A NEW ANAGRUS (HYMENOPTERA: MYMARIDAE),
EGG PARASITOID OF PROKELISIA SPP.
(HOMOPTERA: DELPHACIDAE)

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Abstract.—Anagrus sophiae S. Trjapitzin, NEW SPECIES, is described and illustrated on the
basis of a type-series from California and Florida. This species is a common egg parasitoid of
the planthopper Prokelisia marginata (Van Duzee) that feeds on salt marsh cordgrass, Spartina
alterniflora Loisel, in salt marshes along the Atlantic, Gulf, and Pacific Coasts of the United
States, and S. foliosa Trinius on the Pacific Coast. The new species also parasitizes eggs of P.
dolus Wilson in Florida. Differences in the biology as well as variability of some morphological
characters of A. sophiae are discussed based on a comparative study of the two populations from
California and Florida. The new species is compared with A. delicatus Dozier.

Key Words.—Insects, Delphacidae, Prokelisia spp., Mymaridae, Anagrus sophiae NEW SPE-
CIES, egg parasitoid

The sibling planthopper species of Prokelisia (Homoptera: Delphacidae), P. marginata (Van Duzee) and P. dolus Wilson, are common phloem feeders of the
cordgrass Spartina alterniflora Loisel (Poaceae) in estuaries on the Atlantic sea-
board and the Gulf of Mexico. In California, P. marginata feeds upon the native
cordgrass S. foliosa Trinius, which is distributed as far north as Bodega Bay in
Sonoma Co. The host planthoppers and their egg parasitoid Anagrus sophiae new
species (Hymenoptera: Mymaridae) are also found on S. alterniflora that was
introduced into San Francisco Bay in the mid 1970s (Daehler & Strong 1994).
Probably because of the lack of native Spartina species in estuaries north of Bodega
Bay, neither A. sophiae nor its host planthopper species occur upon the introduced
populations of S. alterniflora at Florence, Oregon, or in Willapa Bay and Puget
Sound, Washington.

A. sophiae new species (= A. delicatus Dozier of authors, misidentification) is
a common egg parasitoid of Prokelisia planthoppers (Stiling & Strong 1982, Ant-
tolin & Strong 1987, Cronin & Strong 1990). A. sophiae has an extremely dis-
tinctive geographical distribution, very long and narrow, that rings North America
in marine salt marshes where its hosts occur. Our study of this parasitoid has
demonstrated that it represents a distinct morphospecies of Anagrus different
from A. delicatus. The latter species was originally described by Dozier (1936)
from a single female specimen (holotype) and a male allotype swept from along
a creek bed near Elizabethtown, Illinois.

Investigative responsibilities have been divided between authors such that Trja-
pitzin worked on taxonomic aspects and Strong provided natural history informa-
tion about the new species. Terminology for morphological features is that of
Chiappini (1989). Measurements are given in micrometers (μm), with the mean
followed, in parentheses, by the range.
**Depositories.**—Abbreviations for depositories are: CNCI, Canadian National Collection of Insects, Ottawa; INHS, Illinois Natural History Survey, Centralia; UCRC, University of California, Riverside; USNM, National Museum of Natural History, Washington, D.C. An abbreviation used in the description is: F = funicular (flagellar in males) segment.

**Anagrus sophiae** S. Trjapitzin, NEW SPECIES

**Types.**—Holotype: female, labelled: 1. “Anagrus sophiae S. Trjapitzin HOLOTYPE female”; 2. “USA. FLORIDA. WAKULLA Co.: Oyster Bay, Dec. 1988, D. Strong, ex. Prokelisia marginata on Spartina alterniflora”. Holotype deposited in USNM. Paratypes: USA. FLORIDA. WAKULLA Co.: same data as holotype, 2 females, 1 male [UCRC]; same data, 1 female, 1 male [CNCI]; same data, 1 male [USNM]; same data but Mar 1981, 1 female, 1 male [USNM]. CALIFORNIA. SAN FRANCISCO Co.: San Bruno Marsh, behind SamTrans bus terminal, Jul 1992, D. Strong, Prokelisia marginata on Spartina alterniflora, 3 females, 1 male [UCRC]; same data, 1 female [CNCI]; same data, 1 female [USNM].

**Female.**—(n = 10) Color: body light brown; with head, F2–F6, club, mesoscutum, and metasomal terga usually slightly darker; eyes dark brown. Head: about as wide as mesosoma or slightly narrower. Antenna (Fig. 1) sparsely setose, moderately short for genus; pedicel slightly more than 2× as long as F1 which is shortest of funicle; F2 longest of funicle; F3 and F4 subequal, without sensory ridges; F5 shorter than F3, F4, or F6, generally without sensory ridges, but sometimes with a small sensory ridge in some specimens; F6 slightly shorter than F2 but longer than F3–F5, bearing two sensory ridges; club with five sensory ridges. Mesosoma: 0.62 (0.53–0.69) × as long as metasoma. Mesoscutum with a pair of setae near notaulices. Forewing (Fig. 2) slightly shorter than body; 10.0 (9.2–10.6) × longer than wide; with three to five irregular rows of setae at broadest part, setae uniformly distributed on disk. Lengths of distal and proximal macrochaetae in ratio 2:4:1 (1.8–2.8:1). Marginal fringe with longest cilia more than 3× but less than 4× the wing width. Hindwing disk asetose except a complete row of small setae along posterior margin and another incomplete row along anterior margin on distal half. Metasoma: Ovipositor moderately long, generally markedly exserted beyond apex of metasoma, but in Californian specimens only slightly exserted. Ratio of total ovipositor length to length of its exserted part 9:1 (5–15:1). External plates of ovipositor each with three setae. Ovipositor: foretibia ratio 3.1:1 (2.7–3.8:1). Measurements.—Body: 743 (646–796) µm; Head: 117 (95–133) µm; Mesosoma: 234 (198–275) µm; Metasoma: 378 (338–403) µm; Ovipositor: 363 (293–445) µm. Antenna: Scape: 73 (63–76) µm; Pedicel: 42 (38–46) µm; F1: 20 (17–23) µm; F2: 54 (49–61) µm; F3: 46 (38–53) µm; F4: 47 (40–55) µm; F5: 44 (38–51) µm; F6: 51 (46–59) µm; Club: 98 (91–103) µm. Forewing: Length: 548 (494–597) µm; Width: 55 (48–65) µm; Venation: 165 (152–179) µm; Marginal vein: 46 (42–53) µm; Hypochaeta: 34 (32–38) µm; Proximal macrochaeta: 33 (27–42) µm; Distal macrochaeta: 76 (68–84) µm; Longest marginal cilia: 202 (186–217) µm. Hindwing: Length: 515 (471–567) µm; Width: 19 (15–22) µm; Venation: 142 (133–152) µm; Longest marginal cilia: 144 (133–152) µm. Legs: Given as Femur, Tibia, Tarsus: Fore legs: 114 (106–124) µm, 117 (109–125) µm, 152 (137–160); Middle legs: 96 (91–103) µm, 160 (146–175) µm, 137 (122–148) µm, Hind legs: 101 (91–108) µm, 191 (171–209) µm, 160 (152–167) µm.

**Male.**—(n = 5) Similar to female except general body coloration slightly lighter; forewing usually slightly wider (length: width ratio 9:1 (8.8–10.0:1), with disk more densely setose than in female. Genitalia typical for incarnatus species group (Chiappini 1989). Measurements.—Body: 675 (570–760) µm. Antenna: Scape: 68 (61–72) µm; Pedicel: 42 (41–42) µm; F1: 38 (34–43) µm; F2: 56 (49–63) µm; F3: 53 (48–57) µm; F4: 54 (49–57) µm; F5: 54 (49–58) µm; F6: 54 (49–58) µm; F7: 54 (49–57) µm; F8: 55 (49–61) µm; F9: 56 (49–61) µm; F10: 56 (51–61) µm; F11: 57 (51–65) µm. Forewing: Length: 587 (532–608) µm; Width: 64 (53–68) µm. Genitalia: 150 (129–163) µm.

**Diagnosis.**—This species is easily distinguished from all other described Ne-arctic species (i.e., A. armatus (Ashmead), A. columbi Perkins, A. delicatus Dozier, A. epos Girault, A. nigriventris Girault, A. nigriceps Girault, A. puella Girault, and
A. takeyanus Gordh) of the incarnatus group of Anagrus s. str., as defined by Chiappini (1989), by the lack of sensory ridges on F4 of the female antenna. A. sophiae also differs from A. delicatus Dozier by a combination of the following morphological features: relatively short antennae (long in A. delicatus); mesoscutum with a pair of setae near notaulices (apparently absent in A. delicatus); external plates of ovipositor each with three setae (two in A. delicatus); and much lower ovipositor: foretibia ratio (about 4.7:1 in A. delicatus). The latter species will be redescribed and illustrated by the senior author in a separate paper.

Etymology.—The specific name "sophiae" meaning "wise" was chosen to describe the astute oviposition behavior of this insect (Cronin & Strong 1993).

**Comments**

*Anagrus sophiae* new species belongs to the *incarnatus* species group of the subgenus *Anagrus* s. str. whose females are characterized by the following two morphological features: five sensory ridges on the club, and external plates of the ovipositor each with two or three setae (Chiappini 1989). Unlike the majority of species from this group, which have the ratio of lengths of the two macrochaetae on forewing venation lower than 2.0:1, this ratio in *A. sophiae* is generally slightly greater than 2.0:1.

The comparative study of some morphological characters in specimens of *A. sophiae* collected in California (San Francisco Bay, San Francisco Co.) and Florida (Oyster Bay, Wakulla Co.) has shown that considerable difference exists between these two populations. The examined female Californian specimens (*n = 5*) of the new species are characterized by generally smaller body size and a combination of the following morphological features: antenna with shorter funicular segments, ovipositor length 315 (293–331) µm, ovipositor: foretibia ratio 2.8:1 (2.7–2.9:1), ratio of total ovipositor length to length of its exserted part 12:1 (10–15:1); contrasting with the specimens collected in Florida (*n = 5*) which have longer funicular segments of female antenna, ovipositor length 410 (350–445) µm, ovipositor: foretibia ratio 3.4:1 (2.9–3.8:1), and ratio of total ovipositor length to length of its exserted part 6:1 (5–8:1). No significant difference has been found in proportions of funicular segments of female antenna between the populations from these two localities.

Despite the existing differences of the above-mentioned morphological characters in the two populations of *A. sophiae*, the reasons for which are not clear, we have very little doubt that the parasitoids of *Prokelisia* spp. from California and Florida belong to the same species of *Anagrus*. Both populations share the same or very closely related insect and plant hosts found in the similar habitats. Further, considerable intraspecific variation in body size, as well as in some other morphological features such as length of ovipositor, are not uncommon among the species of *Anagrus* and some other genera of the Mymaridae. For instance, considerable morphological differences on a host or geographical basis are known in *A. flaveolus* Waterhouse (Claridge et al. 1988; E. Chiappini, S. V. Trjapitzin & A. Donev, unpublished data) and *A. nigriventris* Girault (SVT, unpublished data).

Conducting cross-breeding experiments between individuals from these two populations of the new species would be very helpful to complement our morphological study and demonstrate conclusively that the two populations belong indeed to only one species. However, the existing differences in the type of reproduction between the two populations of *A. sophiae* make such experiments very difficult to conduct: whereas the Floridian population reproduces by arrhenotoky (Cronin & Strong 1990), the Californian population displays thelytoky, with no males found in the natural population and no mating occurring in laboratory cultures (DRS, unpublished data). Again, such differences in the biology of *Anagrus* species are not unusual. For instance, Claridge et al. (1988) reported that
different populations of *A. perforator* (Perkins) are arrhenotokous in Sri Lanka, but thelytokous in the Philippines. According to Claridge et al. (1988), populations of *A. optabilis* (Perkins) from Philippines and Sri Lanka are thelytokous, whereas Japanese populations of this species reproduce by both gamogenesis and arrhenotokous parthenogenesis (Sahad & Hirashima 1984). Furthermore, Asian *A. optabilis* show different morphological characters of larvae from those of Hawaii (Sahad & Hirashima 1984).

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**LITERATURE CITED**


