A revision of *Ganaspidium* Weld, 1952 (Hymenoptera, Figitidae, Eucoilinae): new species, bionomics, and distribution

Matthew L. Buffington

Systematic Entomology Lab, ARS/USDA, c/o Smithsonian Institution, National Museum of Natural History, PO Box 30712 MRC-168, 10th & Constitution Ave, NW, Washington DC, 20013

† urn:lsid:zoobank.org:author:603275DE-9AE3-40C6-8AD7-6A2AF7485F35

Corresponding author: Matthew L. Buffington (matt.buffington@ars.usda.gov)

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Abstract

The New World eucoiline genus *Ganaspidium* is revised. Species in this genus are parasitoids of some of the most pestiferous species of leaf-mining Agromyzidae (Diptera), including the notorious *Liriomyza trifolii* (Burgess). The following new species are described: *Ganaspidium didionae*, *G. eldiablo*, *G. flemingi*, *G. kolmaci*, and *G. konzaensis*. *Ganaspidium navajoe* (Miller), *comb. n.*, is recognized as junior synonym of *G. pusillae* Weld (*syn. n.*). *Ganaspidium nigrimanus* (Kieffer) and *G. utilis* Beardsley are removed from synonymy, and together with *G. hunteri* (Crawford), are now in *Banacuniculus* Buffington. Species of *Ganaspidium* are recorded from a wide geographic area within North America, and several species appear to be adapted to arid environments. New distribution data, new host records, and a key to known species are provided.

Keywords

Eucoilinae, *Liriomyza*, Agromyzidae, new species, genus revision, species revision, parasitoid
Introduction

Weld (1955) established the genus *Ganaspidium* to accommodate the type species *G. pusillae* Weld (Hymenoptera: Figitidae: Eucoilinae) based on specimens sent to the United States National Museum (USNM) from the ‘Winter Garden Area’ of Texas. This species was reared as a koinobiont endoparasitoid (Godfrey, 1994) of the leaf miner *Liriomyza pusilla* (Meigen) (Diptera: Agromyzidae) taken off black-eyed peas (*Vigna unguiculata* (L.) Walp., Fabaceae) in Monte Alto, Texas. The species that was to become *G. pusillae* was referred to in Weld’s (1952) key as ‘new genus E’. This genus went ignored until Beardsley (1986) determined that *Eucoila hunteri* Perkins belonged in *Ganaspidium*; and, thus, created the combination *Ganaspidium hunteri*. *Ganaspidium hunteri* was discovered to parasitize multiple species of *Liriomyza* in Hawaii on species as diverse as chrysanthemum, cucumber, tomato, and ‘unspecified hosts’ (Beardsley, 1986). In a follow-up paper, Beardsley (1988) provided a key to all eucoiline agromyzid parasites recorded at that time from Hawaii and described a third new species of *Ganaspidium*, *G. utilis* Beardsley. This species has been shown to be instrumental in controlling certain pest species of *Liriomyza*, including *L. trifolii* (Burgess) and *L. huidobrensis* (Blanchard) (Johnson 1987; Lynch and Johnson 1987; Mason and Johnson 1988; Rathman et al. 1991; Rathman et al. 1995).

*Ganaspidium* is easily confused with several closely related genera of Eucoilinae. One paratype of *G. pusillae* is actually *Disorygma pacifica* (Yoshimoto). Several collections I have examined consistently had specimens of *Agrostocynips* Diaz mixed with series of both *Ganaspidium* and *Disorygma* Förster. Miller (1989) assigned two new eucoilines described from North America to the Afrotropical genus *Nordlanderia* Quinlan. Unfortunately, the precise location of the holotypes is unknown, so Buffington (2004) left the following species as *nomina dubia*: *Nordlanderia merickeli* Miller and *N. najavoe* Miller. Comparison of the holotypes of the known species of *Ganaspidium* and many specimens of *Ganaspidium* at the USNM with the scanning electron micrograph images in Miller (1989), however, has allowed me to determine that one of his species belongs in *Ganaspidium*, while the second does not.

Buffington (2004) erroneously synonymized *Ganaspidium nigrimanus* (Kieffer 1907) with *G. utilis* because of the limited material available at the time. This action is now corrected and *G. utilis* is resurrected as a valid species, based on examination of material from the Canadian National Collection of Insects (CNCI, Ottawa, Canada), Texas A& M Insect Collection (TAMU, College Station, TX), the Entomology Research Museum, UC Riverside (Riverside CA), and the USNM (Washington, DC).

In Buffington et al. (2007), *Ganaspidium utilis* and *G. hunteri* were recovered in a clade separated from *G. pusillae*; this clade is sister-group to the Afrotropical lineage *Ealata* Quinlan and Palearctic lineage *Microstilba* Förster. Additional morphological studies of borrowed specimens, as well as those housed at the USNM, revealed that *G. hunteri*, *G. nigrimanus*, and *G. utilis* share very few character states with *G. pusillae*, but do share several states found within *Disorygma* Hartig, *Gronotoma* Förster and *Microstilba*. Because no other eucoiline genus could accommodate these species, Buffington
(2010) described *Banacuniculus* and created the combinations *Banacuniculus hunteri* (Crawford), *B. nigrimanus* (Kieffer) and *B. utilis* (Beardsley). The need for a redefinition of the generic boundaries of *Ganaspidium* is critically needed given that several closely related leafminer-parasitizing genera are typically confused with this genus.

Considering that species of this genus are distributed over a broad geographic range in North, Central, and South America, and its species are parasites of agromyzids of considerable economic importance (Johnson 1987), this paper is presented to help clarify confusion in this important and fascinating genus. This paper contains a redescription of *Ganaspidium* and *G. pusillae*, as well as the description of five species new to science: *Ganaspidium didionae*, *G. eldiablo*, *G. Flemingi*, *G. kolmaci*, and *G. konzaensis*. *Nordlanderia navajoe* Miller, is recognized as junior synonym of *G. pusillae* Weld (new synonym). A key to all known species is included and the biology, when known, is included in each description.

**Materials and Methods**

**List of Repositories**

- **CASC**: California Academy of Sciences, San Francisco, CA, USA (R. Zuparko).
- **CNCI**: Canadian National Collection of Insects, Ottawa, Canada (J. Read).
- **KSCU**: Kansas State University, Manhattan, KS (G. Zolnerowich).
- **TAMU**: Texas A&M University Insect Collection, College Station, TX, USA (E. Riley).
- **UCDC**: Bohart Museum, University of California at Davis, Davis, CA, USA (L. Kimsey).
- **UCRC**: University of California at Riverside, Riverside, CA, USA (S. Triapytsin).
- **USNM**: National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA (M. Buffington).

**Additional sources of specimens.** Extensive collections were made available from Texas by Ricardo Hernandez (Department of Entomology, TAMU) and Kansas by Robert Kula (Systematic Entomology Laboratory (SEL), ARS/USDA, Washington, DC) and Gregory Zolnerowich (Kansas State University, Manhattan, KS). Several specimens of *Ganaspidium* were taken via sweep net in Arizona and Nevada by Michael Gates (SEL) and myself during routine collecting trips. Sweeping low, placate vegetation, with a triangular sweep net (Noyes 1982), resulted in a significant number of specimens from each location.

**Specimen illustration and observation.** Methods for the imaging of specimens using light microscopy follow those of Buffington and van Noort (2007, 2009). An environmental scanning electron microscope (ESEM) was used as well; specimens were shot uncoated in a Philips XL-30 ESEM machine, with lanthanum hexaboride electron source (LaB6). The instrument was operated in low vacuum mode with water vapor as the imaging gas and backscatter imaging with one-half of the diode active. Specimen
mounting and lighting techniques follow Buffington and Gates (2009). Slide mounts were prepared with PVA mounting medium, cured for 72 hours at 43ºC. Original drawings were done in pencil, scanned, and digitally edited using Adobe Photoshop CS2 (original drawings prepared by Theodore Buffington). Specimens were examined with a Leica M10 stereomicroscope, illuminated with a pair of fluorescent desk lights. This type of light is essential for the examination of Ganaspidium, since these lights produce an extremely diffuse illumination, preventing the obscuring of fine sculpture by glare.

**Descriptive format**

Diagnoses focus on features that are easily recognizable by other observers, and closely related species that may have similar gross morphologies are distinguished. Terminology for all descriptive characters, as well as phylogenetic characters, are defined in Buffington (2009) and are not repeated here; surface sculpture terminology follows that of Harris (1979). Following the descriptions are summaries of general distribution, biology and comments on nomenclatural issues (when applicable). The species descriptions are generated by a database application, vSysLab (Johnson 2008), designed to facilitate the generation of taxon by character data matrices and to export the data both as text and as input files for other applications. Exact label data is reported for holotypes. A link to a distribution map is included in each species description.

**Systematic treatment**

*Ganaspidium* Weld, 1955: 274

**Type species:** *Ganaspidium pusillae* Weld, by original designation.

**Diagnosis.** Malar space and ventral clypeal margin with distinct conical protuberances. Notauli absent. Parascutal impression incomplete. Scutellar plate narrow with paired conical protuberances anterior of midpit; midpit positioned in posterior one-third of plate. Setal band at base of syntergum of metasoma complete. Similar to *Disorygma, Microstilba*, and *Nordlanderia*, but distinguished by the absence of notauli and the presence of a hairy ring at the base of the syntergum; also similar to *Agrostocynips*, but with the pronotal plate less than one-half the width of the head, the genal carina absent, and the presence of clypeal and malar protuberances. Similar to *Banacuniculus*, but differing in the morphology of the scutellar plate (conical protuberances present in *Ganaspidium*, absent in *Banacuniculus*) and the incomplete parascutal impression (complete in *Banacuniculus*).

**Redescription.** *Head.* Nearly glabrous with a few scattered setae on lower face, clypeus, inner margins of compound eyes, and gena; ocellar hair patches absent. Ventral one-fourth of lower face with admedial clypeal furrows converging towards the clypeus; point of convergence resulting in the formation of a distinct conical protuber-
ance protruding from anterior margin of clypeus. Orbital furrows absent. Malar sulcus ranging from simple to compound. Malar space smooth to distinctly strigose, with large conical protuberance present. Genal carina absent.

**Antennae.** Female: 13 segments, moniliform, clavate; segments 3–13 sub-equal in length; rhinaria present only on the last 7 segments. Male: 15 segments; segments 3–15 sub-equal in length; rhinaria present on segments 3–15. Segment 3 modified, curved outwardly, excavated laterally.

**Pronotum.** Pronotal plate narrow, with setae present along posterior margin; dorsal margin rounded; pronotal fovea open. Lateral pronotal carina absent. Pronotal triangle absent. Pronotal impression absent. Lateral aspect of pronotum smooth, glabrous in most species.

**Mesoscutum.** Glabrous and smooth. Parascutal impression incomplete. Notauli, mesoscutal keel, parapsidal ridges, and parapsidal hair lines absent.

**Mesoplectus.** Upper and lower part of mesopleuron ranging from completely smooth to longitudinally striate; glabrous. Mesopleural triangle present, faintly indicated (often only visible in the space immediately anterior to the mesopleural spiracle). Mesopleural carina simple; mesopleural hair patch present to absent. Precoxal carina of lower part of mesopleuron present anteriorly and posteriorly, absent ventrally. Surcoxal depression reduced, smooth.

**Scutellum.** Scutellar plate small, narrow; scutellar midpit positioned posteriorly, typically on posterior one-third of plate (MP, Fig. 1A); rim of plate translucent; dorsal surface of plate with pair of tubercles (TUB, Fig. 1A, B). Dorsal surface of the scutellum reticulate to smooth; rounded posteriorly and laterally; posterior carina present or absent. Laterodorsal and posterior projections absent. Laterodorsal and posterior projections absent. Lateral bar as long as wide; ventral lobe absent. Scutellar fovea oval, smooth and deep.


**Wings.** Hyaline; setose. R complete, pigmented along anterior margin of wing; marginal cell truncate, typically deeper than long (Fig. 1C). Apical fringe short.

**Legs.** Fore and mid coxa sub equal in size, hind coxa twice the size of either fore or mid coxa. Fore coxa variously setose; mid and hind coxa with distinct anterior and posterior dorsoventral setal bands. Femora with sparse setal lines; tibiae and tarsomeres with dense, appressed setae. Length of hind tarsomere 1 equal to 0.5x the combined length of remaining hind tarsomeres.

**Metasoma.** Female: Sub equal in size to mesosoma. Base of syntergum with hairy ring, comprised of dense appressed setae and a ring of thin, erect setae; remainder of metasoma glabrous. Micropunctures present on posterior one-third of syntergum and remaining terga. Terga posterior to syntergum gradually directed ventrally, resulting
in 70 degree angle between syntergum and remaining terga. Ovipositor with series of sub apical serrations (seen only in large specimens). Male: as in female, with the terga posterior to syntergum abruptly angled ventrally, resulting in 90 degree angle between syntergum and remaining terga.

**Distribution.** Figure 5.

Neotropical Region: Chile, Costa Rica; Nearctic Region: northern Mexico, continental United States, southern Canada.

**Biology.** Several species of *Liriomyza* have been recorded as hosts (Weld 1955; Harding, 1965, present study). Species of this genus can be found in nearly bioge-
graphic region and have been recovered from hosts in 25 families of Asteraceae (CABI 1992). This incredibly broad geographic and host range helps explain the presence of this host from lush agroecosystems to arid desert habitats.

Comments. Miller (1989) described two species of eucoline wasps that were placed in *Nordlanderia* Quinlan. Although the type specimens for these two species are apparently lost (Miller, pers. comm.), it is clear from the scanning electron micrographs accompanying the original descriptions that these two species do not belong in *Nordlanderia*. One species, *N. navajoae* Miller, bears diagnostic features of *Ganaspidium* and is transferred below; the second species, *N. merickeli* Miller, belongs in *Banacuniculus*, and is formally transferred in Buffington (2010). One paratype of *Ganaspidium pusillae* is actually a specimen of *Disorygma pacifica* (Yoshimoto), reared from *Liriomyza pusilla*. This specimen bears the label “Disorygma” in Nordlander’s hand.

**Species included in *Ganaspidium* Weld**

*G. didionae* Buffington, new species.
*G. eldiablo* Buffington, new species.
*G. flemingi* Buffington, new species.
*G. kolmaci* Buffington, new species.
*G. konzaensis* Buffington, new species.
*G. pusillae* Weld, 1955: 274, holotype in USNM. *Ganaspidium navajoae* (Miller), syn. n., holotype lost.

**Species formerly placed in *Ganaspidium*, now placed in *Banacuniculus* (Buffington, 2010):**

*Banacuniculus hunteri* (Crawford), Buffington (2010). *Ganaspidium hunteri* (Crawford) Beardsley (1986); *Eucoila hunteri* Crawford, 1913: 310, holotype in USNM.

**Key to species of *Ganaspidium***

Note: Diffuse light, such as that produced by fluorescent lights or fiber optic lights with light dispersing film, is absolutely essential to effectively use this key.

1. Frons smooth, malar space, and mesopleuron smooth (Fig. 2B); if malar space striate, striations restricted to ventral margin and not extending to ventral margin of compound eye; if mesopleuron with some striations, these striations restricted to the postero-dorsal margin of the sclerite .................. 2

Frons, malar space and the majority of the mesopleuron distinctly longitudinally striate Figs 3A & B); frons typically striate from mandibular base to ventral margin of compound eye............. *G. konzaensis* Buffington, sp. n.
2. Dorsal surface of scutellar plate with a pair of distinct tubercles present on the anterior half of the plate (Fig. 1A) .............................................................. 3
   – Dorsal surface of scutellar plate nearly flat, with a slight hump where in other species the scutellar plate tubercles are present (Fig. 4A) ................................................................................................................................. G. kolmaci Buffington, sp. n.

3. Dorsal surface of the scutellum entirely smooth, occasionally with weak wrinkles along the margin of posterior carina (Fig. 4D) .................. 4
   – Dorsal surface of scutellum distinctly rugulose to strigose, never smooth (Fig. 2B) ....................................................................................................... 5

4. Posterior margin of scutellum without a distinct carina differentiating the dorsal surface from the postero-lateral surface; dorsal surface of scutellum totally smooth ................................................................. G. eldiablo Buffington, sp. n.
   – Posterior margin of scutellum with a distinct and well-developed posterior carina, differentiating the dorsal surface of the scutellum from the postero-lateral surface; dorsal surface of scutellum smooth, with occasional weak wrinkles posteriorly along the posterior carina............. G. flemingi Buffington, sp. n.

5. Dorsal surface of scutellum distinctly rugulose with a large, distinctly cleft, posterior carina (Fig. 4C); tubercles of the scutellar plate massive, height of tubercle equal to the width of the tubercle base; malar space striate .............. G. didionae Buffington, sp. n.
   – Dorsal surface of scutellum more delicately sculptured, with fine strigae radiating from the underside of the scutellar plate (Fig. 2 B); posterior carina very thin and not cleft; tubercles of the scutellar plate smaller, height of each tubercle equal to one-half to one-third length of tubercle base; malar space occasionally striate but much more typically smooth........ G. pusillae Weld

Ganaspidium didionae Buffington, sp. n.
urn:lsid:zoobank.org:act:23635553-5CB6-4754-7C9C-793E9EBE5CBF9
urn:lsid:biosci.ohio-state.edu:osuc_concepts:253200

Figure 4C

Description. Malar sulcus compound. Malar space partially striate, striations extending one-half to two-thirds distance from ventral margin of malar space to base of compound eye. Malar protuberance smooth, elongate, extending beyond length of ventral margin of malar space. Clypeal protuberance elongate, overhanging anterior margin of clypeus. Tubercles of scutellar plate present, distinct, large, length of tubercle equal to or greater than width of tubercle base. Dorsal surface of scutellar plate concave around midpit, two setal bearing pits at base of each tubercle. Carina along posterior margin of scutellum present, distinctly cleft, defining transition from dorsal surface of scutellum from posterior surface. Dorsal surface of scutellum entirely rugulose/wrinkled. Midpit of scutellar plate in posterior half of plate; plate small, revealing dorsal surface of scutellum when viewed dorsally. Mesopopleural setal patch absent. Mesopleuron
entirely smooth; smooth anteriorly, striate along the postero-dorsal margin. Lateral aspect of pronotum anteriorly with some short setae, remainder glabrous. Marginal cell of forewing distinctly deeper than long. Metasoma of sub-equal size to mesosoma in lateral view.

**Diagnosis.** This species is unique within *Ganaspidium* as it is the only species with a horizontally striate scutellar plate. The strongly reticulate dorsal surface of the scutellum is also rather unique, only shared with *G. konzaensis* and *G. kolmaci*; *G. didionae*
is separated from these two by the horizontally striate scutellar plate as well as a limited degree of striation on the malar space (fully striate in *G. konzaensis*) and distinct tubercles on the scutellar plate (significantly reduced in *G. kolmaci*).

**Etymology.** Named in honor of author Joan Didion. Several fiction and non-fiction pieces by Ms. Didion focus on the desert Southwest of the United States. The gender is feminine.

**Link to distribution map.** http://hol.osu.edu/map-full.html?id=253200


**Ganaspidium eldiablo Buffington, sp. n.**

urn:lsid:zoobank.org:act:7564C834-EEF1-4BCD-B809-A21707B77987

urn:lsid:biosci.ohio-state.edu:osuc_concepts:253202

**Figure 4D**

**Description.** Malar sulcus compound. Malar space smooth. Malar protuberance smooth, elongate, extending beyond length of ventral margin of malar space. Clypeal

**Diagnosis.** This species can be separated from all other *Ganaspidium* by having the dorsal surface of the scutellum smooth anteriorly, striate posteriorly, and lacking the posterior carina of the scutellum. This species is most easily confused with *G. pusillae* and *G. flemingi*, both of which possess a distinct posterior carina of the scutellum.

**Etymology.** Name refers to the type locality along the ‘El Camino Diablo Real’ in southwestern Arizona. The gender is neuter.

**Link to distribution map.** [http://hol.osu.edu/map-full.html?id=253202](http://hol.osu.edu/map-full.html?id=253202)

**Material examined.** Holotype, female: UNITED STATES: ARIZONA. Pima Co., 17mi E Papago Well, Camino del Diablo, along wash, Organ Pipe Cactus Na-
Paratypes: (17 females, 4 males) **UNITED STATES:** ARIZONA. Pima Co., 17mi E Papago Well, Camino del Diablo, along wash, Organ Pipe Cactus National Monument, 29.VIII.2006, sweeping, Gates & Buffington (14 females, 3 males, USNM ENT 00655297, 00655298, 00655299, 00655301-00655306, 00655308, 00655309, 00655310-00655315 (USNM)). CALIFORNIA. Riverside Co., Thousand Palms, 26.IV.1955, W. R. M. Mason (1 female, USNM ENT 00655546 (CNCI)); Riverside Co., Whitewater Canyon, 310m, 2.VI.1998 (1 female, UCRC ENT 196990 (UCRC)). OREGON. Lake Co., 13.5mi SW Christmas Valley, 5.VIII.1995, sweeping, J. D. Pinto (1 male, UCRC ENT 196979 (UCRC)). WASHINGTON. Grant Co., Potholes State Park, 26.VII.1985, Moss, Finnamore & Thormin (1 female, USNM ENT 00655556 (CNCI)).

**Figure 5.** General distribution map of all species of *Ganaspidium.*
**Ganaspidium flemingi** Buffington, sp. n.

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urn:lsid:biosci.ohio-state.edu:osuc_concepts:253203

Figure 4B

**Description.** Malar sulcus compound. Malar space smooth. Malar protuberance smooth, elongate, extending beyond length of ventral margin of malar space. Clypeal protuberance elongate, overhanging anterior margin of clypeus; short, not overhanging anterior margin of clypeus. Tubercles of scutellar plate distinct, small, length of tuber less than one-half width of tubercle base. Dorsal surface of scutellar plate concave around midpit, two setal bearing pits at base of each tubercle. Carina along posterior margin of scutellar present, delicate, defining transition from dorsal surface of scutellum from posterior surface. Dorsal surface of scutellum smooth except for faint wrinkles along posterior carina. Midpit of scutellar plate in posterior half of plate; plate small, revealing dorsal surface of scutellum when viewed dorsally. Mesopleural setal patch absent. Mesopleuron entirely smooth. Lateral aspect of pronotum anteriorly with some short setae, remainder glabrous. Marginal cell of forewing distinctly deeper than long. Metasoma of sub-equal in size to mesosoma in lateral view.

**Diagnosis.** This species can be separated from all other species of *Ganaspidium* by having an entirely smooth dorsal surface of the scutellum, with only a few gentle wrinkles present along the posterior carina of the scutellum, and having a completely smooth malar space. Most easily confused with *G. pusillae*, which will often have a smooth anterior half, but distinctly wrinkled/striate posterior half of the dorsal surface of the scutellum.

**Etymology.** Named in honor of Ian Fleming, author and creator of the British secret agent *James Bond 007*, and long time resident of The Bahamas. The gender is masculine.

**Link to distribution map.** http://hol.osu.edu/map-full.html?id=253203

Co., watershed, Konza Prairie Biological Station, 16.VIII-26.VIII.2005, malaise trap (1 female, USNM ENT 00655618 (USNM)); Geary Co., watershed, Konza Prairie Biological Station, 27.VI-8.VI.2005, malaise trap (1 male, USNM ENT 00655619 (USNM)).

NEW MEXICO. Valencia Co., 20mi W Los Lunas, along streambed, Carrizo Creek, 23.VIII.1977, malaise trap, S. Peck & J. Peck (1 female, USNM ENT 00655555 (CNCI)).

**Comments.** The presence of this taxon in The Bahamas is intriguing. Most eu-coiline leafminer parasites from the Caribbean belong to the Zaeucoilini (Buffington, 2009). It is likely that this species is a North American native that has been introduced to The Bahamas via human activity, as has occurred with *B. utilis* and *Disorygma pacifica* (Yoshimoto) in the Hawaiian Islands.

**Ganaspidium kolmaci** Buffington, sp. n.
urn:lsid:biosci.ohio-state.edu:osuc_concepts:253205
Figure 4A

**Description.** Malar sulcus simple. Malar space partially striate, striations extending one-half to two-thirds distance from ventral margin of malar space to base of compound eye. Malar protuberance smooth, elongate, extending beyond length of ventral margin of malar space. Clypeal protuberance elongate, overhanging anterior margin of clypeus. Tubercles of scutellar plate extremely reduced, hardly distinguishable. Dorsal surface of scutellar plate flat, smooth, setal bearing pits present surrounding midpit. Carina along posterior margin of scutellum absent; present, delicate, defining transition from dorsal surface of scutellum from posterior surface. Dorsal surface of scutellum smooth anteriorly, reticular/strigate posteriorly. Midpit of scutellar plate in posterior half of plate; plate small, revealing dorsal surface of scutellum when viewed dorsally. Mesopopleural setal patch absent. Mesopleuron entirely smooth; smooth anteriorly, striate along the postero-dorsal margin. Lateral aspect of pronotum anteriorly with some short setae, remainder glabrous. Marginal cell of forewing as deep as long. Metasoma of sub-equal in size to mesosoma in lateral view.

**Diagnosis.** This species can be separated from all other *Ganaspidium* by the presence of reduced tubercles on the scutellar plate. This characteristic requires careful observation because the tubercles are difficult to observe. In all other species of *Ganaspidium*, the paired tubercles are well developed and easily seen in profile (e.g. Fig. 1B).

**Etymology.** Named in honor the doctors and staff of the Kolmac Clinic, Washington, DC. The gender is masculine.

**Link to distribution map.** http://hol.osu.edu/map-full.html?id=253205

**Material examined.** Holotype, female: UNITED STATES: UT, Wayne Co., 8mi W Caineville, Moki Ruin, 4920ft, 14.X.2002, sweeping, J. D. Pinto, USNM ENT 00655300 (deposited in USNM). Paratypes: (28 females, 18 males) ARGENTINA: Neuquén Prov., 21km WNW Junín de los Andes, hwy 62, 3km inside park,
A revision of *Ganaspidium* Weld, 1952 (Hymenoptera, Figitidae, Eucoilinae): new species...


*Ganaspidium konzaensis* Buffington, sp. n.

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urn:lsid:biosci.ohio-state.edu:osuc_concepts:253206

Figures 3A–B

**Description.** Malar sulcus compound. Malar space completely striate from ventral margin of malar space to base of compound eye. Malar protuberance smooth, elongate, extending beyond length of ventral margin of malar space. Clypeal protuberance elongate, overhanging anterior margin of clypeus. Tubercles of scutellar plate present,
distinct, large, length of tubercle equal to or greater than width of tubercle base. Dorsal surface of scutellar plate concave around midpit, two setal bearing pits at base of each tubercle. Carina along posterior margin of scutellum present, distinctly cleft, defining transition from dorsal surface of scutellum from posterior surface. Dorsal surface of scutellum entirely rugulose/wrinkled. Midpit of scutellar plate in posterior half of plate; plate small, revealing dorsal surface of scutellum when viewed dorsally. Mesopleural setal patch absent. Mesopleuron distinctly striate along the anterior, posterior margins; often entire sclerite striate. Lateral aspect of pronotum anteriorly with some short setae, remainder glabrous. Marginal cell of forewing as deep as long. Metasoma of sub-equal in size to mesosoma in lateral view.

**Diagnosis.** This species is separated from all other species of *Ganaspidium* by the distinctly striate mesopleuron and fully striate malar space. In some *G. pusillae* and *G. kolmaci*, the postero-dorsal corner of the mesopleuron can be striate, as well as the ventral one-half to one-third of the malar space, but in neither case is the entire surface striate as in *G. konzaensis*.

**Etymology.** Named for the type locality of the holotype, Konza Prairie Biological Reserve, Geary County, Kansas. The gender is neuter.

**Link to distribution map.** http://hol.osu.edu/map-full.html?id=253206


*Ganaspidium pusillae* Weld, 1955

urn:lsid:biosci.ohio-state.edu:osuc_concepts:251125

Figures 1A–C, 2A–B

*Nordlanderia navajoae* Miller, 1989, new synonymy

**Redescription.** Malar sulcus simple. Malar space partially striate, striations extending one-half to two-thirds distance from ventral margin of malar space to base of compound eye. Malar protuberance smooth, elongate, extending beyond length of
ventral margin of malar space; smooth, short, not extending beyond length of ventral margin of malar space. Clypeal protuberance elongate, overhanging anterior margin of clypeus; short, not overhanging anterior margin of clypeus. Tubercles of scutellar plate distinct, small, length of tuber less than one-half width of tubercle base. Dorsal surface of scutellar plate concave around midpit, two setal bearing pits at base of each tubercle. Carina along posterior margin of scutellum present, delicate, defining transition from dorsal surface of scutellum from posterior surface. Dorsal surface of scutellum smooth anteriorly, reticular/strigate posteriorly. Mid-pit of scutellar plate in posterior half of plate; plate small, revealing dorsal surface of scutellum when viewed dorsally. Mesopopleura setal patch absent. Mesopleuron entirely smooth; smooth anteriorly, striate along the postero-dorsal margin. Lateral aspect of pronotum anteriorly with some short setae, remainder glabrous. Marginal cell of forewing distinctly deeper than long. Metasoma of sub-equal size to mesosoma in lateral view.

**Diagnosis.** Differs from other species of *Ganaspidium* by having moderately developed tubercles on the scutellar plate, dorsal surface of scutellum smooth anteriorly and delicately sculptured posteriorly, and a complete posterior scutellar carina; other species in the group either lack the posterior carina, have an entirely smooth dorsal surface of the scutellum, indistinct or very well-developed tubercles on the scutellar plate.

**Biology.** Recorded from *Liriomyza huidobrensis* (Blanchard) (present study), *L. pusilla* (Meigen) (Weld, 1955), and *L. munda* Frick (Harding, 1965).

**Link to distribution map.** http://hol.osu.edu/map-full.html?id=251125


Discussion

Buffington et al. (2007) considered Ganaspidium pusillae to be the sister-group to what was referred to then as the Gronotoma group of genera. Forshage and Nordlander (2008) resurrected Diglyphosemini Belizin, 1961, and referred to taxa formally included within the Gronotoma group, based on Fontal-Cazalla et al. (2002) and Buffington et al. (2007), as members of this tribe; hence, Ganaspidium is included within Diglyphosemini. This tribe will be formally circumscribed in a subsequent paper that will be a companion to Buffington (2009). Although the morphology of Ganaspidium could be considered rather derived within Eucoilinae (e.g. scutellar plate small, tubercles present on the scutellar plate, mostly Nearctic distribution; Fontal-Cazalla et al. 2002), it appears that these characters are instead autapomorphies for
the genus as a whole. The host preference for Agromyzidae, as well as the presence of conical protuberances on the anterior margin of the clypeus and malar spaces, appears to be the ground plan for the Diglyphosemini; the protuberances are shared with *Banacuniculus*, *Ealata*, *Microstilba*, *Nordlanderia* Quinlan, and *Tobiasiana* Kovalev (Buffington et al. 2007; Buffington 2010). The arid habitats in which some species of *Ganaspidium* appear to thrive is another peculiar aspect of this genus (Fig. 5) and is linked to the broad distribution of *Liriomyza* species (CABI 1992). The shrub *Larrea tridentata* (Sesse’ and Moc. Ex DC.) Coville (Zygophyllaceae) possesses a similar distribution to many *Ganaspidium* species (Runyan 1934; Marshall 1995), and may be a critical host reservoir for agromyzids attacked by *Ganaspidium*. Specimens have been swept off what appears to be completely dormant (Runyan 1934) or dead shrubs *L. tridentata* in the Great Basin of North America. Exactly how these wasps survive and what hosts they are utilizing are unknown. Further fieldwork and careful rearing protocols are needed to learn more about this small yet effective natural enemy of agromyzid flies.

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References


