman and Eastop (1994). Sorenson (1994) revised *Essigella*, synonymising many of the species described by Hottes in the 1950s.

DNA barcoding was performed on a single specimen from the Kent population (designation ENTOBAR1978), together with specimens of *E. californica* from a New Zealand population provided by Dr Eckehard Brockerhoff (Scion, New Zealand) on *Pinus radiata* D.Don (designation ENTOBAR1977, comprised of a pool of three adult specimens). DNA was extracted using a DNAeasy Blood and Tissue kit (QIAGEN, Manchester, UK) following the manufacturer's protocol and partial COI gene sequences were amplified using the primers Lep-F1 and Lep-R1 (Hebert *et al*., 2004). Polymerase chain reaction products were purified using a QIAquick PCR purification kit (QIAGEN), cloned using the pGEM®-T Easy Vector System (Promega, Southampton, UK) and two randomly selected clones sequenced on both strands.

Sequence reads were assembled, polymorphic sites identified (one in ENTOBAR1977 and two in ENTOBAR1978) and the sequences submitted to the National Center for Biotechnology Information, Bethesda, USA (Accession numbers KM888107 and KM888108). The partial COI gene sequences from the two populations showed 99.5% sequence similarity due to the presence of the polymorphic sites. The *E. californica* sample from Kent showed a 100% sequence similarity to the Barcode of Life database for this species.

Behaviour and ecology

Essigella californica was found in Bedgebury National Pinetum, Kent on 28.vii.2012 on two mature *P. montezumae* trees. None was found on other conifer species in the vicinity. Observations were subsequently made on the same trees in September 2012, July and August 2013, and February 2014. In the latter two years hand searching was supplemented with beating. Searching was time consuming and had to be done very carefully to avoid disturbing the aphids, but it provided additional information about the behaviour and ecology of the species.

The aphids either fed singly or in small groups spaced out along the needle (Plate 9, Fig. 1). They were apparently in competition for this resource with abundant *Eulachnus rileyi* (Williams). Both species favoured one year old and senescent needles, which are rich in translocated nutrients (Katerere, 1984). It was observed that, if disturbed, *E. californica* became active and evasive, usually moving to the base of the needles as described by Carver & Kent (2000) and Kimber, Glatz, & Shaw (2013). Exactly the same behaviour has been described for *Eu. rileyi* by Baker & Broad (2009). In Kent, *Eu. rileyi* was sometimes attended by *Myrmica* ants (Plate 9, Fig. 2). We have not observed ants attending *Essigella*, but Sorensen (1994) recorded ants attending *E. californica* when they were aggregated near the base of needles. Wharton & Kriticos (2004) suggest that *E. californica* is not able to compete particularly well with other *Essigella* or *Lachnus* aphid species.

We did not observe any predation of *Essigella*, although we recorded various potential predators such as the coccinellid *Exochomus quadripustulatus* (L.) on the affected trees. One parasitized mummified aphid (unfortunately empty) was found attached to a needle (Plate 9, Fig. 3). The pale legs suggest it was either *E. californica* or *Eu. brevipilosus* Börner, but not *Eu. rileyi* which has dark legs. The parasite was present, pupating below the mummy, indicating that it was a *Praon* species, specifically *Praon bicolor* Mackauer (Baker & Broad, 2009).

Essigella californica has a sexual reproductive stage, but this has only been observed at high altitudes in North America. In Australia, no sexual forms have been

found and reproduction is entirely parthenogenetic. We were unable to find any *E. californica* viviparae by searching or beating the Montezuma Pine in winter in February. We did find a small *Eulachnus*/*Essigella* nymph, but were unable to rear it to the adult stage for identification.

Discussion

Essigella californica is native to western North America, where it occurs from southern British Columbia and Alberta south to Mexico and east to Nebraska. It has a wide host range amongst the Pinaceae and has been recorded from 29 *Pinus* species. It is most commonly reported from Monterey pine. There are also records of *E. californica* feeding on Douglas-fir (*Pseudotsuga menziesii* (Mirbel)) (Sorensen, 1994). It has been introduced into Australia, New Zealand, southern Brazil, Chile and Argentina, and is now well established throughout the pine growing areas of these countries. The first European record was in France in 1990, and it has since been reported from Spain, Madeira, Italy and Malta (Wharton & Kriticos, 2004). The presence of *E. californica* populations in France suggests that the Kent pines could have become colonised through natural dispersal of winged individuals, especially if dispersal was assisted by southerly or south-easterly winds. The first find at the Royal Botanic Gardens at Kew was more likely the result of an accidental importation.

Forest Research undertook a pest risk assessment to determine the probability of *E. californica* establishing in the UK and the amount of damage it might cause (Wood, 2014). The assessment determined that the aphid could colonise Scots Pine (*P. sylvestris*) and Corsican Pine (*Pinus nigra ssp. laricio* Maire) in all areas of the UK where these species are grown, and other pine species where they occur.

Essigella californica is not considered a significant economic pest in its native habitat in North America, or in New Zealand or South America. In Australia, however, it is considered an economically important pest as it causes extensive defoliation in commercial *P. radiata* plantations, particularly when the trees are under stress due to drought (Eyles *et al.*, 2011). In France, *E. californica* has been associated with localised needle yellowing on *P. radiata*, which might sometimes affect a whole branch, but it is not currently considered an economically important pest (Turpeau & Remaudière, 1990).

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Reference specimens have been deposited in the Fera Invertebrate Reference Collection and the collections of Natural History Museum, London.

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SHORT COMMUNICATION

***Stiroma bicarinatus* (Herrich-Schäffer) (Hemiptera: Delphacidae) refound in Surrey**. – On 24.vi.2015 (and again on 17.vii.) I swept several males and females of the plant hopper *Stiroma bicarinata* from a herb-rich damp grassland around the 'village' pond on Coldharbour Common, Surrey (TQ149538). The area is on a slope with seepages, and supports a very rich insect fauna with other interesting bug species including *Adelphocoris ticinensis* (Meyer-Dür) (Hem., Miridae) The only previous Surrey record is from Shere by J. Edwards in the late 19th Century. The flight period tallies well with Ossiannilson (1978), who gives 'low vegetation in light leafy woods' as main habitat. The Coldharbour site is surrounded by woodland and has scattered sallow bushes. Nickel (2003) reports that the species is often found in tussocks of *Deschampsia flexuosa*, but also on a wide range of grasses including *Holcus mollis*, *Dactylis glomerata, Elymus repens* and *Arrhenatherum elatius*. – JONTY DENTON, 31 Thorn Lane, Four Marks, Hants, GU34 5BX.

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PLATE 9. Fig. 1. Nymph (L) and adult (R) of *Essigella californica* (c. 2 mm) on *P. montezumae*. Fig. 2. *Myrmica* ant attending the aphid *Eulachnus rileyi* (c. 2.4 mm) on *Pinus montezumae*. Fig. 3. Parasitized mummy of *Essigella/Eulachnus* on *P. montezumae*. Photos copyright InfluentialPoints, all rights reserved. Fig. 4. Adult *Japananus hyalinus*, (c. 5 mm) Cambridge, 9.viii.2015. Photo: K. Edkins.