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# *Selitrichodes neseri* n. sp., a new parasitoid of the eucalyptus gall wasp *Leptocybe invasa* Fisher & La Salle (Hymenoptera: Eulophidae: Tetrastichinae)

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## Abstract

*Selitrichodes neseri* Kelly & La Salle **n. sp.** (Hymenoptera: Eulophidae: Tetrastichinae), is described as a parasitoid of the invasive eucalyptus gall wasp *Leptocybe invasa* Fisher & La Salle (Hymenoptera: Eulophidae: Tetrastichinae), which is causing substantial damage particularly in commercial *Eucalyptus* plantations. *Selitrichodes neseri* was originally collected in Australia in 2010 when searching for biological control agents of *L. invasa*. It has since been reared in quarantine in South Africa where it is being evaluated for release as a biological control agent of *L. invasa*.

**Key words**: gall inducer , biological control

## Introduction

The invasive eucalyptus gall wasp, *Leptocybe invasa* Fisher & La Salle (Hymenoptera: Eulophidae) is a global pest in *Eucalyptus* plantations. *Leptocybe invasa* is particularly damaging to the new growth of different *Eucalyptus* spp. and clones (Nyeko *et al*. 2010). Due to its preference of young leaves (including petioles) and shoots (Fig. 1) for oviposition, *L. invasa* is a problem especially in nurseries (Mendel *et al*. 2004). In instances when large numbers of *L. invasa* are present plants may become deformed (Fig. 1) and growth may be stunted due to heavy galling (Nyeko 2005).

*Leptocybe invasa* was originally detected in the Mediterranean Basin in 2000 (Mendel *et al*. 2004) initiating the description of this species and research on its biology. It has subsequently spread to Sub-Saharan Africa, India, Southeast Asia (CABI 2007), Brazil (Costa *et al*. 2008), and the USA (Florida) (Gaskill *et al*. 2009). In Africa, *L. invasa* was first reported in 2002 from Kenya (Mutitu 2003) and Uganda (Nyeko 2005), in June 2007 from South Africa (Neser *et al*. 2007) and Zimbabwe (Ministry of Environment & Natural Resources Management 2010) and in 2010 from Mozambique (Tree Protection News 2010). Since its initial detection, *L. invasa* has been reported from most areas in South Africa where *Eucalyptus* is commercially grown (Tree Protection News 2010).

Because *L. invasa* completes its development within the gall, control measures such as chemical control are not feasible, and may also interfere with existing biological control achieved against other *Eucalyptus* pests. Possible control measures would include breeding resistant/less susceptible *Eucalyptus* species and clones, as well as biological control. Kim *et al* (2008), Protasov *et al*. (2008) and Doğanlar *et al* (2010) reported on parasitoids of *L. invasa* from Australia, namely *Quadrastichus mendeli* Kim & La Salle (Eulophidae), *Selitrichodes kryceri* Kim & La Salle (Eulophidae) and *Megastigmus* species (Hymenopetra: Torymidae). Three additional *Megastigmus* spp. were found to be associated with *L. invasa* in Israel, India and Turkey (Protasov *et al*. 2008, Kulkarni *et al*. 2010), and *Megastigmus zebrinus* Grissell, presumed to be an Australian species (Grissell 2006), was reared from 2010

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**FIGURES 1, 2** (Photos: Stefan Neser): **1**, Twig, petiole and leaf lamina galls as found at type locality on young plant of *Eucalyptus* sp.; **2**, *Selitrichodes neseri* inserting ovipositor into a *Leptocybe invasa* gall on *Eucalyptus grandis x Eucalyptus camaldulensis* (GC540).

onwards from galls of *L. invasa* in Gauteng Province, South Africa (Stefan Neser, pers. com.; provisional identification as *M. zebrinus* by Gerhard L. Prinsloo). *Aprostocetus gala* (Walker) (Eulophidae) was also found to parasitize *L. invasa* galls in India (Kulkarni *et al*. 2010).

In an attempt to find additional biological control agents for *L. invasa*, more galled *Eucalyptus* material was collected from *Eucalyptus* spp. in Australia in 2010. Emerging arthropods were exposed to *L. invasa* galls to identify any potential parasitoids. *Selitrichodes neseri* females (Figs 2, 3) displayed oviposition behaviour on galls of *L. invasa* presented to them (Stefan Neser, pers. com.). Adult specimens were subsequently transferred to the Forestry and Agricultural Biotechnology Institute (FABI) quarantine facilities at the University of Pretoria for further observations.

## Material and methods

*Parasitoid collection site*. The original material of *S. neseri* (six females and four males) was reared from galls on leaves, petioles and twigs (Fig. 1) collected on 21 May 2010, from unidentified *Eucalyptus* spp. at Nanango, Queensland (S.26º41'19.3"; E.151º59'02.75"). Galls were collected from well-branched seedlings, less than 3 m tall, under sparse, tall parent trees. The galled material was imported to South Africa and initially handed in to the quarantine facilities of ARC-PPRI according to import permit conditions. In addition to the ten *S. neseri*, two females of *L. invasa* and several other insects also emerged from the galled material. These included several adults of unidentified Cecidomyiidae (Diptera) (AcSN 3097, apparently also gall-formers), 4 females and 1 male of a *Quadrastichus sp*. (AcSN 3096), 62 adults of a *Megastigmus* sp. (AcSN 3097, not *M. zebrinus* Grissell (Gerhard L. Prinsloo, pers. com.), as well as single individuals of Hymenoptera, including an unidentified Mymaridae believed to be associated with other insects hidden on the plant material (Stefan Neser, pers. com.).

*Terminology*. Terminology used in this paper follows Graham (1987), La Salle (1994) and Gibson (1997). OOL, ocellar-ocular distance; POL, post-ocellar distance; CC, costal cell; SMV, submarginal vein; MV, marginal vein; STV, stigmal vein; PMV, postmarginal vein; PDL, pedicel; F1–3, funicular segment 1–3; A1–3, anellus 1–3; C1–3, claval segment 1–3.

*Acronyms*. Acronyms used in the text are as follows. ANIC, Australian National Insect Collection, CSIRO Ecosystem Sciences, Canberra, Australia; BMNH, Natural History Museum, London, UK; QMB, Queensland Museum, Brisbane, Australia; SANC, South African National Collection of Insects, ARC-PPRI-Agricultural Research Council, Plant Protection Research Institute, Pretoria, South Africa; USNM, United States National Museum of Natural History, Washington, D.C., USA. AcSN-Collection Number

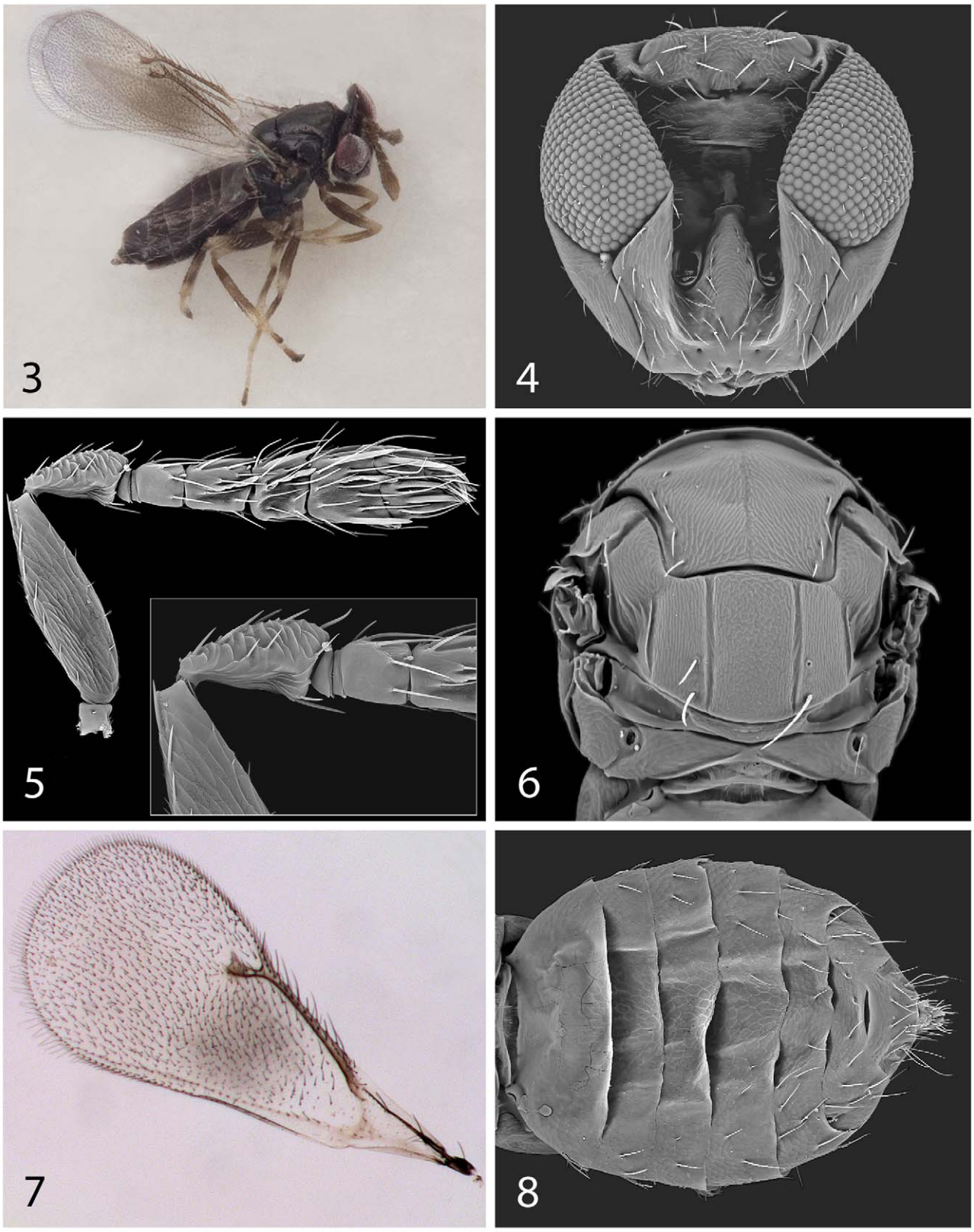
## *Selitrichodes* Girault

*Selitrichodes* Girault (1913) was treated by Kim *et al*. (2008) who resurrected the genus from synonymy under *Aprostocetus* Westwood, provided a generic diagnosis and list of included species, and newly described *S. kryceri* as a potentially beneficial parasitoid of *Leptocybe invasa*. At that time they recognised 12 species of *Selitrichodes* from Australia. No species are known from outside of Australia except for those which have moved (intentionally or not) with *Eucalyptus*. Most Australian species are known from Queensland through collections made by A.A. Girault, although indications from rearing activities and specimens in collections are that this genus has wide distribution across Australia. It was recognized that most species were associated with galls, but little detailed biological information was available for most species and there was no indication that any of the species were gall inducers. Subsequently, *Selitrichodes globulus* La Salle & Gates was described as an invasive species from California that induces galls on blue gum, *Eucalyptus globulus* (La Salle *et al*. 2009).

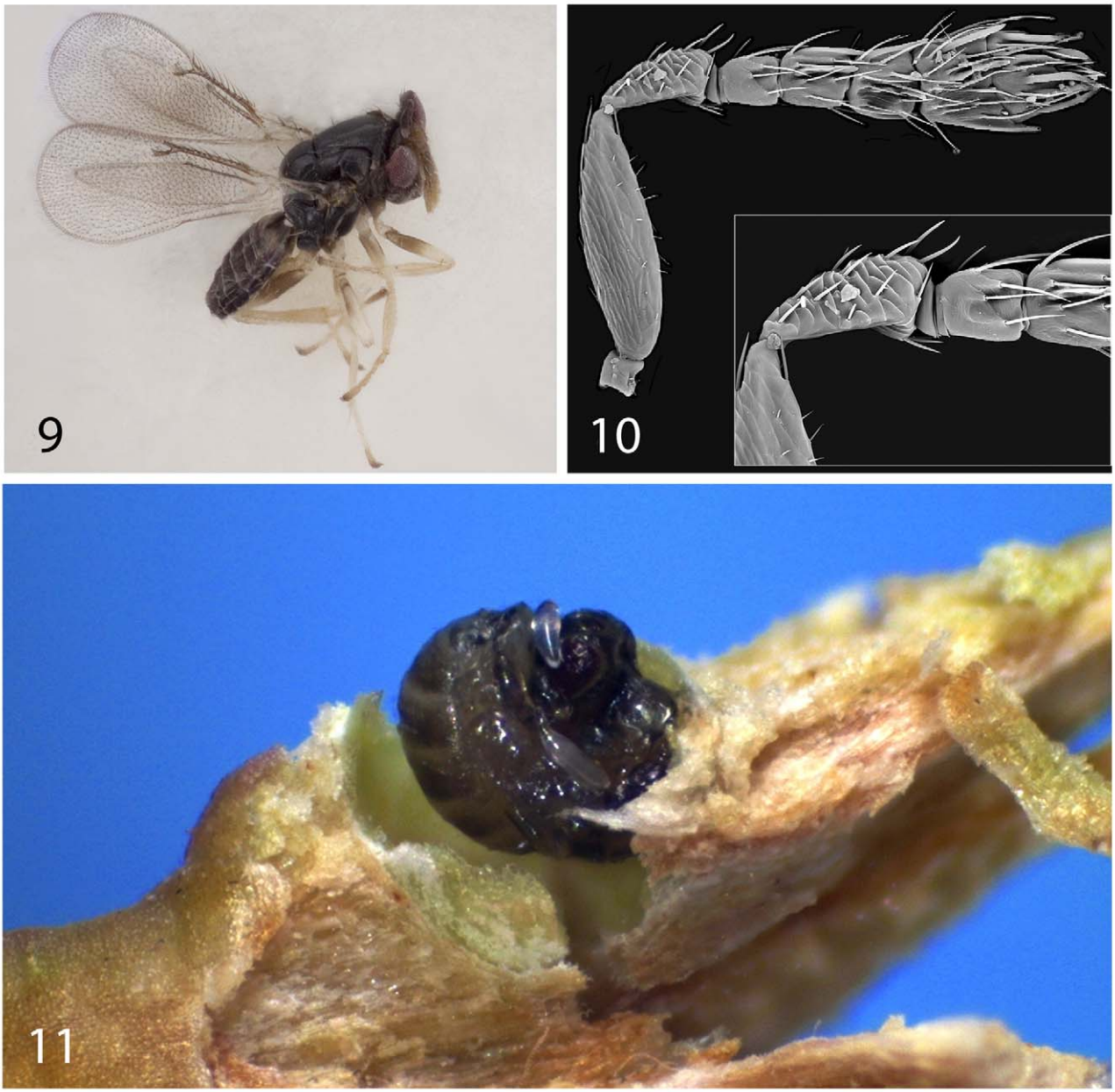
### *Selitrichodes neseri* Kelly & La Salle, sp. nov.

Figs 2–11

**Diagnosis**. *Selitrichodes neseri* is the only known species of *Selitrichodes* with a distinctly infumated patch behind the marginal vein (Fig. 7). Other diagnostic characters are forewing with 2 setae on submarginal vein and head and body almost entirely dark brown to black without yellow markings, except for the male where the face is yellow.




**FIGURES 3–8**. *Selitrichodes neseri* female: **3**, dosolateral habitus; **4**, head in frontal view; **5**, antenna in lateral view; **6**, mesosoma in dorsal view; **7**, wing in dorsal view; **8**, metasoma in dorsal view.




**FIGURES 9–11**. 9 and 10, *Selitrichodes neseri* male: **9**, dosolateral habitus; **10**, antenna in lateral view. **11**, *Selitrichodes neseri* eggs on a pupa of *Leptocybe invasa* (more than one egg probably a cage artefact) (Photo: Stefan Neser).

**Description.** ***Female*** (Figs 2–8). Length 0.87–1.08 mm. Head black. Antenna with scape dark brown (may be lighter apically); flagellum brown. Mesosoma black; gaster dark brown. Coxae black (may be lighter apically); trochanters dark brown; femora dark brown to black; fore and middle tibiae light brown to yellow; hind tibia dark brown with apical third brown to yellow.

*Head* (Fig. 4). Ocellar triangle without grooves. POL about 2.5 times as long as OOL. Scrobal area without distinct median carina; with a small transverse crack-like suture about halfway between frontal suture and torulus. Torulus level with ventral margin of eye. A broad depression (supraclypeal area) below torulus extending to clypeus and with some pilosity. Gena swollen and with malar sulcus somewhat curved near mouth margin. Clypeal margin bidentate.

*Antenna* (Fig. 5) with 2 anelli, 3 funicular and 3 claval segments. First anellus longer than second. First and second funicular segments slightly longer than wide (F1 1.13–1.38; F2 2.00–1.38), third slightly wider than long to subquadrate (F3 0.90–1.2). Relative length of funicular segments to pedicel as follows: PDL: F1: F2: F3 = 1: 0.50–0.64: 0.55–0.60: 0.43–0.65. Clava 1.90–2.58 times longer than wide, wider than funicle, with terminal spine; C3 very short and its end broad, tapering slightly apically. Scape slightly flattened.

*Mesosoma* (Fig. 6). Pronotum very short medially in dorsal view. Midlobe of mesoscutum with one row of 5 adnotaular setae on each side (some setae may form a partial second row). Scutellum with anterior pair of setae located behind middle. Dorsellum rounded posteriorly and overhanging propodeum. Mesosternum convex just in front of trochantinal lobes and without precoxal suture. Propodeum in dorsal view medially shorter than dorsellum. Propodeal spiracle with entire rim exposed and separated from anterior margin of propodeum by less than its largest diameter; rim of spiracle with a seta (seta of left spiracle broken in Fig. 6). Paraspiracular carina absent. Callus with 0 or 1 seta.

*Forewing* (Fig. 7). Hyaline, with a distinct infumated patch behind marginal vein. Submarginal vein with 2 dorsal setae. Costal cell with one or more setae and a line of ventral setae near apex. Relative length of wing veins to stigmal vein as follows: CC: MV: STV: PMV = 2.83–4.33: 3.08–4.78: 1: 0.33–0.45: PMV one-third to just less than one-half length of stigmal vein. Speculum small and open posteriorly, the cubital line of setae not extending to basal line; speculum with one or more setae dorsally and with one to a few small setae on underside of wing. Wing disk beyond speculum densely pilose.

*Metasoma* (Fig. 8). Gaster distinctly longer (1.56–1.66 times) than mesosoma. Hypopygium reaching less than half length of gaster. Cercus with 3 setae, subequal in length and slightly curved. Ovipositor sheath slightly protruding, short in dorsal view.

***Male*** (Figs 9, 10). Length 0.65–0.73 mm. Head dark brown to black, with yellow markings on lower face generally extending dorsally from mouth margin beyond toruli for about half distance to anterior ocellus, and laterally to inner eye margin and not reaching malar sulcus except in lighter specimens sometimes extending beyond malar sulcus onto gena. Antennae light yellow to white, funicle darker in some specimens. Legs light yellow to white, except for darker femora. Mesosoma and gaster dark brown to black, with base of gaster lighter. Gastral petiole very light yellow to white.

*Antenna* (Fig. 10) with 2 anelli, 3 funicular and 3 claval segments. F1 and F2 quadrate to slightly longer than wide, F3 wider than long, with each successive segment increasingly broader. Funicle and clava without compact subbasal whorls of long setae. Scape with ventral plaque less than one-quarter length of and situated near apex of scape.

**Material Examined.** Holotype female (ANIC): Laboratory reared at the Agricultural Research Council, Plant Protection Research Institute, emerged in culture x.2010 (originally from Australia, Queensland, Nanango, S.26º41'19.3"S; E.151º59'02.75"E, S. Neser, ex. leaf, petiole and twig galls on *Eucalyptus* sp., ix 2010).

49♀ 115♂ paratypes. Same data as holotype (49♀ 54♂ as follows: 17♀ 24♂ ANIC; 17♀ 15♂ SANC; 5♀ 5♂ BMNH; 5♀ 5♂ USNM; 5♀ 5♂ QMB); same data as holotype except emerged in culture ix.2010 (61♂ ANIC).

**Etymology.** Named in honour of Stefan Neser, who first collected the species and provided valuable information on its biology.

**Notes on biology.** Specimens of *S. neseri* were exposed to ungalled *Eucalyptus grandis x Eucalyptus camaldulensis* (hybrid/clone number: GC540 ) potted plants to determine their possible role as a gall former or primary parasitoid. Unlike its congener *S. globulus* (La Salle *et al*. 2009), it was confirmed that *S. neseri* is not a gall former.

*Selitrichodes neseri* were reared on galled *E. grandis* x *E. camaldulensis* (GC540) potted plants in the FABI quarantine facility at an average room temperature of 26°C. Males and females were released into a sleeve enclosing the galled branches and leaves, and honey paper added to the sleeves to extend the longevity of adults. Galls exposed to *S. neseri* contained mature larvae or pupae of *L. invasa*. The sleeves were removed and the branches cut shortly before the anticipated emergence of the *S. neseri* offspring. Plant material was subsequently placed in large, unventilated polyethylene containers ("cake savers") to allow monitoring of emerging specimens. Developmental time in the laboratory (egg-to-egg) ranged from 18–30 days. *Selitrichodes neseri* can be successfully reared under laboratory conditions, even in mature galls on severed shoots (Stefan Neser, pers com.), as is evident by the number of generations (10) and large numbers of adults reared within the first year. Dissections of *L. invasa* galls exposed to *S. neseri* showed single, relatively large eggs present externally on mature *L. invasa* larvae or pupae (Fig. 11), as well as *S. neseri* larvae feeding on mature *L. invasa* larvae and pupae. This indicated that *S. neseri* is a primary parasitoid of *L. invasa* and not an inquiline.

Galls induced by *Quadrastichus gallicola* Prinsloo & Kelly on *Erythrina lysistemon* (Fabaceae) resemble galls of *L. invasa*, but were not found to be suitable for oviposition by *S. neseri*. More detailed studies of the biology and host range of *S. neseri* are underway.

The biological control of *L. invasa* has to remain a priority for all countries involved in the commercial production of susceptible species of *Eucalyptus*. *Selitrichodes neseri* is an additional parasitoid that shows much promise for biological control of this pest.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