

## Review of the Australasian species of *Anagrus* (Hymenoptera Mymaridae)

by Serguei V. TRIAPITSYN

Entomology Research Museum, Department of Entomology, University of California, Riverside, CA 92521, U.S.A. (e-mail : serguei@mail.ucr.edu).

### Abstract

The Australasian species of the fairyfly genus *Anagrus* HALIDAY, 1833 (Hymenoptera Mymaridae) are revised and keyed. The following new taxa are described and illustrated : *A. (Anagrus) antipodus* S. TRIAPITSYN sp. n. and *A. (Anagrus) klop* S. TRIAPITSYN sp. n., both from Australia, and *A. (Anagrella) quasibrevis* S. TRIAPITSYN sp. n. from Papua New Guinea. Three new synonymies are proposed : *A. longitubulosus* PANG & WANG, 1985 under *A. (Paranagrus) perforator* (PERKINS, 1905), *A. parnilaparvatae* PANG & WANG, 1985 under *A. (Paranagrus) optabilis* (PERKINS, 1905), and *A. toyae* PANG & WANG, 1985 under *A. (Anagrus) frequens* PERKINS, 1905. *Anagrus lutulentus* GIRAULT, 1911 is transferred to the genus *Cleruchus* ENOCK, 1909 as *C. lutulentus* (GIRAULT, 1911) comb. n. The role of the common European species *A. avalae* SOYKA, 1955 in past biological control programs against its leafhopper host, *Edwardsiana crataegi* (DOUGLAS, 1876), in apple orchards in New Zealand and Tasmania, Australia, is discussed.

**Keywords** : Mymaridae, *Anagrus*, taxonomy, Australasia.

### Introduction

This paper reviews members of the cosmopolitan mymarid genus *Anagrus* HALIDAY, 1833 in Australasia, i.e., the area that includes Australia, New Zealand, Papua New Guinea, and adjacent islands. A few specimens from French Polynesia are also included, although geographically it is part of Oceania. Material from Christmas Island is included only because it is an Australian territory; its *Anagrus* fauna is mainly Oriental.

The history of taxonomic studies of *Anagrus* in the region dates back to 1904 when two famous exploratory entomologists, A. KOEBELE and R.C.L. PERKINS, discovered two new species in Queensland, Australia : *A. frequens* PERKINS, 1905 and *Paranagrus optabilis* PERKINS, 1905. They successfully

introduced these two species into Hawaii for a classical biological control program against the sugar cane planthopper, *Perkinsiella saccharicida* KIRKALDY, 1903 (PERKINS, 1905). *Anagrus* (*Paranagrus*) *perforator* (PERKINS, 1905), originally described from Fiji (PERKINS, 1905), was later also discovered in Queensland (GIRAULT, 1912). In his review of the Australian Mymaridae, GIRAULT (1912) described a new species of *Anagrus*, *A. baeri* GIRAULT, and a new variety of *A. armatus* (ASHMEAD, 1887), *A. a.* var. *australiensis* GIRAULT, both from Queensland. Since GIRAULT's early work, it was not until late in the last century that taxonomic studies on *Anagrus* resumed with my review of the described Australian species (TRJAPITZIN, 1995), which included a key and a redescription of the holotype of *A. baeri*. In that review I also synonymized *A. armatus* var. *australiensis* under *A. frequens* and determined that another of GIRAULT's species, *A. lutulentus* GIRAULT, 1911, does not belong to *Anagrus*.

After visiting the most important collections of parasitic Hymenoptera in Canberra and Brisbane, Australia, in January 1999, it has become clear to me that large numbers of more recently collected *Anagrus* specimens from this region are available and need to be revised. This study has become possible after loans of material were received from the major Australian and New Zealand systematic collections; specimens from other museums in North America and Europe were also examined.

In this paper, 14 named and two unnamed species of *Anagrus* are recognized from the region, as well as several species that remain undetermined because of insufficient or poorly preserved material. However it is expected that the true diversity within this genus may be somewhat greater because the western and northernmost parts of Australia, Papua New Guinea, and the islands of Melanesia have not been adequately sampled. Within the Australasian region, the native fauna of *Anagrus* appears to be richest in Papua New Guinea and also in the northernmost parts of Northern Territory and Western Australia (all with at least seven recognized species including several undescribed ones), slightly less diverse in Queensland (at least five species), but is rather depauperate in the rest of mainland Australia, Tasmania, and especially in New Zealand. Out of six known species that occur in New Zealand, only two, *A. frequens* and *A. optabilis*, are likely indigenous; the rest are common European species unintentionally introduced there and recorded for the first time in this paper. It is interesting to note that throughout Australia and New Zealand, the species richness of *Stethynium* is much greater than that of *Anagrus*; I attribute this to an assumption that the ecological niche of *Anagrus* species as principal egg parasitoids of small- and medium-size leafhoppers (Cicadellidae) is taken there by numerous *Stethynium* species. Indeed, 51 species of *Stethynium* have been described so far from Australia alone, while in the rest of the world, only two extant species of this genus are presently recognized as valid (HUBER, 1987). A similar situation exists in New Zealand, according to my examination of the *Stethynium* specimens deposited in the New Zealand Arthropod Collection; many of those had been misidentified as *Anagrus*. Another indication that my assumption above may be correct is the fact that the two most common native species of *Anagrus* in Australia and New Zea-

land, *A. frequens* and *A. optabilis*, are primarily parasitoids of planthopper (Delphacidae) eggs, thus leaving exploitation of the huge resource of leafhopper eggs there to *Stethynium* species.

Approximately 515 specimens of *Anagrus* were examined during the course of this study. Initially, almost all were point- or card-mounted; exemplars were then selected from the series and, along with all singletons, cleared in 10% KOH and slide-mounted in Canada balsam. When possible, body length was measured from dry specimens; other measurements were made from slide-mounted specimens at 250X; all measurements (as length or length/width, if necessary) are given in micrometers ( $\mu\text{m}$ ). When several specimens from a series were measured, the mean is indicated, followed by the range in the parentheses. The choice of measurements and terminology used follows SAHAD & HIRASHIMA (1984) and CHIAPPINI *et al.* (1996).

Abbreviations for the collections are as follows : ANIC, Australian National Insect Collection, CSIRO, Canberra, Australian Capital Territory, Australia; BMNH, The Natural History Museum, London, England, U.K.; CISC, University of California, Berkeley, California, U.S.A.; CNCI, Canadian National Collection of Insects, Ottawa, Ontario, Canada; NZAC, New Zealand Arthropod Collection, Landcare Research, Auckland, New Zealand; QDPI, Queensland Department of Primary Industries, Indooroopilly, Queensland, Australia; QMBA, Queensland Museum, Brisbane, Queensland, Australia; SCAC, South China Agricultural University, Wushan, Guangzhou, Guangdong, China; UCDC, The Bohart Museum of Entomology, University of California, Davis, California, U.S.A.; UCRC, University of California, Riverside, California, U.S.A.; USNM, National Museum of Natural History, Washington, D.C., U.S.A. An abbreviation used in the key and the descriptions is : F = funicular (flagellar in males) segment. The abbreviations which come with the New Zealand place names are area codes designated by CROSBY *et al.* (1976).

### Genus *Anagrus* HALIDAY, 1833

*Comments* : Information on the history of the taxonomic studies on the genus, including lists of the synonyms and diagnoses of its subgenera and species groups, etc., is available elsewhere (CHIAPPINI, 1989; CHIAPPINI *et al.*, 1996; CHIAPPINI & LIN, 1998; TRIAPITSYN & BEARDSLEY, 2000) and is not repeated here.

#### Key to Australasian species of *Anagrus*, females

- |    |   |   |
|----|---|---|
| 1  | Ocelli on a well-defined triangular stemmaticum .....   | 4   |
| 1' | Ocelli not on a stemmaticum, which is absent (subgenus <i>Anagrella</i> BAKKENDORF, 1962) ..... | 2   |
| 2  | F2 more than 2 × length of F1 .....   | 3   |
| 2' | F2 less than 2 × length of F1 (Fig. 1) .....  | <i>A. quasibrevis</i> sp. n.                |
| 3  | Antennal club much longer than F2 (Fig. 3) .....  | <i>A.</i> sp. "A"                           |
| 3' | Antennal club shorter than F2 .....   | <i>A. ?semiglabus</i> CHIAPPINI & LIN, 1998 |

- 4 Two lobes of posterior scutellum widely separated by a longitudinal groove (subgenus *Paranagrus* PERKINS, 1905) . . . . . 5
- 4' Two lobes of posterior scutellum very narrowly separated by a longitudinal groove (subgenus *Anagrus* HALIDAY, 1833 s. str.) . . . . . 6
- 5 Ovipositor either not exerted beyond apex of gaster or slightly exerted (no more than by 1/5 of its total length) . . . . *A. optabilis* (PERKINS, 1905)
- 5' Ovipositor markedly exerted beyond apex of metasoma (by about 1/3-1/4 of its total length) . . . . . *A. perforator* (PERKINS, 1905)
- 6 Antennal club with 3 sensory ridges (*atomus* species group) . . . . . 7
- 6' Antennal club with 5 sensory ridges (*incarnatus* species group) . . . . . 14
- 7 F3 without sensory ridges . . . . . 8
- 7' F3 with 1 sensory ridge . . . . . 12
- 8 F4 without sensory ridges . . . . . 9
- 8' F4 with sensory ridges . . . . . 10
- 9 Forewing blade with one complete, medial row of microtrichia beyond venation, leaving two bare areas along margins in the broadest part (Fig. 5); body light brown . . . . . *A. klop* sp. n.
- 9' Forewing blade with several rows of microtrichia beyond venation, leaving one bare area along posterior margin in the broadest part; body dark brown . . . . . *A. ustulatus* HALIDAY, 1833
- 10 F4 with 2 sensory ridges . . . . . *A. japonicus* SAHAD, 1982
- 10' F4 with 1 sensory ridge . . . . . 11
- 11 Bare area on forewing blade long, occupying its posterior half along posterior margin; only 2 rows of microtrichia anterior to bare area . . . . . *A. frequens* PERKINS, 1905
- 11' Bare area on forewing blade short, situated along posterior margin at wing's apex only; 3 or 4 rows of microtrichia present anterior to bare area . . . . . *A. atomus* (LINNAEUS, 1767)
- 12 F4 with 2 sensory ridges . . . . . *A. flaviapex* CHIAPPINI & LIN, 1998
- 12' F4 with 1 sensory ridge . . . . . 13
- 13 Forewing blade more or less uniformly covered with microtrichia beyond venation, without distinct bare area along posterior margin in the broadest part . . . . . *A. baeri* GIRAULT, 1912
- 13' Forewing blade with long bare area occupying its posterior half along posterior margin . . . . . *A. ?frequens* PERKINS, 1905
- 14 Mesoscutum without adnotaular setae . . . . *A. incarnatus* HALIDAY, 1833
- 14' Mesoscutum with adnotaular setae . . . . . 15
- 15 Forewing broad (length : width about 7), its blade more or less uniformly covered with microtrichia arranged in several rows beyond venation . . . . . *A. avalae* SOYKA, 1955

- 15' Forewing narrow (length : width more than 9); its blade with a single complete medial row of microtrichia running from just beyond venation to wing's apex (Fig. 7) ..... 16
- 16 F5 with 1 sensory ridge (Fig. 6); ratio between total ovipositor length and that of its exerted part 3-4 : 1 ..... *A. antipodus* sp. n.
- 16' F5 without sensory ridges; ratio between total ovipositor length and that of its exerted part about 6 : 1 ..... *A.* sp. "B".

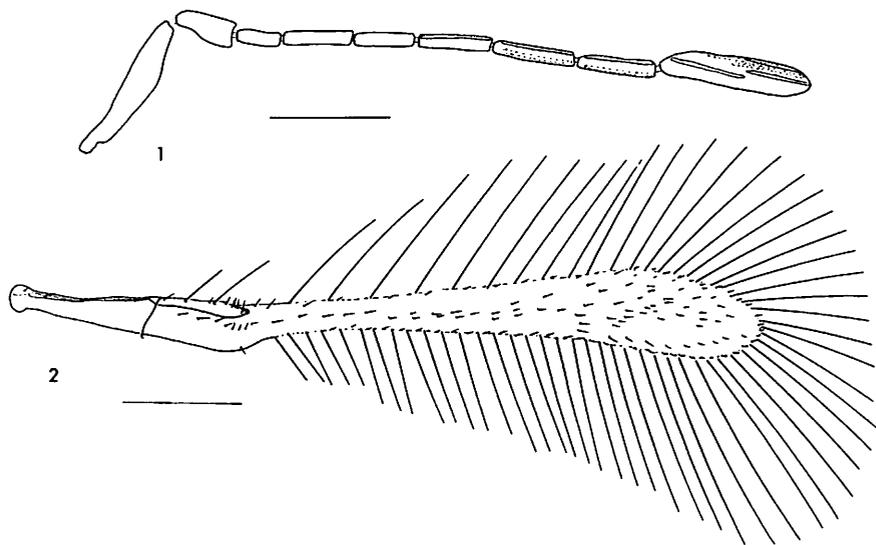
*Anagrus (Anagrella) quasibrevis* S. TRIAPITSYN, sp. n.

(Figs 1-2)

*Type material* : Holotype female on slide, parts under 4 coverslips (hindwings and midlegs missing), labeled : 1."PNG : GULF Prov. Ivimka Camp 110 m Lakekamu Basin 7.7°S 146.8°E 21-30.XI.1996 RR Snelling MT UCDC"; 2."*Anagrus (Anagrella) quasibrevis* S. Triapitsyn HOLOTYPE ♀" [UCDC].

*Description* :

Female. *Coloration* : Body and appendages brown except scape, pedicel, posterior scutellum, propodeum, and mesopleura light brown; forewing blade strongly infuscated with brown behind and beyond venation. *Head* : Slightly wider than mesosoma. Antenna (Fig. 1) sparsely setose; scape slender, 2.6 × longer than pedicel; F1 shorter than pedicel; F2 subequal in length to F4, both longer than F3; F5 as long as F6, slightly longer than F2 or F4; sensory ridges



Figs 1-2. *Anagrus quasibrevis* sp.n. (holotype female). 1 : Antenna; 2 : Forewing. Scale bars = 0.1 mm.

on F4 (1), F5 (2) and F6 (2); club slightly longer than two preceding segments combined, with 5 sensory ridges. *Mesosoma* : Slightly shorter than metasoma. Mesoscutum with a pair of adnotaular setae. Forewing (Fig. 2) about  $9 \times$  as long as wide; distal macrochaeta less than  $2 \times$  length of proximal macrochaeta; forewing blade without a distinct bare area in the broadest part, where discal microtrichia arranged in several irregular rows. *Metasoma* : Ovipositor reaching mesophragma anteriorly and slightly exerted beyond apex of gaster posteriorly; ratio of total ovipositor length to length of its exerted part 7 : 1. External plates of ovipositor each with 2 distal setae. Ovipositor length/ foretibia length ratio 2.7 : 1.

*Measurements* : Body : 819; head width : 264; ovipositor : 380. Antenna : scape : 128; pedicel : 49; F1 : 40; F2 : 60; F3 : 49; F4 : 65; F5 : 70; F6 : 70; club : 131. Forewing : 637/72; longest fringe cilia : 190. Legs (given as femur, tibia, tarsus) : fore 146, 142, 164; hind 146, 237, 175.

*Male* : unknown.

*Diagnosis* : The new species can be easily distinguished from all other species of the subgenus *Anagrella* by F2 very short, F5 with two sensory ridges, and the forewing blade strongly infuscated. Morphologically, it is most close to *A. (Anagrella) brevis* CHIAPPINI & LIN, 1998 which, however, has only one sensory ridge on F5 and the forewing almost hyaline (CHIAPPINI & LIN, 1998). Otherwise, the shape and chaetotaxy of the forewing of *A. quasibrevis* is very similar to that of *A. brevis*.

*Etymology* : The specific name is self-explanatory, i.e., resembling *A. brevis*.

***Anagrus (Anagrella) sp. "A"***  
(Fig. 3)

*Material examined* : PAPUA NEW GUINEA, New Britain Island, Bainings Mountains, Raunsepna, 7-14.IV.1999, L. Leblanc, C. Mitparingi, 1♀ [CNCI].

*Diagnosis* : Female. *Coloration* : Body and appendages brown except scape, pedicel, posterior scutellum, propodeum, and mesopleura light brown; forewing blade infuscated with brown behind and beyond venation. *Head* : Wider than mesosoma. Antenna (Fig. 3) with scape slender,  $2.8 \times$  longer than pedicel; F1 slightly shorter than pedicel; F2 longest of funicular segments,  $2.1 \times$  longer than F1; F3 slightly shorter than each of the following three segments which are subequal in length; sensory ridges on F4 (1), F5 (1) and F6 (1); club about as long as two preceding segments combined, with 5 sensory ridges. *Mesosoma* : Shorter than metasoma. Mesoscutum with a pair of adnotaular setae. Forewing  $9 \times$  as long as wide; distal macrochaeta slightly more than  $2 \times$  length of proximal macrochaeta; forewing blade with a single median row of microtrichia and several scattered setae at the broadest part. Hindwing about  $32 \times$  as long as wide. *Metasoma* : Ovipositor not reaching mesophragma anteriorly and slightly exerted beyond apex of gaster posteriorly; ratio of total

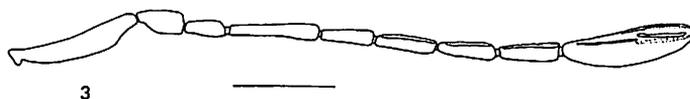


Fig. 3. *Anagrus* sp. "A". Antenna, female. Scale bar = 0.1 mm.

ovipositor length to length of its exerted part 12 : 1. External plates of ovipositor each with 2 distal setae.

This species is close to *A. quasibrevis* described above and can be separated from it using the characters indicated in the key. The forewing blade in *A. sp.* "A" is infuscated with brown, although not as strongly as in *A. quasibrevis* sp. n.

*Measurements* : Body : 720.

*Male* : unknown.

*Comments* : This species is not being described as new and is not given a scientific name because the single known specimen is incomplete.

*Anagrus (Anagrella) ?semiglabus* CHIAPPINI & LIN, 1998

*Anagrus (Anagrella) semiglabus* CHIAPPINI & LIN, 1998 : 555-557.

*Type locality* : Qianshan, Liaoning Province, China.

*Type material* : Not examined.

*Material examined* : AUSTRALIA. Victoria, Mt. Buffalo National Park, ca. 20 km SE Myrtleford, 500 m, 5-3.XII.1990, D. Pollock, L. Reichert, 1 ♀ [ANIC].

*Comments* : The single female specimen from Victoria, Australia, agrees in every regard with the description and illustrations of the Chinese species *A. semiglabus* CHIAPPINI & LIN, 1998; however, the apparent lack of a sensory ridge on F5 does not allow me to positively identify the Australian specimen as *A. semiglabus*.

*Anagrus (Paranagrus) optabilis* (PERKINS, 1905)

*Paranagrus optabilis* PERKINS, 1905 : 199.

*Paranagrus optabilis* PERKINS; GIRAULT, 1912 : 159.

*Paranagrus osborni* FULLAWAY, 1919 : 53.

*Anagrus optabilis* (PERKINS); SUBBA RAO, 1983 : 388, 390, 396, 398, 400.

*Anagrus optabilis* (PERKINS); SAHAD & HIRASHIMA, 1984 : 65-68, 73-75.

*Anagrus panicicolae* SAHAD in SAHAD & HIRASHIMA, 1984 : 68-71.

*Anagrus parnilaparvatae* PANG & WANG, 1985 : 178-179 syn. n.

*Anagrus optabilis* (PERKINS); TRJAPITZIN, 1995 : 106.

*Anagrus (Paranagrus) optabilis* (PERKINS); CHIAPPINI *et. al.*, 1996 : 564-566.

?*Anagrus (Paranagrus) paranilaparvatae* PANG & WANG; CHIAPPINI & LIN, 1998 : 558-560.

*Anagrus (Paranagrus) optabilis* (PERKINS); TRIAPITSYN & BEARDSLEY, 2000 : 28-30.

*Type locality* : Bundaberg, Queensland, Australia (the lectotype).

*Type material* : Examined; in order to validate the lectotype designation by TRIAPITSYN & BEARDSLEY (2000) in accordance with ICZN Article 74.7 (1999), I hereby indicate an express statement of its taxonomic purpose : the lectotype was designated in order to maintain stability of usage of the name and to resolve confusion about the type specimens of this species. *Anagrus paranilaparvatae* PANG & WANG, 1985 : a paratype female on slide labeled : 1. "Foshan, Guangdong, CHINA, June, 1982, He Jiamxing leg Host : *Nilaparvata lugens* [sic]"; 2. "*Anagrus paranilaparvatae* Pang & Wang Paratype ♀" [SCAC].

*Material examined* : AUSTRALIA. **Australian Capital Territory** : Blundells Creek : II.1987, D.H. Colless, 1♀, 1♂; 3 km E Piccadilly Circus, IV.1985, Lawrence, Weir, Johnson, 3♀♀ [ANIC]. Canberra, Black Mountain, 35°16'S, 149°06'E, G. Gibson : 22-29.XI.1998, 1♀; 9-15.XI.1999, 2♂♂ [CNCI]. **Queensland** : 11 km NW Bald Hill, 26.VI-13.VII.1989, I. Naumann, 1♀ [ANIC]. Biggenden, ca. 32 km SE Munna Creek, 24.IX.1995, J.D. Pinto, 1♀ [UCRC]. Brisbane, 1.XI.1920, H. Hacker, 1♀ [CISC]. Brisbane Forest Park, 27°16'04"S, 152°49'48"E, 2-9.I.1997, N. Power, 1♀ [CNCI]. Bunya Mountains National Park, 4-6.XII.1985, D. Bickel, G. Cassis, 1♀ [ANIC]. Cairns, 1.IV.1991, J.D. Pinto, 2♀♀, 1♂. Gordonvale near Mulgrave River, 30.III.1991, J.D. Pinto, 2♀♀ [CNCI]. Hann River, 20.X-17.XI.1993, P. Zborowski, M. Horak, 2♂♂. Heathlands : 22.III-7.VI.1992, T. McLeod, 5♀♀, 3♂♂; 7.VI-25.VII.1992, P. Zborowski, E. Nielsen, 2♀♀; 25.VII-18.VIII.1992, P. Zborowski, J. Cardale, 3♀♀; 1♂; 18.VIII-17.IX.1992, P. Zborowski, L. Miller, 1♀ [ANIC]. Mt. Nebo, 1.IV.1974, I.D. Galloway, 1♀ [QDPI]. 3-9 km ENE Mt. Tozer, 28.VI-10.VII.1986, J.C. Cardale, 2♀♀ [ANIC]. Indooroopilly, DPI, 21-28.II.1983, 8♀♀ [QMBA]. Tolga, 30.III.1991, J.D. Pinto, 1♀, 2♂♂ [CNCI]. **Tasmania** : Pelion Hut, 3 km S Mt. Oakleigh, 4.IV-15.V.1990, 12♀♀. **Victoria** : Acheron Gap, 15 km NNE Warburton, 6-12.XII.1990, D. Pollock, L. Reichert, 2♀♀. **Western Australia** : Prince Frederick Harbour, 15.00S, 125.21E, 6-11.VI.1988, I.D. Naumann, 1♀. 14 km SE Kalumburu Mission, 14.25S, 126.40E, 3-6.VI.1988, T.A. Weir, 4♀♀. Mitchell Plateau, 14.52S, 125.50E, 2-6.VI.1988, I.D. Naumann, 5♀♀ [ANIC]. Walpole Nornalup National Park, 17-21.I.1987, J.S. Noyes, 2♀♀ [CNCI]. **NEW ZEALAND**. **AK**, Birkenhead, I-III.1981, J.F. Longworth, 18♀♀, 2♂♂. **NN**, Kongahu, I.1981, J. Jones, 1♀ [NZAC]. **PAPUA NEW GUINEA**. **New Britain Island**, Bainings Mountains : Raunsepna, 7-14.IV.1999, L. Leblanc, C. Mitparingi, 1♀; Base Camp DPI Sta. Riv., 28.IV-13.V.1999, L. Leblanc, M. Kalamen, 1♀ [CNCI].

*Comments* : *Anagrus optabilis* is a common and widely distributed species in the Australian, Oriental and southeastern Palearctic regions, and also was collected from Spain (BAQUERO & JORDANA, 1999). It is a well-known egg parasitoid of corn, sugar cane, and rice planthoppers, and as such *A. optabilis* was used as a classical biological control agent in Hawaii (PERKINS, 1905; CLAUSEN, 1978). The biology of this species in Japan was studied by SAHAD (1984). For the detailed morphological descriptions and illustrations of *A. optabilis*, see SAHAD & HIRASHIMA (1984) and TRIAPITSYN & BEARDSLEY (2000).

CHIAPPINI & LIN (1998) provided a translation of the original description of

*A. paranilaparvatae* and noted, based on their detailed, illustrated study of the specimens from Fujian, China, that this species may be conspecific with *A. optabilis*. Examination of the paratype specimen of *A. paranilaparvatae* showed that it fits well within the known range of *A. optabilis*, as discussed by TRIAPITSYN & BEARDSLEY (2000), hence the above synonymy.

All but a few specimens of this species from parts of Australia (i.e., Australian Capital Territory, Tasmania, Victoria, and Western Australia) and from New Zealand display the same morphological feature that potentially can be of a specific value: F3 of the female antenna lacks a sensory ridge. In the specimens of *A. optabilis* from Queensland, Australia, and other parts of the world, F3 almost always bears a sensory ridge. While attributing this to an intraspecific variability (also see comments for *A. frequens* PERKINS, 1905), I do not reject a possibility that further morphometric, biological, or molecular studies might find additional distinguishing characters from the typical form of *A. optabilis* and thus justify description of a new *Anagrus* (*Paranagrus*) species based on such specimens.

*Anagrus* (*Paranagrus*) *perforator* (PERKINS, 1905)

*Paranagrus perforator* PERKINS, 1905 : 199.

*Paranagrus perforator* PERKINS; GIRAULT, 1912 : 159.

*Anagrus* (*Paranagrus*) *perforator* (PERKINS); GIRAULT, 1913 : 12.

*Anagrus perforator* (PERKINS); SUBBA RAO, 1983 : 388, 390-391, 396, 398, 400.

*Anagrus perforator* (PERKINS); SAHAD & HIRASHIMA, 1984 : 71-72.

*Anagrus longitubulosus* PANG & WANG, 1985 : 181-182 **syn. n.**

*Anagrus perforator* (PERKINS); TRJAPITZIN, 1995 : 106.

*Anagrus* (*Paranagrus*) *perforator* (PERKINS); CHIAPPINI *et. al.*, 1996 : 567-568.

*Anagrus* (*Paranagrus*) *perforator* (PERKINS); CHIAPPINI & LIN, 1998 : 557-558.

?*Anagrus longitubulosus* PANG & WANG; CHIAPPINI & LIN, 1998 : 557 (tentative synonymy and translation of the original description).

*Anagrus* (*Paranagrus*) *perforator* (PERKINS); TRIAPITSYN & BEARDSLEY, 2000 : 27-28.

*Type locality* : Fiji.

*Type material* : Not examined, probably lost. *Anagrus longitubulosus* PANG & WANG, 1985 : 1 paratype female on slide labeled : 1."Guoyao, CHINA, 15 May 1981, Hu Ji leg. Host : *Nilaparvata lugens*"; 2."*Anagrus longitubulosus* [sic] Pang & Wang Paratype ♀" [SCAC].

*Material examined* : AUSTRALIA. Queensland, Nelson, 18.V.1912, A.A. Girault, 1♀ (on window) [USNM]. PAPUA NEW GUINEA. New Britain Island, Bainings Mountains, Raunsepa, 7-21.IV.1999, L. Leblanc, C. Mitparingi, 2♀♀ [CNCI].

*Comments* : *Anagrus perforator* can be easily distinguished from the closely related species *A. optabilis* by having a long, markedly exerted ovipositor. SAHAD & HIRASHIMA (1984) provided an illustrated morphological descrip-

tion of *A. perforator*. GIRAULT (1912, 1913) published important records of this species from Queensland, Australia.

CHIAPPINI & LIN (1998) came short of formally synonymizing *A. longitubulosus* under *A. perforator* although indicated that they might represent the same species. Examination of the paratype female of *A. longitubulosus* left no doubt that it is the case, thus providing a justification for the synonymy formalized herein.

***Anagrus (Anagrus) klop* S. TRIAPITSYN, sp. n.**  
**"atomus" species group**  
 (Figs 4-5)

*Type material* : Holotype female on slide, under 2 coverslips, labeled : 1. "14.25S 126.40E CALM Site 4/3 14km SbyE Kalumburu Mission W.A. 3-6 June 1988 T.A. Weir", "Malaise trap closed forest", "RETURN TO ANIC"; "Mounted by V. Berezovskiy 1999 Canada balsam"; 2. "*Anagrus (Anagrus) klop* S. Triapitsyn HOLOTYPE ♀ Det. S. Triapitsyn 2000" [ANIC].

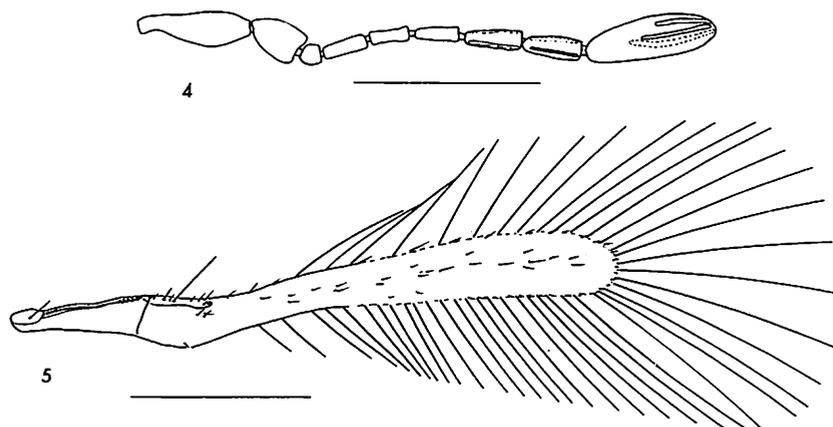
*Description* :

Female. *Coloration* : Body and appendages light brown except head and anterior half of mesoscutum slightly darker; wings hyaline. *Head* : Slightly wider than mesosoma. Antenna (Fig. 4) short, with scape 1.4 × longer than pedicel; F1 globular; F2 subequal in length to F4 and each slightly longer than F3; F5 longer than F4; F6 the longest funicular segment; sensory ridges on F5 (1) and F6 (2); club slightly longer than combined length of two preceding segments. *Mesosoma* : About as long as metasoma. Mesoscutum without adnotaular setae. Forewing (Fig. 5) narrow, 8.5 × as long as wide; distal macrochaeta much more than 2 × length of proximal macrochaeta; forewing blade with a single complete submedian row of microtrichia and a few scattered setae arranged in several irregular rows, leaving a distinct bare area in the broadest part along posterior margin and a smaller bare area along anterior margin. *Metasoma* : Ovipositor not reaching mesophragma anteriorly and barely exerted beyond apex of gaster posteriorly; ratio of total ovipositor length to length of its exerted part 11 : 1. External plates of ovipositor each with 1 distal seta. Ovipositor length/ foretibia length ratio 2.1 : 1.

*Measurements* : Body : 438; head width : 117; ovipositor : 158. Antenna : scape : 49; pedicel : 35; F1 : 11; F2 : 26; F3 : 22; F4 : 27; F5 : 31; F6 : 38; club : 73. Forewing : 339/40; longest fringe cilia : 153. Hindwing : 292/15; longest fringe cilia : 110. Legs (given as femur, tibia, tarsus) : fore 84, 73, 95; middle 76, 99, [distal tarsal segment missing]; hind 84, 106, 99.

*Male* : unknown.

*Diagnosis* : The new species differs from the two described species from the *atomus* species group with a short ovipositor, that also lack sensory ridges on F4 of the female antenna, *A. erythroneuræ* S. TRJAPITZIN & CHIAPPINI, 1994 and *A. ustulatus* HALIDAY, 1833, in having only one complete row of discal microtrichia and a lighter body coloration.



Figs 4-5. *Anagrus klop* sp.n. (holotype female). 4 : Antenna; 5 : Forewing. Scale bars = 0.1 mm.

*Etymology* : "Klop" means "a true bug" in Russian and also has a second meaning - a small living object; i.e., the specific name is chosen to emphasize the minute size of this species.

***Anagrus (Anagrus) ustulatus* HALIDAY, 1833**  
**"atomus" species group**

*Anagrus ustulatus* HALIDAY, 1833 : 347.

*Anagrus* sp.; CHIAPPINI, 1987 : 83, 88, 93-94.

*Anagrus (Anagrus) ustulatus* HALIDAY; CHIAPPINI, 1989 : 104.

*Anagrus ustulatus* HALIDAY; TRJAPITZIN, 1995 : 107-108 (in part).

*Type locality* : Unknown (?England).

*Type material* : Not examined; redescribed by GRAHAM (1982).

*Material examined* : NEW ZEALAND. **AK** : Auckland, 23.IV.1990, J.G. Charles, 2♀♀, 2♂♂ ("ex. eggs of *Ribautiana tenerrima* on boysenberries") [BMNH]. Birkenhead, X.1980, J.F. Longworth, 1♀. Massey, V.1980, E.W. Valentine, 2♀♀. Mt. Albert, 15.XII.1989, J.G. Charles, 8♀♀, 4♂♂ ("ex. eggs of *Ribautiana tenerrima* on boysenberries") [NZAC]. **HB** : Havelock North, 21.III.1990, 1♀ ("ex. eggs of *Edwardsiana crataegi* on unsprayed apple"; "*Anagrus* nr. *ustulatus* Haliday det. J.S. Noyes 1990"). Hawkes Bay, 9.V.1990, ♀. White, 2♀♀, 1♂ ("ex. eggs of *Edwardsiana crataegi* on apple twigs") [BMNH]. Napier, Bluff Hill, 11-15.III.1980, C.F. Butcher, M.F. Tocker, 1♂ [NZAC]. **MC** : Lake Ellesmere, 7.V.1990, G. Burnip : 1♀, 1♂ ("ex. *Typhlocybinae*, prob. *Ribautiana tenerrima*, on brambles"); 1♀ ("ex. *Typhlocybinae* - *Ribautiana tenerrima*") [BMNH]. Lincoln University Biological Fruit Production Block, 30.XI.1995, G. Burnip, 3♀♀, 2♂♂ on slides and several more specimens in ethanol ("associated with Fuji apples") [NZAC, UCRC].

*Comments*: This species was redescribed and illustrated by CHIAPPINI (1987, 1989). The leafhoppers *Edwardsiana crataegi* (DOUGLAS, 1876) and

*Ribautiana tenerrima* (HERRICH-SCHÄFFER, 1834) are recorded here for the first time as hosts of *A. ustulatus*; before, its only other known host was the rose leafhopper, *Edwardsiana rosae* (LINNAEUS, 1758) (CHIAPPINI, 1987).

***Anagrus (Anagrus) japonicus* SAHAD, 1982**  
**“atomus” species group**

*Anagrus japonicus* SAHAD, 1982 : 201-203.

*Anagrus japonicus* SAHAD; SAHAD & HIRASHIMA, 1984 : 50-52.

*Anagrus (Anagrus) japonicus* SAHAD; CHIAPPINI *et. al.*, 1996 : 571.

*Type locality* : Hakozaki, Fukuoka Prefecture, Kiushu Island, Japan.

*Type material* : Not examined, holotype female was examined by CHIAPPINI *et. al.* (1996).

*Material examined* : AUSTRALIA. Northern Territory, 58 km SE Adelaide River, 28.III.1991, J.D. Pinto, 1♀ [CNCI]. Off-shore Australian islands : Christmas Island : 10.28S, 105.42E, Lily Beach Rd., 13-28.IV.1989, J.C. Cardale, 1♀; 10.25S, 105.41E, Settlement, 11-30.IV.1989, J.C. Cardale, 1♀ [ANIC]. JAPAN. Honshu I., Mie Prefecture, Kuona City, 13.viii.1981, M. Rose, 1♀ [UCRC]. PAPUA NEW GUINEA. New Britain Island, Bainings Mountains, Raunsepna, 14-21.IV.1999, L. Leblanc, C. Mítparingi, 1♀ [CNCI].

*Comments* : *Anagrus japonicus* is recorded here for the first time outside of Japan.

***Anagrus (Anagrus) frequens* PERKINS, 1905**  
**“atomus” species group**

*Anagrus frequens* PERKINS, 1905 : 198.

*Anagrus armatus* (ASHMEAD, 1887); GIRAULT, 1912 : 155-158 (misidentification).

*Anagrus armatus* var. *australiensis* GIRAULT, 1912 : 158-159.

*Anagrus cicadulinae* FERRIÈRE, 1930 : 40.

*Anagrus frequens* PERKINS; SUBBA RAO, 1983 : 388, 391, 396, 399, 400.

*Anagrus frequens* PERKINS; SAHAD & HIRASHIMA, 1984 : 58-60.

*Anagrus toyae* PANG & WANG, 1985 : 179-181 *syn. n.*

*Anagrus frequens* PERKINS; TRJAPITZIN, 1995 : 106-107.

*Anagrus (Anagrus) frequens* PERKINS; CHIAPPINI *et. al.*, 1996 : 571-572.

*Anagrus (Anagrus) frequens* PERKINS; CHIAPPINI & LIN, 1998 : 561.

*Anagrus toyae* PANG & WANG; CHIAPPINI & LIN, 1998 : 561 (translation of the original description).

*Anagrus (Anagrus) frequens* PERKINS; TRIAPITSYN & BEARDSLEY, 2000 : 32-33.

*Type locality* : Bundaberg, Queensland, Australia (the lectotype).

*Type material* : Examined; in order to validate the lectotype designation by TRIAPITSYN &

BEARDSLEY (2000) in accordance with ICZN Article 74.7 (1999), I hereby indicate an express statement of its taxonomic purpose : the lectotype was designated in order to maintain stability of usage of the name and to avoid confusion about the type specimens of this species. For the same purposes, the lectotype was designated for *Anagrus cicadulinae* FERRIÈRE, 1930 (TRIAPITSYN & BEARDSLEY, 2000). Also examined was the holotype female of *A. armatus* var. *australiensis* GIRAULT, 1912 (TRJAPITZIN, 1995) and the paratype female of *A. toyae* PANG & WANG, 1985 on slide, labeled : 1. "Foshan, Guangdong, CHINA, He Jiamxing leg. April, 1982 Host : *Toya propigua* [sic]; 2. "*Anagrus toyae* Pang & Wang Paratype ♀" [SCAC].

*Material examined* : AUSTRALIA. **Australian Capital Territory** : Blundells Creek, 3 km E Piccadilly Circus, II.1984-III.1985, Lawrence, Weir, Johnson, 11♀♀, 6♂♂ [ANIC]. Canberra, Black Mountain, 35°16'S, 149°06'E, G. Gibson : 11-7.II.1999, 2♀♀, 3♂♂; 5-21.III.1999, 1♂; 26.IV-2.V.1999, 1♂ [CNCI]. **New South Wales** : Barrington Tops, 11.II.1984, I.D. Naumann, 2♀♀. Congo, 8 km SE Moruya, 22-26.III.1982, M.S. Upton, 2♀♀. **Northern Territory** : 58 km SE Adelaide River, 28.III.1991, J.D. Pinto, 3♀♀ [CNCI]. 53 km SSW Darwin, 12°52'10.5"S, 130°35'04.4"E, M. Hoskins : 27-30.X.1998, 3♀♀; 8-12.XII.1997, 1♀ [CNCI]. **Queensland** : Acacia Ridge nr. Brisbane, G. Gordh : Calamuale Rd., 1.IX.1980, 1♂; 20.IX.1980, 1♂ [UCRC]. 15 km WNW Bald Hill, 27.VI-12.VII.1989, I. Naumann, 11♀♀ [ANIC]. Bellenden, Ker State Forest, 20.IX.1979, E.C. Dahms, J.B. Woolley, J. LaSalle, 1♀ [CNCI]. Biggenden, ca. 32 km SE Munna Creek, 24.IX.1995, J.D. Pinto, 14♀♀, 14♂♂. Blackbutt Creek, 9 km E Blackbutt, 22.IX.1995, J.D. Pinto, 1♀, 2♂♂ [UCRC]. Bramston Beach, 2-18.IX.1987, A. Walford-Huggins, 1♀ [ANIC]. Brisbane, 19.X.1936, A. May, 3♀♀ [QDPI]. Brisbane Forest Park, 27°16'04"S, 152°49'48"E, 2-9.I.1997, N. Power, 1♂. Cairns : 14.V.1984, E.R. Oatman, 1♀; 1.IV.1991, J.D. Pinto, 11♀♀ [CNCI]. Cockatoo Creek Xing, 17 km NW Heathlands, III-VI.1992, T. McLeod, 6♀♀ [ANIC]. Gatton, 3.VI.1981, 1♀, 1♂ ("D-vac in potato crop"); same data except 5-18.V.1981, 2♂♂ [QDPI]. 8 km W Gordonvale, 1.IV.1991, J.D. Pinto, 1♀ [CNCI]. Heathlands, I-VII.1992, T. McLeod and various collectors, 11♀♀, 3♂♂ [ANIC]. Indooroopilly, DPI, 21-28.II.1983, 23♀♀, 1♂. Innisfail, 11.I.1912, A.A. Girault, 1♀ [QMBA]. Kuranda, 29.III.1991, J.D. Pinto, 2♀♀. Magnetic Island, 19°09'S, 146°52'E, R.W. Matthews, 1♀ [CNCI]. Mt. Glorious, 6.III-22.IV.1982, A. Hiller, 1♀ [QMBA]. 35 km NE Mt. Webb, 30.IV-3.V.1981, I.D. Naumann, 1♀. 3 km ENE Mt. Tozer, 28.VI-4.VII.1986, J.C. Cardale, 1♀, 1♂ [ANIC]. Port Douglas, 31.III.1991, J.D. Pinto, 1♀ [CNCI]. Proserpine, 4.XI.1912, 1♀ [QMBA]. Split Rock, 18.II-25.IV.1993, P. Zborowski, 1♀ [ANIC]. Tolga, 30.III.1991, J.D. Pinto, 2♀♀, 1♂. Wangett, Back Ripple Range, 23 km SE Port Douglas, 31.III.1991, J.D. Pinto, 1♀ [CNCI]. 1♀ on slide (most probably from Queensland), label illegible except "*Anagrus baeri* Gir. ♀ *Pseudectroma* 1928" [QMBA]. **Tasmania**, Pelion Hut, 3 km S Mt. Oakleigh, 11.II-1.III.1990, 1♀ [ANIC]. **Western Australia** : 160 km SW Katherine, 27.III.1991, J.D. Pinto, 1♂. Kununurra, 2 km N Hidden Valley National Park, 24.III.1991, J.D. Pinto, 4♀♀. Kununurra, 10 km N Ivanhoe-crossing, 24.III.1991, J.D. Pinto, 1♂. 10 km N Kununurra, 25-29.III.1991, J.D. Pinto, G. Gordh, 1♂ [CNCI]. Mitchell Plateau, 2-6.VI.1988, I.D. Naumann, 1♀. Prince Frederick Harbour, 1-11.VI.1988, I.D. Naumann, 1♀ [ANIC]. Walpole Normalup National Park, 17-21.I.1987, J.S. Noyes, 2♂♂ [CNCI]. Off-shore Australian islands : **Christmas Island**, Flying Fish Cove, 20.IV.1989, J.C. Cardale, 2♀♀. **Norfolk Island**, Filmy Fern Walk, NINP, 14.XI.2.XII.1984, I.D. Naumann, 1♀ [ANIC]. **FRENCH POLYNESIA. Tahiti Archipelago** : **Bora Bora** : 21.VII.1982, H.E. Andersen, 2♀♀ [UCRC]; Baie de Poofai, 6.IX.1984, D.M. LaSalle, 1♀. **Moorea**, Haapiti Marker 16 on hwy, 1.IX.1984, D.M. LaSalle, 2♀♀. **Tahiti**, Maeva Beach, 8.IX.1984, D.M. LaSalle, 3♀♀ [CNCI]. **NEW ZEALAND. AK** : Birkenhead, X.1980, J.F. Longworth, 1♀. Massey, IV.1980, E.W. Valentine, 1♀. Titirangi, IV.1980, P.A. Maddisgn, 4♀♀. **ND**, Ngailonga

Forest, 29.II.1960, R.A. Cumber, 1♀. [NZAC]. PAPUA NEW GUINEA. New Britain Island, Bainings Mountains, Base Camp DPI Sta. Riv., 28.IV-13.V.1999, L. Leblanc, M. Kalamen, 1♀. Madang, Riwa, IV.1987, H.C.J. Godfray, 1♀ [CNCI]. 25 km NE Port Moresby, SDA College, 31.XII.1985, G. Gordh, 1♂ [UCRC].

*Comments:* This is by far the most common *Anagrus* species in the region, particularly in Queensland, Australia. A good, illustrated redescription of *A. frequens* is available (SAHAD & HIRASHIMA, 1984) based on the Japanese material. Recently, TRIAPITSYN & BEARDSLEY (2000) studied some of the original material of this species from Queensland, and also made morphometric studies of *A. frequens* specimens reared from several different hosts, showing variation of some morphological characters. The minor differences between *A. toyae* and *A. frequens* are likely also host-induced and therefore the former species is synonymized here under the latter.

Among specimens examined during the course of this study, there were some from Australia and New Zealand that differ from the typical form by possessing a sensory ridge on F3 of the female antenna. Those specimens would key to *A. ?frequens* and are marked as such on the identification labels; however, at this point I am reluctant to describe a new species based on this sole character which may be subject to intraspecific variability in other *Anagrus* species, for instance in *A. avalae* SOYKA, 1955 (CHIAPPINI & TRIAPITSYN, 1997). This variability may be either host-induced or geographical, or perhaps caused by other, unknown factors, as it has already been stated for the Chinese specimens (CHIAPPINI & LIN, 1998).

*Anagrus (Anagrus) atomus* (LINNAEUS, 1767)  
"atomus" species group

*Ichneumon atomus* LINNAEUS, 1767 : 941.

*Anagrus atomus* (LINNAEUS); HALIDAY, 1833 : 347.

*Anagrus atomus* (L.); CHIAPPINI, 1987 : 73-90.

*Anagrus (Anagrus) atomus* (LINNAEUS); CHIAPPINI, 1989 : 102-104.

*Anagrus (Anagrus) atomus* (L.); CHIAPPINI & LIN, 1998 : 561-562.

*Anagrus (Anagrus) atomus* (L.); TRIAPITSYN, 1998 : 82-84.

*Type locality* : Unknown.

*Type material* : Most probably is lost.

*Material examined* : NEW ZEALAND. AK, Birkenhead, XII.1980-I.1981, J.F. Longworth, 2♀♀ [NZAC]. HB, Havelock North, 21.III.1990, 1♀ (ex. eggs of *Edwardsiana crataegi* (DOUGLAS, 1876) on apple) [BMNH]. NN, Rotoiti Lake, 4-9.II.1978, S. & J. Peck, 3♀♀. TK, 23 km S Aria, 14.XII.1983, L. Masner, 1♀ [CNCI].

*Comments:* See CHIAPPINI (1987, 1989) for the illustrated redescription, list of synonyms, and other information on this common and widespread European species. *Anagrus atomus* was found recently in Argentina and Chile (TRIAPITSYN, 1999a), China (CHIAPPINI & LIN, 1998), Iran and North America (TRIAPITSYN, 1998), and also in Turkmenistan (CHIAPPINI *et. al.*, 1996). Its known

host associations are indicated by CHIAPPINI et. al. (1996) and TRIAPITSYN (1998). The Froggatt's apple leafhopper, *Edwardsiana crataegi* (DOUGLAS, 1876), is a new host record for *A. atomus*.

***Anagrus (Anagrus) flaviapex* CHIAPPINI & LIN, 1998**  
**"atomus" species group**

*Anagrus empoascae* DOZIER, 1932; SUBBA RAO, 1966 : 189 (misidentification).

*Anagrus (Anagrus) flaviapex* CHIAPPINI & LIN, 1998 : 562-564.

*Anagrus flaviapex* CHIAPPINI & LIN; TRIAPITSYN, 1999b : 237-239.

*Type locality* : Shaxian County, Fujian Province, China.

*Type material* : Not examined.

*Material examined* : AUSTRALIA. Off-shore Australian islands : **Christmas Island** : 10.26S, 105.40E, Flying Fish Cove, 20.IV.1989, J.C. Cardale, 1♀; 10.25S, 105.41E, Settlement, 11-30.IV.1989, J.C. Cardale, 2♀♀ [ANIC]. INDIA. **Karnataka**, Bangalore District, Yelahanka, 2-3.XI.1984, 1♂ ("ex. *Empoasca signata* (Haupt) on castor bean") [UCRC]. **Tamil Nadu**, Nilgiris, Udagamandalum, 24.IX.1986, E.E. Grissell, 1♀ [USNM].

*Comments* : The illustrations of the female antenna and wings are given with the original description of this species (CHIAPPINI & LIN, 1998); the male is described by TRIAPITSYN (1999b) based on the reared material from India. *Empoasca libyca* (DE BERGEVIN & ZANON, 1922) [= *E. signata* (HAUPT, 1927)] is a new host record for *A. flaviapex*, provided the identification of the leafhopper by an unknown collector was correct.

***Anagrus (Anagrus) baeri* GIRAULT, 1912**  
**"atomus" species group**

*Anagrus baeri* GIRAULT, 1912 : 155.

*Anagrus baeri* GIRAULT; TRJAPITZIN, 1995 : 106-107.

*Type locality* : Babinda, Queensland, Australia.

*Type material* : Examined (TRJAPITZIN, 1995).

*Material examined* : AUSTRALIA. **Queensland** : Cockatoo Creek Xing, 17 km NW Heathlands, 26.I-29.II.1992, P. Feehney, 1♀; 12 km SSE Heathlands, 26.I-1.III.1992, P. Feehney, 1♀ [ANIC]. Emerald at Nogoia River, 13.IV.1988, J.D. Pinto, G. Gordh, 1♀ [CNCI]. Nambour, 17.I.1961, H.G.G., 1♀ ("Ex. stems of *Vigna sesquipedalis* infested by *Melanagromyza phaseoti* (Coq.), No. 333" [QDPI]). FRENCH POLYNESIA. **Tahiti Archipelago**, **Bora Bora**, Baie de Poofai, 6.IX.1984, D.M. LaSalle, 2♀♀ [CNCI].

*Comments* : *Anagrus baeri* was described from a single specimen captured from the foliage of a wild imported citron which was infested with coccids and leafhoppers (GIRAULT, 1912). TRJAPITZIN (1995) redescribed and illustrated the holotype female of *A. baeri*.

*Anagrus (Anagrus) incarnatus* HALIDAY, 1833  
 “*incarnatus*” species group

*Anagrus incarnatus* HALIDAY, 1833 : 347.

*Anagrus (Anagrus) incarnatus* HALIDAY; CHIAPPINI, 1989 : 112-113.

*Anagrus (Anagrus) incarnatus* HALIDAY; TRIAPITSYN, 1997 : 7-8.

Type locality : Unknown (?England).

Type material : Not examined; redescribed by GRAHAM (1982).

Material examined : NEW ZEALAND. AK : Birkenhead, X.1980-III.1981, J.F. Longworth, 10♀♀. Huia, X.1980, B.M. May, 1♀. Lynfield, IV.1980, G. Kuschel, 1♀. BP, Mamaku Plateau, Galaxy Rd. 27 km W Rotorua, 6-11.III.1978, S. & J. Peck, 1♀. BR, St. Arnaud, 600 m, 9.XII.1980, J.S. Noyes, E. Valentine, A.K. Walker, 3♀♀ (native grassland, sphagnum bog). WI, Palmerston North, Munro's Bush, III.1981, 1♀ [NZAC].

Comments : This species was redescribed and illustrated by CHIAPPINI (1989). TRIAPITSYN (1997) provided the most recent lists of the synonyms and known hosts of *A. incarnatus*. This common Palaearctic species is recorded here for the first time from New Zealand. I have very little doubt that it has been accidentally introduced there. *Anagrus avalae* and *A. incarnatus* are the only known members of the *incarnatus* species group so far discovered in New Zealand. Interestingly, neither of them is indigenous to the region.

*Anagrus (Anagrus) avalae* SOYKA, 1955  
 “*incarnatus*” species group

*Anagrus armatus* var. *nigriceps* GIRAULT, 1915 : 276 (preoccupied by *Anagrus nigriceps* (SMITS VAN BURGST, 1914)).

*Anagrus armatus* (ASHMEAD, 1887) var. *nigriventris* GIRAULT, 1911; DUMBLETON, 1934 : 33-37 (misidentification).

*Anagrus armatus* ASHMEAD; EVANS, 1943 : 47-48 (misidentification).

*Anagrus armatus nigriventris* GIRAULT; MILLER, 1947 : 118 (misidentification).

*Anagrus avalae* SOYKA, 1955 : 24 (oldest available replacement name for *A. nigriceps* GIRAULT, 1915 not SMITS VAN BURGST, 1914).

*Anagrus armatus* (ASHMEAD); VALENTINE, 1967 : 1127 (misidentification).

*Anagrus (Anagrus) avalae* SOYKA; CHIAPPINI, 1989 : 108.

*Anagrus armatus* (ASHMEAD); NOYES & VALENTINE, 1989 : 6, 10, 25-26 (misidentification).

*Anagrus ustulatus* HALIDAY; TRIAPITZIN, 1995 : 107-108 (in part, incorrect guess).

*Anagrus (Anagrus) oregonensis* S. TRIAPITSYN in CHIAPPINI *et. al.*, 1996 : 578-579 (unnecessary replacement name for *A. nigriceps* GIRAULT, 1915).

*Anagrus avalae* SOYKA; CHIAPPINI & TRIAPITSYN, 1997 : 119-124.

*Anagrus avalae* SOYKA; TRIAPITSYN, 1998 : 104-105.

Type locality : Mount Avala nr. Belgrade, Serbia, Yugoslavia.

*Type material* : Examined; see CHIAPPINI & TRIAPITSYN (1997).

*Material examined* : AUSTRALIA. Tasmania, 4 females on slide, labeled : "*Anagrus armatus* Egg parasite of *Typhlocyba australia* emerged at Hobart 3-12-35 from eggs from Nelson, N.Z. J.W. Evans" [ANIC]. Victoria, Mitcham, V.1983, C. Lai (D. Yu), 1♀ [CNCI]. NEW ZEALAND. AK, Birkenhead (AK), XII.1980, 3♀♀ [NZAC]. NN, Nelson, 9♀♀, 1♂ on 4 slides, labeled : "*Anagrus armatus* var. *nigriventris* Girault Gahan Bred ex. eggs of *Typhlocyba australis* Frogg. (= *T. xanthippe*) Dec. 1932 Nelson, N.Z. L.J. Dumbleton." [USNM].

*Comments* : The identity of this common European species has been long mistaken in New Zealand and then Australia since DUMBLETON (1934) published the incorrect identification by A.B. GAHAN (as "*Anagrus armatus* ASHMEAD var. *nigriventris* GIRAULT") of the egg parasitoid reared by L.J. DUMBLETON in Nelson, New Zealand, from eggs of the Froggatt's apple leafhopper, or the canary fly, *Edwardsiana crataegi* (DOUGLAS, 1876) (also known as *Edwardsiana australis* (FROGGATT, 1918), *Typhlocyba australis* (FROGGATT), *T. froggatti* BAKER, 1925, *Edwardsiana froggatti* (BAKER), etc.). This parasitoid, under the names *Anagrus armatus* (ASHMEAD, 1887) or *A. armatus nigriventris* GIRAULT, 1911, both of which are in fact New World species, has been mentioned in many catalogs and other scientific publications since then, as it turned out to be an economically important biological control agent against the Froggatt's apple leafhopper in New Zealand, providing good control of both overwintering eggs (78-93% parasitization) and summer eggs (66% parasitization) of the host (DUMBLETON, 1934, 1937). In 1935, *A. avalae*, as *A. armatus* (ASHMEAD) or *A. armatus nigriventris* GIRAULT, was introduced from New Zealand into Tasmania and became successfully established in apple orchards there (EVANS, 1943; MILLER, 1947). Later, this species was introduced from Tasmania into mainland Australia, first in 1940 into South Australia and then in 1943 and 1947-1948 into Western Australia (CLAUSEN, 1978), according to whom neither attempt was successful. However, the recent discovery of *A. avalae* in Mitcham, Victoria (see "Material examined" above), may prove it to be at least partially wrong, unless there were unrelated, accidental introductions of this species to Australia, which is quite possible.

My identification of this species in New Zealand is based in part on the study of L.J. DUMBLETON's voucher specimens, collected in December of 1932 and sent by him for identification to A.B. GAHAN. I finally located this material, poorly mounted on slides, during my recent visit to USNM in August 2000, after many years of unsuccessful searching for the original material on which L.J. DUMBLETON based his well-known publications of 1934 and 1937. I was thus wrong in guessing that the egg parasitoid he referred to might be *A. ustulatus* HALIDAY, 1833 (TRJAPITZIN, 1995), the species of *Anagrus* that was more recently reared out of Froggatt's apple leafhoppers' eggs in New Zealand (see "Material examined" for *A. ustulatus*). The discovery of J.W. EVANS' specimens of "*Anagrus armatus*", that were introduced from New Zealand into Hobart, Tasmania, confirmed the fact that *A. avalae* was misidentified as such. It is clear now that both these species co-exist currently in New Zealand, and

therefore it is impossible to determine which of them, *A. avalae* or *A. ustulatus*, or both, were referred to under the name *A. armatus* (ASHMEAD) by TEULON & PENMAN (1986). Voucher specimens of their material, collected mainly by using sticky boards in an apple orchard near Christchurch, New Zealand, in association with the population of *E. crataegi*, are presumed lost.

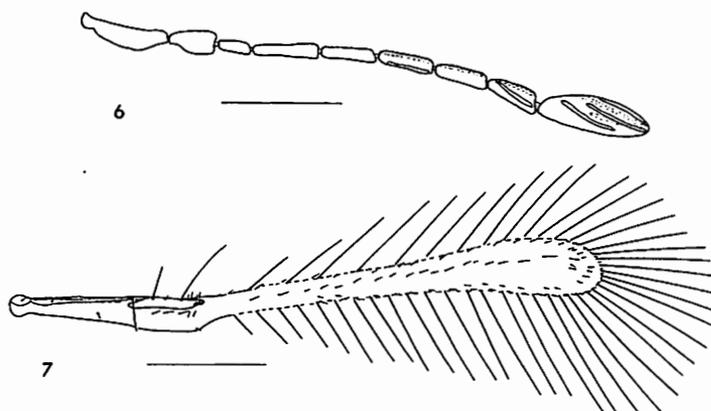
There is no doubt that *A. avalae* was long ago accidentally introduced into New Zealand from Europe, possibly with apple or plum stock containing parasitized overwintering leafhopper eggs in the twigs. *Anagrus avalae* was redescribed, illustrated, and discussed by CHIAPPINI & TRIAPITSYN (1997) who also indicated its leafhopper host associations in Europe and North America. The leafhopper *E. crataegi* is added here to that host list.

***Anagrus (Anagrus) antipodus* S. TRIAPITSYN, sp. n.**  
**"incarnatus" species group**  
 (Figs 6-7)

*Type material* : Holotype female on point, labeled : 1."11.39S 142.27E QLD Cockatoo Ck. Xing 17 km NW Heathlands 22 Mar - 25 Apr 1992 T. McLeod. open forest MALAISE #5"; 2."*Anagrus (Anagrus) antipodus* S. Triapitsyn HOLOTYPE ♀" [ANIC]. Paratypes (all on points except when indicated) : AUSTRALIA. Queensland : 11 km NW Bald Hill, 13.44S, 143.20E, 26.VI-13.VII.1989, I. Naumann, 3♀♀ (including 1 on slide). 15 km WNW Bald Hill, 13.43S, 143.19E, 27.VI-12.VII.1989, I. Naumann, 4♀♀ (including 1 on slide) [ANIC]. Cairns, 1.IV.1991, J.D. Pinto, 1♀ [CNCI]. Cockatoo Creek Crossing, 17 km NW Heathlands, 11.39S, 142.27E : 15-26.I.1992, I. Naumann, T. Weir, 1♀; 1-21.III.1992, P. Feehney, 2♀♀; 22.III-25.IV.1992, T. McLeod, 4♀♀ (including 2 on slides); 25.IV-7.VI.1992, T. McLeod, 4♀♀; 7.VI-25.VII.1992, P. Zborowski, E. Nielsen, 2♀♀; 25.VII-18.VIII.1992, P. Zborowski, J. Cardale, 1♀. Heathlands, 11.45S, 142.35E : 26.I-29.II.1992, P. Feehney, 1♀; 25.IV-7.VI.1992, T. McLeod, 7♀♀; 25.VII-18.VIII.1992, P. Zborowski, J. Cardale, 1♀ (on slide). 12 km SSE Heathlands, 11.51S, 142.38E : 1-21.III.1992, P. Feehney, 1♀; 22.III-25.IV.1992, T. McLeod, 3♀♀ (including 2 on slides) [ANIC, UCRC]. Tolga, 30.III.1991, J.D. Pinto, 1♀ [CNCI]. Western Australia : Mitchell Plateau : 14.52S, 125.50E, 2-6.VI.1988, I.D. Naumann, 1♀; 14.49S, 125.50E, 9-19.V.1983, I.D. Naumann, J.C. Cardale, 1♀. Off-shore Australian islands : Christmas Island : 10.28S, 105.42E, Lily Beach Road, 13-28.IV.1989, J.C. Cardale, 1♀ [ANIC].

*Description* :

Female. *Coloration* : Body pale to light brown; the following parts darker : head trabeculae and stemmaticum, mesoscutum, axillae, basal and subapical terga of gaster, and ovipositor sheaths. Appendages light brown to brown except for pale scape and pedicel; wings hyaline. *Head* : Markedly wider than mesosoma. Antenna (Fig. 6) with scape  $1.9 \times$  length of pedicel; F1 cylindrical,  $0.7-0.8 \times$  length of pedicel; F2 longest of funicle segments; F3 subequal in length to F6, each slightly longer than F5 and shorter than F4; sensory ridges on F4 (2); F5 (1) and F6 (2); club slightly longer than combined length of two preceding segments. *Mesosoma* : Shorter than metasoma. Mesoscutum with a pair of adnotaular setae. Forewing (Fig. 7) narrow,  $9.9-11.7 \times$  as long as wide; distal macrochaeta about  $2 \times$  length of proximal macrochaeta; forewing blade with a single complete median row of microtrichia and a few scattered setae at



Figs 6-7. *Anagrus antipodus* sp.n. (paratype female). 6 : Antenna; 7 : Forewing. Scale bars = 0.1 mm.

apex. Hindwing disc bare except for a row of microtrichia along posterior margin. *Metasoma* : Ovipositor reaching or overlapping mesophragma anteriorly and markedly exerted beyond apex of gaster posteriorly; ratio of total ovipositor length to length of its exerted part 3.3-4.1 : 1. External plates of ovipositor each with 1 or 2 distal setae. Ovipositor length/ foretibia length ratio 3.3-3.6 : 1.

*Measurements* ( $n=4$ ) : Body : 522 (506-546); ovipositor : 359 (332-380). Antenna : scape : 72 (66-80); pedicel : 38 (37-40); F1 : 28 (26-29); F2 : 55 (53-58); F3 : 46 (42-51); F4 : 48 (44-53); F5 : 44 (37-51); F6 : 46 (42-51); club : 96 (88-106). Forewing : 493 (467-510)/47 (44-51); longest fringe cilia : 151 (146-157). Hindwing : 458 (437-482)/15 (14-15); longest fringe cilia : 116 (113-120). Legs (given as femur, tibia, tarsus) : fore 114 (110-124), 105 (99-113), 137 (128-150); middle 108 (102-110), 161 (150-170), 142 (135-153); hind 108 (98-114), 188 (175-197), 159 (146-172).

*Male* : Unknown. There are several males in the ANIC that belong to at least two different species of *Anagrus* and were collected approximately at the same time and in the same localities as the female *A. antipodus* n. sp. Therefore, I prefer not to associate any of them with the female of this species; this would be done best by rearing a series of both males and females from the same host.

*Diagnosis* : Morphologically, this very distinctive species is most closely related to the Chinese species *A. paranagrosimilis* CHIAPPINI & LIN, 1998 and also to *A. oahuensis* S. TRIAPITSYN & BEARDSLEY, 2000, known from Hawaii and Mexico. These two species have a sensory ridge on F3 of female antenna, which *A. antipodus* sp. n. lacks, and F2 not as long relative to other funicular segments as in the new species.

*Etymology* : The specific name is derived from the word "antipode".

*Comments* : There are also several female specimens from Queensland, Australia (material in ANIC) and New Britain Island, Papua New Guinea (material in CNCI) that closely resemble this species but are not included in the type series nor regarded in the description. All of them have F1 almost globular, not cylindrical as in *A. antipodus* sp. n. It is unclear if this character is subject to intraspecific variability or, otherwise, indicates that two different species are present. For now, this remains an unresolved matter.

***Anagrus (Anagrus) sp. "B"***  
**"*incarnatus*" species group**

*Material examined* : AUSTRALIA. Northern Territory, 53 km SSW Darwin, 12°52'10.5"S, 130°35'04.4"E, 10-15.XII.1997, T. Ahearns, 1♀ [CNCI]. Western Australia, Mitchell Plateau, 14.52S, 125.50E, 2-6.VI.1988, I.D. Naumann, 1♀ [ANIC].

*Diagnosis* : This species is very close to *A. antipodus* sp. n. described above; the only morphological features that separate them are those indicated in the key. It is possible that *Anagrus* sp. "B" is a geographical variation form of *A. antipodus*, an assumption that at present cannot be either proven or rejected.

**Species incorrectly placed in *Anagrus***

***Cleruchus lutulentus* (GIRAULT, 1911) comb. n.**

*Anagrus lutulentus* GIRAULT, 1911 : 135-137.

*Anagrus lutulentus* GIRAULT; TRJAPITZIN, 1995 : 105 (removed from *Anagrus*; *incertae sedis*).

*Type locality* : Perth, Western Australia, Australia.

*Type material* : Examined; holotype male on slide, labeled : 1. "998 Perth W. Austr. G. Compere Mymarid [in pencil] *Anagrus* [*Anaphes* - crossed out] *lutulentus* Girault Type"; 2. "*Anagrus lutulentus* Gir. Type No. 13835 U.S.N.M."; 3. "*Cleruchus lutulentus* (Girault) ♂ Det. S. Triapitsyn 2000" [USNM].

*Comments* : This western Australian species, known from a single male specimen collected by the famous biological control explorer George Compere, was found wrongly placed in *Anagrus* by TRJAPITZIN (1995). It was considered then to possibly belong to a genus near *Erythmelus* ENOCK, 1909. However, a more careful examination of the holotype during my recent visit to USNM left no doubt that *lutulentus* is a member of the genus *Cleruchus* ENOCK, 1909, where it is being transferred here as a new combination.

The holotype specimen of *C. lutulentus* is poorly mounted and incomplete : on the left antenna, only 2 basal flagellomeres are left, and the right antenna has remained with only 9 flagellomeres (all of which are longer than wide). Some other distinguishing morphological features of this species are as follows : pronotum is divided medially as typical for *Cleruchus*; scutellum is di-

vided into anterior and posterior parts; two parallel, weak keels on the propodeum; and forewing with subparallel margins, its blade bare except for one line of microtrichia along the anterior margin and one submedial (slightly closer to anterior margin) row of several discal setae.

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