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Research Article

PITTOSPORUM PIT SCALE, *PLANCHONIA ARABIDIS* (HEMIPTERA: ASTEROLECANIIDAE) AND ITS LEAF GALLS INDUCED ON PITTOSPORUM TOBIRA IN SOUTHERN ITALY

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Abstract. The morphology of the adult female pittosporum pit scale, *Planchonia arabidis*, a commonly encountered sap-feeding insect in Europe, is described and illustrated, based on material collected from southern Italy on Pittosporum tobira. Histopathological observations are made for the first time on the aforementioned host-plant on which typical pit galls are induced by *P. arabidis*. Distribution and host-plant data is also provided for this species at a global level.

Keywords Pit scales, Mediterranean, Histopathology

1 Introduction

The family Asterolecaniidae constitutes a well defined group of 23 genera of scale insects (Hemiptera: Coccoidea), commonly referred to as pit scales, and currently accommodates 229 species worldwide (Ben-Dov 2006). They are highly specialised plant-sap feeders and many species produce deep circular pits that disfigure the host-plant, hence their common name. All of the European species are rather similar in appearance, with the adult female being circular or oval in shape, and between $0.5-5.0$ mm in length. General body colouration can vary from pale yellow or green, to dark brown. Each female is enclosed in a glassy wax test with a marginal fringe of wax filaments. The pit scale genus *Planchonia* contains ten species worldwide, of which six are established in Europe and the Mediterranean. A further species, Euphorbia pit scale *P. stentae* (Brain), has been found in the UK on *Hoodia gordonii* (Masson) Sweet ex Decne (Euphorbiaceae) imported from Namibia, but has not established (Malumphy 2009). *Planchonia arabidis* Signoret is the most widespread and abundant species of *Planchonia* in Europe. It is a serious pest of some ornamental plants in the USA, causing distortion and death of the growing tips (Gill 1993), and on one occasion damaged a sugar beet (*Beta vulgaris* L.) crop in Brownstown, Washington State, USA, resulting in about 50% yield reduction (Landis 1968). It has also been recorded causing severe damage to Crimean ivy (*Hedera taurica* Carr.) in the Crimea, Ukraine (Vasil'eva 1986), a plant widely used for vertical landscaping and ground cover. Feeding by *P. arabidis* usually induces a deep 'pit gall' on the surface of the host plant, whereas most *Planchonia* spp. only induce a shallow depression in the host, or have no visible effect on the surface of the plant, apart from localised chlorosis. Pit gall development varies with host-plant species and feeding location, the pits are usually more pronounced when the scales feed near the growing tips.

The purpose of this study is to present a detailed morphological description and illustration of the adult female *Planchonia arabidis*, review its global distribution and host-plant data, and to provide detailed histopathological observations on the leaf galls induced by the in-

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sect on Pittosporum tobira.

2 Material and methods

Specimens of *Planchonia arabidis* used in the present study were collected in May 2011 from a private garden in Specchiolla, Brindisi province, Southern Italy (geographical coordinates 40° 44′ 84”N; 17° 44′ 21”E). The *P. arabidis* were preserved in 75% alcohol, slide-mounted in Canada balsam according to published methods (Malumphy 2002), and studied with a Zeiss compound microscope (Axioscope 2 plus). For the histopathological observations, galled and ungalled midrib portions of the host-plant (Pittosporum tobira) were fixed in FAA (formaldehyde - Acetic solution), dehydrated in a tetriary butyl alcohol series, and embedded in paraffin ($58°C$ melting point). Embedded material was sectioned at 15 micrometers thick sections, and stained with safranin and fast green and mounted permanently for microscopic examination (Johansen 1940).

Figure 1: Adult female pittosporum pit scales, *Planchonia arabidis* on Pittosporum ©US National Collection of Scale Insects Photographs Archive, USDA Agricultural Research Service, Bugwood.org

3 Results

Planchonia arabidis Signoret, 1877 - Pittosporum pit scale (Figs. 1 and 2)
Planchonia arabidis Signoret, 1877: 608.
Planchonia hederae Lichtenstein, 1880: xlv. Synonymy by Russell, 1941: 44.
Planchonia valloti Lichtenstein, 1882: lxxv. Synonymy by Fernald, 1903: 51.
Asterolecanium massalongianum Targioni Tozzetti, 1893: 295. Synonymy by Fernald, 1903: 51.
Pollinia thesii Douglas, 1893: 55. Synonymy by Russell, 1941: 44.
Asterolecanium arabidis; Cockerell, 1896: 327. Change of combination.
Planchonia arabidis; Kozár and Drozdják, 1998: 30. Revived combination

3.1 Description

Adult female. *Habitus.* Test varies from oval to broadly pyriform, dorsum strongly convex, whitish to pale brown, translucent to opaque, with a wax fringe around the margin and along the mid-dorsum (these are often missing as they are easily rubbed off), usually about 2.0−3.5 mm long and 1.5−2.5 mm wide, occasionally up to 5.0 mm long and 3.5 mm wide. *Slide mounted.* Oval to broadly pyriform, posterior end tapering, apex of abdomen usually slightly concave, 1.7 − 3.2 mm long and 1.2−2.2 mm wide. Antennal tubercles circular, with 2 large thick and 2 − 7 short setae. Labium with 2 pairs of setae. Leg vestiges entirely absent. Anal lobes undeveloped, with 6 pairs of short setae, and a pair of long (100 − 128 microns) apical setae. Anal-ring well developed with about 46 pores and 6 setae (80 − 104 microns), situated in anal tube. Body margin with 2 − 3 rows of large 8-shaped pores, usually becoming a single row posteriorly; these joined sub-marginally by 2 − 3 parallel rows of quinquelocular pores, becoming a single row anteriorly and posteriorly. Spiracles with broad bar, heavily sclerotised, peritreme with quinquelocular pores, and each with a band of quinquelocular extending along the stigmatic furrow to the body margin. Ventral surface with small 8-shaped pores scattered, but also forming a submarginal band anteriorly. Multilocular disc pores with 6−11 loculi (most with 10 loculi), in 3 or 4 complete transverse bands, and 2 − 4 interrupted rows. Dorsal surface with numerous large 8-shaped pores, these often form 5 − 7 transverse bands in median area. Small 8-shaped pores scattered between large 8-shaped pores and margin, occasionally scarce or absent. Simple disc pores numerous. Tubular ducts distributed evenly, ca 40 microns long. The above description is adapted from Russell (1941), Kosztarab et al. (1988), Gill (1993), Kosztarab (1996) and from the material examined during the present study. *Planchonia arabidis* is morphologically highly variable, particularly regarding the number and distribution of large and small 8-shaped pores, quinquelocular pores, and multilocular pores. Descriptions and illustrations of the adult female are provided by Russell (1941), Borchsenius (1950), Ferris (1955), Kosztarab et al. (1988), Gill (1993), Kosztarab (1996) and Stumpf and Lambdin (2006). Russell (1941) provides a key for the identification of *Asterolecanium* of the world, which includes all six species now assigned to *Planchonia*, established in Europe and the Mediterranean.

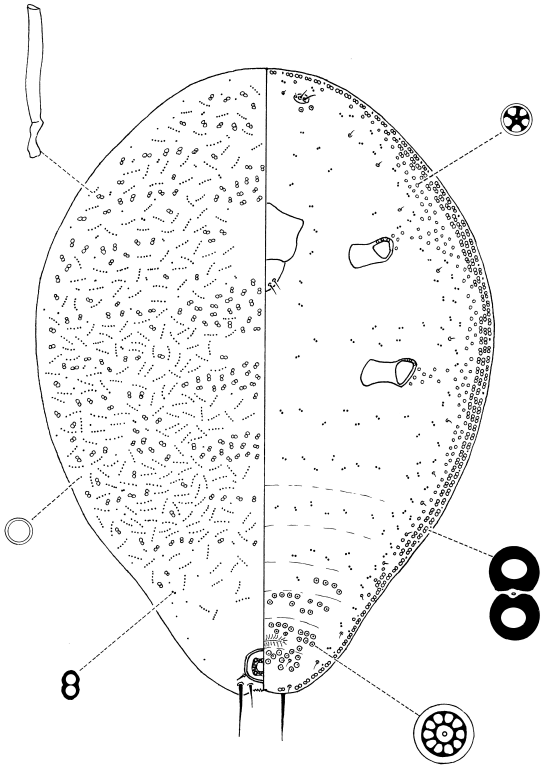

Figure 2: *Planchonia arabidis* Signoret; dorsum on the left and venter on the right

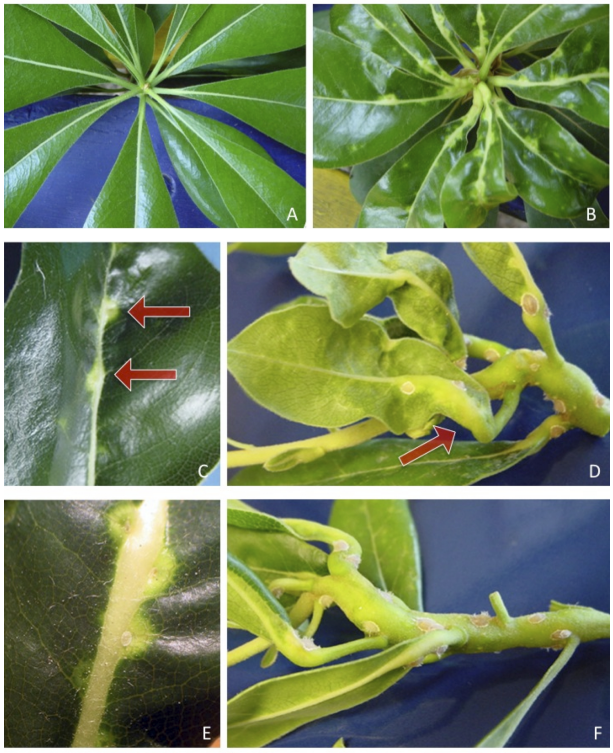

Figure 3: Leaf and stem galls of Pittosporum tobira plants induced by *Planchonia arabidis* (Italian population); A. Healthy apical foliage for comparison; B. Heavy infestation of apical foliage, with numerous galls prevalently located on midribs; C and E. Close up illustration of midrib galls (arrows), growth at scale's feeding sites; D and F. Stem and leaf infestation, showing deformed leaves (arrow), caused by the disorder of xylematic structures induced during the neoplatic expansion of the gall.

3.2 Geographical distribution

Planchonia arabidis occurs throughout Europe, from the Mediterranean in the south to Sweden in the north, and from Portugal in the west to the Ukraine in the east. It also occurs in the Near East, and has been introduced to Madeira, North America and the Caribbean (Ben-Dov 2012).

3.3 Host plants

Planchonia arabidis is polyphagous, recorded feeding on 27 plant genera belonging to 23 plant families, including many ornamental species (Ben-Dov 2012). In Europe it is most frequently found on common ivy (*Hedera helix* L.), and in the USA on *Ceanothus* and Pittosporum.

3.4 Histopathology of induced galls on Pittosporum

Induced galls by *Planchonia arabidis* on Pittosporum tobira are mainly found on or near the midrib of leaves (Figs. 3B, C, and E) but can be occasionally observed on the stem (Fig. 3 D and F). Gall induction starts only after insertion of the insect stylets, and is frequently associated with various degrees of deformation of infected leaves. The gall morphogenesis is characterised by large hyperplasia around the feeding points where radial proliferation of parenchyma cells (more than $12-15$ cell layers) causes strong disorganisation of the vascular elements (Fig. 4D). The midribs in un-infected leaves are iso-diametric in size, and their vascular system in cross section shows xylem and phloem in compact and regular arrangement (Figs. 4 A and B). The main changes in relation to the galled midribs are exclusively observed in the vascular system. The xylematic elements are disorganized and divided in three separated bundles to the hyperplasia of the associated parenchyma (Fig. 4D). In mature midrib galls, the gall diameter is about $1.5-2$ times the size of healthy midribs. The stimulus of this gall induction start from the saliva (soon after the host-parasite relationship is well established), but the precise mechanism of induction and subsequent growth, is unknown. Additional observations are needed in the next growth season.

The process of gall induction by *P. arabidis* and development on Pittosporum (although a wide host-range of the species is known worldwide) is unusual and unique for this cosmopolitan scale and is reported here for the first time. The gall-making ability of *P. arabidis* enlarges the list of Asterolecanidae gall inducers. Although galls and leave deformations can be conspicuous

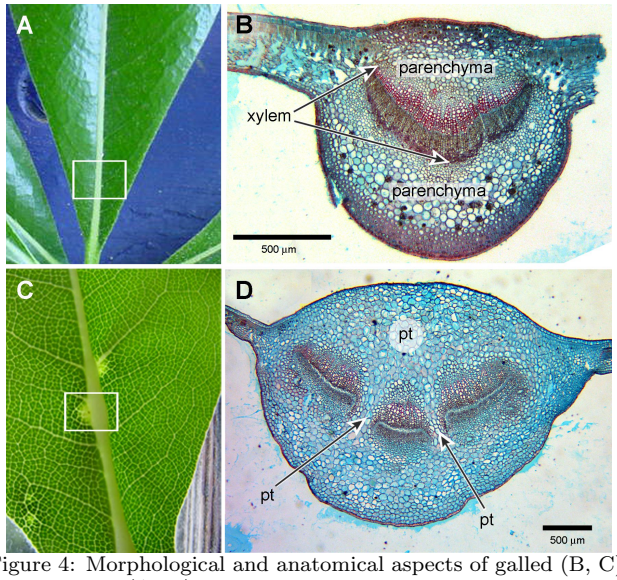

Figure 4: Morphological and anatomical aspects of galled (B, C), and ungalled (A, B) midrib portions of Pittosporum tobira; B. Cross section of ungalled midrib portion, showing entire structure of xylem and parenchyma tissues; C. Midrib *Planchonia* - feeding point with evident abaxial and adaxial expansion; D. Cross section of mature midrib gall showing hyperplasia (parenchyma cell proliferation) disorganising the vascular structure. Note the evident interruptions (arrowed) by the neoplastic parenchymatic tissues (pt).

mainly at the apical foliage (Fig. 3B), they rarely do any real agronomic damage to plants. It's only in cases of heavy infestations that occur repeatedly over several seasons which may slow the growth of the plant or make the appearance unattractive.

Our preliminary results presented here suggest that future research is needed. This pest species has a potential to cause serious problems on ornamental plants, and could be a potential threat within Mediterranean regions.

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