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Dasymutilla Ashmead (Hymenoptera, Mutillidae) in Panama: new species, sex associations and seasonal flight activity

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Abstract. A taxonomic revision of Panamanian species of the genus *Dasymutilla* Ashmead (Hymenoptera, Mutillidae) is presented and a key for the six species is given, all recognized from both sexes. *Dasymutilla colorado* Cambra, Williams and Quintero **sp. nov.**, from central and eastern Panama, is described and illustrated. Sex associations permitted us to make the following five synonymies: *D. sleipniri* Manley and Pitts, 2007 (male) under *D. phya* (Cameron, 1895) (female); *D. deyrollesi* Mickel, 1937 (male) and *Sphaerophthama* [sic.] *temaxensis* Cameron, 1895 under *Dasymutilla araneoides* (Smith, 1862) (female); *D. ionothorax* Manley and Pitts, 2007 (male) under *Dasymutilla spilota* Manley and Pitts, 2007 (female); and *D. guanacaste* Manley and Pitts, 2007 (male) under *D. paradoxa* (Gerstaecker, 1874) (female). Seasonal flight activity for *Dasymutilla* from six years of continuous malaise trappings in Barro Colorado Island is presented.

Key words. Sphaeropthalminae, taxonomy, Neotropic, new synonymies, new distribution records.

Introduction

Dasymutilla Ashmead, 1899 is a genus of mutillid wasp that ranges southward from the United States into Mexico, Central America, and northern South America (Manley and Pitts 2007). Larvae of *Dasymutilla* are mainly parasitoids of prepupae or pupae of ground-nesting wasps and bees. Manley and Pitts (2007) indicate that of the 139 species and subspecies of tropical and subtropical *Dasymutilla*, the hosts for only 14 species are known.

Recent work on the taxonomy of the genus *Dasymutilla* has improved our knowledge of the mutillid fauna of Central America and the Caribbean with the description of 45 new species, seven new synonymies and some new combinations in the last ten years (Manley and Pitts 2007; Williams and Pitts 2013; Luz et al. 2016). Many Central American species, however, are known from a single sex and little is known about their seasonality of flight. Mutillid seasonality and abundance are poorly understood in general, though a few studies have been conducted using malaise or pitfall traps in the New World (Deyrup and Manley 1990; Flores et al. 2004; Aranda and Graciolli 2016; Vieira et al. 2017).

Brothers (2006) noted that species of *Dasymutilla* and *Traumatomutilla* André, 1901 have morphological characteristics in common, and thus considered synonymizing or subdividing these two genera. Because each genus includes over 150 species across a broad geographic range, intra-generic variation in structural features is high (Manley and Pitts 2007; Williams et al. 2017). Unpublished molecular phylogenetic analyses (Williams 2012), however, revealed reciprocal monophyly for the genera. The most consistent feature that Williams (2012) found for dividing these clades, however, was presence in North America (*Dasymutilla*) or South America (*Traumatomutilla*). Years of dedicated work will be needed to elucidate the relationship between these large genera, but a treatment of species in the southernmost country where *Dasymutilla* is dominant could be a vital step in that process.

Therefore, we here present a focused view of *Dasymutilla* in Panama. Extensive collecting efforts and museum work facilitated discovery of five new synonymies. Now, all six species are known from both sexes; for comparison, Costa Rica has 16 species, but only nine are known from both sexes (Manley and Pitts 2007). In addition, we present seasonal flight records for three *Dasymutilla* species sympatric on Barro Colorado Island, and report new distribution records.

Materials and Methods

The study site for flight seasonality was the field station of the Smithsonian Tropical Research Institute (STRI) in Barro Colorado Island (BCI), located in Gatun Lake of the Panama Canal, 9°09′17″N, 79°50′53″W. The island has a territorial extension of 54 km^2, an elevation of approximately 137 m above sea level and is covered by lowland tropical forest. BCI presents an annual precipitation of 2623 mm, nearly 90% of which falls in the rainy season, mid-May to mid-December (Windsor 1990). Day-time temperatures can reach an average of 32° C, with night-time lows of approximately 23° C. The seasonal activity of *Dasymutilla* flight was studied by sampling specimens from 10 Malaise traps (Townes modified) installed at ground level in the old forest (Fig. 1) by the Smithsonian Environmental Studies program (see Richards and Windsor 2007). The samples we examined were collected weekly from January 2001 to December 2006. Specimens from BCI were identified by RAC and the collection data were initially presented in Saavedra (2014). The morphological characters examined, including some of the integument and setal color, are presented in Table 1. Morphological illustrations of the scutellar scale, mesosoma and mesoscutellum shape, and sternum two (S2) with seta-filled pit were presented by Manley and Pitts (2007).

The following acronyms are used for morphology: T2, T3, etc., for second, third, etc. metasomal terga; S for metasomal sterna; OOD is the smallest distance between the eye margin and a lateral ocellus; IOD is the smallest distance between a lateral ocellus and the median ocellus; and DLO is the diameter of a lateral ocellus. The term scutellar scale is used for a transverse carina found in females at the approximate dorsal junction between the mesonotum and propodeum. The term pygidium is used for a plate-like structure that is defined by lateral carinae, found on the terminal dorsal metasomal segment in females.

The following codens are used for the collections where type specimens and other materials are deposited:

ANSP Academy of Natural Sciences, Philadelphia, Pennsylvania, USA.
BMNH The Natural History Museum, London, United Kingdom.
CDFA California State Collection of Arthropods, California Department of Food and Agriculture, Sacramento, California, USA.
EMUS Department of Biology Insect Collection, Utah State University, Logan, Utah, USA.
INBio Instituto Nacional de Biodiversidad, Costa Rica.

MIUP Museo de Invertebrados G.B. Fairchild, Universidad de Panamá.
UCDC The Bohart Museum of Entomology, University of California, Davis, California, USA.
USNM National Museum of Natural History, Smithsonian Institution, Washington, DC, USA.
ZMB Museum für Naturkunde, Berlin, Germany.

Unless otherwise stated, all of the specimens examined for this study are stored in the MIUP. In the Material Examined sections, the abbreviation 'm' is used for males and 'f' for females.

Table 1. Morphological characters examined for Panamanian species of *Dasymutilla*.

Dasymutilla	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
araneoides	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0
colorado	0	0	0	1	1	0	1	0	0	1	1	1	0	0	0	2	0	1	1	0	0	0	0	1	1
paradoxa	0	0	0	0	0	0	2	1	0	1	0	0	0	0	0	2	1	0	0	0	1	0	1	1	1
phya	0	0	0	0	0	0	2	1	0	0	1	1	0	0	0	2	1	0	0	0	1	0	1	1	1
pulchra	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	1
spilota	0	0	1	0	1	0	0	0	0	0	1	1	0	1	1	1	0	1	0	0	0	0	0	0	0

Male

Head

0. Mandible apex: 0. Tridentate. 1. Bidentate.
1. Genal carina: 0. Absent. 1. Present.
2. Clypeus: 0. Anterior margin with two denticles or tubercles (mostly covered by setae). 1. Without two denticles or tubercles.

Male Mesosoma

3. Marginal cell: 0. Truncate apex. 1. Pointed apex.
4. Tibial spur: 0. Black. 1. White.
5. Mesopleuron: 0. Without protuberance near tegula. 1. With protuberance.
6. Scutellum anterior margin: 0. Convex, 1. Angulate medially. 2. With short median process.
7. Axilla: 0. Not touching scutellum. 1. Touching scutellum.
8. Apices of middle and hind femora: 0. More or less rounded, not sulcate. 1. Squarely truncate, surface of outer lobe of truncation sulcate.

Male Metasoma

9. S2: 0. With seta-filled pit. 1. Without seta-filled pit.
10. S2: 0. With longitudinal, medial and anterior, low carina or keel. 1. Without carina, evenly flat or convex.
11. Hypopygium apical margin: 0. With median spine or projection, 1. With median V or U- shaped notch.
12. S7 Posterolateral angles: 0. Not dentiform. 1. Dentiform.
13. S7 lateral borders: 0. Without carina. 1. With curved carina.
14. Pygidium longitudinal medial high carina: 0. Absent. 1. Present.

Female

Head

15. Genal carina: 0 Absent. 1. Feebly carinate. 2. Distinctly carinate.
16. Subgenal carina: 0. Absent. 1. Present, parallel with genal carina.
17. Antennal scrobe: 0. Carina present, distinct. 1. Carina very weak to absent.
18. Head, including outer margin of eyes: 0. As broad as or narrower than mesosoma. 1. Distinctly broader than mesosoma.
19. Posterolateral angle of head: 0. Without tubercle. 1.With smooth tubercle.

Female Mesosoma

20. Scutellar scale: 0. Present. 1. Absent.
21. Mesosoma: 0. Longer than broad in dorsal view. 1. As broad as, or broader than, long.
22. Mesosoma: 0. Perpendicularly truncate posteriorly. 1. Rounded gently into propodeum.
23. Tarsomere five apex. 0. Without laminar process covering base of claws. 1. With laminar medially notched process covering base of claws.

Female Metasoma

24. T2 discal area: 0. With two rounded patches of white pubescence. 1. Without two roundedpatches of white pubescence.

Key to species of *Dasymutilla* in Panama (Males)

This key should function for any Panamanian male mutillids that have the axillae armed with a posterior tooth or truncate projection, have T1 petiolate with T2, and have their tergal fringes lacking plumose setae. Although *Traumatomutilla* are not treated here, the genus is included in the key to help with diagnosis.

1. S2 with a seta-filled pit **2**
— S2 without a seta-filled pit **6**

2(1). Mesopleuron with a strong protuberance near tegula; S2 with a conspicuous longitudinal carina or keel running from anterior margin of sternal pit to anterior margin of segment; T2 mostly yellow . . . . . ***D. pulchra* (Smith)**
— Mesopleuron without protuberance; S2 without longitudinal carina; T2 black or mostly yellow **3**

3(2). Tibial spurs white, contrasting with black tibiae **4**
— Tibial spurs black, concolorous with tibiae **5**

4(3). Mesosoma largely reddened; T7 medially with longitudinal elevated carina; lateral margin of hypopygium with curved carina . . . . . ***D. spilota* Manley and Pitts**
— Entire body black; T7 without elevated carina medially; lateral margin of hypopygium without carina . . . . . ***Traumatomutilla* André**

5(3). T2 to T5 covered mostly with dense red setae; T6 to T7 with black setae; anterior margin of mesoscutellum with slight median angulation; posterior margin of hypopygium with distinctive median spine directed posteriorly; S2 pit oval, 0.2× length of segment ***D. araneoides* (Smith)**
— T2 covered mostly with sparse yellow setae; T3 to T7 with black setae; anterior margin of mesoscutellum with short median process; posterior margin of hypopygium with small median v-shaped notch; S2 pit long and narrow, at least 0.4× length of segment ***D. phya* (Cameron)**

6(1). Mesoscutellum anterior margin with short median process; marginal cell apex truncate (Fig. 25); axilla forming elongate "arm" connecting to mesoscutellum posteriorly; posterior margin of hypopygium with a distinct median spine directed posteriorly; S2 base with conspicuous, medial and short, longitudinal keel; T2 mostly yellow; tibial spurs black. . . . . ***D. paradoxa* (Gerstaecker)**
— Mesoscutellum anterior margin with slight median angulation; marginal cell apex pointed (Fig. 24); axilla punctate dorsally, sessile with mesoscutellum, with posterior face truncate; posterior margin of hypopygium with a small median notch or a distinct median spine directed posteriorly; S2 without longitudinal keel; T2 black; tibial spurs white **7**

7(6). Posterior margin of hypopygium with a small median notch; T4 to T5 with dense white setae . . . . . ***D. colorado* Cambra, Williams and Quintero, sp. nov.**
— Posterior margin of hypopygium with a distinct median spine directed posteriorly; T4 to T5 with black setae . . . . . ***Traumatomutilla* André**

Key to species of *Dasymutilla* in Panama (Females)

This key should function for any Panamanian female mutillids that have a pygidium at least partially defined by lateral carinae on T6, have T1 petiolate or sub-petiolate with T2, and have their tergal fringes lacking plumose setae. Although *Traumatomutilla* are not treated here, the genus is included in the key to help with diagnosis.

1. Tibial spurs white, contrasting with brown to black tibiae **2**
— Tibial spurs black, concolorous with black legs **4**

2(1). T2 marked with two white setal patches, integument brown to black beneath patches (Fig. 14) . . . . . ***D. spilota* Manley and Pitts**

— T2 marked with two or four whitish to yellow integumental patches **3**

3(2). Mesosoma red, contrasting with black head, T2 with two small white pale integumental patches on discal area (Fig. 17); pygidium higher than wide, narrow at base (Fig. 19) . . . . . ***D. colorado* Cambra, Williams and Quintero, sp. nov.**

— Head and mesosoma black, T2 with two or four yellow integumental patches; pygidium generally broad, nearly as wide as high . . . . . ***Traumatomutilla* André**

4(3). Scutellar scale absent, mesosoma elongate with dorsal propodeal face longer than posterior face (Fig. 6, 9); subgenal carina present, parallel with genal carina **5**

— Scutellar scale present, mesosoma perpendicularly truncate posteriorly, posterior propodeal face as long or longer than dorsal face (Fig. 3, 12); subgenal carina absent **6**

5(4). Pygidium convex, with lateral carinae obscure posteriorly; clypeus evenly convex; T2 apical fringe and T3 predominantly with black setae . . . . . ***D. phya* (Cameron)**

— Pygidium flat, defined by a distinct carina on the apical and lateral margins; clypeus with longitudinal medial tubercle; T2 and T3 predominantly with golden setae or interspersed black and golden setae . . . . . ***D. paradoxa* (Gestaecker)**

6(4). T2 black but marked with four golden yellow integumental patches that can be medially confluent; mesonotal dorsum armed with lateral tubercle (Fig. 11) . . . . . ***D. pulchra* (Smith)**

— T2 marked with two white setal patches, integument black beneath patches; mesonotal dorsum rounded laterally (Fig. 2) . . . . . ***D. araneoides* (Smith)**

Dasymutilla araneoides (Smith, 1862)

(Fig. 2–4, 23)

Mutilla araneoides Smith 1862: 35, holotype female, Panama, BMNH. Mickel (1964): combination under *Dasymutilla*.

Sphaerophthalma [*sic*] *temaxensis* Cameron 1895: 355, holotype female, Mexico, Temax, N. Yucatan, BMNH. Mickel (1964): combination under *Dasymutilla* and subspecies rank. **New synonymy.**

Sphaerophthalma [*sic*] *melanogaster* Cameron 1895: 373, holotype male, North Yucatan, Mexico, BMNH. Quintero and Cambra (2001): synonymy, biology and distribution.

Dasymutilla deyrollesi Mickel 1937: 190, holotype male, Mexico, USNM. **New synonymy**.

Diagnosis. FEMALE. This common species can be recognized by its unique coloration (Fig. 2), specifically the head and pronotum are clothed with white to orange setae; the propodeum has lateral patches of whitish setae; T2 has lateral patches of white setae; and T3–4 each have a medially interrupted band of white setae. The following diagnostic characters are also useful: the antennal scrobe has a distinct dorsal carina; the gena is carinate; the posterolateral margin of the head is unarmed; the tibial spurs are black; and the mesosoma has a distinct scutellar scale with an irregular arcuate transverse carina anterior to the scale. MALE. This species is similar in color and structure to *D. sicheliana* (Saussure, 1868), and thus far can be differentiated only by its southern Neotropical distribution and in having the lateral areas of T2 and S2 blackened (Fig. 4). The following characters are useful for diagnosis: the clypeus is bidentate anteriorly; the axillae are broad and have a truncate face posteriorly; the tibial spurs are black; the body is black and clothed with black or white setae, except metasomal segments 2–5 are predominantly reddish and clothed with reddish setae; S2 has a medial seta-filled pit; and the hypopygium is not margined laterally by a sharp carina.

Distribution. Mexico to Colombia.

Material examined (MIUP except where noted)**. PANAMA: Panamá Province:** Chorrera, El Limón, 30.iv–8.v.2011, M. Franco, 3m (1m, CDFA). **Colón Province:** Santa Rita, 22.xii.1997, D. Quintero, 1f; San Lorenzo, 4.xii.2003, P. González, 1f. **Veraguas Province:** Bahía Honda, 28.v–2.vi.2002, R. Cambra & A. Santos, 2f (1f, CDFA). **Coclé Province**: El Roble, 25.ii.1998, L. De Gracia, 1f. **Herrera Province:** El Montuoso, 900m, 15–18.v.2007, D. Curoe, 1f. **Los Santos Province:** Los Guabos, 11.ii.1999. J. Bernal, 1f. **COSTA RICA** (INBio): **Guanacaste Province:** Est. Murciélago, 8 km SW de Cuajiniquil, P.N. Guanacaste, 100m, 16.vi–4.vii.1993, C. Cano, 2f; 6–24.i.1994, F. Quesada, 2f; 6–7.xii.1993, 1f; 10–20

Nov 1993; Fca. Jenny, 30 km N de Liberia, P.N. Guanacaste, 27–29.v.1993, E. Araya, 3f; 5–20.ix.1993, E. Araya, 1f; 16.x–10.xi.1991, 3f; 20.viii–12.ix.1992, 1m; 6–15.xi.1993, E. Araya, 4f; 16–23.vi.1993, 1f; 16–20.v.1994, 5f; 7–28.vi.1994, 6f; 20–27.iii.1993, 3f; 9–14.v.1993, 1f; 18–25.iv.1993, 2f; 5–26.viii.1993, 300 m, 1f; Playa Naranjo, Sta. Rosa, P.N. Guanacaste, xii.1990, 5f; Los Almendros, P.N. Guanacaste, 28.iii–24. iv.1992, G. Gallardo, 4f; 28.vii–14.viii.1992, E. Lopez, 1f; 23.x–13.xi.1992, E. Lopez, 1f; 3–25.x.1993, 300 m, E. Lopez, 1f; 10–30.iii.1993, E. Lopez, 1f; 13.x–3.xi.1993, K. Martinez, 1f; 3–22.viii.1993, E. Lopez, 1f; Est. Palo Verde, 10 m, P.N. Palo Verde, 12–24.viii.1992, U. Chavarría, 1f; viii.1991, U. Chavarría, 1f; 7–11.vi.1999, 10m, J. Jimenez, 1f; Est. Sta. Rosa, 300 m, iv.1989, 1f; i.1990, 2f; vii.1989, 1f; Est. Cacao, 1000–1400 m, SW ladera volcan Cacao, x.1989, R. Blanco, 1f; ix–xii.1989, B. Guadamuz, 1f; Est. Las Pailas, 800 m, P.N. Rincón de la Vieja, 27vii–5.viii.1992, C. Cano, 1f; 8–18.i.1992, C. Cano, 1f; 22.xi–29. xii.1992, J. Sihezar, 1f; Est. Maritza, 600 m ladera O volcan Orosi, 27.ii–10.iii.1992, K. Flores, 1f; 3 km NO de Nacaome, 100 m, P.N. Barra Honda, i.1993, M. Reyes, 1f; iii.1993, M.Reyes, 1f; 5–27.vii.1992, M. Reyes, 1f; Agua Buena, 220 m, P.N. Guanacaste, 24.viii–14.ix.1992, E. Lopez, 1f; A.C.G. La Cruz, P.N. Guanacaste, cerro El Hacha, 400m, ii.1988, J. Bustamante, 2f. **Heredia Province:** S. Rosa, S. Domingo, 31.iii.1993, 1200 m, M. Zumbado, 1f. **Puntarenas Province:** Aluvion R. Limón, Buenos Aires, A.C. Amistad, 100m, 16.v.1993, M.Zumbado, 1f; Vuelta Campana, R. Terraba, 100–500 m, Rey Curre, 3.vii–2. viii.1992, S. Rojas, 1f; 2–28.ii.1993, S. Rojas, 3f; Los Angeles, Baquera, 120m, 13.vi.1998, F. Alvarado, 1f. **NICARAGUA: Masaya District,** 5 km E. Masaya, 16.i.1994, V. den Berghe, 1f; Granada, volcan Mombacho, Sta. Ana, 600m, J. Maes, 15.ii.1998, 1m; 16.iii.1998, 1m; 15.v.1998, 2m; San Juan del Sur, playa La Flor, 1–8.iv.2000, V. den Berghe, 34f, 1m. **EL SALVADOR:** Soyapango, 8.i.1988, 1f; CAPREX, 15.iii.1998, 1f; San Jacinto, 21.ii.1988, 1m. **GUATEMALA:** Solola, San Marcos, La Laguna, 11.iv.1995, 1f; San Juan, Sacatepeque, Antiqua, 15.iii.1995, 1f; Zacapa, Teculután, 2.iv.1995, L. Morales, 1m.

Remarks. Quintero and Cambra (2001) present biological information for *D. araneoides* (host, habitat, mating behavior and adult feeding). In Panama (Playa Las Lajas, Chiriqui), Cambra and Quintero (unpublished) observed nest defense behavior from a female wasp *Microbembex monodonta* (Say) (Crabronidae) that was patrolling near her nest entrance. Next, the *M. monodonta* detected the presence of a female of *D. araneoides* approaching the entrance of her nest and flew quickly to the mutillid wasp, holding it with its legs, lifted the mutillid in flight, raising to about 15 cm from the sandy ground. Immediately, the mutillid was left to fall some 60 cm away from the site from which it was encountered. For the next 15 minutes the mutillid did not return to the entrance of the nest of *M. monodonta*. The synonymy of *D. deyrollesi* Mickel, 1937 is based on comparison of type specimens, coincidental distribution, and comments of Manley and Pitts (2007: 48). The formerly recognized subspecies, *D. a. temaxensis,* was separated from nominotypical *D. araneoides* females based on the size of the setal patches on T2 (Manley and Pitts 2007). This character is notoriously variable in other species and forms a gradient within *D. araneoides*. Additionally, both former subspecies are widely distributed, co-occurring in Costa Rica, Mexico, and Panama (Manley and Pitts 2007). Therefore, the designation of subspecies in *D. araneoides* is discontinued.

***Dasymutilla colorado* Cambra, Williams and Quintero, new species**
(Fig. 17–22, 24)

Holotype female. PANAMA, Panamá **Province,** Monumento Natural Barro Colorado, Península Gigante, 1.viii.1990, A. Mena (captured in copula, mounted on same pin with male Allotype, deposited in CDFA). **Paratypes** (MIUP except where noted)**. PANAMA: Panamá Province:** same data as holotype (1m, CDFA); 23.vii.1990, D. Quintero, 1f; 30.vii.1990, A. Mena, 1f; 27–29.viii.1990, 1f; 3.viii.1990, 1f; Barro Colorado Island: 14.vi.1993, J. Coronado, 1f; 27.iv.1994, J. Pickering, 1m; 4–11.v.1994, 1m; 11–18.v.1994, 1m; 18–25.v.1994, 1m; 3–10.vi.2002, 1m; 20–27.vii.1994, 1m; 10–17.viii.1994, 1m; 29.viii.2001, D. Windsor (1m, CDFA); 26.xii.2001, 1m; 22–28.v.2002, 1m; 29.v.2002, 4m; 12–20.vi.2002, 2m; 26.vi.2002, 1m; 4–12.ix. 2002 (1m, CDFA); 11.vi.2003, 1m; 10.ix.2003, 1m; 17.ix.2003, 1m; 24–31. iii.2004, 1m; 5–12.v.2004, 2m; 19.v.2004, 5m; 26.v.2004, 4m; 9.vi.2004, 1m; 15.ix.2004, 1m; 29.xii.2004, 1m; 4.v.2005, 1m; 11.v.2005, 3m; 18.v.2005, 3m; 25.v.2005, 2m; 15.vi.2005, 1m; 24–31.viii.2005, 1m; 25.i.2006, 1m; 19.iv.2006, 1m; 26.iv.2006, 1m; 3.v.2006, 1m; 10.v.2006, 3m; 27.ix.2006, 1m; 28.iii.2007, 1m; 3.vi.1981, 2f; 17.iv.1981, 1f; 7.v.1981, 1f; 25.v.1981, 1f; 21.viii.1977, 1m; 3–6.vi.1967, M. Naumann,

1m; 7.vi.1956, C. Rettenmeyer, 1m; P. Nac. Soberanía, camino Plantación, 16.ix.2000, D. Quintero & A. Santos (1f, CDFA); Campana, Chica, 1–25.x.2013, Y. Cheng, 1m; P. Nac. Campana, 16.vi.1991, J. Coronado, 1f; 10.vi.2007, Y. Christopher (1f, CDFA); Cerro Azul, Urbanizacion Las Nubes, 2.ix.2001, D. Quintero, 1f. **Coclé Province:** El Copé, 900m, 24.ix.1990, D. Quintero, 2f. **Darién Province:** P. Nac. Darién, Pirre, Estación Rancho Frío, 3–17.x.2002, R. Cambra, 1f; P. Nac. Darién, Estación Cruce de Mono, 250 msnm, 7°55′N, 77°39′W, 8.ii.1993, R. Cambra & J. Coronado, 1f; 17.ii.1993, 1f; 26.ii.1993 (1m, CDFA).

Diagnosis. FEMALE. This species can be separated from other *Dasymutilla* by the triangular pygidium. It can be separated from *Traumatomutilla* with a similar triangular pygidium by the unarmed posterolateral head margins, the rounded femoral apices, and the red mesosoma. The following diagnostic characters are also useful: the antennal scrobe has a dorsal carina that is sometimes weak; the gena has a distinct carina; the mesosoma is longer than broad and has a distinct scutellar scale; and T2 is marked with two yellow subcircular patches. MALE. This species has the integument black, clothed with black and white setae only; T4 and T5 each have a dense band of white setae; the tibial spurs are white; S2 lacks a seta-filled pit; the posterior margin of the hypopygium has a median notch, and the forewing marginal cell is apically acute.

Description. FEMALE (holotype). Body length 11 mm. Body black, except apical flagellomeres, mandible, and leg joints partly brown, mesosoma largely reddish dorsally and laterally; and T2 with two distinct yellow subcircular patches. Head and mesosoma with appressed setae predominantly pale yellow and erect setae predominantly blackish; metasoma with distinct white setal patch on T1 and T2; with distinct whitish fringe or band on T4–5 and S2–5; whitish setae on T2 patches and laterally on T2–3; remaining metasomal setae black. *Head*. Genal carina present and distinct; subgenal carina absent; antennal scrobe with dorsal carina partially obliterated; head, including outer margin of eyes; broader than mesosoma; posterolateral angle of vertex without tubercle. Entire head with deep contiguous punctures, many interspaces cariniform. *Mesosoma*. Longer than broad in dorsal view, perpendicularly truncate posteriorly; dorsally with deep contiguous punctures, interspaces mostly cariniform; humeral carina weak, basically continuous to epaulet; scutellar scale present; lateral and posterior propodeal faces smoothly rounded together with similar dense punctation; mid and hind femora rounded apically; tarsomere five apex with laminar process notched medially, process covering base of claws. *Metasoma*. T1 narrowly petiolate with globose T2; T2–6 with deep contiguous punctures, interspaces mostly cariniform; pygidial area higher than wide, narrow at base, with few weak longitudinal striae.

MALE. Body length 10.5 mm. *Color*. Entirely black except flagellum, mandible and leg joints partly brown. Setae predominantly scattered whitish except head with erect black setae; mesoscutum with erect and appressed black setae; T1, T4, and T5 with distinct white setal bands, remaining tergites with setae mostly black. *Head*. Genal carina absent; clypeus anterior margin with two denticles or tubercles; mandible apically oblique, tridentate; ocelli small: OOD ~5× DLO, IOD subequal to DLO; head slightly swollen posteromedially. *Mesosoma*. Mostly with deep confluent punctures; mesopleuron without protuberance near tegula; tegula mostly smooth; axilla punctate dorsally, apically oblique with truncate setose posterior face; propodeum reticulate; apices of mid and hind femora more or less rounded, not sulcate; tibial spur white; marginal cell with pointed apex to marginal vein. *Metasoma*. T1 narrowly petiolate with T2; S2 without seta-filled pit; S2 base without carina, evenly convex; T6 mostly smooth with apical setal fringe; hypopygium apical margin with median V-shaped notch; S7 Posterolateral angles not dentiform, lateral borders without carina.

Distribution. Known only from central and eastern Panama.

Etymology. From the Spanish "*colorado*" meaning red colored. Jointly named in reference to the female's uncommon mesosomal color and Barro Colorado Island, where the type was collected and this project originated. Treat as noun in apposition.

Remarks. In the key to Neotropical *Dasymutilla* (Manley and Pitts 2007), females of this species run to various couplets depending on how the antennal scrobe carina is scored. Most specimens key to couplet 32 with *Dasymutilla twegeni* Manley and Pitts, 2007 from Mexico. They can be separated from *D. twegeni* by having the mesosoma reddish and the pygidial area higher than wide, narrowed basally,

and mostly unsculptured. Other specimens key to couplet 47 with *Dasymutilla buenavista* Manley and Pitts, 2007 from Mexico. They can be separated from *D. buenavista* by having the mesosoma reddish, T2 with two yellow maculae, without a sinuate carina anterior to the scutellar scale, and having the pygidial area mostly unsculptured. Still other females key to couplet 47 and were discussed briefly as potential members of the genus *Traumatomutilla* in Williams et al. (2017). The diagnostic characters and habitus photos presented here will allow immediate recognition of this species.

Males are similar to *Dasymutilla militaris nigriceps* (Cresson, 1865) from Cuba, Bahamas and Dominican Republic. Both species have the integument black, clothed with black and white setae, S2 without seta-filled pit, and the posterior margin of the hypopygium with a median notch. It differs from *D. m. nigriceps* in the following combination of characters: the wings are uniform in color with the marginal cell apically acute; T2 has erect and sparse white setae basally; T3 is clothed mostly with black setae; the pygidial area is mostly unsculptured; while *D. militaris* has the wings banded and marginal cell apically truncate, has the T2 base and T3 totally with dense decumbent white pubescence that hides the integument; and the pygidial area is finely rugose.

Dasymutilla and *Traumatomutilla* are notoriously difficult to separate and could eventually be synonymized (Manley and Pitts 2007). Both genera are diverse and morphologically variable, with *Dasymutilla* being predominantly North American and *Traumatomutilla* being predominantly South American. This species functionally represents a middle ground between the genera, having female coloration similar to *Dasymutilla*, male coloration similar to *Traumatomutilla,* and occurring at the border between North and South America. Because *Dasymutilla* is the older name, we place *D. colorado* in that genus.

Dasymutilla paradoxa (Gerstaecker, 1874)

(Fig. 5–7, 25)

Mutilla paradoxa Gerstaecker 1874: 76, holotype female, Colombia, Bogotá, ZMB; Nonveiller 1990: 87, *incertae sedis*.
Sphaerophthalma [*sic*] *icaris* Cameron 1895: 360, holotype female, Nicaragua, Chontales, No. 15.813 BMNH, examined.
Traumatomutilla icaris: Cambra (1997): 122, additional distribution and material examined.
Dasymutilla icaris: Manley and Pitts (2007): 57, transferred to *Dasymutilla*.
Dasymutilla guanacaste Manley and Pitts 2007: 56, holotype male, Costa Rica, Pr. Guanacaste, Guanacaste NP, Volcan Cacao Sta., IV-13-95, UCDC. **New synonymy**.
Dasymutilla paradoxa: Luz et al. (2016): 365, placed *D. icaris* in synonymy under *D. paradoxa*; created *D. paradoxa* species-group for eight *Dasymutilla* species.

Diagnosis. FEMALE. This species is apparently unique among *Dasymutilla* in having most of body clothed with appressed golden setae (Fig. 5). It can be recognized first by its placement in the *paradoxa* group, based on having four integumental patches on T2, having black tibial spurs, and having an elongate mesosoma that lacks a scutellar scale, then separated from other *paradoxa* group members by its coloration, its defined pygidium, and by the erect clypeal tubercle. MALE. This species can be placed in the *paradoxa* group by its elongate arm-like axillae. It can be separated from the other paradoxa group members by its predominantly black body color, its unarmed hypopygium, and by lacking a seta-filled pit on S2. Its coloration is similar to that of *D. phya*, particularly in the almost entirely yellow T2 (Fig. 7).

Distribution. Nicaragua, Costa Rica, Panama, Colombia (Cambra 1997; Manley and Pitts 2007; Luz et al. 2016).

Material examined (MIUP except where noted). **PANAMA: Darién Province:** P. Nac. Darién, Estación Cruce de Mono, 25–28.ii.1993, R. Cambra, 2f (1f, CDFA). **Panamá Province:**15 specimens collected in Barro Colorado Island with ten Malaise traps from the years 2001 to 2006 (Saavedra 2014). **COSTA RICA** (INBio): **Alajuela Province:** San Cristobal, 600–620m, 8–25.iv.1997, F. Quesada, 1f. **Guanacaste Province**: Est. Maritza, 600 m, W ladera volcan Orosi, 27.ii–10.iii.1992, R. Vargas, 1m; Est. Pitilla, 700 m. 9 km S de Sta. Cecilia, ix.1989, 1m; Est. Cacao, 1000–1400 m, ladera SO volcan Cacao, 21–29.v.1992, F. Chavarría, 1m; Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P.N. Guanacaste, 27.vii–14.viii.1992, C. Moraga, 1f; 31.iii–15.iv.1992, 1f; Est. Sta. Rosa, 300 m, P.N. Guanacaste, vii.1989, 1f; i.1990, 1f; xii.1990, D. Enezen, 1f; 3–12.vi.1992, 1f; Est. Maritza, 600 m, ladera O. volcan Orosi, v.1990, R. Blanco, 1f; Fca. Pasmompa, Est. Pitilla, 400 m, 5 km SW Sta. Cecilia, iii.1989, 1f; Est. Murciélago,

8 km Sw Cuajiniquil, 100 m, ii.1989, 1f; Est. Palo Verde, 10 m, P.N. Palo Verde, 6–16.iii.1993, U. Chavarría, 1f; A.C.T. Bagaces, P.Nac. Palo Verde, 6–18.i.2000, I. Jimenez, 1f. **Limón Province:** Est. Hitoy Cerere, 100 m, R. Cerere, Res. Biol. Hitoy Cerere, iv.1992, G. Carballo, 1m; Sector Cerro Cocori, Fca. de E. Rojas, 150 m, 28.v–17.vi.1992, E. Rojas, 1m; iv.1993, 1m; iii.1992, 1m. **Puntarenas Province:** Rancho Quemado, 200 m, Península de Osa, v.1992, F. Quesada, 2m; vi.1992, F. Quesada, 2m; iv.1992, D. Brenes, 1m; Est. Sirena, 0–100 m, P.N. Corcovado, iii–vi.1991, 3m; Rancho Quemado, 200 m, Península de Osa, 21.iii–7.iv.1992, F. Quesada. **NICARAGUA: Masaya District,** Laguna de Apoyo, xi.1992, E. van den Berghe, 1f.

Remarks. Cambra (1997) mentioned the sex association for *Traumatomutilla icaris* (Cameron), but did not describe the male. The male associated with *T. icaris* by Cambra is here recognized as morphologically identical to *Dasymutilla guanacaste* Manley and Pitts, **syn. nov.**

Dasymutilla phya (Cameron, 1895)

(Fig. 8–10, 26)

Sphaerophthalma [*sic*] *phya* Cameron 1895: 350, holotype female, Bugaba, Chiriquí, BMNH; Nonveiller 1990:88, *incertae sedis*.

Traumatomutilla phya: Cambra and Quintero (1992): 477, transfered to *Traumatomutilla;* Cambra (1997): distribution and additional material examined.

Sphaerophthalma [*sic*] *melissa* Cameron 1895: 360, syntype female, Panama, Bugaba, BNHM. *Traumatomutilla melissa*: Cambra and Quintero (1992): 477; Luz et al. (2016) designation of lectotype and synonymy under *D. phya.*

Dasymutilla phya: Luz et al. (2016): 366, transfered to *Dasymutilla*; included in *D. paradoxa* species-group.

Dasymutilla sleipniri Manley and Pitts 2007: 90, holotype male, Panama CZ, Barro Colorado Is., UCDC. **New synonymy.**

Diagnosis. FEMALE. This species is apparently unique among *Dasymutilla* in having the pygidium convex and apparently undefined. It can be recognized first by its placement in the paradoxa group, based on having four integumental patches on T2, having black tibial spurs, and having an elongate mesosoma that lacks a scutellar scale, then separated from other paradoxa group members by its coloration (Fig. 8), its poorly defined pygidium, and by the absence of an erect clypeal tubercle. MALE. This species can be placed in the paradoxa group by its elongate arm-like axillae. It can be separated from the other paradoxa group members by its predominantly black body color, its unarmed hypopygium, and by having a seta-filled pit on S2. Its coloration is similar to that of *D. paradoxa*, particularly in the almost entirely yellow T2 (Fig. 10).

Distribution. Costa Rica and Panama (Cambra 1997; Manley and Pitts 2007; Luz et al. 2016).

Material examined (MIUP except where noted)**. PANAMA: Panamá Province:** 267 specimens collected in Barro Colorado Island with ten Malaise traps from the years 2001 to 2006 (Saavedra 2014). **COSTA RICA: Guanacaste Province:** Est. Maritza, 600 m, ladera O. volcan Orosi, 27.ii–10.iii.1992, K. Martínez, 1f (INBio); i.1990, R. Blanco, 1m (INBio). **Limón Province:** Est. Hitoy Cerere, 100 m, R. Cerere, Res. Biol. Hitoy Cerere, iv.1992, G. Carballo, 1f (INBio). **Puntarenas Province:** Rancho Quemado, 200 m, Península de Osa, 21.iii–7.iv.1992, F. Quesada, 1f (INBio). **San José Province:** Est. Carrillo, 700 m, P.N. Braulio Carrillo, 15–17.ii.1993, 2f (INBio), 1f (MIUP).

Remarks. Cambra (1997) mentioned the sex association for *Traumatomutilla phya* (Cameron), but did not describe the male; this male is here recognized as morphologically identical to *Dasymutilla sleipniri* Manley and Pitts, **syn. nov.**

Dasymutilla pulchra (Smith, 1855)

(Fig. 11–13, 27)

Mutilla pulchra Smith 1855: 62, holotype female, Acapulco, Guerrero, Mexico, No.15.443 BMNH.

Mutilla nortoni Blake 1870: 68, holotype female, Mexico, ANSP. Mickel (1964): Synonymy.

Mutilla ducalis Smith 1879: 224, holotype female, Mexico, Orizaba, BMNH. Mickel (1964): synonymy.

Sphaerophthalma [*sic*] *chiron* Cameron, 1897: 378, holotype female, Mexico, Venta de Zopilote, BMNH. Mickel

(1964): synonymy.

Dasymutilla pulchra: Mickel (1964) transfered to *Dasymutilla*. Cambra and Quintero (1992): 464, 471, male figure, material examined; Manley and Pitts (2007): 82, male description.

Diagnosis. FEMALE. This is the only mainland *Dasymutilla* species that has a scutellar scale and a lateral mesonotal tubercle. The following diagnostic characters are also useful: the antennal scrobe has a distinct dorsal carina; the gena is carinate; the posterolateral margin of the head is unarmed; the mesosoma has a transverse arcuate band of pale silver to golden setae; and T2 is marked with four yellow to orange patches that are often coalescent. MALE. This is the only male *Dasymutilla* species to have the mesopleuron armed with a distinct tooth or tubercle. The following characters are also useful for diagnosis: the antennal scrobe has a dorsal carina; the axilla has a posterior truncate face; S2 has an ovate anteriorly situated seta-filled pit; and T2 has a large coalescent yellow integumental patch.

Distribution. Mexico, Guatemala, Honduras, Nicaragua, Costa Rica, Panama. First record for Nicaragua.

Material examined (MIUP except where noted)**. PANAMA, Veraguas Province:** Santa Fe, 26.iii. 1999, A. Santos, 1f; Bahía Honda, 7–17.xii.2001, R. Cambra, 2m (1f, CDFA); 28.v–2.vi.2002 (1m, CDFA). **Panamá Province:** Cerro Azul, Residencial Las Nubes, 15.x.1999, R. Cambra, 1f; 24.v.2009, 1m. **Coclé Province:** Valle de Antón, 13.vii.1991, J. Coronado, 2m; La Pintada, 16–19.i.2002, P. González, 1f. **COSTA RICA** (INBio): **Alajuela Province:** San Cristobal, 600–620m, 5–25.i.1998, F. Quesada, 2f. **Guanacaste Province:** Tierras Morenas, Tilarán, 685m, ix.1994, G. Rodríguez, 1f; Est. Los Almendros, 300m, 4–20.xi.1994, E. López, 1f; vi.1995, E. Araya, 2f; Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, 6.i–13.iv.1993, J. Sihezar, 1f; 24.x–12.xi.1992, D. García, 2f; 22.xi–29.xii.1992, J. Sihezar, 1f; 19.vi–1. vii.1993, K. Taylor, 1f; 30.xi–12.xii.1999, R. Gonzalez, 1f; Fca. Yafa, 320 m, 8–26.i.1993, E. Lopez, 1F; Est. Pitilla, 700 m, 9 km S Sta. Cecilia, iii.1990, P. Rios, 3f; xi.1989, P. Rios, 1m; 2.iii–21.iv.1989, 1f; 22.x–8.xi.1992, P. Rios, 1f; 27.ii–2.iii.1989, R. Miranda, 3f; ii.1990, 1f; x.1989, C. Moraga, 1f; Fca. Pasmompa, Est. Pitilla, 400 m, 5 km SO Sta. Cecilia, iii.1989, 2f; Est. Maritza, 600 m, ladera O. del volcan Orosi; viii.1990, 1f; 27.ii–10.iii.1992, M. Reyes, 1f; ii.1992, P. Campos, 1f; 1.vi–30.vii.1992, 2m; 28.ii–10. iii.1992, D. García, 1f; Fca. Jenny, 30 km N de Liberia, v.1991, E. Araya, 1f; 16.x–10.xi.1991, 1f; 8–12. xii.1993, E. Araya, 1f; sector El Hacha, P.N. Guanacaste, xi–xii.1991, E. Lopez, 1f; cerro El Hacha, 300 m, 12 km SE de La Cruz, ix.1991, E. Lopez, 1f; cerro El Hacha, 400m, ii.1988, J. Bustamante, 1f; Los Almendros, P.N. Guanacaste, 23.x–13.xi.1992, E. Lopez, 1f; 11–30.vi.1993, E. Lopez, 2f; P.N. Sta. Rosa, vi.1986, 300 m, D. Enezen, 1f; vi.1985, D. Enezen, 1f. **Puntarenas Province:** Est. La Casona, Res. Biol. Monteverde, 1520 m, vii.1993, N. Obando, 1f. **NICARAGUA: Managua District,** Laguna de Xiloa, 4.i.1994, 1f; Granada, volcan Mombacho, 30.iv.1998, J. Maes, 1m; 15.v.1998, 2m; 2.vi.1998, 1m; Masaya, volcan Masaya, 27.xi.1991, v. den Berghe, 1f. **GUATEMALA:** Tikal, Petén, 15.viii.1974, D. Engleman, 1f; Baja Verapaz, J. Schuster, 1f; Escuintla, vi.1980, A. Valle, 1f; Dpto. Santa Rosa, 3.x.1982, M. Agüero, 1f. **MEXICO: Jalisco,** Chamela, 2.ix.1989, D. Curoe, 1f; Est. Biol. Chamela, 8–10.xii., F. Hovore, 1m; Sayula, Isla Grande, 1366 m, 13.xi.1994, L. Miranda, 1f; **Oaxaca,** 4.4 miles W. of Mitla, 18.vi.1992, W. Johnson, 1f.

Remarks. This species is widespread in Mexico and Central America. The male was initially recognized by Quintero and Cambra (1992) and described by Manley and Pitts (2007).

Dasymutilla spilota Manley and Pitts, 2007

(Fig. 14–16, 28)

Dasymutilla spilota Manley and Pitts 2007: 91–92, holotype female, Costa Rica, Chomes Punt, III-91, UCDC.

Dasymutilla ionothorax Manley and Pitts 2007: 60, holotype male, Costa Rica, Alajuela, Bijagua 20 km S. Upala, XII-13-I-9-91, EMUS. **New synonymy.**

Diagnosis. FEMALE. This species is recognized by a unique combination of characters: the antennal scrobe is ecarinate; the gena is weakly carinae; the scutellar scale is distinct and is accompanied by anterior and anterolateral transverse carinae; the tibial spurs are white; the head and mesosoma are predominantly clothed with white to golden setae; and T2 has a pair of laterally situated whitish setal patches. MALE. This species can be recognized by a unique combination of characters: the clypeus is

rounded anteriorly; the axillae are sessile basally and have a posteriorly directed tooth; the tibial spurs are white; the body is black except the mesosomal dorsum is usually reddish; T2 has a basal pair of laterally situated whitish setal patches; and the hypopygium is margined laterally by a sharp carina.

Distribution. Mexico, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica and Panama.

Material examined (MIUP except where noted)**. PANAMA: Chiriquí Province:** Las Lajas, 24.iii.1992, R. Contreras, 1f; Las Moras, 8.ii.1989, M. Sánchez, 1f. **Veraguas Province:** Parque Nac. Coiba, Isla Coibita, 6–11.iii.1998, R. Cambra & A. Santos, 12f, 3m (1m, CDFA); Parque Nac. Coiba, Isla Coiba, 7.iii.1998, R. Cambra & A. Santos, 1f; La Mesa, 29.iii.1988, S. Díaz, 1f. **Los Santos Province:** Isla Cañas, 28.xi.1988, R. Rodríguez & D. Quintero, (1f, 1m, CDFA); Cambutal, 7.xii.1986, E. Vivero & M. Olmos, 1f, 1m; Playa Monagre, 6–7.ii.1989, J. Bernal, 14f, 1m. **Herrera Province:** Desembocadura río Parita, 24.iv.1986, R. Cambra, 1f. **Coclé Province:** Antón, San Juan de Dios, 2–3.i.1987, R. Rodríguez, 4f; Antón, Caballero, 22.xii. 1987, D. Quintero & R. Cambra, 4f; Antón, Tranquilla Norte, 12.iii.1988, R. Rodríguez, 1f, 8m; 8–10.i.1991, 2f, 1m; Valle de Antón, 11–12.ii.1992, R. Rodríguez, 6m. **Panamá Province:** Playa Farfán, 26.ii.1988, S. Díaz, 1f, 1m; Chepo, Río Mamoni, 12.iv.1986, R. Cambra, 1f; Chorrera, Playa Leona, Río Perequete, 27.ii.1991, R. Cambra (1f, 1m, CDFA); 19–20.iii.1991, 2f, 8m; Veracruz, Playa Venado, 3.i.1986, R. Cambra, 3f (1f, CDFA); 7.xi.1988, 3f; Capira, 12.iii.1992, J. Coronado, 3m; Isla del Rey, San Miguel, 1–5.iv.1985, R. Cambra, 2f. **Darién Province:** Yaviza, 29.v.1990, R. Cambra, 1f. **COSTA RICA** (INBio): **Guanacaste Province:** Fca. Jenny, 30 km N de Liberia, P.N. Guanacaste, i 1992, E. Araya, 6f; 16–20.v.1994, E. Araya, 7f; Playa Naranjo, Sta. Rosa, P.N. Guanacaste, iv 1991, E. Alcazar, 1f; Est. Palo Verde, 10 m, P.N. Palo Verde, 25.iii–21.iv 1992, A. Gutierrez, 1f; Rio Calero, P.N. Guanacaste, 8.xii.1990, 1f; Est. Sta. Rosa, 300 m, i.1990, 1f; i.1991, M. Zumbado, 1f; Est. Murcielago, 8 km S.O. de Cuajiniquil, 80m, 11.i–19.ii.1994, E. Araya; 1m. **NICARAGUA: Managua District,** Laguna de Xiloa, 4.i.1994, 1f; Granada, J. Maes, 9m. **GUATEMALA:** Escuintla, Fca. Palmeras, 2 mar 1991, E. Gonzalez, 1f. **El SALVADOR:** Los Chorros, 20.vi.1963, 1f; Apopa, 17.xi.1991, 1f ; Zona costera, 15.v.1995, 1m. **HONDURAS**: Fco. Morazan, San Antonio de Oriente, El Zamorano, 5–15.iv.1990, R. Cave, 1m; EL Paraiso, Yuscaran, 25.v.1993, B. Castro, 1f.

Remarks. This sex association and synonymy is based on coincidental distribution and a pair observed in copula in Isla Coibita, Veraguas. *Dasymutilla spilota* could be a junior synonym of *Dasymutilla xalisco* (Blake, 1871) (holotype female Mexico ANSP, No. 4507 examined). Females of both species are similar, except *D. xalisco* has the pubescent white patches of T2 connected medially, while in *D. spilota* they are separated medially. These pubescent patches, however, are variable in size in *D. spilota*, from widely separated medially to almost in contact. Also, the presence of male of *D. spilota* in Mexico (Manley and Pitts 2007), suggests that both species might fall in synonymy.

Seasonal flight activity for *Dasymutilla* from Barro Colorado Island, Panama

Out of the six species of *Dasymutilla* we recognize as present in Panama, the following three species were found in sympatry on Barro Colorado Island: *D. colorado*, *D. paradoxa* and *D. phya*. The latter was found as the most abundant *Dasymutilla* species during our six continuous sampling years (2001–2006) in BCI (Tables 2, 3). *Dasymutilla colorado* and *D. phya* were collected for the entire duration of the six sampling years; specimens of *D. paradoxa* were not collected in BCI during 2006. The largest number of individuals were collected in BCI during 2002, with numbers gradually diminishing from 2003 to 2006 (Table 2, Fig. 29, 30). Paton (2016) shows that annual cumulative precipitation on BCI increased

Table 2. Total of *Dasymutilla* specimens captured by year in BCI.

Species	2001	2002	2003	2004	2005	2006	TOTAL
D. paradoxa	3	2	4	4	2	0	15
D. phya	57	74	66	40	14	16	267
D. colorado	2	11	3	15	11	8	50
TOTAL	62	87	73	59	27	24	332

Table 3. Total of *Dasymutilla* specimens captured by month in six years (2001–2006) in BCI.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
D. paradoxa	0	3	4	6	2	0	0	0	0	0	0	0
D. phya	3	10	29	89	64	39	12	3	7	6	3	2
D. colorado	1	0	1	2	25	12	0	1	6	0	0	2
TOTAL	4	13	34	97	91	51	12	4	13	6	3	4

from the years 2000 to 2007. We speculate that the additional rain during those years might have had a negative impact on ground nesting hosts for *Dasymutilla* females, thus diminishing mutillid populations and their flight activity.

The ground-nesting activity of bees and wasps, many of them hosts for mutillids, is higher during the mid-December to end of April dry season in Panama. Aranda and Graciolli (2016) relate the higher abundance of Mutillidae during the corresponding period in Brazil to the increased presence of families of potential hosts (Crabronidae was recognized as the best potential host; also Sphecidae and Apidae [Halictinae and Colletinae]).

The peak capture month in Panama for *D. paradoxa* and *D. phya* was April; for *D. colorado* it was May, both months that form the transition period from dry to rainy seasons. The abundance of *D. paradoxa* and *D. phya* diminished during the remaining months of the rainy season. Specimens of *D. phya* were collected during all months of the year; specimens of *D. colorado* were not collected during February, July, October or November; *D. paradoxa* was not observed during eight months, from June to January. We interpret the peak abundance of *Dasymutilla* species during the months of April, May and June (first part of the rainy season in Panama) is related to the nesting activity of their host during the preceding months of February and March (dry season in Panama). The development time for Mutillidae, from egg to adult, varies from 20–22 days (Cambra et al. 2017) to 45 days (Cambra, unpublished data). Diapause has not been reported for Mutillidae from Panama.

Seasonal flight studies in mutillids inhabiting temperate zones suggest that flight activity in *Dasymutilla* males is related to the emergence of females (Deyrup and Manley 1990) with mating occurring on the ground immediately after emergence (Brothers 1972; Manley and Pitts 2007). Deyrup and Manley (1990) suggest that when mutillid species are active for long periods (in southern Florida, most species fly throughout the year), records of their flight activity would be ineffective estimators of longevity; those species with shorter periods of flight activity, or that fly only during a particular season, may better estimate longevity. Deyrup and Manley (1990) also note the absence of evidence on phenological niche partitioning or dependence on hosts that are only briefly available because most mutillid species are not host specific. Also, all abundant species showed large population fluctuations during their four year study (1983 to 1986). Eight of the twelve species represented by at least 25 specimens were active during eight or more months of the year. The prolonged flight season in southern Florida is probably related to the mild climate of the study site (Deyrup and Manley 1990).

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Literature Cited

Aranda, R., and G. Graciolli. 2016. Environmental heterogeneity in parasitoid-host interaction for Mutillidae (Hymenoptera: Apocrita). Environmental Entomology 45(5): 1107–1114.

Blake, C. A. 1870. Descriptions of two new species of *Mutilla* from Mexico. Transactions of the American Entomological Society 3: 68.

Brothers, D. J. 1972. Biology and immature stages of *Pseudomethoca f. frigida*, with notes on other species (Hymenoptera: Mutillidae). University of Kansas Science Bulletin 50(1): 1–38.

Brothers, D. J. 2006. Familia Mutillidae. p. 577–594. *In*: F. Fernández and M. J. Sharkey (eds.). Introducción a los Hymenoptera de la Región Neotropical. Sociedad Colombiana de Entomología y Universidad Nacional de Colombia; Bogotá, Distrito Capital, Colombia. Xxx + 894 p.

Cambra, R. A. 1997. Comparacion de la diversidad en la Sphaeropthalminae (Hymenoptera: Mutillidae) de Costa Rica y Panamá, con notas sobre biología. Scientia 12(2): 115–128.

Cambra, R. A., and D. Quintero. 1992. Velvet ants of Panama: distribution and systematics (Hymenoptera: Mutillidae). p. 459–478. *In:* D. Quintero and A. Aiello (eds.). Insects of Panama and Mesoamerica: Selected Studies. Oxford University Press; Oxford. 692 p.

Cambra, R. A., M. L. Tunes Buschini, D. Quintero Arias, F. Brozoski, and P. Rudiak Lustosa. 2017. *Ephuta icema* Casal, 1969 and its host *Auplopus subaurarius* Dreisbach, 1963 (Hymenoptera: Mutillidae, Pompilidae) from Brazil. Zootaxa 4272(2): 285–290.

Cameron, P. 1895. Fam. Mutillidae. p. 329–376. *In*: F. D. Godman and O. Salvin (eds.). Biologia Centrali-Americana. Insecta. Hymenoptera. (Fossores.) Vol. II, R.H. Porter; London. 413 p.

Cameron, P. 1897. Fam. Mutillidae. p. 377–395. *In*: F. D. Godman and O. Salvin (eds.). Biologia Centrali-Americana. Insecta. Hymenoptera. (Fossores.) Vol. II, R.H. Porter; London. 413 p.

Deyrup, M., and D. G. Manley. 1990. Seasonal flight activity of male velvet ants (Hymenoptera: Mutillidae) in South Florida. Entomological News 101(2): 99–108.

Flores, G.E., S. J. Lagos, and S. Roig-Juñet. 2004. Artrópodos epígeos que viven bajo la copa del algarrobo (*Prosopis flexuosa*) en la Reserva Telteca (Mendoza, Argentina). Multequina 13: 71–90.

Foster, R., and N. V. L. Brokaw. 1990. Estructura e historia de la vegetación de la Isla Barro Colorado. p. 191–200 *In:* E. Leigh, S. Rand, and D. M. Windsor. Ecología de un Bosque Tropical: Ciclos Estacionales y Cambios a Largo Plazo. Smithsonian Tropical Research Institute; Balboa, Panama. 547 p.

Gerstaecker, A. 1874. Mutillarum Americae meridionalis indigenarum synopsis systematica et synonymica. Archiv für Naturgeschichte 40, 41–77, 299–328.

Luz, D. R., K. A. Williams, and P. R. Bartholomay. 2016. The mutillid wasps of the *Dasymutilla* paradoxa species-group (Hymenoptera, Mutillidae). Zootaxa 4193(2): 361–372.

Manley, D. G. and J. P. Pitts. 2007. Tropical and subtropical velvet ants of the genus *Dasymutilla* Ashmead (Hymenoptera: Mutillidae) with descriptions of 45 new species. Zootaxa 1487: 1–128.

Mickel, C. E. 1937. New world Mutillidae in the Spinola collection at Torino, Italy (Hymenoptera). Revista de Entomologia, Rio de Janeiro 7: 165–207.

Mickel, C. E. 1964. Synonymical notes on neotropical Mutillidae (Hymenoptera). Proceedings of the Royal Entomological Society of London (B) 33: 163–171.

Paton, S. 2016. STRI 2016 Meteorological and Hydrological Summary for Barro Colorado Island. (Available at http://biogeodb.stri.si.edu/physical_monitoring/pdf/BCI%20Met&Hyd%20Report%202016.pdf. Last accessed August 2017.)

Quintero, D., and R. A. Cambra. 2001. On the identity of *Scaptopoda* F. Lynch Arribálzaga, new taxonomic changes and new distribution records for Neotropical Mutillidae (Hymenoptera), with notes on their biology**.** Transactions of the American Entomological Society 127(3): 291–304.

Richards, L. A., and D. M. Windsor. 2007. Seasonal variation of arthropod abundance in gaps and the understorey of a lowland moist forest in Panama. Journal of Tropical Ecology 23: 169–176.

Saavedra, D. 2014. Diversidad y abundancia de avispas Mutillidae (Hymenoptera) en Isla Barro Colorado, Provincia de Panamá, Panamá. Thesis, Licenciatura en Biología, Universidad de Panamá, Panamá. 98 p.

Smith, F. 1855. Catalogue of Hymenoptera in the collection of the British Museum. Part III. Mutillidae and Pompilidae. Trustees of the British Museum; London. 240 p.

Smith, F. 1862. Descriptions of new species of Aculeata Hymenoptera, collected at Panama by R.W. Stretch, Esq., with a list of described species, and the various localities where they have previously occurred. Transactions of the Entomological Society of London 1(3): 1–44.

Smith, F. 1879. Mutillidae, Leach. p. 189–227. *In:* F. Smith. Descriptions of new species of Hymenoptera in the collection of the British Museum. Trustees of the British Museum; London. 276 p.

Vieira, C. R., C. Waichert, K. A. Williams, and J. P. Pitts. 2017. Evaluation of Malaise and yellow pan trap performance to assess velvet ant (Hymenoptera: Mutillidae) diversity in a Neotropical savanna. Environmental Entomology 46(2): 353–361.

Williams, K. A. 2012. Systematics of Mutillidae (Hymenoptera) with special emphasis on *Dasymutilla* and their allies. All Graduate Theses and Dissertations. Paper 1200. Utah State University Press; Logan, UT, USA. 327 p. (Available at http://digitalcommons.usu.edu/etd/1200/. Last accessed November 2017.)

Williams, K. A., P. R. Bartholomay, and M. L. Oliveira. 2017. Species groups of *Traumatomutilla* André (Hymenoptera: Mutillidae). Insecta Mundi 0533: 1–38.

Williams, K. A., and J. P. Pitts. 2013. Caribbean and Mexican additions to the *Dasymutilla bioculata* species-group (Hymenoptera: Mutillidae). Annals of the Entomological Society of America 106(4): 429–436.

Windsor, D. M. 1990. Climate and moisture variability in a tropical forest: Long-term records from Barro Colorado Island, Panama. Smithsonian Contributions to the Earth Sciences 29: 1–145.

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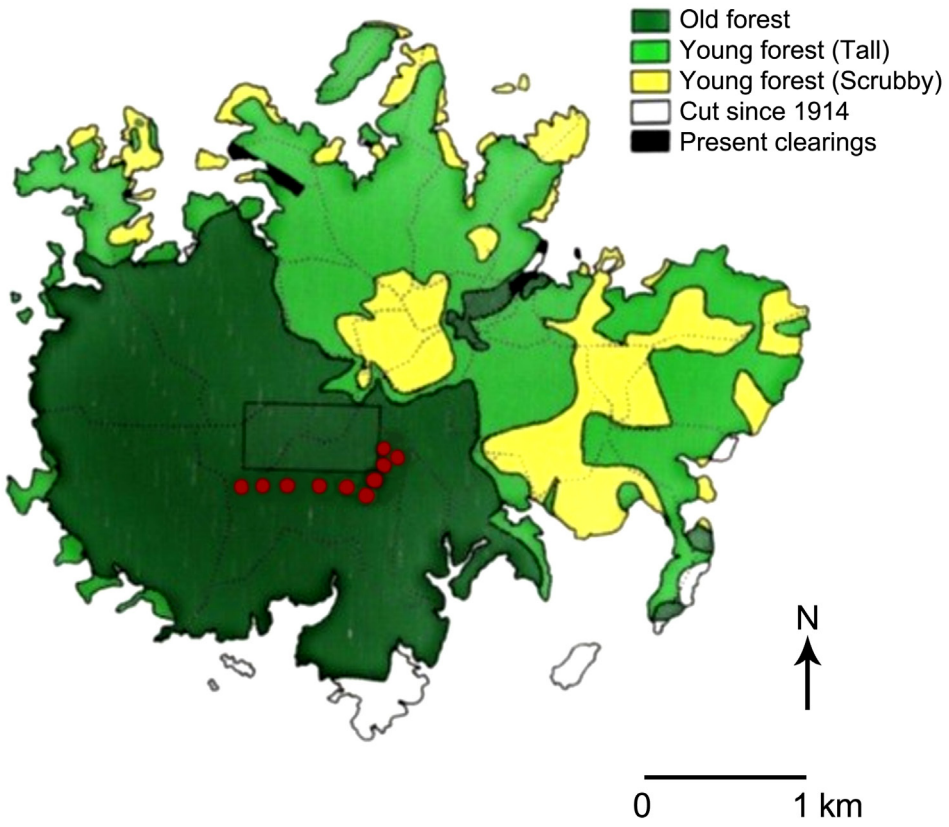
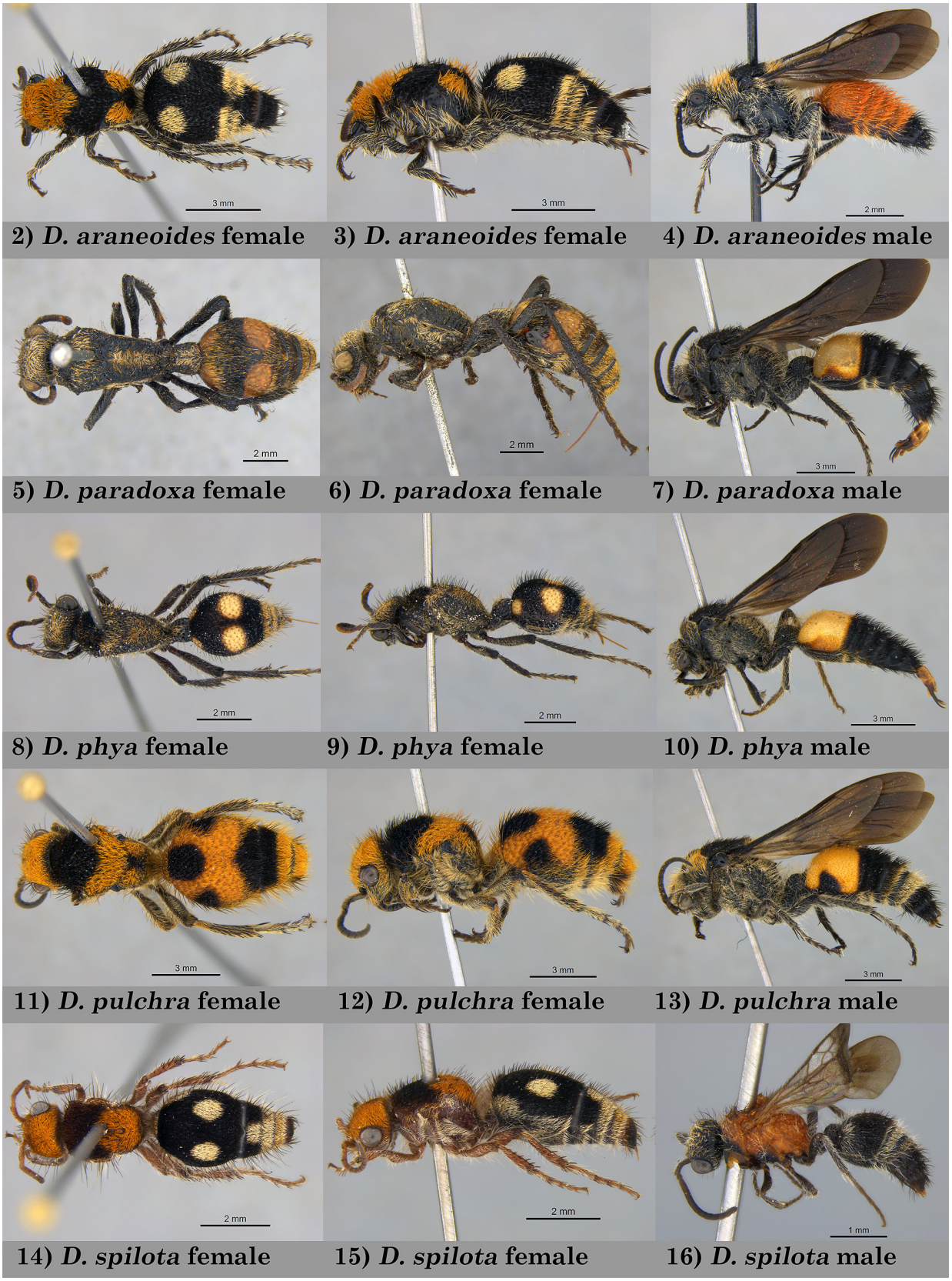
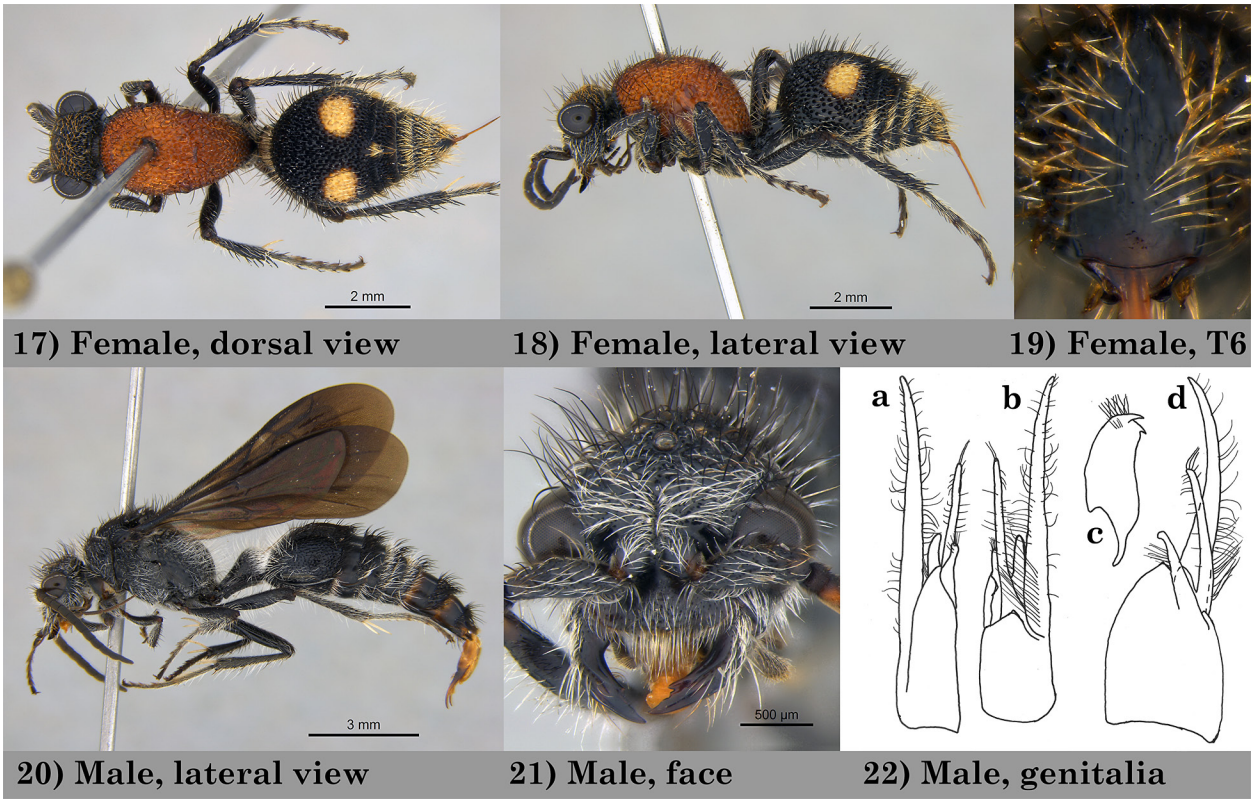


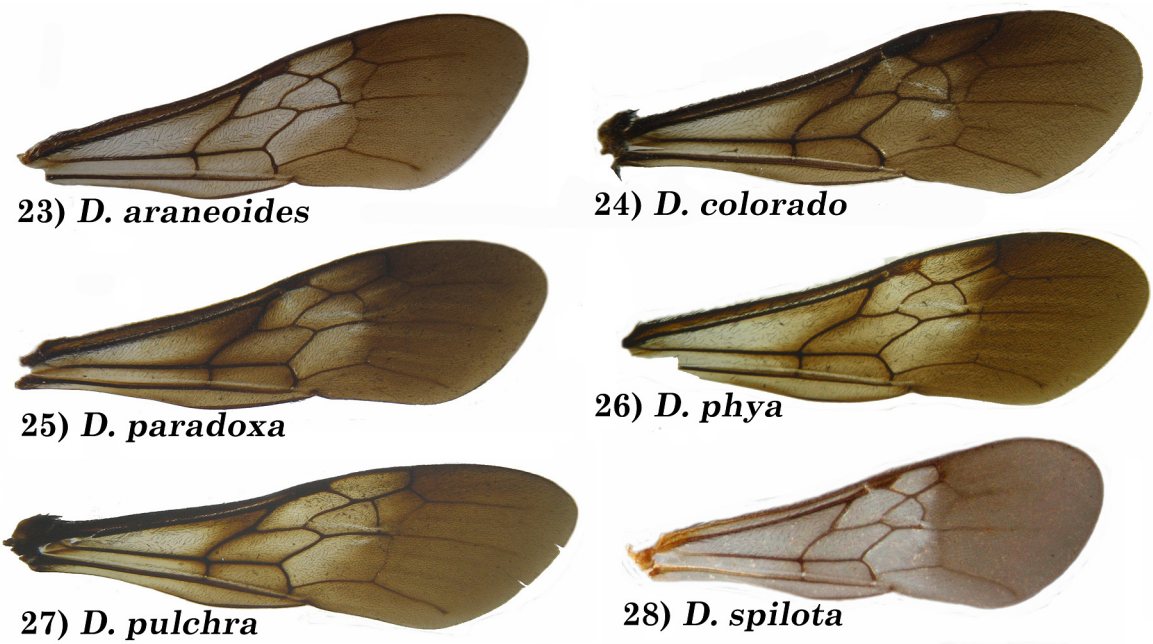
Figure 1. Location of Malaise traps (red spots) on Barro Colorado Island [Modified from Foster and Brokaw 1990].



Figures 2–16. *Dasymutilla* species, habitus photographs.



Figures 17–22. *Dasymutilla colorado,* **sp. nov. 17–19)** Female photographs. **20–21)** Male photographs. **22)** Male genitalia illustrations. a) Dorsal view. b) Ventral view. c) Penis valve lateral view. d) Lateral view.



Figures 23–28. *Dasymutilla*, right forewing. **23)** *D. araneoides*. **24)** *D. colorado*, **sp. nov. 25)** *D. paradoxa*. **26)** *D. phya*. **27)** *D. pulchra*. **28)** *D. spilota.*

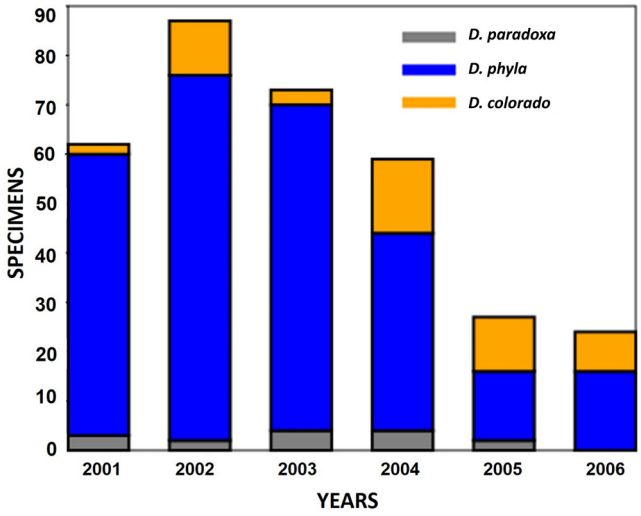


Figure 29. Total *Dasymutilla* specimens captured by ten Malaise traps over six years (2001 to 2006).

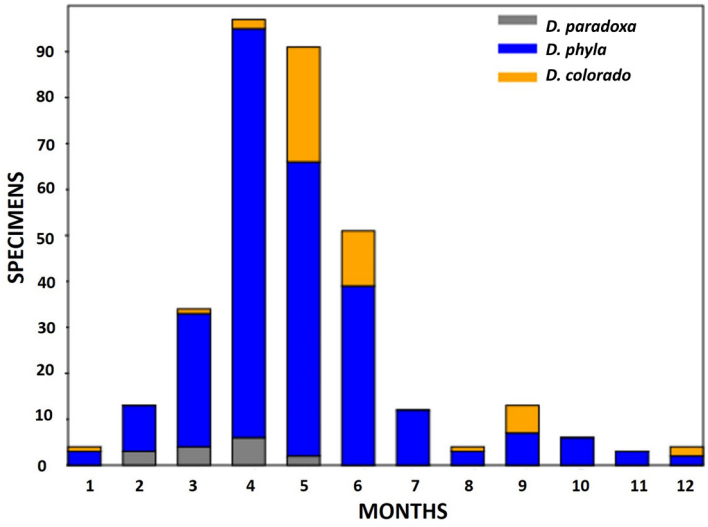


Figure 30. Total *Dasymutilla* specimens captured by month in six years (2001 to 2006) with ten Malaise traps in BCI.