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A NEW SPECIES OF *MEGASELIA* RONDANI (DIPTERA: PHORIDAE) FROM THE BIOSCAN PROJECT IN LOS ANGELES, CALIFORNIA, WITH CLARIFICATION OF CONFUSED TYPE SERIES FOR TWO OTHER SPECIES

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Abstract.—The paratype series of *Megaselia globipyga* Borgmeier was found to contain two species, neither of which matched the holotype. The holotype of *M. globipyga* is here fully illustrated for clarity, and new biological and geographical data for the species are given. A **new species, *Megaselia risoria* Hartop, Wong, and Eiseman**, is described from two of the paratypes of *M. globipyga*, a paratype from the original type series of *M. postcrinata* Borgmeier, and a singleton from the BioSCAN Project.

Key Words: taxonomy, urban biodiversity, type material

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Megaselia Rondani (Phoridae) is a genus rife with taxonomic challenges and frustrations. Recently, author Eiseman sent a series of specimens from Massachusetts to author Hartop for identification. These specimens clearly matched some specimens from the BioSCAN Project, an urban biodiversity study (Brown et al. 2014, Hartop 2014), and some of the specimens keyed to *M. globipyga* (some failed to key because of variation in the costal indices that is not accounted for in the keys). Examination of the type series for *M. globipyga* revealed a total of three different species. Both Eiseman's specimens and BioSCAN material matched the holotype (although color differences between the fresh material and old, air dried, type material further added to the confusion), but the three paratypes represented two different species, neither of which matched the holotype. Two specimens from the paratype series were found to match an unknown singleton from the BioSCAN Project. When these specimens were taken through the keys, it led to the examination of the type series of *M. postcrinata* Borgmeier, a species described from a female specimen. In this series, one of several disparate male paratypes matched the BioSCAN singleton and *M. globipyga* paratypes. This species is herein described as *Megaselia risoria* sp. nov. The problem of historic over-reliance on superficial characters and resulting misidentifications cannot be overstated; it is not uncommon for multiple species to have masqueraded as a single species in identified material and even type series, sometimes for decades.

Materials and Methods

BioSCAN specimens were collected by Malaise traps into 95% ethanol. Eiseman's specimens were reared to adulthood in a plastic vial and then preserved in 95% ethanol. Specimens were dissected and slide mounted by first clearing in clove oil and then mounting in Canada Balsam. Dried type material was softened in lactic acid and then rinsed with water before clearing in clove oil. Specimens were examined using a Leica M205C stereo microscope and an Olympus BX40 compound microscope. Specimens were photographed with a Keyence VHX-5000 digital microscope. Specimens from the BioSCAN project are deposited in the Natural History Museum of Los Angeles County, USA (LACM). All material from the Smithsonian (USNM) remains in that collection. Methods for dissection and specific mounting protocol followed those recommended for this genus (Disney 2009).

As technology has much improved since the original description of *M. globipyga* in 1966, we here offer high quality photographs and a detailed drawing of the genitalia for this species in addition to the newly described species. We also present a chart of species character states for both, following the previously established system of Hartop and Brown (2014). Clarification of some of the characters for this system can be found in Hartop et al. (2015). The visual aids also follow this system for both species, with the exception of the hypandrium, which is normally dissected out and photographed but here was left intact (due to the historic nature of many of the specimens involved). The expanded details of description should aid in confident future identifications of both species.

Results

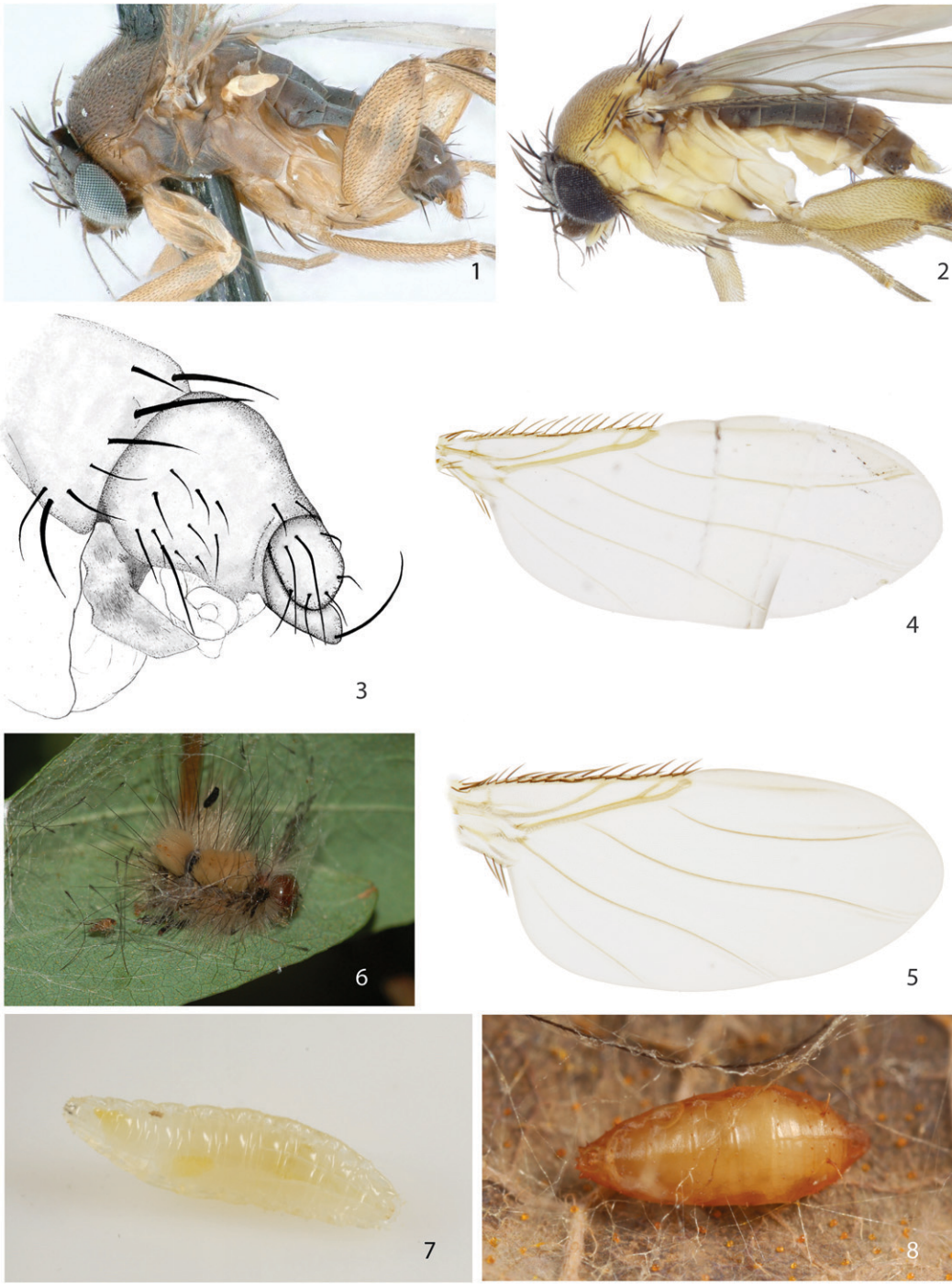
Megaselia globipyga Borgmeier

(Figs. 1, 2, 3, 4, 6, 7, 8)

Megaselia globipyga Borgmeier 1966 p.6 (key) 105, fig. 88

Diagnosis.—♂. Costal length ranging from 0.41–0.45 of the wing length, allowing this species to key in either group VII or group VIII in the keys of Borgmeier (1966), although *M. globipyga* is only found in the group VIII key. In the group VII key, *M. globipyga* keys to couplet 11 where it is easily differentiated from *M. nigra* Meigen by the undiverted setal palisade on the hind leg. This species cannot definitively be told apart from *M. postcrinata* Borgmeier at the same couplet; the latter was described from the female and the paratype series was found to contain several disparate males. Future molecular work (or the lucky find of a copulating pair) may allow us to correctly match a male with the female holotype, which may eventually lead to a synonomy of a separately described male.

Although the near century-old holotype of *M. globipyga* would clearly be classified as a "brown" species (Fig. 1), a fresh, chemically dried mount looks remarkably lighter (Fig. 2) and would likely be called a "yellow" species. The two are indistinguishable in color once slide mounted, confirming the difference as an artifact of preservation. If *M. globipyga* is keyed in either the group VII or group VIII keys as a yellow species, it reaches *M. longipennis* Malloch, which was described from females. Borgmeier did purport to have examined males of this species, but since these were undoubtedly superficially matched to the females and almost certainly represent several species, the authors do not recommend calling any male phorid



Figs. 1–8. 1, *Megaselia globipyga* (holotype), lateral habitus. 2, *Megaselia globipyga* (chemically dried specimen from the BioSCAN Project), lateral habitus. 3, ♂ genitalia of *Megaselia globipyga*, left lateral aspect. 4, Right wing of *M. globipyga* (holotype). 5, Right wing of *Megaselia larvivora* (paratype). 6, Adult ♀ *Megaselia globipyga* (lower left) with dead *Orgyia* caterpillar. 7, Larva of *Megaselia globipyga*. 8, Puparium of *Megaselia globipyga*.

M. longipennis at this time. Even if Borgmeier's description was to be trusted, the short apical hairs on the anal tube of *M. longipennis* would be easily differentiated from the prominent setae found on *M. globipyga*. As with *M. postcrinata*, only with future molecular work or a mating pair will we be able to identify the males of *M. longipennis*.

In more recent literature, *M. globipyga* was found to closely resemble *M. larvivora* Disney (2013) in host (both species reared from moth larvae) and in the overall shape of the male genitalia. Upon comparison with the types of *M. larvivora*, however, two characters easily separate these similar species: *M. globipyga* has a distinct prolongation of the epandrium just under the anal tube (Fig. 3) that *M. larvivora* lacks, and the fork created by R_{2+3} and R_{4+5} is noticeably more acute in *M. larvivora* (see *M. globipyga* Fig. 4 versus *M. larvivora* Fig. 5).

Description.—See Table 1.

Distribution.—The holotype is from Priest Lake, Lookout Mountain, ID. Paratypes from Chatcolet, ID, Lake McDonald, MT, and Mica, WA were found to be other species and thus should be removed from this species' range. Los Angeles, California and Attleboro, Bristol County, Massachusetts (USA) are now recorded.

Biology.—Specimens from Massachusetts were reared from the remains of a white-marked tussock moth caterpillar (Lepidoptera: Erebidae: *Orgyia leucostigma* (J.E. Smith)). The dead caterpillar was discovered on 18 July 2013 amid some webbing spun across the undersides of two leaves of dangleberry (Ericaceae: *Gaylussacia frondosa* (L.) Torr. and A. Gray ex Torr.). It had evidently begun spinning a cocoon before succumbing to hymenopteran parasitoids. A number of eulophid wasp (Hymenoptera: Eulophidae) pupae were attached to its remains, and from these 12 adult females of *Elachertus cidariae* (Ashmead) emerged on 27 July. Since *Elachertus* larvae are primary parasitoids, and *O. leucostigma* is a known host of *E. cidariae* (Schauff 1985), we consider it safe to assume that the wasp larvae were the cause of death. At the time of collection, an adult female *Megaselia* was observed moving about on the caterpillar remains (Fig. 6). She was sufficiently interested in the carcass that she did not attempt to escape when the leaves were picked and placed in a vial. She was removed from the vial two days later. Several phorid larvae (Fig. 7) were found on the caterpillar on 26 July, and it was presumed that the female had oviposited and these were her offspring; however, it is conceivable that another phorid had oviposited previously. Puparia (Fig. 8) were first noted on 31 July, with at least one larva still active on this date. Three adult males of *M. globipyga* and three females that are likely, but not definitively, *M. globipyga* (they are the same as the female that was observed on the caterpillar, but the female of *M. globipyga* is undescribed) emerged from 17 to 19 August.

There have been many reported cases of phorids reared from different stages of the lepidopteran life cycle but most of the cases were from known saprophages attacking already dead hosts (Disney 1994), as may be the case here. There have also been cases of phorids attacking already diseased hosts and even a few of true parasitoidism (Disney et al. 1992, Disney 1994, Stoepler and Disney 2013), including that of the similar species *M. larvivora*. In this case, the presence of the eulophid wasp pupae may point to an initial parasitization that allowed a subsequent phorid infection,

Table 1. Species descriptions, *M. globipyga* and *M. risoria*. Character remarks in parentheses, general remarks in last row.

	M. globipyga	*M. risoria*
Head		
SA ratio	0.47-0.63	0.50-0.55
VIF position	normal	normal
SPS vesicles	present (few)	absent
Palpal setae length	long	long
Labellum spinosity	not spinose	not spinose
Thorax		
Anepisternum	bare	bare
Relative halter color	lighter	lighter
# NP setae	2	2
NP cleft	absent	present (large)
Scutellar setae	2+2	2+2
Leg		
ts1 palisade	1-5	1-5
t2 palisade	0.61-0.70	0.63-0.69
t3 comb bifurcate	absent	absent
t3 setulae	PD	PD
f3 basal setae	B>AV	B>AV
f3 basal setae differentiation	absent	absent
Wing		
Wing Length (mm)	1.46-1.69	1.70-1.94
Subcosta	incomplete	incomplete
R seta	long (just over 2x vein width)	long
R2+3	present	present
Costal index	0.41-0.45	0.41-0.45
Costal ratios	3.3-4.5: 1.8-2.5: 1	3.90-4.96: 2.35-2.47: 1
Costal setae length (mm)	0.10-0.14	0.10-0.15
Number alular setae	4	4
Alular setae length (mm)	0.09-0.13	0.09-0.14
Wing color	lightly infuscated/clear	lightly infuscated/clear
Genitalia		
AT length	AT+/-E	AT+/-E
E setation	hairs only, one longer	hairs only, 1 strong
Relative posterior setation	all +/-	H>E>T6>C
General Remarks		Large notopleural cleft

consistent with some known phorid life histories (Brown 1999).

Type material.—Holotype ♂ (USNMENT 01100452), USA: ID: Priest Lake, Lookout Mountain, 20.VIII.19 (Melander). Paratypes from Chatcolet, ID, Mica, WA were found to be *M. risoria* sp. nov. and the paratype from Lake McDonald, MT was found to be *M. atrox* Borgmeier 1968 (due to the condition of this specimen that identification should be considered somewhat provisional). A paratype from the same location as the holotype was represented by an empty pin in the collection (assumed lost). The final paratype is apparently from the same location as one of the other paratypes, and was not examined (in the collection of Borgmeier at the Universidade de São Paulo).

Material examined. USA: CALIFORNIA: Los Angeles County: Hollywood, Los

Feliz, Mid-Wilshire, 5 ♂, III-VII.2014, BioSCAN, Malaise traps (LACM). MASSACHUSETTS: Bristol County: Attleboro, Bishop St., 3 ♂, VII-VIII.2013, Eiseman, Ex. dead *Orgyia* larva with eulophid pupae (LACM).

Megaselia risoria Hartop, Wong, Eiseman Sp. Nov.

(Figs. 9, 10, 11, 12)

Megaselia globipyga: Borgmeier 1966a p.6 (key) 105, fig. 88, in part, paratypes from Chatcolet, ID and Mica, WA.

Megaselia postcrinata: Borgmeier 1966a p.4 (key) 69, figs. 46-47, in part, paratype from Orcas Island, WA.

Diagnosis.—♂. Specimens have a costa ranging from 0.41–0.45 of the wing length, allowing the species to key in either group VII or group VIII in the keys of Borgmeier (1966). In the group VII key, this species keys to couplet 11 where, like *M. globipyga*, it is easily differentiated from *M. nigra* Meigen by the undiverted setal palisade on the hind leg but cannot definitively be told apart from *M. postcrinata*, which was described from females. In the group VIII key, *M. risoria* keys to *M. globipyga*, from which it can easily be distinguished by the presence of a notopleural cleft which *M. globipyga* lacks.

Description.—See table 1.

Remarks.—The male of *M. postcrinata* is unknown. Within the *M. postcrinata* paratypes from the USNM collection are six males belonging to four species, any of which could be conspecific with the female holotype. Given this uncertainty, we consider *M. postcrinata* to be an unrecognizable taxon in the male sex. This will remain so until such time as a male can be unequivocally associated with the female holotype.

The males in the paratype series of *M. postcrinata* belong to the following species:

M. risoria—1 ♂, WA: Orcas Island

M. globipyga—1 ♂, WA: Mt. Rainier

Male "A" sp. nov. (in prep)—3 ♂, OR: Portland, WA: Dewatto, Mukilteo. This species matches unknowns from the BioSCAN Project that are in the process of being described.

Male "B"—1 ♂, WA: Tacoma. Additional specimens are needed to determine the identity of this species with any certainty.

Three additional male paratypes from the Borgmeier collection at the Universidade de São Paulo were not examined.

Distribution.—Known from CA: Los Angeles, ID: Chatcolet, WA: Mica, Orcas Island.

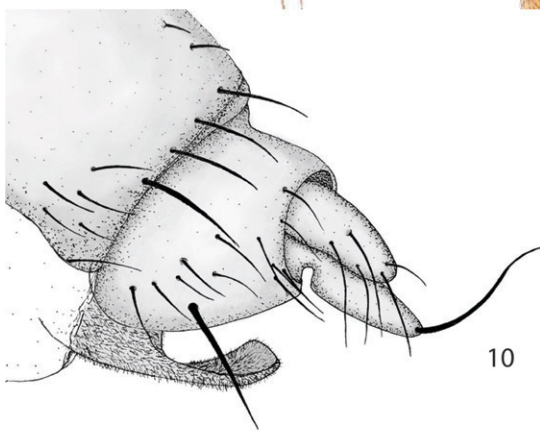
Etymology.—From the Latin word "risor", meaning smile or laughter, referring to the happy shape of the prominent notopleural cleft of this species (Fig. 11).

Biology.—Unknown.

Type material.—Holotype: ♂, USA: WASHINGTON: Orcas Island, above Mountain Lake, 18.VIII.1925, Melander, (USNMENT 01100510). Paratypes: ♂, USA: CALIFORNIA: Los Angeles, Pico-Union, 3-10.V.2014, Marquez, Malaise Trap (LACM ENT 329319). ♂, USA: IDAHO: Chatcolet, VIII.1915, Melander (USNMENT 001100511). ♂, USA: WASHINGTON: Mica, 14.VII.1918, Melander (USNMENT 01100512).

Discussion

The genus *Megaselia* is in great need of revision. That two undescribed species were found in the type series of *M. globipyga* reflects how poorly early workers understood the species limits of this genus. In this case, the appearance of



Figs. 9–12. 9, *Megaselia risoria* (holotype), lateral habitus. 10, ♂ genitalia of *Megaselia risoria*, left lateral aspect. 11, Detail of notopleuron of *Megaselia. risoria*. showing notopleural cleft. 12, Right wing of *Megaselia risoria* (holotype).

specimens reared from a dead caterpillar in Massachusetts was serendipitous: it gave us biological data for a species whose paratype series led us to yet another species, the result being the description of a new species that was found in both material from our urban biodiversity project in Los Angeles and hidden within

two decades-old paratype series. It is likely that this series of events is not a rarity and that future work on specimens and type series in the genus will reveal a plethora of new species, as was the case described herein.

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