

## Neotype Designation for *Anagrus atomus* (Linnaeus) (Hymenoptera: Mymaridae)

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*Abstract.*—A neotype is designated for *Anagrus atomus* (Linnaeus), the type species of the common and widespread fairyfly genus *Anagrus* Haliday (Hymenoptera: Mymaridae). An illustrated description of the neotype specimen, collected at the type locality in Uppsala, Sweden, is provided. The taxonomic status of *A. atomus* is discussed, with particular reference to the closely related species *A. ustulatus* Haliday.

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*Anagrus atomus* (Linnaeus) (Hymenoptera: Mymaridae) is an economically important egg parasitoid of various crop-damaging leafhoppers (Hemiptera: Cicadellidae) in the genera *Arboridia* Zachvatkin, *Edwardsiana* Zachvatkin, *Empoasca* Walsh, *Erythroneura* Fitch, *Neoliturus* Distant, *Zygina* Fieber, and *Zyginidia* Haupt (Vidano and Arzone 1988, Triapitsyn 1998). *Anagrus atomus* has been recorded from numerous leafhopper species, sometimes due to misidentifications of both the host and parasitoid. It is a widely distributed species, present throughout Europe and also in Asia (China, Iran, Israel, Kyrgyzstan, Pakistan, Republic of Korea, Eastern Russia, Turkey, Turkmenistan), America (Argentina, Canada, Chile, USA), Africa (Cape Verde Islands, Egypt), and Australasia (New Zealand) (Triapitsyn and Berezovskiy 2004). Probably it was unintentionally introduced into countries such as Argentina, Chile, and New Zealand.

Linnaeus described *Ichneumon atomus* in 1767. His very brief description (p. 941), in which he specified that the habitat is Uppsala, translated from Latin, is: “it is variegated pale and fuscous, it is smaller than *Acarus sirene*, so small that it is visible

only when moving and it can be numbered among the smallest winged insects”. This description of course could fit any small, pale microhymenopteran in several families. Therefore, a study of its type is needed but unfortunately, as Fitton (1978) and Graham (1982) stated, it is not present in the collection of Linnaeus owned by the Linnean Society of London, England.

When Haliday (1833) defined the genus *Anagrus* he included two new species (*A. ustulatus* and *A. incarnatus*) and designated *Ichneumon atomus* as the type species of *Anagrus* but did not specify whether he had studied its type or not. His redescription of *A. atomus* is as brief as that of Linnaeus. Besides measurements of the body and the wings, he only stated that the head, the apex of the antennae, the prothorax and the “anus” are fuscous while the wings are hyaline and have a beautiful fringe.

Bakkendorf (1926) synonymized almost all the previously described species of *Anagrus* under *A. incarnatus*. Debauche (1948), in contrast, re-established *A. atomus* as a valid species and redescribed it. He also synonymized *A. ustulatus* under *A. atomus*, unfortunately without mentioning

whether or not he had examined Haliday's or Linnaeus' types (we suppose that he hadn't).

Chiappini (1987) redescribed *A. atomus* based on specimens from the Debauche collection and also on other specimens she captured in traps and reared from grape leaves in Italy, all of which were identified as *A. atomus* in accordance with the earlier concepts of this species (Debauche 1948, Viggiani 1970, Graham 1982). She did not designate a neotype, as, at that time, the case could not be included in the "circumstances admitted" specified in article 75 of the International Code of Zoological Nomenclature (1985). Besides, her 1987 publication was not a "revisory work", and the type of *A. atomus* could still be in Uppsala (Graham 1982). In the same paper (Chiappini 1987), based on ecological as well as morphological features, she recognized another distinct, then unnamed species which subsequently (Chiappini 1989) proved to correspond to *A. ustulatus*. By then Graham (1982) had already reinstated *A. ustulatus* as a valid taxon, designated a lectotype for it, and stated that it differed from *A. atomus* by its darker coloration, wider fore wings and, in females, by different proportions of the funicle articles.

Lately, some doubts have been raised whether *A. ustulatus*, the most closely related species to *A. atomus*, is really a different species because definitions of both taxa seemed uncertain, largely due to unavailability of the type material of *A. atomus*. In addition, other circumstances have changed since Chiappini (1987) published the first paper on the subject. First, a lot of revisory papers on *Anagrus* were published by Chiappini (1989), Chiappini et al. (1996), Chiappini and Lin (1998), Triapitsyn (1997, 1998, 1999, 2001), and Triapitsyn and Beardsley (2000). Second, Mats Eriksson (curator of the Zoology Section) and Hans Mejlun (curator of the entomological collections) thoroughly searched the Linnaeus collection at the Museum of Evolution (Uppsala Universi-

ty), but were "unable to find anything like Mymaridae in their holdings" (M. Eriksson, pers. comm.). Third, specimens according to Haliday's (1833) brief redescription as well as to Debauche's (1948) and Graham's (1982) concept of *A. atomus* were captured in Uppsala, Sweden, the type locality of *Ichneumon atomus*, by Fredrik Ronquist, formerly of the Department of Systematic Zoology, Evolutionary Biology Centre, Uppsala University. Several other *Anagrus* species were also captured at the type locality (Triapitsyn and Berezovskiy 2004) but, of these, the only species belonging to the *atomus* species group (Chiappini 1989) was *Anagrus ustulatus* (see Comments for the diagnosis).

Therefore, considering that the identity of *A. atomus* has long been in doubt, that no specimen(s) of *Ichneumon atomus* are present in either the Linnaeus collections at Uppsala or London, that no neotype has ever been designated for the type species of *Anagrus*, that all described species of this genus (for which type specimens exist) have been carefully revised by us, and that fresh material from the original type locality is available, it now seems appropriate to designate here a neotype for *A. atomus* (Linnaeus). Its description follows; an abbreviation used in the text is: F = an antennal funicle article.

#### *Anagrus (Anagrus) atomus* (Linnaeus)

(Figs 1–3)

*Ichneumon atomus* Linnaeus, 1767: 941.

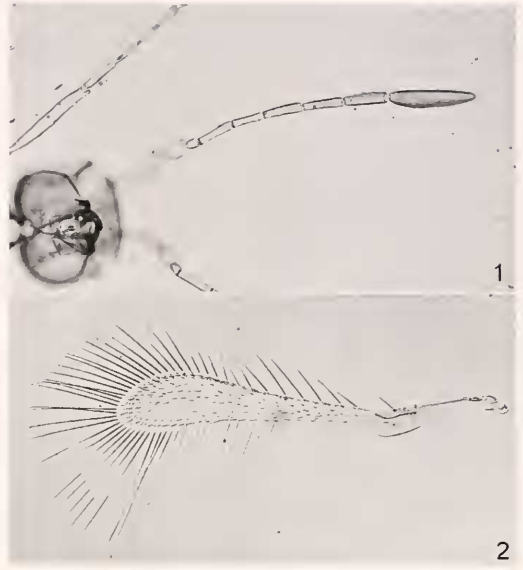
*Anagrus atomus* (Linnaeus): Haliday, 1833: 347; Chiappini, 1989: 102–104 (diagnosis, synonyms, and list of earlier citations); Triapitsyn and Berezovskiy, 2004 (distribution).

*Type material*.—Neotype female of *Ichneumon atomus* Linnaeus, 1767, here designated in accordance with ICZN Article 75 (ICZN 1999), on slide, labelled: 1. "*Ichneumon atomus* Linnaeus, 1767 = *Anagrus atomus* (Linnaeus 1767) (Hymenoptera: Mymaridae) NEOTYPE [female symbol] Des. by S. Triapitsyn & E. Chiappini

2003"; 2. "SWEDEN: Uppsala, Hågadalen, 26.viii-5.ix.1990, F. Ronquist, MT baited with rotten meat. Mounted at UCR/ERM by V. V. Berezovskiy 2002 in Canada balsam". The neotype was borrowed from the Canadian National Collection of Insects, Ottawa (CNCI). By agreement with John Huber at the CNCI the neotype will be deposited in the Museum of Evolution, Uppsala University, Uppsala (UZIU). The neotype is in good condition, mounted in Canada balsam under two coverslips, one containing the wings (detached from the body), and the other the rest of the body (cleared in KOH prior to slide mounting).

*Other material studied.*—Three other specimens of *A. atomus* were collected at or near the same locality as the neotype. Their collection data and depositories are as follows: 1 female on slide [CNCI]; SWEDEN: Uppland Uppsala, Hågadalen, 17-26.viii.1990, F. Ronquist, MT. 1 female on card [CNCI]; SWEDEN: Uppsala, Hågadalen, 26.viii-5.ix.1990, F. Ronquist, MT baited with rotten meat (same data as the neotype). 1 female on card [Entomology Research Museum, University of California, Riverside, California, USA (UCRC)]; SWEDEN: Uppland Uppsala, Eriksberg, 30.vii-11.viii.1986, F. Ronquist, MT/PT. Two females and a male in the Oxford, England, part of the Haliday collection, labelled respectively as W21 "*Anagrus atomus* Linn Haliday Coll.", W20, and W16 were also examined.

*Description.*—**Color:** Head brown, except vertex mostly light brown (stemmaticum brown), eyes and ocelli red; scape and pedicel light brown, flagellum brown (apical flagellomeres slightly darker); pronotum, posterior half of mesoscutum, anterior scutellum, metanotum and propodeum light brown, anterior half of mesoscutum and axillae brown, posterior scutellum pale; wing venation brown; legs light brown (tarsi a little darker); gastral terga brown, with light brown membranous bands between them.



Figs 1-2. *Anagrus atomus* (Linnaeus), neotype female. 1. Antenna. 2. Fore wing.

**Head:** About as wide as mesosoma. Antenna (Fig. 1) sparsely setose; scape 3.6 x as long as wide and 2.2 x as long as pedicel; F1 oval, much shorter than pedicel and shortest of funicle articles; F2 a little longer than F3 and slightly shorter than F4 or F5 which are equal in length, F6 longest and broadest of funicle articles; longitudinal sensilla on F4 (1), F5 (1) and F6 (2); clava a little longer than two preceding articles combined, with three longitudinal sensilla positioned subapically.

**Mesosoma:** A little shorter than metasoma. Mesoscutum finely longitudinally striate, without adnotaular setae. Fore wing (Fig. 2) 6.8 x as long as wide; distal macrochaeta about 2.5 x length of proximal macrochaeta; fore wing blade slightly infuscated behind venation but otherwise hyaline, with distinct bare area in broadest part next to posterior margin, discal microtrichia arranged in 3 or 4 irregular rows; longest marginal cilia 2.9 x maximum fore wing width. Hind wing hyaline; disc with a few microtrichia at apex and a row of microtrichia along posterior margin.

**Metasoma:** Ovipositor almost reaching mesophragma anteriorly and a little ex-



Fig. 3. *Anagrus atomus* (Linnaeus), female (from egg of a grape leafhopper, *Verago*, Piacenza, Italy).

served beyond apex of gaster posteriorly (by about 1/15 of its total length). External plates of ovipositor with one seta each. Ovipositor length/ foretibia length 1.9:1.

Measurements (in micrometers,  $\mu\text{m}$ ).—Body length (taken before slide mounting) 559; head length/width (length taken before slide mounting) 100:161; mesosoma 209; metasoma 281; ovipositor 236. Antenna: scape 75; pedicel 34; F1 17; F2 44; F3 39; F4 48; F5 48; F6 52; clava 107. Fore wing length/width 546:80; longest marginal cilia 233. Hind wing length/width 500:23; longest marginal cilia 179. Legs (given as coxa, trochanter, femur, tibia, tarsus): fore 66, 42, 130, 124, 155; middle 48, 39, 124, 173, 158; hind 70, 40, 120, 188, 164.

*Diagnosis*.—*Anagrus atomus* can be distinguished from all other species of the *atomus* species group, as defined by Chiappini et al. (1996), by the following combination of features: F3 without longitudinal sensilla, F4 longer than the previous articles and bearing one longitudinal sensillum, F2 and F3 together much longer than F6, at least by half their combined length, mesoscutum without adnotaular

setae, hairless area present only at broadest part of fore wing, and fore wing length/width less than 10.

*Comments*.—Specimens of *A. atomus* from vineyards in southern Europe (e.g., Italy and France) may show a different color pattern on the gaster, with the terga from about fourth to seventh yellow (Fig. 3), whereas the northern forms appear to be slightly darker or more uniformly colored.

The three specimens labeled as W21, W20, and W16 in the Oxford part of the Haliday collection clearly belong to *A. atomus*, as correctly stated by Graham (1982).

We also re-examined the lectotype male of *A. ustulatus* Haliday (n 70), together with the two female specimens (n 72 and 73) under this name in the Haliday collection at the National Museum of Ireland, in Dublin, in order to verify the possible synonymy of *A. ustulatus* under *A. atomus*. The lectotype agrees with what had already been stated by Graham (1982) and Chiappini (1989); namely, the ratio between the lengths of the macrochaetae on the fore wing marginal vein is greater than two, the fore wing has a hairless area on the disc, and it is very wide compared to that of *A. atomus*. The male genitalia, which had already been studied by Chiappini (1989) who stated (contrary to Graham) that they were typical of the *atomus* species group, were not checked again because to do so would require ungluing the type specimen. In contrast to the lectotype of *A. ustulatus* the ratio between the lengths of the macrochaetae is less than two in the females n 72 and 73, as is typical of members of the *incarnatus* species group of *Anagrus*. Therefore, these two females cannot be conspecific with the lectotype of *A. ustulatus* as they belong to a different species group. In addition, the fore wings of females n 72 and 73 are narrower and without a bare area on the disc and F2 is the longest, unlike either *A. atomus* or *A.*



*ustulatus*. Specimens n° 72 and 73 belong to *A. incarnatus*, according to the most recent concept of this species (Triapitsyn 1997).

Therefore, the species concept for *A. ustulatus* should be based only on the lectotype designated by Graham (1982). This male has fore wing proportions different from *A. atomus* males but equal to those of the males of the *Anagrus* species found on bramble and rose (Chiappini 1987) and whose females differ from those of *A. atomus* by F4 being as long as F3 and without longitudinal sensilla (Chiappini 1989), and by the fore wing being wider. Many other data, both ecological (Chiappini 1987) and chemical, support the separation of *A. atomus* from *A. ustulatus*. For example, the cuticular hydrocarbon patterns in these two species differ considerably, as the second species displays a notable amounts of alkenes not present in the first's pattern (Floreani et al. in prep.). On the basis of this knowledge, we treat *A. ustulatus* as specifically distinct from *A. atomus*, even though we know that more studies, particularly of field populations of *Anagrus*, are needed to better characterize these two species.

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