

## Taxonomy and host associations of *Anagrus baeri* Girault, 1912 (Hymenoptera: Mymaridae), an egg parasitoid native to Queensland, Australia

### Таксономия и перечень хозяев *Anagrus baeri* Girault, 1912 (Hymenoptera: Mymaridae), природного паразита яиц в Квинсленде, Австралия

Serguei V. Triapitsyn<sup>1</sup>, Chris Freebairn<sup>2</sup>  
Сергей В. Тряпицын<sup>1</sup>, Крис Фрибайрн<sup>2</sup>

<sup>1</sup> Entomology Research Museum, Department of Entomology, University of California, Riverside, California 92521, USA.

<sup>2</sup> Maroochy Research Station, Queensland Horticulture Institute, Queensland Department of Primary Industries, Nambour, Queensland 4560, Australia.

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**ABSTRACT.** The male of *Anagrus baeri* Girault, a fairyfly species previously known from the female sex only, is described and illustrated based on specimens from Queensland, Australia, where it is native; the female of *A. baeri* is redescribed. This egg parasitoid is economically important in southeastern Queensland, where its hosts include the leafhoppers *Austroasca alfalfae* (Evans) on castor oil, *Ricinus communis* L., and alfalfa, *Medicago sativa* L., and also *Empoasca smithi* Fletcher & Donaldson on castor oil and citrus, *Citrus* spp.

**РЕЗЮМЕ.** По материалам из Квинсленда, Австралия, описаны самцы *Anagrus baeri* Girault, ранее известного только по самкам; приводится переписание самок *A. baeri*. Этот яйцевой паразитоид имеет важное хозяйственное значение в юго-восточном Квинсленде, так как в число его хозяев входят цикадки *Austroasca alfalfae* (Evans), вредящие клещевине (*Ricinus communis* L.) и люцерне (*Medicago sativa* L.), а также *Empoasca smithi* Fletcher & Donaldson, вредящая клещевине и цитрусовым (*Citrus* spp.).

### Introduction

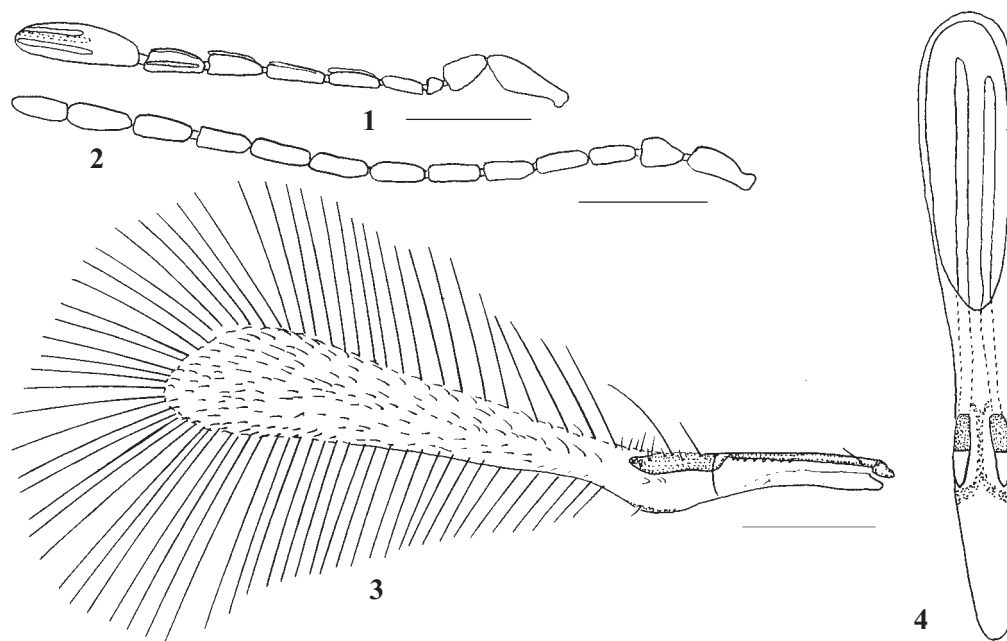
Australian citrus leafhopper, *Empoasca smithi* Fletcher & Donaldson, 1992 (Hemiptera: Clupeorrhyncha: Cicadellidae) is the only species of the genus *Empoasca* Walsh, 1862 currently recorded in Australia [Fletcher & Donaldson, 1972]. It is a serious pest of citrus, *Citrus* spp. (Rutaceae), in the Central Burnett area of Queensland, centered on Gayndah and Mundubbera, but also occurs to the northwest in the Emerald area, and to the east in coastal citrus near Bundaberg. Oviposition, nymphal development and adult feeding occurs on soft flush growth, but when flush hardens, especially in autumn, adults feed on the skin of green

mature and coloring fruit, damaging up to 80% of fruit if uncontrolled. Australian citrus leafhopper is most damaging to the valuable early season varieties Imperial mandarin and Navel orange, but in some years also damages mid season varieties such as Hickson and Ellendale mandarin and late season Valencia oranges.

In the course of studies on the biology, ecology and control of *E. smithi* [Freebairn & Smith, 1999], at least three species of mymarid (or fairyfly) (Hymenoptera: Mymaridae) wasps were discovered parasitizing its eggs in citrus, and those of Lucerne leafhopper, *Austroasca alfalfae* (Evans, 1941), on castor oil (or bean), *Ricinus communis* L. (Euphorbiaceae), and lucerne, *Medicago sativa* L. (Fabaceae). Collections were made by holding plant material in emergence boxes, by extraction in kerosene from yellow sticky traps and with a Malaise trap.

Voucher specimens preserved in 80% ethanol or kerosene were sent to the senior author for curation and identification. Specimens were critical point dried, mounted on cards, then representatives were slide-mounted in Canada balsam for detailed study. Positive identifications were made to one species of the cosmopolitan fairyfly genus *Anagrus* Haliday, 1833, *A. baeri* Girault, 1912, and to at least two species of *Stethynium* Enock, 1909, a very common and diverse mymarid genus in Australia which is closely related to *Anagrus*. By far the most common of the *Stethynium* species was *S. empoascae* Subba Rao, 1966, reared by the junior author of this communication from eggs of *A. alfalfae* on castor oil [Triapitsyn, 2002]. Taxonomic comments on *S. empoascae* and additional data on the known host associations of this species in India, from where it was originally described, are provided by Triapitsyn [2002].

*Anagrus baeri* was described originally from a single specimen captured in Babinda, Queensland, from



Figs. 1–4. *Anagrus baeri* Girault: 1 — antenna, ♀; 2 — same, ♂; 3 — forewing, ♂; 4 — genitalia ♂, dorsal view [all scale lines = 0.1 mm].

Рис. 1–4. *Anagrus baeri* Girault: 1 — усик ♀; 2 — усик ♂; 3 — переднее крыло ♂; 4 — гениталии ♂, сверху [масштабные отрезки = 0.1 мм].

the foliage of a wild imported citron infested with coccids and leafhoppers [Girault, 1912]. Trjapitzin [1996] redescribed and illustrated the holotype female of *A. baeri* and provided a key to the described Australian species of *Anagrus*. More recently [Triapitsyn, 2001], information was added to the knowledge of the distribution of this species and a key to the Australasian species of *Anagrus* was given, which included *A. baeri*.

*Anagrus baeri* is a member of the *atomus* species group of the subgenus *Anagrus* Haliday s. str. as defined by Chiappini et al. [1996], as it has three longitudinal sensilla on the clava of the female antenna, and morphologically appears to be closely related to *A. frequens* Perkins, 1905, the most common species of *Anagrus* in Queensland [Triapitsyn, 2001]. However, *A. frequens* is known in Queensland and elsewhere mainly as a parasitoid of planthopper (Hemiptera: Archaeorrhyncha: Delphacidae) eggs [Triapitsyn & Beardsley, 2000]. *Anagrus baeri* can be easily distinguished from *A. frequens* by the presence of a longitudinal sensillum on the third funicle segment of the female antenna and by the characteristic forewing, which lacks a bare area on the broadest part of the disc.

An amended redescription of the female and a description of the male of *A. baeri* follow. Terms for morphological features are those of Gibson [1997]. All measurements (as length, unless otherwise indicated) are given in microns ( $\mu\text{m}$ ). An abbreviation used in the description is: F = funicle segment of the female antenna or flagellar segment of the male antenna. Abbreviations for the depositories of specimens are as follows: ANIC, Australian National Insect Collection, CSIRO, Canberra, Australian Capital Territory, Australia; CNCI, Cana-

dian National Collection of Insects, Ottawa, Ontario, Canada; QDPI, Queensland Department of Primary Industries, Indooroopilly, Queensland, Australia; QMBA, Queensland Museum, Brisbane, Queensland, Australia; UCRC, Entomology Research Museum, University of California, Riverside, California, USA.

## Taxonomy

### *Anagrus (Anagrus) baeri* Girault, 1912

Figs 1–4.

*Anagrus baeri* Girault, 1912: 155.

*Anagrus baeri* Girault: Trjapitzin, 1996: 106–107.

*Anagrus (Anagrus) baeri* Girault: Triapitsyn, 2001: 281.

**MATERIAL.** Australia, Queensland (all specimens were collected by C. Freebairn): 65 ♀♀ — Brisbane, Nundah: 30.V.2000 (“ex. eggs of *Austroasca alfalfae* (Evans) on castor oil”); 17 ♀♀ — 9–15.VI.2000, (“ex. eggs of *A. alfalfae* on castor oil”); 13 ♀♀ — Gympie, 1.VI.2000, (“ex. sample of castor oil”); 16 ♀♀ — Gayndah nr. Weir, 12.V.2000, (“ex. lucerne infested heavily with *A. alfalfae*”); 29 ♀♀, 2 ♂♂ — Mundubbera: 27.V.1997, (“ex. eggs of *A. alfalfae* on castor oil”); 4 ♀♀, 2 ♂♂ — 5.X.1998, (“ex. eggs of *A. alfalfae* on castor oil”); 1 ♀ — 17.III.2000, (“D-vac in lucerne”); 11 ♀♀, 1 ♂ — 17–31.III.2000, (“from yellow sticky traps in castor oil”); 3 ♀♀ — 12–17.V.2000, (“Malaise trap near castor oil”); 10 ♀♀ — 17.V.2000, (“ex. castor oil leaf”); 6 ♀♀, 1 ♂ — 2.VI.2000, (ex. leafhopper eggs on castor oil); 2 ♀♀ — VI.2000, (“Malaise trap”); 12 ♀♀ — Nambour, Maroochy Research Station: 20.X.1996, (“ex. eggs of *Empoasca smithi* culture on castor oil”); 32 ♀♀ — 1.XII.2000, (“from culture on castor oil”). Materials are kept in ANIC, CNCI, QDPI, QMBA, UCRC.

**REDESCRIPTION. Female.** Body length 437–560. General body coloration of live or freshly preserved specimens reddish-brown [Plate 9.16 in Smith et al., 1978]; color of body and appendages of dead specimens pale to light brown with following parts darker (brown): stemmaticum, trabecu-

lae, occiput, flagellum (except F1), mesoscutum (especially its anterior half), axilla, wing venation, gastral terga, and tip of ovipositor.

Mandible tridentate. Antenna (Fig. 1) with F2 slightly shorter than F3; longitudinal sensilla on F3 (1), F4 (1), F5 (1), F6 (2) and clava (3). Trjapitzin [1996] indicated that F6 of the holotype of *A. baeri* bears one longitudinal sensillum, that is almost certainly wrong as all other specimens of this species have 2 longitudinal sensilla on F6. This mistake occurred because the holotype female is uncleaned and thus is very difficult to examine.

Mesoscutum without adnotaular setae. Forewing [Fig. 2, p. 107 in Trjapitzin, 1996] 7.5–8.3 x as long as wide, slightly narrower than in male but with chaetotaxy very similar to that on male forewing (Fig. 3).

Ovipositor reaching or slightly overlapping mesophragma anteriorly and usually moderately exerted beyond apex of gaster posteriorly, ratio of total ovipositor length to length of its exerted part 6–11:1. Ovipositor length/foretibia length ratio 2.1–2.2:1. External plate of ovipositor with 1 seta.

**DESCRIPTION. Male.** Color similar to female except flagellum light brown, almost concolorous with scape and pedicel. Otherwise similar to female as redescribed above and by Trjapitzin [1996], except for sexually dimorphic characters normal for the genus such as antenna (Fig. 2) and genitalia (Fig. 4). Forewing (Fig. 3) about 7.3 x as long as wide, disc without a differentiated hairless area along posterior margin. Genitalia (Fig. 4) elongated, aedeagus relatively long for the species-group, digitus with spine long and straight.

Measurements ( $n=2$ ). Body: 528–610. Antenna: scape: 55–58; pedicel: 36–37; F1: 37–40; F2: 44–49; F3: 40–47; F4: 44–46; F5: 45–47; F6: 47–48; F7: 46–48; F8: 45–48; F9: 46–50; F10: 49–50; F11: 49–50. Forewing: length: 485–554; width: 66–76. Genitalia: 129–138.

**DISTRIBUTION.** The material examined for this paper is from the southeastern corner of Queensland, from suburban Nundah in Brisbane (27°30'S, 153°W) to Mundubbera (25°30'S, 151°15'W), 150 km west of Bundaberg. These records provide a new southern limit to the distribution of *A. baeri*. The current northern, western and eastern limits of the species are Heathlands on Cape York, Queensland (12°S, 142°30'E) (ca. 80 km south of Bamaga), Emerald (25°30'S, 148°15'W) (on the Tropic of Capricorn, ca. 300 km west of Rockhampton) and Bora Bora Island, Tahiti Archipelago, French Polynesia [Triapitsyn, 2001].

**HOST ASSOCIATIONS.** The known hosts of *A. baeri* in Australia are the leafhoppers *A. alfalfae* on castor oil and lucerne and *E. smithi* on castor oil and citrus. On castor oil, *A. alfalfae* is usually the most abundant leafhopper with *E. smithi* present in low numbers, however the reverse can also be true. In lucerne a range of leafhopper species is usually present. For the 16 females collected 12.V.2000 the lucerne was heavily infested with *A. alfalfae* with few individuals of any other leafhopper species present, so it is highly likely that these wasps came from this species.

In citrus, where *E. smithi* but not *A. alfalfae* breeds, *A. baeri* occurs in most orchards, but accounts for a low proportion of total parasitism compared with the predominant *S. empoascae*. This appears to be the case even in orchards where lucerne is a component of the inter-row sward or is grown nearby for commercial hay production or dairy cattle fodder. When *A. baeri* was released into citrus heavily infested with *E. smithi*, it established and appeared responsible for the subsequent decline in the citrus leafhopper population, but then became rare, coincident with the appearance and rise to dominance of *S. empoascae*.

*Anagrus frequens*, though regarded as the most common *Anagrus* species in Queensland, is rare on yellow sticky traps in citrus, castor oil, or in or near lucerne. This may reflect the scarcity of its major hosts, planthoppers, in citrus and castor oil, however these can be quite numerous in lucerne.

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