

## Neotropical Eucoilidae (Cynipoidea) Associated with Fruit-infesting Tephritidae, with New Records from Argentina, Bolivia and Costa Rica

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**Abstract.**—Host and distribution records are presented for five species of Neotropical Eucoilidae (Hymenoptera: Cynipoidea) reared in association with fruit-infesting Tephritidae. All previously recorded tephritid host associations for New World species are critically reviewed with the conclusion that several of these records are doubtful. Members of the genera *Aganaspis* and *Odontosema* are confirmed as parasitoids of *Anastrepha* and *Ceratitis*. Based on isolated puparia, *Dicerataspis* and *Lopheucoila* are recorded as parasitoids of Drosophilidae and Lonchaeidae, respectively. It is suggested that *Dicerataspis* is unlikely to attack Tephritidae, and records of *Lopheucoila* from Tephritidae require confirmation. One new species reared from Tephritidae, *Aganaspis nordlanderi* Wharton, is described.

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The Eucoilidae are solitary endoparasitoids that oviposit in the larval stage of cyclorrhaphous Diptera and emerge as adults from the host puparium. Several eucoilid species have been implicated as important natural enemies of different phytophagous dipteran species (Wishart and Monteith 1954, Harding 1965, Valladares et al. 1982, Johnson 1987), and two species have been used for the biological control of fruit fly pests (Clausen 1978). The Asian species *Aganaspis daci* (Weld) has been introduced to the New World, and the Neotropical endemic *Aganaspis pelleranoi* (Brèthes) was reared and released from 1941 to 1945 in several areas of Tucumán, Argentina (Nasca 1973). At present, *A. pelleranoi* is being mass-produced in Metapa de Dominguez, Chiapas, Mexico (Ruiz et al. 1996).

Members of the genus *Aganaspis* are the only eucoilids thus far utilized in biological control efforts against Tephritidae. The two species involved, *A. daci* and *A. pelleranoi*, are also the only eucoilids attacking tephritids for which biological infor-

mation other than host records has been published. Different aspects of the basic biology of *A. daci* were studied in the laboratory associated with programs directed against *Bactrocera dorsalis* (Hendel) in Hawaii (Clausen et al. 1965) and *Anastrepha suspensa* (Loew) in Florida (Nuñez-Bueno 1982). This species has also been introduced to Mexico (Jimenez-Jimenez 1956) and Costa Rica (Wharton et al. 1981, Jiron and Mexzon 1989). Establishment in Mexico and Costa Rica is doubtful, but in Florida it is established on *Anastrepha suspensa* (Loew), though in low numbers (Baranowski et al. 1993). A detailed biology of *A. pelleranoi* was given by Ovruski (1994a, 1994b).

The aim of this note is to provide preliminary information on the diversity of eucoilid species associated with tephritid fruit flies in the Neotropics, and clarify the status of species previously recorded as tephritid parasitoids. While several species have been associated with tephritids, few of these have been reared from puparia that were sufficiently isolated to enable



verification of the host. Data presented here are based on surveys of tephritid parasitoids and on literature records.

## MATERIALS AND METHODS

Fruits damaged by tephritid larvae were collected from 1991 to 1994 in Tucumán, Catamarca and La Rioja provinces in northwestern Argentina, and from August, 1979 through November, 1982 in the provinces of Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas, and San José in Costa Rica. Additional eucoilid specimens were also received from Bolivia, and all reared material housed in the U. S. National Museum of Natural History, Washington, D. C. (USNM) was examined. Samples collected in Argentina and Costa Rica consisted of fallen fruit and fruit still on the tree. In Argentina, fruit samples were placed in styrofoam boxes with damp sand in the bottom as a pupation substrate. Fruit fly puparia were recovered weekly and transferred to a closed wooden box for holding until emergence of flies or parasitoids. The procedure differed slightly for the samples from Costa Rica (Wharton et al. 1981), where 81,279 puparia were isolated (most of them in individual vials) for verification of host records. Tephritids of the genera *Anastrepha* Schiner and *Ceratitis* MacLeay (or their parasitoids) accounted for 69,012 of these puparia, with *C. capitata* representing 64.8% of the total tephritids. Lonchaeidae (also discussed below) were represented by 4583 puparia.

Specimens reported on here are housed at Museo de La Plata, Argentina (MLP), Museo de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina (MBR), Instituto Fundación Miguel Lillo, Tucumán, Argentina, Texas A&M University, College Station (TAMU), and USNM. Measurements for the description of the new species are as described by Nordlander (1978, 1982).

## RESULTS AND DISCUSSION

Several species of Eucoilidae, representing at least five genera, have been reared in association with fruit-infesting tephritids. Most of the species are almost certainly attacking other Diptera associated with ripe and decomposing fruit (e.g. Drosophilidae, Lonchaeidae, Phoridae, Neriidae). We have verifiable host records from Tephritidae for *Aganaspis* and *Odonotosema*. The published records for *Dicertaspis*, *Lopheucoila*, *Rhoptomeris*, and *Trybliographa* attacking tephritids in the New World need confirmation. Species of the genus *Leptopilina*, well-known parasitoids of Drosophilidae, may also be reared commonly from rotting fruit. Though Drosophilidae tend to colonize fruit after tephritids, fallen, broken fruit may have more rapidly decaying portions inhabited by Drosophilidae at the same time as more sound portions still inhabited by tephritid larvae. Since fruit is often collected and reared in bulk, it is easy to obtain parasitoids of both Drosophilidae and Tephritidae, for example, from the same sample. Unless puparia are isolated individually, correct host associations cannot be made.

These seven genera may be separated by the characters in Table 1. Additionally, *Lopheucoila* is unique within this group of genera in having a small spine on the dorsal plate of the scutellum and longitudinal ridges on the mesoscutum. See also papers by Weld (1952), the updated classification by Nordlander (1978, 1980, 1981) and the description of *Aganaspis* by Lin (1987).

### *Aganaspis* Lin

The genus *Aganaspis* was relatively recently described (Lin 1987) to accommodate four species from southeast Asia (Taiwan and Malaysia). One of these species, *A. daci* (Weld), was originally described in *Trybliographa* (Weld 1951b) but its generic placement had always been problematic (Kerrich and Quinlan 1960, Nordlander 1981). *Aganaspis daci* is the only one of the



Table 1. Genera of Eucilidae reported from fruit-infesting Tephritidae in the Neotropics compared with *Leptopilina*, parasitoids of Drosophilidae commonly reared from the same fruits.

Genus	Scutellar disc posteriorly in dorsal view	Fore wing	Posterior-dorsal margin of pronotal plate	4th antennal segment (2nd flagellomere) of male	Anterior and posterior parts of pronotal plate fused or separate laterally
<i>Aganaspis</i>	rounded or truncate or weakly bilobed	distinctly setose	protruding above anterior margin of mesoscutum; deeply concave medially	$4 \leq 3$ not bent	widely to narrowly separated
<i>Dicerataspis</i>	bifurcate, with 2 tooth-like lobes directed posteriorly	distinctly setose	weakly protruding above anterior margin of mesoscutum; undulant, with 4 rounded lobes	$4 < 3$ not bent	contiguous or narrowly separated
<i>Lopheucoila</i>	weakly dentate, with 4 lobes; somewhat truncate	bare or nearly so	protruding above anterior margin of mesoscutum; deeply concave medially	$4 < 3$ not bent	fused or contiguous
<i>Odontosema</i>	bifurcate, with 2 tooth-like lobes directed posteriorly	bare or nearly so	protruding above anterior margin of mesoscutum; deeply concave medially	$4 < 3$ not bent	fused or contiguous
<i>Rhoptromeris</i>	rounded or truncate	distinctly setose	not protruding above anterior margin of mesoscutum; evenly rounded or very weakly concave medially	$4 > 3$ bent outwardly	fused
<i>Trybliographa</i>	rounded or truncate	distinctly setose	not protruding above anterior margin of mesoscutum; evenly rounded or very weakly concave medially	$4 \leq 3$ not bent	fused
<i>Leptopilina</i>	rounded or truncate	distinctly setose	not protruding above anterior margin of mesoscutum; evenly rounded or very weakly concave medially	$4 > 3$ usually bent	widely separated



four originally included species for which hosts have been recorded. Nordlander (in litt.) suggested that the New World species *pelleranoi* should also be placed in *Aganaspis*. This transfer was made by Ovruski (1994a), bringing the total number of species in *Aganaspis* to five. All four of the Old World species have distinctly setose eyes (more noticeable in the female), while those from the Neotropics do not. This is one of the easiest ways to recognize *A. daci* in those areas of the New World where it has been introduced.

The placement of *pelleranoi* and *nordlander*, n. sp. (described below) in *Aganaspis* broadens the limits of this genus, and opens up the possibility that several of the Neotropical species formerly placed in either *Trybliographa* or *Pseudeucoila* may actually belong here. As indicated by Nordlander (1981, Table 2), several generic names are available for these species, and placement of most of the previously described species will not be possible without a revision of the entire group. Collection records (e.g., Weld 1932) and label data on specimens in the USNM suggest that several of these species have been reared from tephritids, but most records are not sufficiently precise to preclude the possibility that the actual hosts may be other fruit-inhabiting flies. See further discussion below under *Trybliographa*.

### *Aganaspis pelleranoi* (Brèthes)

De Santis (1965) placed *Ganaspis carvalhoi* Dettmer, 1929 as a junior subjective synonym of *Eucoila pelleranoi* Brèthes, 1924. The senior author has confirmed this synonymy through comparison of one of Dettmer's syntypes in USNM with one of the syntypes of *pelleranoi* from the Brèthes collection (MBR). Both types match the specimens we reared from Argentina and Costa Rica, confirming their identity as *pelleranoi*.

Known hosts and distribution records of *A. pelleranoi* are as follows:

*Hosts*.—*A. ludens* (Loew), *A. obliqua* (Macquart) (Aluja et al. 1990), *A. serpentina*

(Wiedemann) (Costa Lima 1940), *A. striata* Schiner (Clausen 1978), *A. distincta* Greene (Katiyar et al. 1995), *A. fraterculus* (Wiedemann) (Brèthes 1924), *Ceratitis capitata* (Wiedemann) (De Santis 1965), and *Rhagoletis turpiniae* Hernández-Ortiz (Hernández-Ortiz 1993). The records from "*Lonchaea* sp." and "*L. pendula* Bezzi" (Borgmeier 1935 and Costa Lima 1948, respectively) are suspect, and require verification. As noted by McAlpine and Steyskal (1982), the name *pendula* has been misapplied on numerous occasions to Neotropical lonchaeids of the genus *Neosilba* McAlpine that have been reared from fruit. Our own records suggest that *A. pelleranoi* may only rarely attack lonchaeids. Of 295 specimens of *A. pelleranoi* that we reared from isolated puparia in Costa Rica, 191 (64.7%) were from *C. capitata* (mostly in coffee), 81 from *Anastrepha* (nearly all *A. striata*), and only two were from a lonchaeid (*Neosilba batesi* (Curran), **new record**). Twenty-one other specimens of *Aganaspis* were also reared from *Neosilba* in Costa Rica, but these are only tentatively assigned to *pelleranoi* because of slight but consistent color differences relative to the other specimens of *A. pelleranoi* reared during these studies.

We reared *A. pelleranoi* from infested fruits of the following species: *Casimiroa edulis* Llave and Lex., *Citrus aurantiifolia* (Christm.) Swingle, *Coffea arabica* L., *Ficus carica* L., *Juglans australis* Grisebach, *Prunus domestica* L., *Prunus persica* (L.) Batsch, *Psidium guajava* L., *P. friedrichsthalianum* (O. Berg) Niedenzu, *P. littorale* Raddi (= *cattleianum*), *Syzygium jambos* (L.) Alston, and *Terminalia catappa* L. These data, together with previously published records, suggest that *A. pelleranoi*, like several of the other commonly encountered tephritid parasitoids, has little or no host plant preferences. See additional comments below under discussion of *Odontosema*.

*Distribution*.—Argentina: Buenos Aires, Misiones, Salta, Tucumán, Jujuy, Corrien-



tes (De Santis 1967, Diaz 1986), La Rioja and Catamarca (**new records**); Bolivia: Santa Cruz de La Sierra (**new record**); Perú (Clausen 1978); Brazil (Dettmer 1929); Venezuela (Katiyar et al. 1995); Colombia (Yepes and Velez 1989); Costa Rica (Wharton et al. 1981); El Salvador (Ovruski et al. 1996); and Mexico (Aluja et al. 1990). There are also specimens in the USNM from Panama, Guatemala, and Belize (all **new records**).

During the survey for tephritid parasitoids in Costa Rica (Wharton et al. 1981), several species resembling *A. pelleranoi* were reared. Only one of these was repeatedly reared from tephritids, and it is described next.

*Aganaspis nordlanderi* Wharton, new species

(Figs. 1, 3, 4, 6–8, 10, 12)

Quantitative measurements, based on 5 females and 2 males, are presented either as ranges or means to the nearest 0.05.

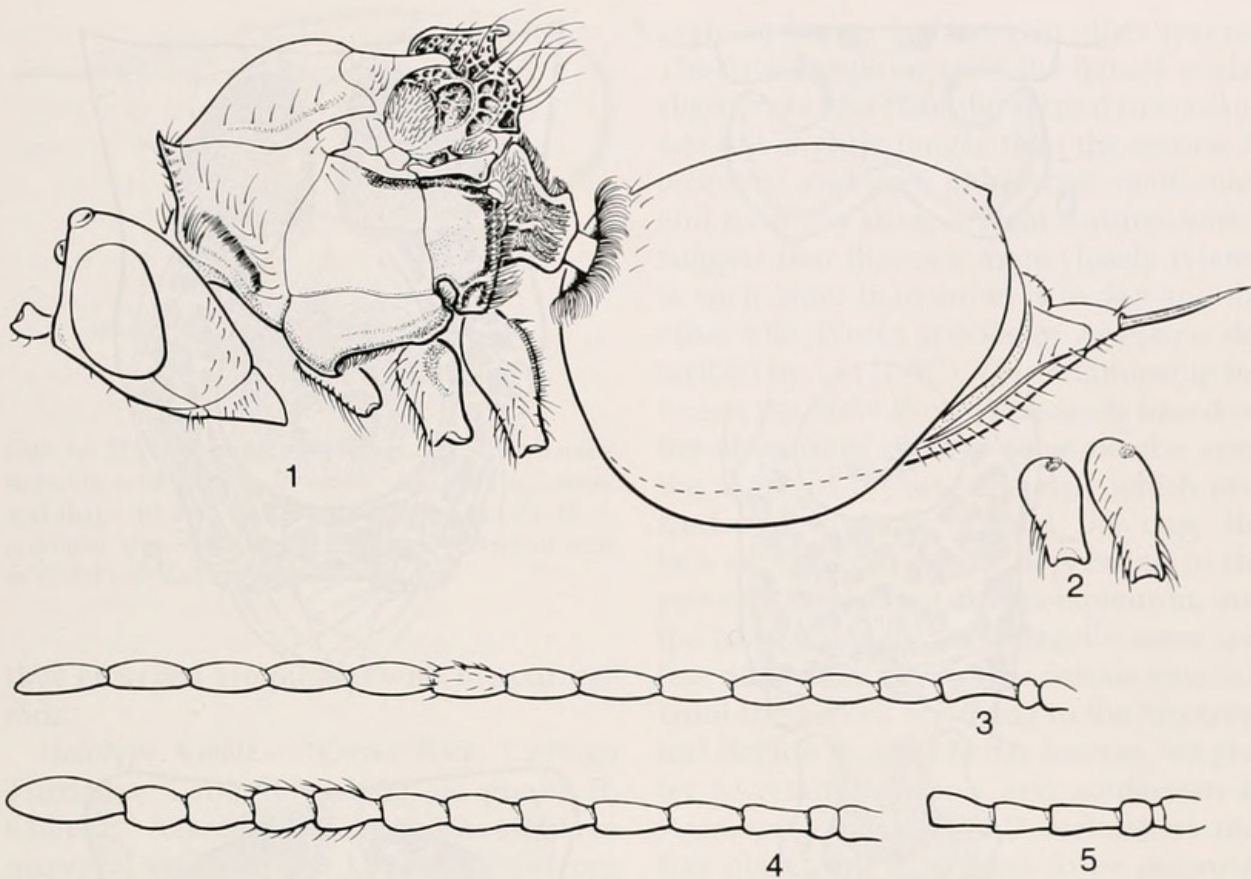
*Female* (Fig. 1).—Body length 2.3–3.5 mm; fore wing length 2.3–3.1 mm.

Head in dorsal view 1.05–1.15 times wider than mesoscutum; 1.75–1.90 times wider than long, when length measured in profile; temples strongly receding in dorsal view. Frons, vertex, and occiput bare; eyes without visible setae at 50 $\times$ . Face shining, unsculptured; malar sulcus a weak, narrow groove, without additional striae; antennal base elevated, especially laterally, forming shallow depression between antenna and eye. Posterior ocelli widely separated: distance between them 1.2–1.3 times distance between posterior ocellus and eye. Antenna (Fig. 4) short, about 2.5 times height of head; without distinct club, the segments gradually broadening distally, first 4–5 flagellomeres weakly clavate: each slightly broader subapically than medially; first flagellomere slightly shorter than second, relative lengths, first 8 flagellomeres: 1.0:1.1:1.1:1.05:1.0:1.0:0.95:0.95; ratio of length to maximum width, first 8 flagellomeres: 2.4:

2.3:2.2:2.0:1.9:1.8:1.65:1.55; flagellomeres each with 3–5 whorls of setae.

Mesosoma 1.25 times longer than high; 1.6 times longer than wide; 1.3 times higher than wide. Pronotal collar (Figs. 1, 6) distinctly protruding above anterior margin of mesoscutum in lateral view, deeply bilobed; median bridge wider than anterior ocellus; lateral arms of anterior and posterior parts narrowly but distinctly separated; posterior part of pronotal plate with a few, completely decumbent setae, otherwise bare and polished, 2.3–2.8 times wider than median bridge. Mesoscutum divided into three parts of approximately equal width by two longitudinal rows of 5–6 decumbent setae per row; margin with scattered setae separated from each other by their own length; short, shallow, crescentic grooves present on posterior half directly anterior to lateral bars of scutellum. Scutellar disc (Figs. 7, 8, 10) distinctly reticulate, with dorsoposteriorly-directed setae somewhat longer than in *pelleranoi*; in dorsal view (Fig. 8) disc slightly excavated medially, and thus weakly bilobed, the lobes protruding slightly beyond cup; posterior margin of disc sinuate in profile; height of posterior margin of scutellum about 1.5 times length (in lateral view) of flat portion of cup; scutellar cup (Fig. 8) large, broadly tear-drop shaped, with posterior margin weakly rounded, nearly truncate, anterior margin short, not extending through scutellar fovea, surface nearly flat, not drooping posteriorly, shallowly excavated medially, with only one or two punctures and 2–4 short, erect setae laterally; width of cup 0.5–0.6 times width of disc. Fore wing (Fig. 12) 2.6–2.9 times longer than wide; marginal setae short, longest subapical seta 0.08–0.1 times maximum width of wing; radial cell deep, completely open along wing margin, second radial abscissa 2.7–3.1 times longer than first; costal cell densely setose, ventral surface with 3–4 longitudinal rows of setae. Mid and hind coxae (Fig. 1) with extensive patches of





Figs. 1–5. *Aganaspis* spp. 1, *A. nordlanderi*, habitus. 2, *A. pelleranoi*, mid and hind coxae, lateral view, showing small patches of dense setae dorsoposteriorly. 3, *A. nordlanderi*, male antenna, setae not shown except for 8th flagellomere. 4, *A. nordlanderi*, female antenna, setae not shown except along margins of 7th and 8th flagellomeres. 5, *A. pelleranoi*, basal 5 antennal segments of female.

dense setae, patch on mid coxa extending about half length of coxa from base, patch on hind coxa extending more than half length of coxa.

Second metasomal tergum 1.0–1.1 times length of mesosoma.

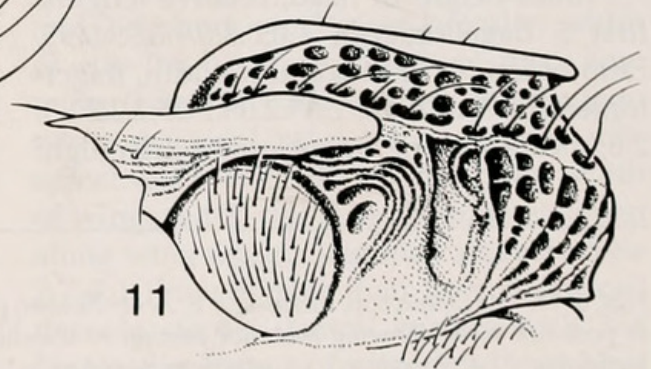
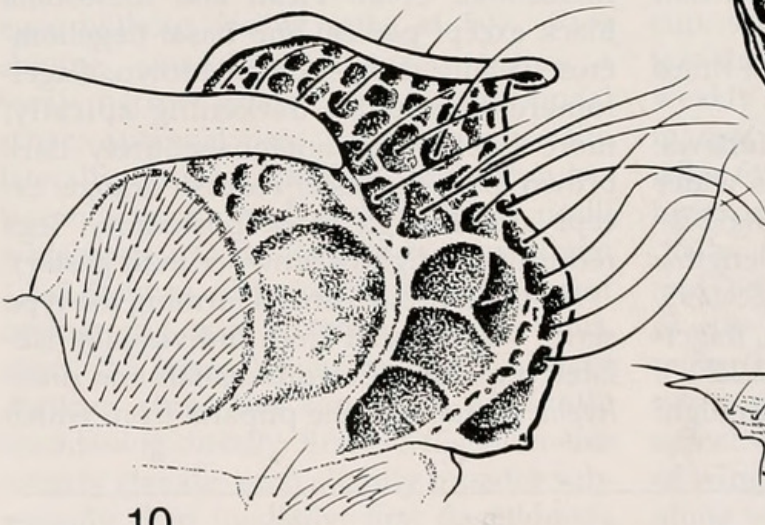
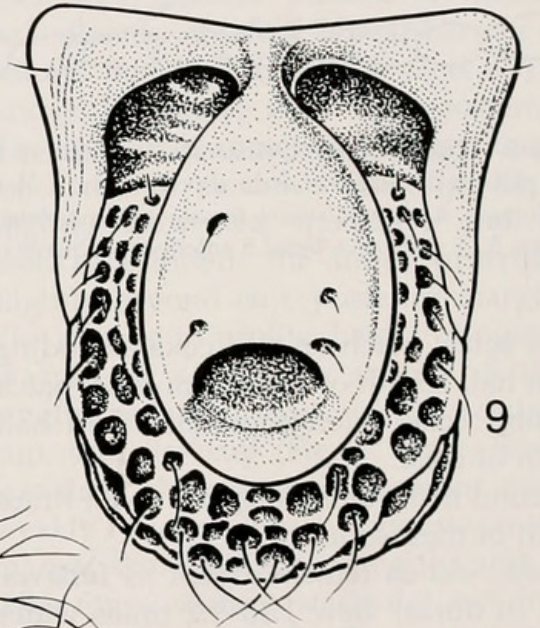
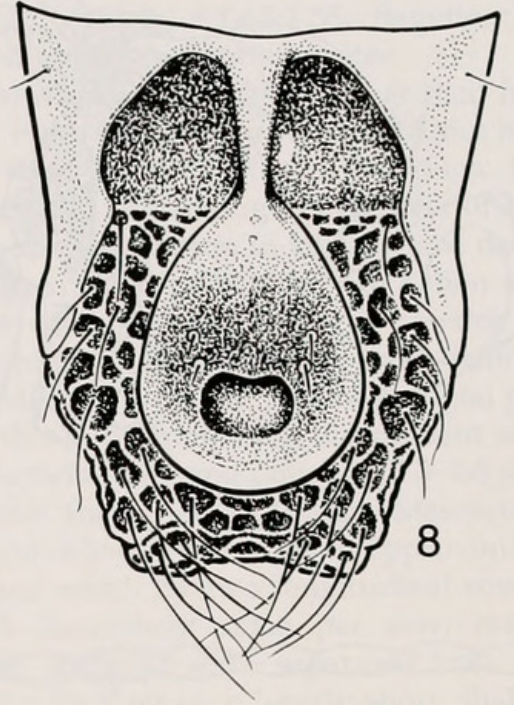
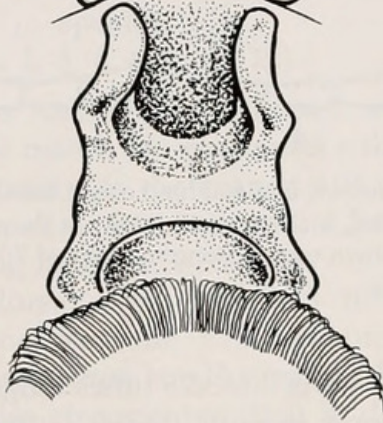
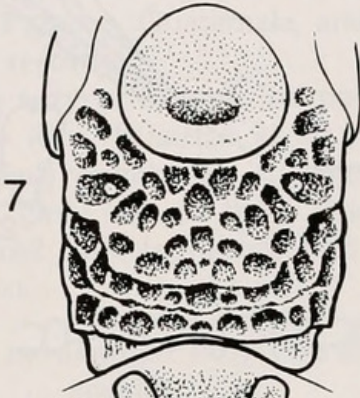
*Male*.—As in female except as follows: head in dorsal view 1.15–1.2 times wider than mesosoma; antenna (Fig. 3) long, 3.2–3.3 times height of head; relative lengths, first 5 flagellomeres: 1.0:0.8:0.9:0.95:0.95, ratio of length to maximum width, flagellomeres 1–5 and 10: 2.85:2.05:2.25:2.25:2.3:2.6; mesosoma 1.2 times longer than high;

fore wing 3.6–3.75 times longer than wide; second tergum 0.85–0.9 times length of mesosoma. Color. Head and mesosoma black except pedicel and basal flagellomeres usually dark reddish brown, flagellomeres gradually darkening apically, more rarely with antenna entirely dark brown to black; gaster reddish-orange, except apical terga black posteriorly; legs red-brown (slightly browner than gaster).

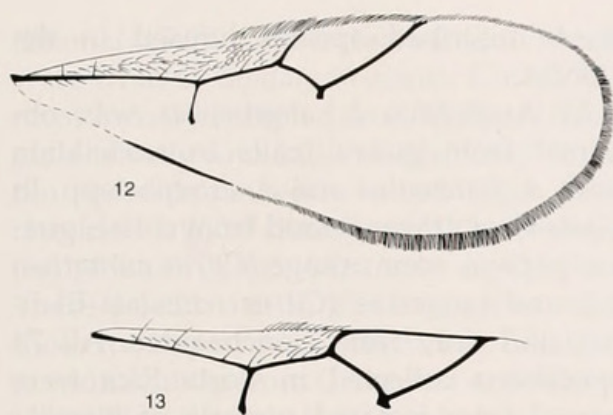
*Hosts*.—The specimens forming the type series were reared from individually isolated puparia of *Ceratitis capitata* and *Anastrepha striata*, and the puparia from which

Figs. 6–11. *Aganaspis* spp, mesosoma. 6, *A. nordlanderi*, pronotum in dorsal view. 7, *A. nordlanderi*, propodeum in posterior view, showing posterior portion of scutellum, setae not shown except portion of basal ring on metasoma. 8, *A. nordlanderi*, scutellum in dorsal view. 9, *A. pelleranoi*, scutellum in dorsal view. 10, *A. nordlanderi*, scutellum in lateral view. 11, *A. pelleranoi*, scutellum in lateral view.









Figs. 12, 13. *Aganaspis*, fore wings. 12, *A. nordlanderi*, showing setal pattern in costal cell, marginal setae, and shape of radial cell, other setae not shown. 13, *A. pelleranoi*, showing relatively reduced pattern of setae in costal cell and closed radial cell.

they emerged are pinned with the parasitoids.

**Holotype female.**—"Costa Rica: Cartago Turrialba, Catie 10.vii.1980 ex: guava R. Chavez." Reared from *Anastrepha striata* in guava. Deposited in USNM. Paratypes (TAMU), all reared from *Ceratitidis capitata* in Costa Rica: 3 females, 2 males, same locality, 8-vi-1980, 26-vi-1980, 30-ix-1981, and 8-vi-1982, J. Duran and R. Chavez, collectors, from coffee and naranja agria; 1 female, Puntarenas, San Vito, 23-ix-1980, R. Chavez, from guava.

**Diagnosis.**—This species differs from *pelleranoi* in the more densely setose costal cell of the fore wing (with only a single longitudinal row of setae on ventral surface in *pelleranoi*: compare Figs. 12 and 13), the completely open radial cell, the more extensively furry hind coxa (Fig. 1 vs. Fig. 2), the smaller scutellar cup (width of cup/width of disc = 0.55 in *nordlanderi* vs. 0.75 in *pelleranoi*; scutellar cup extending nearly to anterior margin of scutellar fovea in *pelleranoi*: compare Figs. 8 and 10 with Figs. 9 and 11), and the relative proportions of the flagellomeres (Fig. 4 vs. Fig. 5) and first and second radial abscissae.

**Discussion.**—*Aganaspis nordlanderi* has a distinctly smaller scutellar cup than either *pelleranoi* or *daci*, and the surface is not

quite as flat as in these two other species. The first flagellomere of the female is also slightly shorter than the second in *nordlanderi* but slightly longer than the second in *pelleranoi* and *daci*. Otherwise, *nordlanderi* and *pelleranoi* share several features which suggest that they are more closely related to each other than either is to *daci* and the other Old World species of *Aganaspis* described by Lin (1987). This relationship between the New World species is based on the absence of distinct setae on the eyes, the shape of the scutellar disc which protrudes posteriorly beyond the cup, the lack of a deep, median depression in the posterior margin of the metapleuron, and the more elongate basal flagellomeres and less distinctive club of the female antenna. Until the genera occurring in the Neotropical Region become better known, we prefer to retain *pelleranoi* and *nordlanderi* in *Aganaspis*, with the full realization that this placement may need to be reconsidered at some later date.

### *Dicerataspis* Ashmead

There are two described species, and Weld (1952) recorded an additional, apparently undescribed species from Florida. The genus is known from Mexico and Florida south through the Caribbean to Brazil and Argentina (Weld 1921, 1952, Diaz 1974). The species have not been revised, and most of the reared material in the USNM has been tentatively associated with the name *D. grenadensis* Ashmead, 1896. At least two species are represented in our material from Costa Rica. The species differ in the sculpture of the scutellum, infumation of the wing, and shape of the radial cell. A revision of the genus is needed before species names can be assigned with any degree of confidence.

Based on records in the USNM, largely from the rearings by Zetek in the Panama Canal Zone, members of this genus have been reared from a variety of fruits (*Ficus*, *Labatia*, *Psidium*, *Carica*, and *Anacardium*) in association with several different spe-



cies of the tephritid genus *Anastrepha*. *Dicerataspis* has also been associated with one species of *Rhagoletis* from Mexico (Hernández-Ortiz 1993). However, precise associations have rarely if ever been made. Our own material was reared in association with *Anastrepha fraterculus* and *Anastrepha* sp. from *Psidium guajava* (guava) in Tucumán, Argentina, and from *Drosophilidae* in peaches and guava in Costa Rica. The single specimen from guava in Costa Rica was reared from a carefully isolated drosophilid puparium and represents the first specific, verified host association to our knowledge. All of our other material was batch-reared, and could not be directly associated with the individual puparia from which they emerged. The specimens from guava in both Costa Rica and Argentina agree most closely with the description of *D. grenadensis*.

Given the small size of the species of *Dicerataspis* and their development as solitary parasitoids, normal hosts are likely to be drosophilids or other small *Diptera* in fruit, rather than tephritids. Parasitism of *Anastrepha* or other tephritids needs verification.

### *Lopheucoila* Weld

Weld (1951a) described the genus *Lopheucoila* for three New World species, only one of which, *L. anastrephae* (Rohwer), has ever been associated with specific hosts. *Lopheucoila anastrephae* was originally described from specimens supposedly reared from *Anastrepha* sp. in Trinidad (Rohwer 1919). Weld (1951a) subsequently reported this species from *A. fraterculus* in Panama and *Lonchaea* sp. in Brazil, as well as from Mexico and Peru (unassociated with hosts). As noted above under the discussion of hosts of *A. pelleranoi*, the Brazilian record from *Lonchaea* undoubtedly refers to a species of *Neosilba*. All of the specimens of *Lopheucoila* reared from Argentina and Costa Rica during the present study were *L. anastrephae*, based on comparison with type material of the

three described species housed in the USNM.

In Argentina, *L. anastrephae* was obtained from guava fruits in association with *A. fraterculus* and *Anastrepha* spp. In Costa Rica, it was reared from coffee, guava, papaya, sour orange (*Citrus aurantium* L.), and tangerine (*Citrus reticulata* Blanco), and only from *Lonchaeidae*. All 74 specimens collected in Costa Rica were reared from isolated puparia of *Neosilba batesi* (Curran), the most abundant of the two species of *Lonchaeidae* in the Costa Rican samples. Although 69,000 puparia of *Anastrepha* and *Ceratitis* were collected from 1979–1982 in Costa Rica, *L. anastrephae* was never reared from a tephritid during this period.

### *Odontosema* Kieffer

Kieffer (1909) based the genus *Odontosema* on a single species from Brazil. Borgmeier (1935) later described a second Brazilian species, *O. anastrephae* Borgmeier, collected in association with *A. fraterculus* from guava. One undescribed species has been recorded from *A. striata* and *A. fraterculus* in guava in Veracruz, Mexico (Hernández-Ortiz et al. 1994), and an unidentified *Odontosema* species was reared from *A. fraterculus* in fruit of four species of *Myrtaceae* in southern Brazil (Salles 1996). In Costa Rica, *O. anastrephae* has been reported from *C. capitata* and *Anastrepha* spp. inhabiting several different fruits (coffee, orange and guava) (Wharton et al. 1981). *Odontosema* is probably widely distributed throughout the Neotropical Region, but at present it has only been recorded from Brazil (Borgmeier 1935, Costa Lima 1948, Salles 1996), Costa Rica (Wharton et al. 1981) and Mexico (Hernández-Ortiz et al. 1994, Lopez et al. 1996).

*Odontosema anastrephae* was collected only in Costa Rica, and was not found in Argentina during the present study. This species showed distinct host preferences, with 74% of the 193 reared individuals coming from *Anastrepha* in guavas. An ad-



ditional 15.5% of the reared individuals were from *C. capitata* in citrus. Coffee, the most heavily sampled fruit in Costa Rica, yielded only four individuals. Only 2% of the individuals were reared from Lonchaeidae (all on citrus), with the remaining 98% on either *Anastrepha* or *Ceratitis*. These results are in direct contrast with those for *A. pelleranoi*, which was collected predominantly from *C. capitata* in coffee in Costa Rica. Slightly less than half as many *A. pelleranoi* were reared from *Anastrepha* in guava as from *Ceratitis* in coffee. The pattern of host utilization by *A. pelleranoi* can thus be directly correlated with sampling frequency, with the mostly commonly sampled fruits and tephritids yielding the greatest numbers of *pelleranoi*.

### *Rhoptromeris* Förster

Only one species of this genus has been associated with tephritid fruit flies. This species, *R. haywardi* (Blanchard 1947), was originally included in *Eucoila* and later transferred to *Rhoptromeris* (De Santis 1967). *R. haywardi* was described from Argentina and Uruguay (Blanchard 1947) and has been reared in association with *A. fraterculus* and *C. capitata* (De Santis 1967), as well as *Anastrepha* spp., from *Carica quercifolia* Hill, *Ficus carica*, *Phoebe porphyria* Gris, *Psidium guajava*, and *Prunus persica* in Tucumán (Turica and Mallo 1961). Despite intensive surveys of fruit fly parasitoids that were conducted in several areas of the province of Tucumán for this and related studies (Ovruski 1995) the host fly and host plant associations recorded by Turica and Mallo have not been verified.

Nasca et al. (1980) obtained exceptionally large numbers of *R. haywardi* and the diapiiid *Trichopria anastrephae* Costa Lima (nearly 3,500 and 1,000 individuals respectively) by using a modified model of Hayward's (1940) parasitoid fly-trap. This collecting method consisted of a pit in the soil beneath the host plant into which fallen host-fruit were placed, the pit was then covered with a thin sieve permitting only

the capture of parasitoids. It is very likely this method facilitated the production of drosophilids and their parasitoids. For example *T. anastrephae* is also known to attack drosophilids (Turica and Mallo 1961). This, together with our failure to rear *haywardi* from tephritid puparia in the province of Tucumán, lead us to question the recorded host associations of this species. Parasitism of Tephritidae needs to be verified.

The generic placement of this species also needs verification following Nordlander's (1978) revision of *Rhoptromeris*. As restricted by Nordlander (1978), *Rhoptromeris* consists of parasitoids of Chloropidae and other small dipterous larvae such as those that commonly breed in the base of grass stems (Poaceae), and it is unlikely that *haywardi* belongs to this largely Holarctic genus.

### *Trybliographa* Förster

Several eucoilids associated with fruit-infesting Diptera in the Neotropical Region have been placed in the genus *Trybliographa* at one time or another. These include species placed in *Pseudeucoila*, a junior synonym of *Trybliographa* (Hellén 1960, Nordlander 1980), as well as various subgenera of either *Trybliographa* or *Pseudeucoila* (Weld 1952). Three of these, including the species originally described as *Trybliographa daci* by Weld (1951b), are treated above under the genus *Aganaspis*. Most of the others, however, cannot be readily assigned to genus at the present time because the Neotropical genera are badly in need of revision. These species appear to belong to what Nordlander (1982) referred to as the *Ganaspis* group of genera. Nordlander (1981, 1982) discussed some of the problems associated with the *Trybliographa* and *Ganaspis* groups of genera, presented a list of generic names that he considered valid, and provided useful information on the location and status of the type material. According to Nordlander (1981), *Trybliographa* is predominantly



Holarctic. It is therefore unlikely that any of the species previously associated with fruit-infesting Diptera in the neotropics belong to this genus. We have examined several such specimens in the USNM collection of *Trybliographa* and *Pseudeucoila* labelled as reared from tephritids or other fruit-infesting flies, and were unable to discover any that belong to *Trybliographa* s. s. as defined by Nordlander (1981). Aside from the species now transferred to *Aganaspis*, we are aware of only two other species that have been described, and for which tephritid hosts have been reported (additional records available to us are largely in the form of unpublished label data). These are *brasiliensis* von Ihering, 1905 and *hookeri* Crawford, 1913.

Von Ihering's species was first described as *Hexamerocera brasiliensis* and later as *Eucoela* (*Hexamerocera*) *eobrasiliensis* (von Ihering 1914). It was transferred, along with the subgenus *Hexamerocera*, to *Pseudeucoila* by Weld (1932). Nordlander (1978), however, treated *Hexamerocera* as a synonym of *Rhoptromeris*. *Pseudeucoila*, as noted above, is now a synonym of *Trybliographa*. Von Ihering's *brasiliensis* does not fit the current definition of either *Rhoptromeris* or *Trybliographa*, and thus, like *haywardi*, remains unplaced in the Eucoilidae.

Von Ihering's *brasiliensis* is known from Brazil and Panama (Borgmeier 1935) and it was introduced to Puerto Rico during 1935–37 along with other unidentified eucoilid species to aid in the control of *A. obliqua* and *A. suspensa* (Bartlett 1941). The recorded hosts were *A. fraterculus*, *Anastrepha* sp., *C. capitata* and Drosophilidae (Borgmeier 1935, Costa Lima 1948). The type material was collected from peaches, where it was thought to be a parasitoid of *A. fraterculus* (von Ihering 1905). Though von Ihering (1912) provides evidence to support his view of *brasiliensis* as a parasitoid of *Anastrepha*, the actual host was not identified and the possibility that this is a drosophilid parasitoid (because of its

small size) cannot be discounted. Hosts for this species thus need verification.

Crawford's *hookeri* was originally described in *Ganaspis*, but was placed under *Hexamerocera* by Weld in his arrangement of the USNM collection (though formal transfer to *Pseudeucoila* (*Hexamerocera*) was apparently never published). This is a similarly diminutive species, and therefore unlikely to be a parasitoid of *Anastrepha*, as originally recorded. Both *hookeri* (from Puerto Rico) and *brasiliensis* have a complete hairy ring at the base of the second tergum, unlike similarly-sized species of *Leptopilina*, in which the second tergum is bare dorso-medially. The scutellar cup is much larger in *brasiliensis* than it is in *hookeri*.

## CONCLUSIONS

Information on host specificity in eucoilids is largely lacking other than for the work by van Alphen, Vet and colleagues on species of *Leptopilina* attacking Drosophilidae (e.g. van Alphen et al. 1991, Poolman Simons et al. 1992). There are often many species of Diptera, representing several families, present in fruit attractive to eucoilids. Thus, in order to assess host specificity accurately, it is essential to verify all records by isolating individual puparia or exposing known hosts to ovipositing females. For many of the older records (including label data from unpublished studies), host associations were based on eucoilids reared from bulk samples of fruits containing pest tephritids. These must be viewed with caution because of the inevitable inclusion of other flies, such as drosophilids and lonchaeids, in these samples.

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