PARASITIC HYMENOPTERA BRED FROM THE FAMILY AGROMYZIDAE (DIPTERA) WITH SPECIAL REFERENCE TO SOUTH FLORIDA

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ABSTRACT

Five families of hymenopterous parasites including 19 genera and 31 species were reared from the leafminer family Agromyzidae (Diptera) during a survey for these leafminers especially from south Florida.

In early 1963, I commenced a survey for those agromyzid flies associated with grasses, weeds, truck crops, ornamentals, shrubs, and trees of south Florida. All agromyzid determinations were by Kenneth A. Spencer of London, England. Unknown host plants were determined by the late Erdman West, by D. B. Ward (both of the University of Florida), or by Kenneth Langdon (Division of Plant Industry, Florida Department of Agriculture).

During this period of intensive rearing of agromyzid adults from their host plants, I was continually confronted with hymenopterous parasites which prevented some of my rearings of the desired Agromyzidae adults. The parasites were associated with the immatures of these leafminers and in some cases I had to repeat my rearings several times to obtain the specific leafminer associated with a given host. To date, all of the hymenopterous parasites have been determined by C. F. W. Muesebeck, B. D. Burks, or P. M. Marsh (systematic entomologists, U. S. National Museum). I would like to thank these entomologists for their help in making this paper possible, as well as B. D. Burks and George C. Steyskal for critically reviewing this manuscript.

Numerous references on the agromyzid parasites in Florida are reported by Muesebeck et al. (1951), Krombein (1958), and by Krombein and Burks (1967). Many of these references are not cited in this paper as these were too many clarifications to be made especially in the genus Liriomyza Mik. Further, numerous new agromyzid species described by K. A. Spencer and currently being reported by Spencer and Stegmaier (in press) contain data which are unpublished.

Agromyzza pusilla (Meigen) is actually Liriomyza pusilla and this species has been erroneously reported by several authors as the host for various hymenopterous parasites. Liriomyza pusilla (Meigen), in part Steyskal (personal communication) reported that Liriomyza munda covers most of the old records of L. pusilla (Stegmaier 1968). Moreover, L. pusilla is a European species and not known to be in the United States.

Much more intensive research is needed on the host plant range of the Agromyzidae throughout the United States. Our basic knowledge of the

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grass-infesting agromyzid in the United States and the associated parasites is extremely poor. When more intensive research on the host plant range is conducted and when we have obtained a better knowledge of the needed taxonomic clarifications, we will be able to develop a better understanding of the effective hymenopterous parasites associated with the family Agromyzidae throughout the United States.

The purpose of this paper is to report on the known hymenopterous parasites bred from determined Agromyzidae which were reared from known host plants from Florida. All collections, except where noted, are those of the author.

Studies on the parasites of the Liriomyza species have been reported by Webster and Parks (1913), Crawford (1913), Gahan (1917), Tilden (1960), Hills and Taylor (1950), Oatman (1959, 1960), and Harding (1965). Cameron (1939) and Kulp (1968) reported on the Ilex associated Phytomyza spp., and some of their parasites. Griffiths (1956, 1964, 1966a, 1966b, 1967, 1968a, 1968b) reported on some braconid parasites of the Agromyzidae in Europe. Some information on the parasites of the cambial miners in the genera Phytobia and Dendromyzidae are reported by Barnes (1930), Greene (1914), Hanson and Benjamin (1967), Kangas (1935), and Pitcher (1955).

**Braconidae**

*Neopius cubitalis* Fischer: 1 adult, det. C. F. W. Muesebeck. Reared from *Liriomyza surortis* (Willston) infesting Panicum sp., Hialeah, Fla., 6 VI 66. Muesebeck et al. (1951) reported a rearing of *Neopius carinaticeps* Gahan from *Agromyza* sp., mines in *Hordeum* from North Dakota and New Jersey.


Muesebeck et al. (1951) reported the distribution of *O. dimidiatus* from N. Y. to Fla., west to S. Dak., Utah, Calif., and the West Indies. He reported the following insect hosts: *L. munda* Frick (as *Agromyza pusilla*), *Chlorops scutellata* (Fall.) as *A. scutellata*, and *Cerodontha* (*Cerodontha*) dorsalis (Loew). Muesebeck in Krombein (1958) recorded the species from Texas and Muesebeck in Krombein and Burks (1967) reported the species from *L. munda*. Kulp (1968) reported rearing the species from *Phytomyza opacea* Kulp.

*Opis spp.*: det. C. F. W. Muesebeck, reared from *Liriomyza trifolii*, Stegmaier (1966a): 7 adults, det. C. F. W. Muesebeck, reared from *Phytobia* (*Amauromyza*) maculosa (Malloch), Coral Gables, Fla., 28 I 64; 2 adults, det. C. F. W. Muesebeck, reared from *Phytobia* (*Calycomyza*) n. sp. infesting leaves of *Solidago* sp., Hialeah, Fla., 7 I 66; 1 adult, det. C. F. W. Muesebeck, reared from *Phytobia* (*Amauromyza*) maculosa from
leaves of Eriogonum strigosum Muhl., Hialeah, Fla., 28 II 66; Kulp (1968) reported rearing Opilia n. sp. from Phytomyza verticillatae Kulp; he recorded Opilia striativentris Gahan from Phytomyza opaca; and Cameron (1939) reported rearing O. illis Nixon from Phytomyza illis (Curt.).

Oeonogastra n. sp.: det. C. F. W. Muesebeck, 7 adults were reared from Japanagromyza eequalis Spencer (Spencer 1966) infesting leaves of Vigna repens Baker, Hialeah, Fla., 22 III 64. Muesebeck (personal correspondence, 66-16067) indicated that the new species was forwarded to G. T. Riegel who is revising the group.

Eulophidae

Pnigalio spp.: Cameron (1939) recorded P. felti (Cwfd.) from Phytomyza illis Nixon; Kulp (1968) reported rearing P. felti from Phytomyza verticillatae Kulp and Pnigalio guttiventris (Girault) from Phytomyza illicicola Loew and from Phytomyza opaca; Pnigalio proximus (Ashm.) from Phytomyza divitina Kulp (Kulp 1968); and Stegmaier (1967c) reported rearing Pnigalio sp., from Liriomyza brassicae (Riley).

Diglyphus intermedius (Grlt.): Stegmaier (1971) reported rearing the species from Phytomyza vomitoriae Kulp; Burks in Krombein and Burks (1967) recorded the species from Liriomyza propopulosa Frost; however, Spencer (1965) stated that this leafminer may be a synonym of Liriomyza munda Fricke.

Diglyphus pulchripes (Cwfd.): 1 ♂, det. B. D. Burks, reared from L. trifolii infesting leaves of Bidens pilosa L., Miami Springs, Fla., 26 III 63.

Diglyphus sp.: Stegmaier (1966a) reported rearing this species from Liriomyza trifolii.

Tetristichus marylandensis (Grlt.): 1 ♂, det. B. D. Burks, reared from Melanogromyza minimoides Spencer from seed infestations of Melanthora deltoidea Michx, Sanford, Fla., 29 I 64, coll. G. W. Desin; Peck in Muesebeck et al. (1951) recorded the species from Mass., Md., D. C., Va., Mo., and Ill.

Tetristichus sp.: 1 ♂, det. B. D. Burks, reared from an undetermined agromyzid infesting Mikania batatifolia DC., Hialeah, Fla., 28 IX 63.

Diaulinopsis callichroma Cwfd.: Stegmaier (1966c, 1967a, 1967b, 1967c, 1967d) reported rearing this species from Liriomyza brassicae, Phytobia (Amauromyza) maculata, Liriomyza sorosis (Williston), Liriomyza schmidtii (Aldrich), Phytobia (Calycomyza) malvae (Burgess), and Phytobia (Calycomyza) ipomaeae Frost. Peck in Muesebeck et al. (1951) recorded D. callichroma from Ind., Fla., Miss., and Arizona. He reported the host insects as Chlorops scutellata Panzer (as Agromyza scutellata Fall.), Calycomyza artemisiae (Krb.), Cerodontha (Cerodontha) dorsalis Loew, and Liriomyza munda (as L. pusilla). Burks in Krombein and Burks (1967) reported the species in Calif., Mexico, and the West Indies.

Zagrammosoma multilinearum (Ashm.): Stegmaier (1971) reported rearing the species from Phytomyza vomitoriae. Peck in Muesebeck et al. (1951) recorded the species from Md., D. C., S. C., W. Va., Fla., Ohio, Ind., La., and Ks. He reported the host insects as Agromyza parvicornis Loew, L. munda (as A. pusilla), A. aquilegiæ Hardy, and Chlorops scutellata (as A. scutellata).
Zagrommosoma spp.: 1 ♂, det. B. D. Burks, reared from Phytobia (Calycomyzza) hyptidis Spencer, Spencer and Stegmaier (in press) infesting leaves of Hypsyporion pectinata (L.) Poir., Hialeah, Fla., 26 XI 63; Stegmaier (1967d) reported rearing this from Phytobia (Calycomyzza) ipo-maeae.

Mirzagrammosoma lineaticeps Girault. Stegmaier (1966a) reported rearing this species from Liriomyza trifolii. Burks in Krombein and Burks (1967) recorded the species from Fla., Central America, and the West Indies. He reported Liriomyza archboldi Frost as host insect; however, the host plant for L. archboldi is not peas as stated by Frost (1962), but rather Bidens pilosa L. (Spencer and Stegmaier in press).

Closterocerus cinetipennis Ashm.: Stegmaier (1966a, 1966b, 1966c, 1971) reported rearing this parasite from Liriomyza trifolii, L. munda, L. schmidtii, and Phytomyza ilicicola Loew, respectively; Peck in Muesebeck et al. (1951) recorded this parasite from Que., Conn., N. J., D. C., Fla., Mo., and from Iowa from cited insect hosts. Burks in Krombein and Burks (1967) reported the parasite from Wisconsin.

Closterocerus trinctus (Ashm.): Peck in Muesebeck et al. (1951) reported this parasite from Liriomyza melampyga (Loew) (as Agromyza melampygla Loew), A. parvicornis, Phytomyza aquilegia Hardy, P. ilicis, and P. obscurella Fall.; Burks in Krombein and Burks (1967) recorded the species from Que., southward to Fla., west to Wisc., Iowa, and Mo. Kulp (1968) reported the species from Phytomyza ditnani, P. ilicicola, P. ilicis, P. opaca, and P. verticillata; Stegmaier (1971) also reported rearing the parasite from P. opaca.

Chrysocharis majorian (Grlt.): Stegmaier (1966d, 1967b) reported rearing this parasite from Liriomyza commelinae (Frost) and from Liriomyza surosis respectively; 3 ♂, det. B. D. Burks, were reared from Phytobia (Calycomyzza) malvae, Miami, Fla., 15 VIII 63; Burks in Krombein and Burks (1967) recorded the species from Fla., West Indies, Brazil, and it was introduced into Hawaii for biological control purposes.


Derostenus agromyzae Cwfd.: Stegmaier (1966a, 1967b) recorded rearings of this parasite from Liriomyza trifolii and L. surosis; 33 adults, det. B. D. Burks, were reared from Phytobia (Calycomyzza) sp. infesting leaves of Mikania batatifolia, Hialeah, Fla., 28 IX 63; 1 ♂, det. B. D. Burks, was reared from Agromyza proxima Spencer, infesting leaves of Echinocloa watleri (Pursh) Heller, Sweetwater, Fla., 24 VI 63 (Spencer and Stegmaier in press); Burks in Krombein and Burks (1967) recorded the distribution for this parasite as N. Y., south to Fla., west to N. Dak. and Arizona; he includes Mantura floridana Cr. and Liriomyza surosis as insect hosts.

Derostenus diastatae (How.): 12 adults, det. B. D. Burks, reared from Agromyza proxima Spencer (Spencer and Stegmaier in press), Sweetwater, Fla., 24 VII 63; Peck in Muesebeck et al. (1951) recorded the parasite from Conn. to Fla., and Ks.; he reported the host insects as L. munda.
(as A. pusilla), Chlorops scutellata (as Ayromyza scutellata), Diastatula sp. mining corn ears; dipterous miner of Panicum dichotomiflorum Michx., and Fenusa pusilla (Klug.).

Derostenus variipes Cwfd.: Getzin (1960) reported this parasite as the most important parasite of Liriomyza munda during 1958 and 1959 in Texas; Peck in Muesebeck et al. (1951) reported the parasite from L. munda (as A. pusilla) and Phytomyza aquilegia; Stegmaier (1966a, 1966b, 1967a) reported rearing the parasite from Liriomyza schmidtii, L. trifolii, and from Phytobia (Amauromyza) maculosa; Burks in Krombein and Burks (1967) recorded the species from N. Y., south to Florida, west to La. and Texas.

Derostenus spp.: Wene (1953, 1955) reported Derostenus sp. as the primary parasite of L. munda; Stegmaier (1966a, 1966b, 1966c, 1967a) reported rearing this from L. trifolii, L. munda, Phytobia (Amauromyza) maculosa, P. (Calycomyza) jucunda (Wulp), P. (C.) ambrosiae Frick, and Phytomyza vomitoria.

Peediobius lithocolletidis (Ashm.): Kulp (1968) reported rearing this parasite from Phytomyza ilicicola, P. opacea, and P. verticillatae; Stegmaier (1971) reported rearing the species from Phytomyza opacea; Burks (1966) reported the species as a parasite of lepidopterous, dipterous, and coleopterous leafminers.

TORYMIDAE


PTEROMALIDAE

Halictocephra patellana (Dalman): Burks in Krombein and Burks (1967) reported this species as Ilolarctic; Oatman (1959, 1960) recorded this species as a dominant parasite of Liriomyza munda (as L. pictella (Thomson); Stegmaier (1966a, 1966b) reported rearing this species from L. trifolii and L. munda.

Halictocephra sp.: 1 ♀, det. B. D. Burks, was reared from Phytobia (Calycomyza) sp. infesting leaves of Aster viminosusii Small, Hialeah, Fla., 26 XI 63; 5 ♀, 1 ♂, det. B. D. Burks, were reared from Japanagromyza desmodivora Spencer infesting Desmodium tortuosum (SW.) DC., Miami, Fla., 17 X 63; Kulp (1968) reported rearing Halictocephra sp. from Phytomyza ilicicola.

Heteroschema punctata (Ashm.): 8 ♀, 6 ♂, det. B. D. Burks, were reared from Melanagromyza minimoides infesting seed heads of Borrichia frutescens (L.) DC., Miami, Fla., 3 III 66; 8 ♀, 2 ♂, det. B. D. Burks, were reared from M. minimoides infesting the seed heads of Wedelia trilobata Hitch., Miami, Fla., 14 XI 65; Stegmaier (1968a) reported rearing this parasite from a tephritid, Paroxyyna piciolla (Bigot) and from Trupanea actinobola (Loew), (Tephritidae); Steyskal (1972) reported rearing H. punctata from seed heads of Bidens pilosa L., which contained infestations of Paroxyyna piciolla and several other dipterous associates of Bidens.

Stegmaier (1968a) reported rearings of Heteroschema punctata from
Ophiomyia sp. and from Melanagromyza sp.; Peck in Muesebeck et al. (1951) recorded the parasite from Fla. and Ariz., he reported the following as insect hosts of H. punctata: Parozyina picciola and Melanagromyza virens (as Agromyza virens Loew); Burks in Krombein and Burks (1957) recorded the species from Miss., Mo. and the West Indies.

Heteroschema spp.: Stegmaier (1967b) reported rearing this from L. sorosis; 1 ♂, det. B. D. Burks, was reared from Phytobia (Calycomyza) mikaniae Spencer (Spencer and Stegmaier in press) infesting leaves of Mikania batatifolia, Hialeah, Fla., 28 IX 63; 1 ♂, det. B. D. Burks, was reared from a tephritid, Dyseuaresta mexicana (Wiedemann), det. R. H. Foote, infesting seed heads of Melanthera deltoidea Michx., Miami, Fla., 29 IV 66; 2 adults, det. B. D. Burks, were reared from Liriomyza sorosis infesting leaves of Heliotropium curassavicum L., Miami, Fla., 8 VII 67.

Zatropsis sp.: 40 adults, det. B. D. Burks, were reared from Melanagromyza virens infesting stems of dog fennel, Eupatorium capillifolium, Hialeah, Fla., 7 VI 63. The only known host plants, confirmed to date for M. virens are E. capillifolium and Heterotheca subaxillaris (Lam.) Britit. and Rusby (Spencer and Stegmaier in press).

During October 1959 to March 1960, I was conducting rearings from seed heads of Bidens pilosa L. The dipterous fauna were listed by Steyskal (1972) and one of the interesting pteromalids found in his rearings was Colotrechhus ignotus Burks. He reported rearing 2 adults while I reared 9 ♂ and 1 ♀. Burks in Krombein and Burks (1967) stated that this parasite has been reared from seed heads of Bidens and other Composites; he cites no host for the parasite but recorded it from N. C., Fla., Okla., Tex., Ariz., and Calif. My findings, as well as those of Steyskal (1972), indicate that the potential hosts for Colotrechhus ignotus may be any one of the following: Tephritidae (Parozyina picciola, Xanthicicira insecta (Loew); Cecidomyiidae (Asphondyilia bidens Johannsen); Drosophilidae, only (Cladochacta nebulae Coquillett) (Steyaskal 1972); Agromyzidae (Melanagromyza bidens Spencer, Melanagromyza florid Spencer (Spencer and Stegmaier in press). The true host for C. ignotus remains outstanding.

Other parasites found from the seed heads of Bidens pilosa during October 1959 to March 1960 were: Pteromalidae (Halictocoeptera aenea (Walk.) 1 ♂, 9 ♀; Heteroschema punctata (Ashm.) 11 ♀; Halictocopterus sp., 7 ♂, 1 ♀; Eulophidae; Tetraglottis sobrius Gahan, 1 ♀; and Tetrastichus sp., 2 ♀; all of the above parasites were determined by Dr. B. D. Burks and collections of these rearings were from Hialeah and Miami, Florida). Steyskal (1972) reported rearing 20 Halictocoptera sp.; 5 H. punctata adults; 18 Tetrastichus sobrius Gahan and reported that this parasite has been reared from Asphondyilia websteri Felt and from Trupanea sp. in other plants; and Torymus anthomyiae (Ashm.). Steyskal (1972) reported only 6 Melanagromyza sp., from the seed heads of Bidens pilosa, and the author can only suggest that the Melanagromyza population reported by him would have undoubtedly been much greater if it were not for the limiting parasites found associated with the seed feeding agromyzids. More research is needed on the parasites associated with the Diptera populations in the seed heads of Bidens and other Compositae throughout the United States.
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CYNIPIDAE

Eucoilidea longicornis Ashm.: 1 adult, det. B. D. Burks, reared from Melanagromyza chaptae Spencer. Spencer (1966) reported this seed feeding agromyid from the seed heads of Chaptae dentata (L.) Cass., from collections of the author, Homestead, Fla., 22 I 64. I found no other insect associated with the seed heads of the sun bonnet and evidently this is the first report of the host insect for Eucoilidea longicornis. Peck in Muesebeck et al. (1951) cites a single male from Jacksonville, Fla., without host data. The species was described in 1887.

Trybligraphe sp.: 3 ♀, det. B. D. Burks, reared from seed heads of Wedelia trilobata Hitch., Miami, Fla., 14 XI 65. The host for this parasite is Melanagromyza minima (Malloch) (Spencer and Stegmaier in press).

PARASITES LISTED BY AGROMYZID SPECIES

Agromyza parvicornis Loew. Eulophidae: Clisterocerus tricinctus (Ashm.); Zagrannosoma multilineatum (Ashm).

Agromyza proxima Spencer. Eulophidae: Derostenus agromyzae Cwfd.; Derostenus diastatae (How.).

Cerodontha (Cerodontha) dorsalis (Loew). Braconidae: Opisus dimidiatus (Ashm.).

Eucoilidea callichroma Cwfd.

Jyunagromyza eugambia Spencer. Braconidae: Oenonyxstra n. sp.

Japanagromyza desmodivora Spencer. Pteromalidae: Halticoptera sp.

Liriomyza brassicae (Riley). Eulophidae: Chrysocharis sp.; Diaulonis callichroma; Pnigalia sp.

Liriomyza commelinae (Frost). Eulophidae: Chrysocharis majoriani (Grt.).

Liriomyza melampygae (Loew). Eulophidae: Clisterocerus tricinctus.

Liriomyza munda Frick. Braconidae: Opisus dimidiatus; Eulophidae: Chrysocharis sp.; Clisterocerus cinctipennis Ashm.; Derostenus diastatae (How.); Derostenus sp.; Derostenus variipes Cwfd.; Diaulonis callichroma; Diglyphus intermedius (Grt.); Zagrannosoma multilineatum (Ashm.); Pteromalidae: Halticoptera patellana (Dalman).

Liriomyza schmidtii (Aldrich). Eulophidae: Chrysocharis sp.; Clisterocerus cinctipennis; Derostenus variipes Cwfd.; Diaulonis callichroma.

Liriomyza sorosis (Williston). Braconidae: Neopisus eubitalis Fischer; Eulophidae: Chrysocharis majoriani; Chrysocharis sp.; Derostenus agromyzae Cwfd.; Diaulonis callichroma; Pteromalidae: Heteroschema sp.

Liriomyza trifolii (Burgess). Braconidae: Opisus dimidiatus (Ashm.); Opisus sp.; Eulophidae: Chrysocharis sp.; Clisterocerus cinctipennis; Derostenus agromyzae; Derostenus sp.; Derostenus variipes; Diglyphus intermedius (Grt.); Diglyphus pulchripes (Cwfd.); Diglyphus sp.; Mirzagrannosoma lineaticeps Grt.; Pteromalidae: Halticoptera patellana.


Melanagromyza minima Malloch. Cynipidae: Trybligraphe sp.

Melanagromyza minimoides Spencer. Eulophidae: Tetrastichus marylan-
densis (Grit.); Torymidae: Tornyus sp.; Pteromalidae: Heteroschema punctata (Ashm.).
Melanagromyza sirens Loew. Pteromalidae: Heteroschema punctata; Zatropis sp.
Phytobia (Amaromomya) maculosa (Malloch). Braconidae: Opis sp.;
Eulophidae: Chrysoscharis sp.; Derostenus sp.; Derostenus variipes;
Dialulinopsis callichroma.
Phytobia (Calycomyza) ambrosiae Frick. Eulophidae: Derostenus sp.
Phytobia (Calycomyza) artemisiae (Khh.). Eulophidae: Dialulinopsis callichroma.
Phytobia (Calycomyza) hyptidis Spencer. Eulophidae: Zagrammosoma sp.
Phytobia (Calycomyza) ipomaeae Frost. Eulophidae: Chrysoscharis sp.;
Dialulinopsis callichroma; Zagrammosoma sp.
Phytobia (Calycomyza) jucunda (Wulp). Eulophidae: Derostenus sp.
Phytobia (Calycomyza) malvae (Burgess). Eulophidae: Chrysoscharis majorian; Chrysoscharis sp.; Dialulinopsis callichroma.
Phytobia (Calycomyza) mikaniae Spencer. Pteromalidae: Heteroschema sp.
Phytomyza aquilegii Hardy. Eulophidae: Closterocerus tricinctus; Derostenus variipes; Zagrammosoma multilineatum.
Phytomyza ditmani Kulp. Eulophidae: Closterocerus tricinctus; Pnigalio proximus (Ashm.).
Phytomyza illlicola Loew. Eulophidae: Closterocerus cinctipennis; Closterocerus tricinctus; Pediobius lithocolletidis (Ashm.); Pnigalio guttiventris (Grt.); Pteromalidae: Hallicoptera sp.
Phytomyza illicis (Curt.). Braconidae: Opis illicis Nixon; Eulophidae:
Closterocerus tricinctus; Pnigalio fetti (Cwfd.).
Phytomyza opucae Kulp. Braconidae: Opis dimidiatus (Ashm.); Opis striativentris Gahan; Eulophidae: Closterocerus tricinctus; Pediobius lithocolletidis; Pnigalio guttiventris.
Phytomyza verticillatae Kulp. Braconidae: Opis n. sp.; Opis sp.; Eulophidae: Closterocerus tricinctus; Pediobius lithocolletidis; Pnigalio fetti.

LITERATURE CITED

Stegmaier: Parasites of Agromyzidae 281


Spencer, K. A., and C. F. Stegmaier, Jr. The Agromyzidae of Florida with a supplement on the species from the Caribbean. In Arthro-


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