

The genus *Anagrus* (Hymenoptera: Mymaridae) in America south of the United States: a review

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Abstract. The described and economically important species of the mymarid wasp genus *Anagrus* Haliday of the Neotropical region, including northern Mexico, are reviewed. Two new species, *A. brasiliensis* S. Triapitsyn and *A. gonzalezae* S. Triapitsyn, are described and illustrated. *A. empoascae* Dozier is redescribed based on the study of its type series from Haiti, from which a lectotype is designated. *A. incarnatosimilis* Soyka is synonymized with *A. incarnatus* Haliday. *A. porteri* Brèthes is transferred to *Polynema* as *P. porteri* (Brèthes). A key to 13 species of *Anagrus* is given and host associations, when available, are indicated for those species.

Key words: Parasitoids, Neotropical region, host associations, biological control.

Resumen. Se revisa la especie ya descrita muy importante económicamente, de la avispa mymarid *Anagrus* Haliday de la región Neotropical, incluyendo el norte de México. Dos especies nuevas, *A. brasiliensis* S. Triapitsyn y *A. gonzalezae* S. Triapitsyn, son descritas e ilustradas. *A. empoascae* Dozier es descrita basada en el estudio de su tipo de serie de Haití, de la cual un lectotipo es designado. *A. incarnatosimilis* Soyka es sinonimizada con *A. incarnatus* Haliday. *A. porteri* (Brèthes) es transferida a *Polynema* como *P. porteri* (Brèthes). Se presenta una llave para 13 especies de *Anagrus* y la asociación de huéspedes, cuando son disponibles, se indican para esas especies.

Palabras claves: Parasitoides, región Neotropical, asociación de huéspedes, control biológico.

INTRODUCTION

Recent studies of the cosmopolitan mymarid genus *Anagrus* Haliday (Chiappini 1989, Triapitsyn 1995, Chiappini *et al.* 1996) have made it possible to compare the available Neotropical material of this genus with the species from other parts of the world. As correctly noted by Huber (1986), *Anagrus* is one of the three most abundant and "collectable" mymarid genera; thus, numerous unidentified specimens of this genus can be easily found in major systematic collections. For instance, the Canadian National Collection of Insects has at least several hundred specimens of *Anagrus* from the Neotropical region (J. T. Huber, personal communication). However, the vast majority of these specimens were collected by using Malaise and yellow pan traps or by screen sweeping. These collecting methods are excellent for capturing large numbers of diverse material of microhymenoptera, but unfortunately do not provide records of their host associations. The latter are very important as information which can be used for biological control purposes and often as a good complementary tool for correct identification.

The main purpose of this paper is to present a review of the already described species of *Anagrus* in the Neotropical region and to check the published records of *Anagrus* for correctness of identification by examining available voucher specimens. In addition, this review deals with several species of actual or potential economic importance which are either new to science or are new records for the region. The use of *Anagrus* species in biological control programs is well discussed by Huber (1986). Because of the lack of any budget for this study, I was unable to slide-mount the numerous alcohol-preserved specimens mentioned above; however, I studied almost all available, already slide-mounted Neotropical specimens of *Anagrus* in major North American and European collections. A few specimens of reared material were sent to me directly by collectors from several Central and South American countries. Most of these specimens were reared from eggs of known hosts.

For practical purposes, I include the Nearctic part of Mexico in the area covered by this review, although the Nearctic species were previously revised by Chiappini *et al.* (1996). In this I am following the catalogs of De Santis (1979) and De Santis and Fidalgo (1994) which provided

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references and other valuable data on some *Anagrus* species in America south of the United States. *Anagrus epos* Girault is difficult to recognize; it is known from northwestern Mexico (De Santis and Fidalgo 1994), but is not considered in the present review. *A. epos* will be treated together with the other North American species of *Anagrus* which attack eggs of leafhoppers on grape in a forthcoming publication (S. Triapitsyn, in progress). The record of *A. armatus* (Ashmead) from Puerto Rico (De Santis and Fidalgo 1994) is most probably due to a misidentification (see Chiappini *et al.* 1996 for discussion and redescription of *A. armatus*) and therefore this species is also excluded from the key.

Terminology for morphological features used in this paper is that of Sahad and Hirashima (1984) and Chiappini *et al.* (1996). Measurements are given in micrometers (μm), with the mean followed, in parentheses, by the range.

An abbreviation used in the description is: F = funicular (flagellar in males) segment. Acronyms for collections are as follows: BMNH, The Natural History Museum, London, England; BPBM, Bernice P. Bishop Museum, Honolulu, Hawaii, USA; CISC, University of California, Berkeley, California, USA; CNCI, Canadian National Collection of Insects, Ottawa, Canada; EAPZ, Agroecological Inventory Collection, Escuela Agrícola Panamericana, Zamorano, Honduras; IEFA, E. Chiappini collection, Istituto di Entomologia, Piacenza, Italy; IMLA, Fundación e Instituto Miguel Lillo, San Miguel de Tucumán, Argentina; MACN, Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina; UCRC, University of California, Riverside, California, USA; USNM, National Museum of Natural History, Washington, D.C., USA.

Genus *Anagrus* Haliday 1833

Synonyms: *Pteratomus* Packard 1864, *Packardiella* Ashmead 1904, *Paranagrus* Perkins 1905, *Anagrella* Bakkendorf 1962. For the diagnosis and the complete list of references on *Anagrus*, see Yoshimoto (1990) (his book also provides a key to the New World genera of the Mymaridae) and Chiappini *et al.* (1996). For the diagnoses of the three subgenera of *Anagrus*, i.e. *Anagrus* Haliday, 1833 s. str., *Paranagrus* Perkins, 1905 and *Anagrella* Bakkendorf, 1962, see Chiappini *et al.* (1996). Members of *Anagrus* (*Anagrella*) have not yet been found in the New World.

Key to species of the genus *Anagrus* Haliday in America south of the United States (females)

- 1 Pedicel about as long as F1; triangular paramedial plates on postscutellum widely separated2
- 1' Pedicel markedly longer than F1; triangular paramedial plates on postscutellum very close to each other.....3
- 2 F3 and F4 each with a sensory ridge.....*A. optabilis* Perkins
- 2' Both F3 and F4 without sensory ridges.....*A. unilinearis* Soyka
- 3 Antennal funicle with F2 much shorter than F4 or F6 (as in Figure 1).....4
- 3' Antennal funicle not as above.....5
- 4 F2 subglobular, about as long as F1.....*A. brasiliensis* sp. n.
- 4' F2 cylindrical, longer than F1.....*A. takeyanus* Gordh
- 5 Club with 3 sensory ridges6
- 5' Club with 5 sensory ridges7
- 6 F4 with 1 sensory ridge*A. frequens* Perkins
- 6' F4 without sensory ridges*A. erythronerae* S. Trjapitzin and Chiappini
- 7 Mesoscutum with a pair of medial setae near notauli.....10
- 7' Mesoscutum without such a pair of setae near notauli.....8
- 8 F2 usually with 1 sensory ridge (Figure 6): if without, then F3 or F4 with 2 sensory ridges*A. gonzalezae* sp. n.
- 8' F2 always without sensory ridges; F3 and F4 each with only 1 sensory ridge9
- 9 Forewing with a bare area on broadest part of forewing (Figure 9)*A. breviphragma* Soyka
- 9' Forewing without such a bare area on broadest part of forewing*A. incarnatus* Haliday
- 10 F2 with a sensory ridge*A. yawi* Fullaway
- 10' F2 without sensory ridges.....11
- 11 Forewing disc with a more or less distinct hairless area at broadest part*A. empoascae* Dozier
- 11' Forewing disc without distinct hairless area (as in Figure 11).....12
- 12 F3 with a sensory ridge.....*A. nigriventris* Girault
- 12' F3 without sensory ridges.....*A. flaveolus* Waterhouse

***Anagrus (Paranagrus) optabilis* (Perkins)**

Paranagrus optabilis Perkins, 1905: 199.

Anagrus optabilis (Perkins): Sahad and Hirashima, 1984: 65-68, 73-75.

Anagrus optabilis (Perkins): Chiappini *et al.*, 1996: 564-566.

Chiappini *et al.* (1996) provided the most complete list of references on this species and its taxonomic description.

Good quality illustrations can be found in Sahad and Hirashima (1984).

Type locality: Queensland, Australia.

Distribution: See Chiappini *et al.* (1996) for the complete list. New and additional records: Ecuador (De Santis and Fidalgo 1994), South Africa (new record).

Hosts: see Chiappini *et al.* (1996) for the list of known delphacid hosts.

Material examined: none from the Neotropical region.

Other material examined: Malaysia, East Malaysia [Sarawak - on Borneo Island], Sibuluan, 14. XIII.1967, G. H. L. Rothschild, ex. *Sogatella furcifera* on rice, 2 VV [CISC]. Philippines, Luzon, IRRRI, 1982 [BMNH]. Republic of South Africa, Natal, Cathedral Peaks F.S., 1400 ft., 13-31. XII.1979, S. and J. Peck, 1 V [CNCI].

Comments: This species was reported in Ecuador from eggs of sugarcane planthopper, *Perkinsiella saccharicida* Kirkaldy, by De Santis and Fidalgo (1994). I have not yet seen any specimens of this species from the New World.

***Anagrus (Paranagrus) unilinearis* Soyka**

(Figure 1)

Anagrus unilinearis Soyka, 1950: 124-125.

Anagrus unilinearis Soyka: Chiappini *et al.*, 1996: 566.

Type locality: Shareh El-Haram, Egypt.

Distribution: Bulgaria, Egypt, Greece, Mexico (new record), South Africa (new record), Trinidad (new record).

Hosts: unknown.

Material examined: Mexico, Chiapas, Ocozocoautla, "El Kikapu", 15-20. VII.1984, G. Gordh, 2 VV [UCRC]. Trinidad, Valsayn, Springfield Ave., 21-31. V.1974, M. Yaseen, yellow pan trap, 1 V [CNCI]. Other material examined: Republic of South Africa, Natal, Durban, 16-17. X.1925, Rust, on window, 2 VV [CISC].

Comments: The species was redescribed by Chiappini *et al.* (1996). Illustration of the female antenna of *A.*

unilinearis can be also found in Chiappini *et al.* (1996). Here I provide illustration of the female forewing of *A. unilinearis* which is not available elsewhere.

Collected rarely, *A. unilinearis* differs from *A. optabilis* Perkins, a common egg parasitoid of planthoppers (Delphacidae) throughout the world, by lacking sensory ridges on F3 and F4 of the female antenna. Members of the subgenus *Paranagrus* appear to be rare in the New World, to which they might not be native.

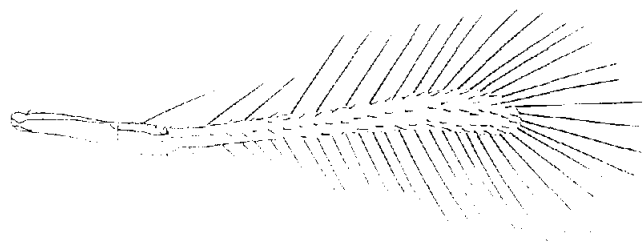


Figure 1. *Anagrus unilinearis* Soyka: forewing, V.

***Anagrus (Anagrus) brasiliensis* S. Triapitsyn, sp. n.**
(Figures 2-4)

Diagnosis: This species is easy to distinguish from all other described species of *Anagrus* by the characteristic funicle of the female antenna which has F2 subglobular and subequal to F1 (Figure 2).

Type material: Holotype V on slide labeled: 1. "Brazil: Sta. Cat. [Santa Catarina], Nova Teutonia, 6. III.1944, F. Plaumann B.M. 1957-341"; 2. "*Anagrus brasiliensis* S. Triapitsyn V HOLOTYPE det. S. Triapitsyn VIII.1996 BMNH" [BMNH]. Paratypes: 1 V, 1 M on separate slides, same data as holotype [BMNH, UCRC].

Description: Female ($n=2$). Color: General coloration of body and appendages brown except head, pronotum and mesoscutum dark brown.

Head: Antenna (Figure 2) rather setose for genus: scape 2.2x as long as pedicel. F1 and F2 subequal and subglobular, less than half length of pedicel and without sensory ridges; F3 slightly shorter than following segments and with 1 sensory ridge, F4-F6 subequal and with 1-2 sensory ridges each; club apparently bears 5 sensory ridges of which only 3 clearly visible.

Mesosoma: Mesoscutum with 2 pairs (anterior and medial) of stout setae near notauli. Forewing (Figure 3) shorter than body; 10-11x longer than wide; with single complete row of setae along middle of blade, thus leaving narrow bare space along margins. Lengths of distal and proximal macrochaetae in ratio 1.6-1.9:1. Marginal fringe with longest cilia about 3x the wing width. Hindwing disc asetose except a row of small setae along posterior margin.

Metasoma: Ovipositor anteriorly barely reaching mesophragma and posteriorly slightly exerted beyond apex of metasoma. Ratio of total ovipositor length to length of its exerted part about 11:1. External plates of ovipositor each with 2 distal setae. Ovipositor: foretibia ratio 2.4-2.5:1.

Measurements: Body: 540-558; Ovipositor: 266-270. Antenna: Scape: 80-82; Pedicel: 37; F1: 15; F2: 16; F3: 33; F4: 38-40; F5: 37-38; F6: 40; Club: 84. Forewing: 450-459/40-44; Proximal macrochaeta: 44-51; Distal macrochaeta: 80-84; Longest marginal cilia: 131. Hindwing: 396-405/15. Legs: [given as femur, tibia, tarsus]: Fore: 95-99, 106-113, 135-149; Middle: 99, 179, 149; Hind: 91, 172, 153.

Male ($n=1$). Similar to female except mesosoma slightly darker. Antenna markedly setose; scape rather long and flagellomeres quite short for genus. F10 and F11 club-like (Figure 4). Genitalia with hook-shaped digiti.

Measurements: Body: F11: 46. Forewing: 540/51. Genitalia: 16 603. Antenna: Scape: 80; Pedicel: 33; F1: 31; F2: 33; F3: 33; F4: 37; F5: 38; F6: 40; F7: 38; F8: 41; F9: 41; F10: 44 4.

Host: Unknown.

Etymology: The name is self-explanatory as it refers to the country of origin of the new species.

Comments: This very peculiar species is provisionally assigned to the *incarnatus* species group as defined by Chiappini *et al.* (1996).

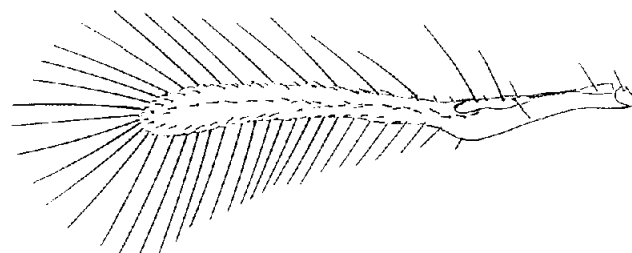


Figure 3. Forewing, V

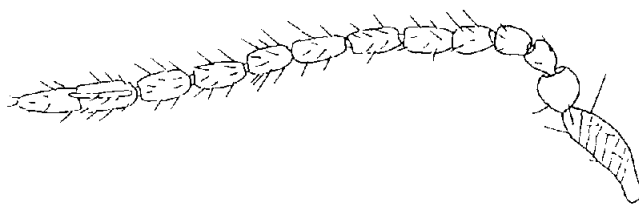


Figure 4. Antenna, M.

Anagrus (Anagrus) takeyanus Gordh

Anagrus takeyanus Gordh: in Gordh and Dunbar, 1977: 85-90.

Anagrus takeyanus Gordh: Chiappini *et al.*, 1996: 575-576.

Type locality: Mt. Carmel, Connecticut, USA.

Distribution: Japan, Mexico (new record), USA (including Hawaii).

Hosts: *Stephanitis pyrioides* (Scott) and *S. takeyai* Drake and Maa (Tingidae).

Material examined: Mexico, Colima, Manzanillo, 8.VIII.1984, G. Gordh, 1 ♀ [UCRC]

Comments: This is the first record of *A. takeyanus* from the Neotropical region. For illustrations and description, see papers by Gordh and Dunbar (1977) and Chiappini *et al.* (1996).

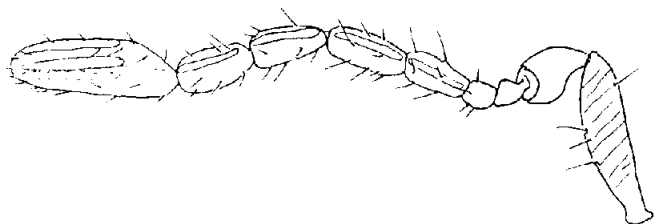


Figure 2. Antenna

Anagrus (Anagrus) frequens Perkins

(Figure 5)

Anagrus frequens Perkins, 1905: 198.

Anagrus frequens Perkins: Sahad and Hirashima, 1984: 58-60.

Anagrus frequens Perkins: Chiappini et al., 1996: 571-572.

Synonyms: *Anagrus armatus* var. *australiensis* Girault.

Type locality: Queensland, Australia.

Distribution: Australia, Colombia (new record), Fiji, Ecuador (new record), Hawaii, Japan, Mexico (new record), Saipan (new record), Thailand (new record), Trinidad (new record).

Hosts: *Peregrinus maidis* (Ashmead), *Perkinsiella saccharicida* Kirkaldy, *Sogatella panicicola* Ishihara (Delphacidae) and *Nephotettix* sp. (new record, Cicadellidae).

Material examined: Colombia, Cauca Valley, IV.1978, J. Pulido, ex. eggs of *Perkinsiella saccharicida*, 19 VV, 2 MM [UCRC]. Ecuador: San Carlos, VI.82, R. Morey, ex. eggs of *Perkinsiella saccharicida* on sugar cane, 14 VV and 1 M [BMNH, UCRC]. Guayaquil, 6.XI.1970, S. H. Risco, ex. eggs of *Perkinsiella saccharicida*, 7 VV [USNM]. Mexico, Colima, Manzanillo, 8.VIII.1984, G. Gordh, 1 V [UCRC]. Trinidad: Curepe, St. Margarita Circular Rd., 9-23.II.1974, F. D. Bennett, yellow pan trap, 1 M; Curepe, CIBC laboratory grounds, 26.II.-13.III.1974, F. D. Bennett, yellow pan trap, 1 V; Valsayn, 12-22.II.1974, M. Yaseen, 1 V [CNCI].

Other material examined: Thailand, Bangkok, 3.II.1967, T. Nishida, ex. *Nephotettix* eggs on rice, 1 V [CISC]. Saipan (Northern Mariana Islands, USA): Chalan Kanoa, 11.XI.1948, R. Doutt, by sweeping grass, 2 VV; same collector [no exact locality], 26.VII.1948, 1 V [CISC].

Comments: Since the females of this species were redescribed and illustrated in detail by both Sahad and Hirashima (1984) (based on Japanese specimens) and Chiappini et al. (1996) (based on Hawaiian specimens), here I only provide the drawing of the male genitalia of *A. frequens* (Figure 5), which have not yet been illustrated in the scientific literature. This mainly Australian and Asian species is probably an accidental immigrant to the Neotropics.

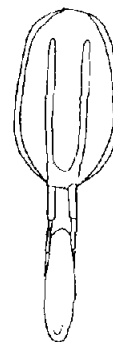


Figure 5. *Anagrus frequens* Perkins: genitalia, M.

Anagrus (Anagrus) erythroneuræ S. Trjapitzin and Chiappini

Anagrus erythroneuræ S. Trjapitzin and Chiappini, 1994: 137-140.

Type locality: Coachella, California, USA.

Distribution: Mexico, USA.

Hosts: *Erythroneura elegantula* Osborn and *E. variabilis* Beamer (Cicadellidae).

Material examined: Mexico, Sonora, Hermosillo, 17.IV.1987, D. González, ex. eggs of *Erythroneura* sp., 1 V [UCRC].

Comments: This species is described in detail and illustrated by Trjapitzin and Chiappini (1994).

Anagrus (Anagrus) gonzalezæ S. Triapitsyn, sp. n. (Figures 6-7)

Diagnosis: This species possesses the unique combination of the following morphological features: F2 of female antenna usually with one sensory ridge and F3-F6 with two sensory ridges each, mesoscutum without a pair of medial setae near notauli, and forewing disc often with a small, narrow bare area in broadest part. The closest species to *A. gonzalezæ* is *A. yawi* Fullaway which has a pair of medial setae on the mesoscutum near the notauli. Otherwise, *A. yawi* is very similar to the new species described below.

Type material: Holotype V on slide labeled: 1. "Honduras, Feo. Morazán, San Antonio de Oriente, El Zamorano, Jan.1994, A. González. Ex. eggs of *Empoasca kraemeri* on *Phaseolus vulgaris*"; 2. "*Anagrus gonzalezæ* S. Triapitsyn V HOLOTYPE USNM" [USNM]. Paratypes: 7 VV and 5 MM on 11 slides; same data as holotype [BMNH, EAPZ].

IEFA, UCRC]; 1 V on slide. Panama, Chiriquí Prov., 2 km W. Cerro Punta, 1700 m. 19.V-8.VI.1977. Peck and Howden [CNCI].

Additional material examined but not included in the paratype list (poor slide mounts): Guiana, Georgetown [Original label: Demerara, East Coast, Pln. Cane Grove], 5.VI.1916, C. B. Williams, "emerged from grass and cane trash". 1 V [BMNH]. Trinidad, Curepe, St. Margarita Circular Rd., 10-24.III.1974, F. D. Bennett, yellow pan trap, 1 V [CNCI].

Description: Female ($n=9$). Color: General coloration of body dark brown with following parts brown or light brown: scape, pedicel and F1 of antenna, distal mesosoma, legs and apex of metasoma.

Head: Antenna (Figure 6) with F1 subcylindrical, about half length of pedicel, F2-F6 subequal (F2 and F3 may be slightly shorter than following segments); F2 usually with one, F3-F6 with two sensory ridges each (F3 sometimes with only 1 sensory ridge), club slightly shorter than combined length of two preceding segments and bears five sensory ridges.

Mesosoma: 0.6-0.8x as long as metasoma. Mesoscutum without a pair of medial setae near notauli. Forewing (Figure 7) shorter than body, 7.3-7.8x longer than wide; with several irregular rows of discal setae, sometimes leaving small bare area in broadest part of blade near posterior margin. Lengths of distal and proximal macrochaetae in ratio 1.6:1.

Metasoma: Ovipositor anteriorly barely overlapping mesophragma and posteriorly slightly exerted beyond apex of metasoma. Ratio of total ovipositor length to length of its exerted part 8-12:1. External plates of ovipositor each with 3 distal setae. Ovipositor: foretibia ratio 2.3-2.4:1.

Measurements ($n=5$): Body: 675 (648-693); Mesosoma: 227 (189-270); Metasoma: 333 (297-369); Ovipositor: 284 (279-292). Antenna: Scape: 90 (84-95); Pedicel: 39 (38-41); F1: 20 (18-24); F2: 52 (51-55); F3: 53 (50-58); F4: 56 (55-58); F5: 56 (55-58); F6: 57 (55-58); Club: 105 (102-106). Forewing: 563 (531-594)/74 (71-77); Proximal macrochaeta: 46 (44-51); Distal macrochaeta: 73 (71-77); Longest marginal cilia: 183 (172-192). Hindwing: 512 (472-526)/20 (18-21). Longest marginal cilia: 150 (134-148). Legs: [given as femur, tibia, tarsus]: Fore: 115 (113-120), 122 (120-124), 176 (168-182); Middle: 107 (106-110), 173 (168-175), 175 (168-182); Hind: 114 (113-117), 192 (186-197), 177 (168-182).

Male ($n=5$). Similar to female except general color darker; forewing wider than in female. Genitalia with hook-like digiti.

Measurements ($n=4$): Body: 626 (585-675). Antenna: Scape: 63 (58-67); Pedicel: 38 (36-40); F1: 46 (40-47); F2: 55; F3: 56 (55-58); F4: 56 (55-58); F5: 56 (54-58); F6: 55 (54-55); F7: 55; F8: 55; F9: 55; F10: 55; F11: 49 (45-54). Forewing: 592 (567-630)/87 (80-91). Genitalia: 146 (139-157).

Host: *Empoasca kraemeri* Ross and Moore (Cicadellidae).

Etymology: The new species is named after the collector, Agripina González Grijalba, as suggested by Ronald Cave who sent me the specimens of *A. gonzalezae* for identification from El Zamorano, Honduras.

Comments: *A. gonzalezae* is a member of the *incarnatus* species group as defined by Chiappini *et al.* (1996).

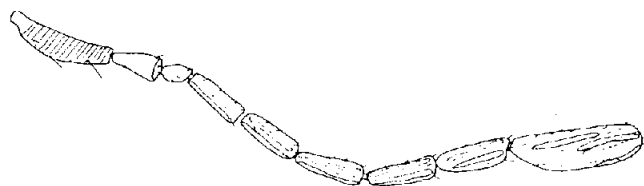


Figure 6. Antenna, V

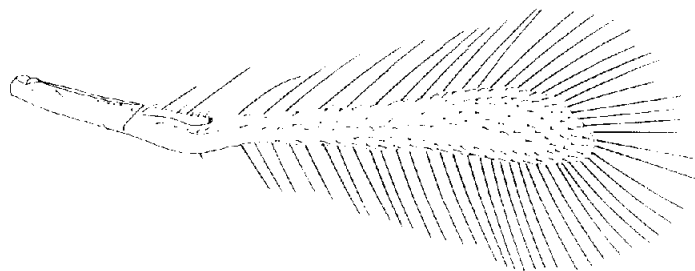


Figure 7. Forewing, V.

Anagrus (Anagrus) breviphragma Soyka
(Figures 8-9)

Anagrus breviphragma Soyka, 1955: 55.

Anagrus breviphragma Soyka: Chiappini, 1989: 105-106
(diagnosis and synonymies, Europe).

Synonyms: *A. longigaster* Soyka, *A. ovipositor* Soyka, *A. silwoodensis* I. Walker, *A. supremus* Soyka, *A. vacuipennis* Soyka.

Type locality: unknown (Chiappini 1989).

Distribution: Argentina (new record), Austria, Brazil (new record), France, Germany, Great Britain, Guadeloupe (new record), Guiana (new record), Italy.

Hosts: *Cicadella viridis* (L.), *Dalbulus maidis* DeLong (Cicadellidae), *Delphacodes kuscheli* Fennah and *Peregrinus maidis* (Ashmead) (Delphacidae).

Material examined: Type material: 1 V paratype of *Anagrus silwoodensis* I. Walker on slide: England, Berkshire, Ascot, Silwood Park, 18.I.1974, I. Walker, ex. egg of *Cicadella viridis* on *Juncus effusus* [BMNH]. Non-type material: Argentina: San Miguel de Tucumán, III.1993, E. L. Dagoberto, ex. *Dalbulus maidis* on corn, 2 VV [IEFA]; San Miguel de Tucumán, [no date], E. Virla, "laboratory (CIRPON) culture on *Dalbulus maidis* eggs of material originated from Argentina, Prov. Salta, Cabeza de Buey", 2 VV [IMLA, UCRC]; Prov. Córdoba, Río Cuarto, 15.XI.1994, E. Virla, "ex. *Delphacodes kuscheli* eggs on oats", 6 VV [IMLA, UCRC]; same as above except 7-15.XI.1994, 3 VV, 1 M [UCRC], Prov. Salta, Cabeza de Buey, 17.V.1994, E. Virla, "ex. *Dalbulus maidis* eggs on corn", 3 VV [UCRC]. Brazil: Minas Gerais, Sete Lagoas, 5.VI.1996, Dalva Santana, "ex. eggs of *Dalbulus maidis* on corn", 7 VV [UCRC]. Guadeloupe: St. François, 13.II.1989, J. Etienne, "ex. egg of *Dalbulus maidis*", 1 V; Petit Bourg Dom. Duclous, 13.VII.1990, J. Etienne, "ex. egg of *Peregrinus maidis*", 2 VV [IEFA]. Guiana: Georgetown [Original label: Demerara, East Coast], 5.VI.1916, C. B. Williams, "emerged from grass and cane trash", 2 VV [BMNH].

Other material examined: Italy: Mortizza, 30.X.1985, E. Chiappini, ex. *Cicadella viridis*, 2 VV; Piacenza, 20.II.1984, E. Chiappini, from eggs on *Carex* sp., 1 M [IEFA].

Comments: This is the first record of *A. breviphragma* from outside of Europe. The identification is based solely on morphological features: however, additional studies, including the use of molecular methods, are needed to demonstrate its correctness. Specimens of this species can be readily available if reared from known hosts both in Europe and South America. For instance, the examined specimens from Argentina are voucher specimens of the unpublished study by Dr. Eduardo Virla of CIRPON, San

Miguel de Tucumán, Argentina. The illustrations provided (Figures 8-9) will help to correctly identify this species when using the above key.

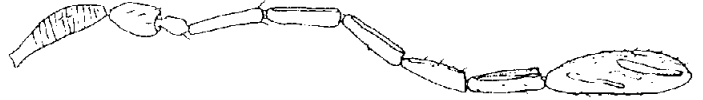


Figure 8. Antenna, V

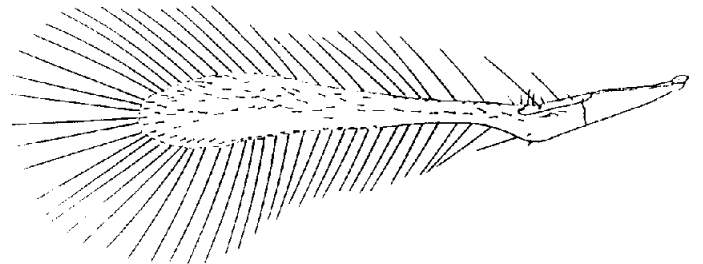


Figure 9. Forewing, V.

Anagrus (Anagrus) incarnatus Haliday

Anagrus incarnatus Haliday, 1833: 347.

A. incarnatus incarnatus Haliday: Debauche 1948: 132-135 (good description and illustrations).

A. pulcher Soyka, 1955: 25; Chiappini, 1989: 113-115 (as *A. incarnatosimilis*).

A. incarnatosimilis Soyka, 1955: 25: **syn. n.**

A. pallidus Foerster sensu Soyka, 1955: 26; Chiappini, 1989: 112-113.

A. pulcherrimus Soyka, 1955: 26; Chiappini, 1989: 113-115 (as *A. incarnatosimilis*).

A. varicolor Soyka, 1955: 26; Chiappini, 1989: 113-114 (as *A. incarnatosimilis*).

A. pallidior Soyka, 1955: 26; Chiappini, 1989: 112-113.

A. neopallidus Soyka, 1955: 26; Chiappini, 1989: 112-113.

A. danicus Soyka, 1955: 26; Chiappini, 1989: 113-115 (as *A. incarnatosimilis*).

A. stenocrani I. Walker, 1979: 198; Chiappini, 1989: 113-115 (as *A. incarnatosimilis*).

A. mutans I. Walker, 1979: 199; Chiappini, 1989: 113-115 (as *A. incarnatosimilis*).

Anagrus incarnatus Haliday; Chiappini, 1989: 112-113 (diagnosis and illustrations).

Anagrus incarnatosimilis Soyka; Chiappini, 1989: 113-115.

Type locality: unknown (Chiappini 1989).

Distribution: Austria, Belgium, ?Chile (Juan Fernandez Islands), Denmark, Finland, Great Britain, Greece, Italy, Japan, Netherlands, Poland, Russia, Turkmenistan (new record).

Hosts: *Cicadella viridis* (L.) (Cicadellidae), *Conomelus anceps* (Germar), *Megamelus notula* (Germar), *Muellerianella fairmairei* (Perris) and *Stenocranus minutus* (F.) (Delphacidae); *Epiophlebia superstes* Selys (Odonata).

Material examined: Type material: 1 V paratype of *Anagrus mutans* I. Walker on slide: England, Berkshire, Ascot, Silwood Park, 11.III.1974. I. Walker, "ex. egg of *Delphacodes fairmairei* on *Juncus effusus*" [BMNH].

Other material examined: England, Cambridgeshire, Woodwalton NNR, 19-28.VII.1978, Fitton and Noyes, 1 V [BMNH]. Japan, Kifune, Kyoto, 23.VI.1995, 4 VV [CNCI, IEFA, UCRC]. Turkmenistan, Ashgabat region, Enev, 14.VII.1993, S. N. Myartseva, pantrap in beet field, 1 V [UCRC].

Comments: The color, lighter in *A. incarnatus* and darker in *A. incarnatosimilis*, seemed to be the only character which separated these two species from each other (Chiappini 1989). However, lighter specimens may occur in *A. incarnatosimilis* from Italy (E. Chiappini, personal communication) as well as from England, where females of *A. mutans* I. Walker were reported to vary in color from light brownish-orange to dark brown (Walker 1979). Moreover, the card-mounted lectotype female of *A. incarnatus* quite possibly faded with time (Graham 1982) and thus appears lighter than in life. Therefore, I have little doubt in synonymizing *A. incarnatosimilis* Soyka and accompanying Soyka's and I. Walker's species of *Anagrus* (i.e., *A. danicus* Soyka, *A. mutans* I. Walker, *A. pulcher* Soyka, *A. pulcherrimus* Soyka, *A. stenocrani* I. Walker, and *A. varicolor* Soyka), all of which were previously

synonymized with *A. incarnatosimilis* by Chiappini (1989) under *A. incarnatus* Haliday.

The specimens of *A. incarnatus* from the Juan Fernandez Islands, Chile reported by De Santis (1979) were not available for my study.

Anagrus (Anagrus) yawi Fullaway

Anagrus yawi Fullaway, 1944b: 57.

Type locality: Los Mochis, Sinaloa, Mexico.

Distribution: Hawaii (USA), Honduras (new record), Mexico.

Hosts: *Empoasca kraemeri* Ross and Moore (Cicadellidae) and *Pycnoderes quadrimaculata* Guérin-Ménéville (Miridae).

Material examined: Type material: Lectotype V, mounted together with 3 MM paralectotypes on slide labeled: 1."April'43 mymarid ex. squash Mexico D. T. Fullaway" (original label); 2."*Anagrus yawi* Fullaway V Lectotype, 3 MM paralectotypes Des. S. Triapitsyn and J. Beardsley, 1995". Paralectotypes: the above 3 MM: 4 VV on separate slide, same data [BPBM]. Non-type material: Honduras, Fco. Morazán, San Antonio de Oriente, El Zamorano, 1.1994, A. González, ex. eggs of *Empoasca kraemeri* on *Phaseolus vulgaris*, 2 VV [UCRC].

Comments: *A. yawi* is redescribed and illustrated in detail by S. V. Triapitsyn and J. W. Beardsley in their revision of the Hawaiian species of *Anagrus* (in review). It is one of the most easily recognizable species of *Anagrus* s. str. (*incarnatus* species group) as it possesses the unique combination of characters of one sensory ridge on F2 of female antenna and a pair of medial setae on the mesoscutum near the notauli.

Anagrus (Anagrus) empoascae Dozier (Figure 10)

Anagrus empoascae Dozier, 1932: 86-87.

Type locality: Damien, Haiti.

Distribution: Brazil (new record), Haiti, Hawaii, Honduras (new record), Mexico (new record), Trinidad (new record).

Hosts: *Empoasca fabalis* (DeLong) and *E. kraemeri* Ross and Moore (Cicadellidae).

Material examined: Type material: Lectotype V, here designated (the left specimen), mounted together with 2 VV

paralectotypes, on slide labeled: 1. "*Anagrus empoascae* Dozier VV reared from red bean foliage infested with *Empoasca fabalis* DeLong Damien, Haiti. Jan.20-1930. H. L. Dozier"; 2. "*Anagrus empoascae* Dozier Type No. U.S.N.M.". Paralectotypes, here designated: the above 2 VV. Paratypes: 8 VV on slide, same label data as above except collection date 22.I.1930 [USNM]. Note: more paralectotype specimens, probably 17 (not examined), may be present in USNM as a part of the type series which contained, according to Dozier (1932), 29 VV (21 co-types and eight paratypes, all mounted in Canada balsam on several slides).

Non-type material: Brazil, Pernambuco, Empresa de Pesquisa Agropecuaria, Estação Experimental de Itapirema, 19.IX.-4.X.1990, J. L. Lins Pereira, ex. eggs of ? *Empoasca kraemeri* on *Vigna unguiculata*, 2 VV, 1 M [CNCI]. Honduras, San Antonio de Oriente, El Zamorano, I.1994, A. González, ex. eggs of *Empoasca kraemeri* on *Phaseolus vulgaris*, 1 V [IEFA]. Mexico, Nuevo Leon, Santiago, Mpio Santiago, Las Tres Blanquitas, 9.VII.1983, G. Gordh, by sweeping, 1 V. Trinidad, Curepe, CIBC laboratory grounds, 26.II.-13.III.1974, F. D. Bennett, yellow pan trap, 1 V [CNCI].

Description: Female ($n=6$, lectotype and paralectotypes). Color: In slide-mounted specimens, general body coloration pale yellow except head, anterior mesoscutum, metasoma and apical flagellum (beyond F1) darker.

Head: Antenna (Figure 10) with scape slightly more than 2x as long as pedicel, F1 subcylindrical, about half length of pedicel, F2 without sensory ridges, usually slightly shorter than following segments but sometimes subequal to F3 or F5, F3-F5 subequal in length and with one sensory ridge each (F4 often slightly longer than F3 or F5), F6 longest of funiculars and bears two sensory ridges, club with five sensory ridges.

Mesosoma: 0.8-1.0x as long as metasoma. Mesoscutum with a pair of medial setae near notauli. Forewing 8.0x (7.8-8.7) longer than wide; several irregular rows of setae in broadest part leave small bare area. Lengths of distal and proximal macrochaetae in ratio 1.4-1.9:1. Marginal fringe with longest cilia 2.5-2.9x the wing width.

Metasoma: Ovipositor barely reaching mesophragma anteriorly and slightly exerted beyond apex of metasoma by about 1/6-1/9 of its total length. External plates of ovipositor each with three distal setae. Ovipositor: foretibia ratio 2.3:1 (2.2-2.4:1).

Anagrus (Anagrus) nigriventris Girault
Anagrus armatus var. *nigriventris* Girault, 1911: 291
Anagrus nigriventris Girault; Chiappini *et al.*, 1996: 581-583.

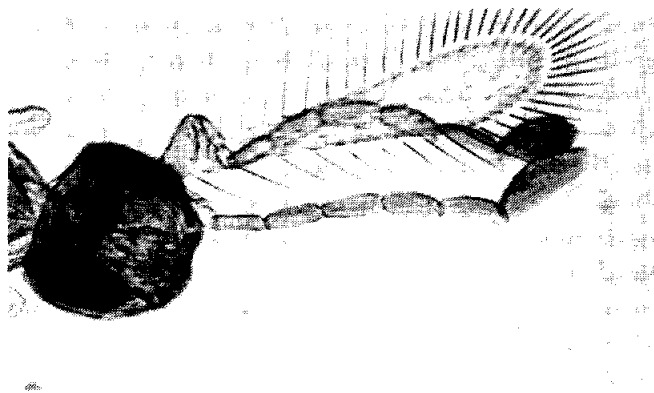


Figure 10. *Anagrus empoascae* Dozier: head, antennae and forewing, V (paralectotype).

Measurements: Body: 518 (494-555); Mesosoma: 194 (179-201); Metasoma: 224 (205-247); Ovipositor: 247(236-255). Antenna: Scape: 77 (76-84); Pedicel: 36 (34-40); F1: 19 (17-20); F2: 44 (40-51); F3: 44 (38-47); F4: 47 (44-48); F5: 45 (38-49); F6: 51 (45-53); Club: 95 (87-99). Forewing: 485 (459-505)/61 (53-65); Proximal macrochaeta: 45 (38-49); Distal macrochaeta: 70 (65-76). Longest marginal cilia: 166 (156-186). Hindwing: 468 (441-498)/19 (17-19). Legs: [given as Femur, Tibia, Tarsus]: Fore: 101 (95-106), 108 (137-148), 148 (144-154); Middle: 88 (84-91), 154 (152-160), 141 (137-148); Hind: 103 (95-110), 165 (160-175), 151 (144-160).

Males of *A. empoascae* appear to be rare: genitalia typical of *incarnatus* species group as defined by Chiappini (1989).

Comments: I have a great deal of difficulty separating *A. empoascae* from *A. epos* Girault. *A. epos* was redescribed recently by Chiappini *et al.* (1996) based on its type material from Illinois, USA. It is possible, after additional specimens of *A. epos* and *A. empoascae* are studied, that these two species will be eventually proven as being conspecific.

To avoid unnecessary repetition, see Chiappini *et al.* (1996) for the list of synonyms, hosts, distribution, and for the detailed description.

Type locality: Centralia, Illinois, USA.

Material examined: México: Nuevo León, Santiago, Mpio Santiago, Las Tres Blanquitas, 9.VII.1983, G. Gordh, by sweeping, 1 V; Nuevo León, El Canida, Mpio Escobedo, 12.VII.1983, F. Reyes and M. Rodríguez, by sweeping, 1 V [CNCI]. Trinidad: Curepe, CIBC laboratory grounds, 26.II.-13.III.1974, F. D. Bennett, yellow pan trap, 1 V; Curepe, St. Margarita Circular Rd., 9-23.II.1974, F. D. Bennett, yellow pan trap, 1 V [CNCI].

Other material examined: Canada, Ontario, 1.5 mi SW Aylmer Catfish Cr., 11.IX.1978, H. Goulet, on *Adiantum pedatum*, 1 V [CNCI]. USA: Arizona, Phoenix, XI.1943, R. Flock, "ex. eggs of *Pycnoderes quadrimaculatus*", 2 VV and 3 MM; same location and collector, XII.1943, 3 VV and 2 MM [BPBM].

Comments: *A. nigriventris* is one of the most common mymarid species in the Nearctic region. The two specimens from Trinidad represent the first record of this species from the Neotropical region. In addition to its rather broad range of cicadellid hosts (Chiappini *et al.* 1996), *A. nigriventris* apparently can also attack eggs of the bean capsid, *Pycnoderes quadrimaculata* Guérin-Méneville (Miridae).

Anagrus (Anagrus) flaveolus Waterhouse
(Figure 11)

Anagrus flaveolus Waterhouse, 1913: 87-88.

?*Anagrus flaveolus* Waterhouse; Dozier, 1932: 86.

Anagrus armatus (Ashmead). De Santis *et al.*, 1988: 93, misidentified.

Anagrus flaveolus Waterhouse; De Santis, 1992: 20-22.

Anagrus flaveolus Waterhouse; Chiappini *et al.*, 1996: 584-586 (redescription and illustration of female antenna).

Type locality: Trinidad.

Distribution: Argentina, Barbados, Brazil, Grenada (new record), Guadeloupe (new record), Guiana (new record), Mexico (new record), Trinidad. I have not been able to examine any material of this species from the other countries listed by De Santis *et al.* (1992) as follows: Bahamas, Cuba, Haiti, Jamaica, Peru, Puerto Rico (USA) and Venezuela.

Hosts: *Dalbulus maidis* DeLong (Cicadellidae), *Delphacodes haywardi* Muir, *Delphacodes kuscheli* Fennah, *Peregrinus maidis* (Ashmead), *Pissonotus* sp., *Toya propinqua* (Fieber) (Delphacidae). Additional hosts (under

laboratory conditions only) are indicated by De Santis *et al.* (1992).

Material examined: Type material: Paratype V on slide labeled: 1. "*Anagrus flaveolus* (Cotype) Waterh. Bred from eggs of *Peregrinus maidis* Trinidad"; 2. "1919-185" [BMNH].

Non-type material: Argentina: San Miguel de Tucumán, E. Virla: 7-30.X.1994, "ex. eggs of *Toya propinqua* on sorghum", 16 VV, 4 MM; [no date], "laboratory culture at CIRPON", 8 VV and 4 MM; VI-VII.1995, "ex. eggs of *Toya propinqua* (laboratory culture at CIRPON)", 3 VV, 2 MM; same as above except 1-2.II.1996, 6 VV, 2 MM; 9.VII.1995, "ex. eggs of *Delphacodes kuscheli* (laboratory culture at CIRPON)", 2 VV, 1 M; VI.1994, "ex. eggs of *Dalbulus maidis* on corn", 4 VV, 6 MM; 20.X-10.XI.1994, "ex. eggs of *Pissonotus* sp. on *Cynodon dactylon*", 2 VV, 2 MM; 20.X-10.XI.1994, "ex. eggs of *Delphacodes kuscheli* and *Toya propinqua* on corn", 4 VV, 1 M; 20.VIII.1995, "ex. eggs of *Toya propinqua* on *Cynodon dactylon*", 3 VV, 1 M; same as above except 12.X-8.XI.1994, 6 VV, 2 MM [IMLA, UCRC].

Comments: The numerous records of *A. flaveolus* or *A. nr. flaveolus* from Asia and adjacent regions do not represent this species (Chiappini *et al.* 1996 for discussion), but in most cases probably correspond to *A. nilaparvatae* Pang and Wang.

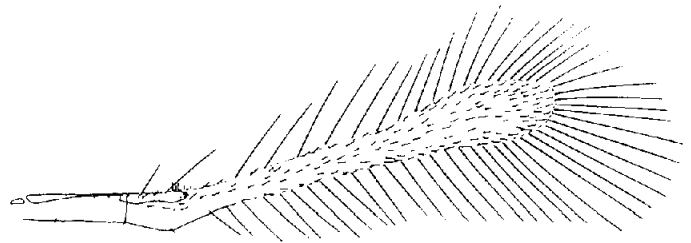


Figure 11. *Anagrus flaveolus* Waterhouse: forewing. V.

Anagrus urichi Pickles
(not included in the key)

Anagrus urichi Pickles, 1932: 204.

Type locality: Trinidad.

Host: *Aeneolamia varia saccharina* Distant (Cercopidae).

Material examined: None.

Comments: I was unable to find material of this species despite many efforts. A. Pickles was a British entomologist working in Trinidad, but none of the major collections in the United Kingdom has any material of *A. urichi*. Pickles (1932) did not mention any type designation. Probably some of Pickles' specimens are still in Trinidad although the two major collections on the island, collections of the IIBC Caribbean Regional Station and of the University of the West Indies, lack any material of this species (M. Morais and Ch. Starr, personal communications). The original description and illustrations do not provide useful information for recognition of this species. For the time being, until the original material is found or fresh specimens are reared from eggs of the same host on sugar cane in the type locality, I consider this species as a *nomen dubium*. For the same reason the record of *A. urichi* from Brazil (De Santis 1979) cannot be confirmed.

Polynema porteri (Brèthes) **comb. n.**

Anagrus Porteri Brèthes, 1917: 82-84.

Type locality: S. Bernardo, Chile.

Distribution: Known only from the type locality in Chile near Santiago.

Hosts: Unknown.

Material examined: Type material: Holotype V on a broken slide, in Canada balsam, mounted more or less dorsally, labeled: 1. "*Anagrus Porteri* Br S. Bernardo Set. 1916 Porter Type"; 2. "or *Barypolynema porteri* (Brth) V Det. A. Ogloblin"; 3. "*Polynema porteri* (Brèthes) V Det. S. Trjapitzin March 1995"; 4. "A 13" [MACN].

Comments: One can easily see, even from the illustrations provided with the original description (Brèthes 1917), that the metasoma in this species is distinctly petiolate. The credit of first noticing this undoubtedly belongs to A. Ogloblin who put his label on the type slide as *Barypolynema porteri* (Brèthes). Here I formalize the new combination by transferring this species to the genus *Polynema* Haliday.

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