NOTA CIENTÍFICA

Wing pattern variation in the Patagonian biting midge, *Forcipomyia* (*Forcipomyia*) *multipicta* Ingram & Macfie (Diptera, Ceratopogonidae)

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Patrón de variación alar en la mosquita patagónica *Forcipomyia* (*Forcipomyia*) *multipicta* Ingram & Macfie (Diptera, Ceratopogonidae)

■ **RESUMEN**. El estudio de la serie-tipo y de ejemplares no típicos de la mosquita patagónica, *Forcipomyia* (*Forcipomyia*) *multipicta* Ingram & Macfie, reveló una variación considerable en el diseño alar de ambos sexos. Uno de los patrones incluye varias áreas claras distintivas, mientras que el otro diseño (e.g., en el holotipo) solo muestra áreas claras marginales en la celda r_3, y algunas que son poco perceptibles o están ausentes. La(s) causa(s) de la pérdida diferencial de macrotriquias, en ciertas áreas de la membrana alar en ejemplares de diferentes series, no puede ser atribuida al sexo, edad de los ejemplares o método de preservación.

PALABRAS CLAVE. Diptera, Ceratopogonidae, mosquita, *Forcipomyia multipicta*, variación intraespecífica, diseño alar, Patagonia.

■ **ABSTRACT**. Examination of the type-series and non-type specimens of the Patagonian biting midge, *Forcipomyia* (*Forcipomyia*) *multipicta* Ingram & Macfie (Diptera: Ceratopogonidae), revealed considerable variation in wing patterns of both sexes. One pattern includes several distinct light spot areas, whereas another pattern (e.g, in the holotype) only features marginal light spots in cell r_3, while other light spots are barely perceptible or absent. The cause(s) of the differential lack of dark macrotrichia in certain areas of the wing membrane in specimens of some series could not be attributed either to their age, sex, or method of preservation.

KEY WORDS. Diptera, Ceratopogonidae, biting midge, *Forcipomyia multipicta*, intraspecific variation, wing pattern, Patagonia.

Wing pigmentation patterns have been used extensively in certain genera of biting and predaceous midges (Diptera: Ceratopogonidae) to distinguish species. However, as with other morphological features, taxonomists should be aware of the possibility of intraspecific variation, which is poorly understood in the family. For example, the wings of biting midges of the genus *Culicoides* Latreille (ca. 1300 extant species; Borkent 2012) bear dense microtrichia, and their size and pigmentation produce patterns

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of dark and light spots or bands that are often characteristic for each species and, therefore, of primary importance in classification (Blanton & Wirth, 1979). Similarly, the genus *Forcipomyia* Meigen, is the 2nd most speciose genus of Ceratopogonidae (ca. 1100 extant species; Borkent 2012), and includes some species that exhibit spotted wing patterns. However, in this genus, the distribution and number of light spots is due to the absence of dark macrotrichia, and dark spots are the result of regions of high densities of these coarse setae.

Felippe-Bauer *et al.* (2003, 2005) described variation in the extent of light spots in *Culicoides peruvianus* Felippe-Bauer and *C. jurbergi* Felippe-Bauer from Peruvian Amazonia, and Spinelli *et al.* (2007) noted the same variation of light spots in *C. felippebauerae* Spinelli from Brazilian Amazonia. In addition, Felippe-Bauer & Silva (2006) discussed morphological variation within ceratopogonids, but especially focussed to abnomalities. There are no published data regarding wing pattern variation of *Forcipomyia* spp.

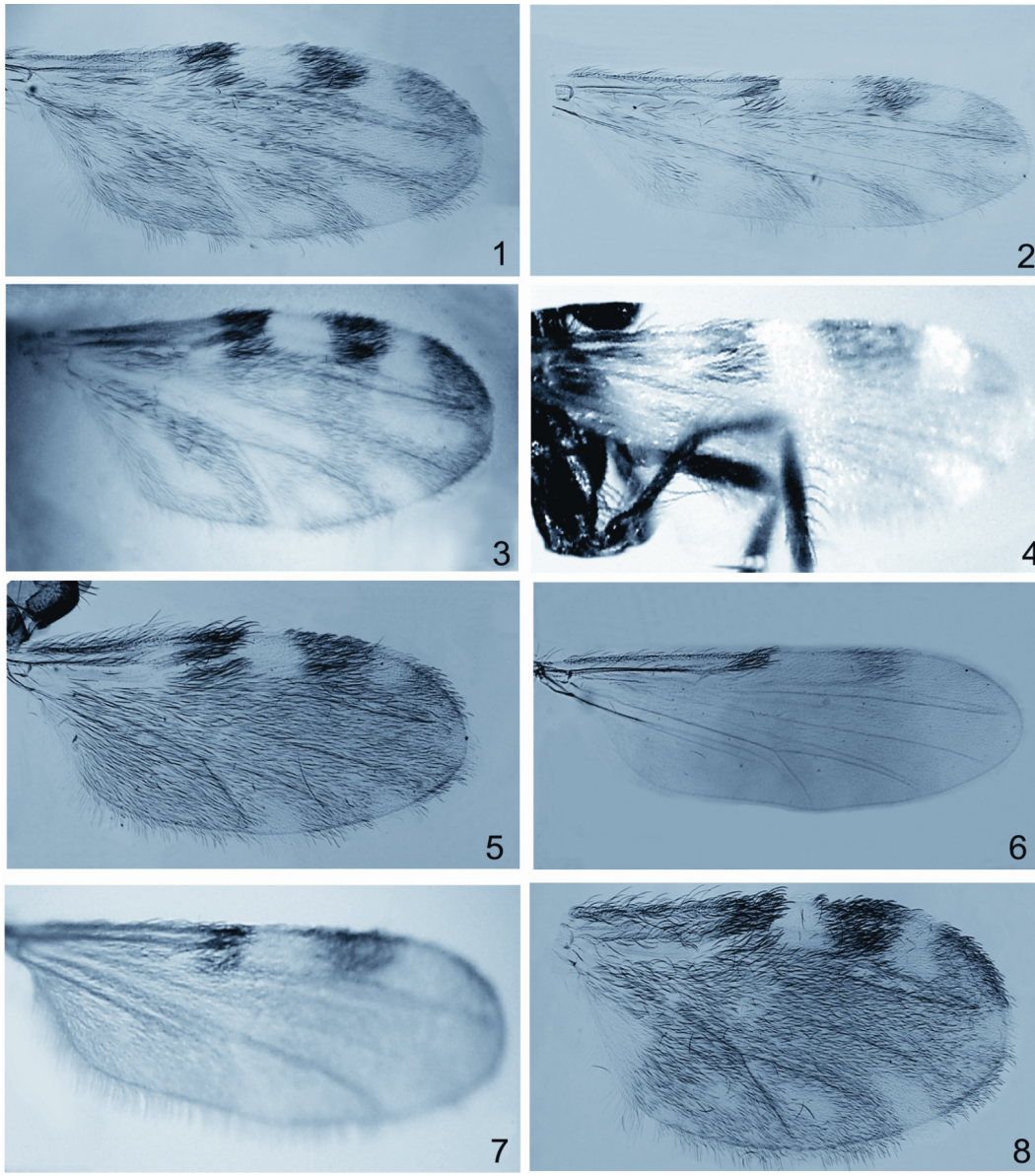
Marino & Spinelli (2001) reviewed the patagonian species of *Forcipomyia* (*Forcipomyia*) sensu stricto, and recognized four species with highly spotted wings: *F. minitheca* Marino & Spinelli, *F. multipicta* Ingram & Macfie, *F. somuncurensis* Marino & Spinelli and *F. yamana* Marino & Spinelli. Among these four species, *F. multipicta* is the most abundant and widely distributed in the *Nothofagus* forests of Argentina and Chile from northern Patagonia to the islands located south of the Beagle Channel. According to Ingram & Macfie (1931) and Marino & Spinelli (2001), females of *F. multipicta* are readily recognized by their single, large spermatheca (two spermathecae in other patagonian congeners with spotted wings) and by the shape and proportions of flagellomeres 8-9, whereas males have distinctive genitalia with a very low aedeagal basal arch, and strongly convex parameres with filiform posterior processes and recurved tips.

The collection of Ceratopogonidae housed at the Museo de La Plata, Argentina (MLP) contains 137 specimens of *F. multipicta*, all of which feature patterned wings as described above. Our detailed examination of these patagonian specimens revealed considerable variation in wing patterns that was similar to specimens in the type-series of this species housed in the Natural History Museum, London, England (BMNH). Herein, we describe and provide wing photographs that depict the range of wing pattern variation within this species.

All specimens examined from the MLP are slide-mounted in Canada balsam by the methods described by Wirth & Marston (1968). The majority of specimens examined in the type-series are pinned except for one female and one male (paratypes), which are also slide-mounted in Canada balsam. The photomicrographs of the wings of pinned specimens were taken with a Sony Cyber-Shot 5.0, digital camera through a binocular microscope; photomicrographs of slide mounted specimens were obtained with a Nikon Coolpix 3.100, digital camera through a binocular compound microscope. Terms for wing venation are those in the Manual of Central America Diptera (Brown *et al.*, 2009).

Some females and males in the MLP exhibit a wing pattern that consists of a light spot distal to the r-m crossvein that extends to the costa, two conspicuous marginal light spots in cell r_3, one small apical light spot in vein M_1, distal light spots in cells m_1, m_2, cua_1 and anal cell, plus a basal light spot in cell m_1 and an elongated mesal light spot in cell m_2 (Figs. 1-2). This pattern is identical to the wing illustration in the original description of a slide mounted female paratype (Ingram & Macfie, 1931: Fig. 3), as well as in some other pinned male paratypes (Fig. 4).

Conversely, other specimens of both sexes have a different wing pattern from the one described above. In these specimens the marginal light spots in cell r_3 are visible but not so contrasting with respect to the dark spots, while the distal pale spots in cells m_1, m_2, cua_1 are barely discernible and lack subapical light spots in cell m_1 and anal cell, as well as mesal spots in cells m_1 and m_2 (Figs. 5-6). This pattern type is present in the



Figs. 1-8. *Forcipomyia multipicta*, wing photomicrographs. 1, female (slide, MLP); 2, male (slide, MLP); 3, female (slide, paratype BMNH); 4, male (pinned, paratype BMNH); 5, female (slide, MLP); 6, male (slide, MLP); 7, male (pinned, holotype BMNH); 8, female (slide, MLP).

pinned male holotype (Fig. 7), and therefore, is not as spotted as the specific epithet suggests. A few specimens exhibit a variant of this pattern with more distinct two light marginal spots in cell r_3 and with faint distal light spots in cells m_1, m_2, cua_1 and the anal cell (Fig. 8).

The reason(s) for the differential lack of dark macrotrichia in certain areas of the wing membrane in some specimens that produce light spots which are totally absent in the male holotype, is unknown. Our detailed examinations of both sexes collected in 1926/27 that are pinned or slide mounted, or other specimens collected during the past 25 years, did not reveal any obvious causes of wing pattern variation attributed to the sex, age of specimens or their method

of preservation. Therefore, we suggest that wing pattern variation in *F. multipicta* may be due to genetic factors.

Material Examined

Type material (BMNH).

ARGENTINA, **Río Negro**: Lake Nahuel Huapi, eastern end (male pinned holotype, female slide mounted allotype). Other paratypes, 3 males, 13 females, from Argentina (type locality and Bariloche, Lake Gutierrez, Lake Correntoso) and Chile (Casa Pangue) (pinned except one male and one female slide mounted).

Other specimens (slide mounted, MLP).

ARGENTINA, **Neuquén**: San Martín de los Andes, 23-IV-1982, M. Gentili, 2 males, 7 females, at light; 10 km N San Martín de los Andes, 24-XI-1984, G. Spinelli, 1 male, 1 female; Collon Cura, 5-III-1998, G. Spinelli, 2 females, at light; 1.7 km N hotel Correntoso, 3-II-1986, G. Spinelli, 1 female, sweep net; Parque Nacional Lanin, Paimún, 6-II-1986, G. Spinelli, 1 female; Parque Nacional Lanin, arroyo Nonthue, 29-I-1988, G. Spinelli, 1 female; Hua-Hum, 16-XI-1994, G. Spinelli, 2 females; Parque Nacional Lanin, Lago Huechulafquen, 28-II-1998, G. Spinelli, 1 female; same data except 1-III-1998, 5 males, 7 females, CDC light trap; Laguna Epulaufquen, 21/23-II-2001, G. Spinelli, 1 male, Malaise trap; Quillen, 30-XI-2001, G. Spinelli, 1 male. **Río Negro**: Lago Escondido (Llao-Llao), 29-XI-1984, G. Spinelli, 1 female, sweep net; Bariloche, Lago Escondido, 3-XII-1988, D. Añon Suarez, 2 females, CDC light trap; Parque Nacional Nahuel Huapi, extremo S Lago Mascardi, 25-I-1988, G. Spinelli, 1 female; Parque Nacional Nahuel Huapi, cerro Chall-Huaco, 6-XII-1992, G. Spinelli, 1 female; Parque Nacional Nahuel Huapi, Lago Mascardi, 14/16-XII-1994, L. Quate, 1 female, Malaise trap; Lago Gutierrez, I-2003, J. Liotta, 1 male, at light; Bariloche, Av. Bustillo km 4.7, 7/21-I-2006, S. Montemayor, 1 female, at light; Parque Nacional Nahuel Huapi, arroyo La Araña, 41°01′18.3′′S 71°49′05′′, 766 m, 13-XII-2006, Garre-Montes de Oca, 1 female, sweep net; Parque Nacional Nahuel Huapi, arroyo Llum, 41°16′13.3′′S 71°30′56.7′′W, 857 m, 4/25-I-2007, Garre-Montes de Oca, 6 females, Malaise trap; Parque Nacional Nahuel Huapi, mallín La Heladera, 41°00′56′′S 71°49′45.4′′W, 878 m, 7-I/4-II-2007, Garre-Montes de Oca, 1 female, Malaise trap; same data except 41°05′13′′S 71°48′26′′W, 769 m, 8-I/3-II-2007, 1 female, Malaise trap; Parque Nacional Nahuel Huapi, Estación Biológica Puerto Blest, 41°01′34.4′′S 71°48′55.7′′W, 791 m, 1/5-II-2007, Garre-Montes de Oca, 7 females, at light; Parque Nacional Nahuel Huapi, arroyo Grande, 41°02′21.8′′S 71°48′27′′W, 763 m, 4/25-II-2007, Garre-Montes de Oca, 1 female, Malaise trap; Parque Nacional Nahuel Huapi, Río Manso Superior, 41°14′8.1′′S 71°46′58.5′′W, 845 m, 7-II/2-III-2007, Garre-Montes de Oca, 3 females, Malaise trap; Parque Nacional Nahuel Huapi, arroyo Blanco, 40°39′3.4′′S 71°24′45.8′′W, 822 m, 12-XII-2007/3-I-2008, Garre-Montes de Oca, 3 females, Malaise trap; same data except 21-I/7-II-2008, 5 females, Malaise trap; Parque Nacional Nahuel Huapi, Laguna Mercedes, 40°52′43.4′′S 71°34′41′′W, 899 m, 14-XII-2007/3-I-2008, Garre-Montes de Oca, 1 female, Malaise trap; same data except 3/21-I-2008, 2 females, Malaise trap; Parque Nacional Nahuel Huapi, arroyo Neuquenco, 40°28′48.3′′S 71°36′44.1′′W, 809 m, 9/23-I-2008, Garre-Montes de Oca, 3 females, Malaise trap; Parque Nacional Nahuel Huapi, Cascada Blanca, 20-II-2008, G. Spinelli, 1 female, sweep net; Parque Nacional Nahuel Huapi, Lago Fonck, 41°20′9.5′′S 71°45′17.41′′W, 771 m, 26-II/19-III-2009, Garre-Montes de Oca, 1 female, Malaise trap. **Chubut**: Parque Nacional Los Alerces, margen E Lago Futalaufquen, 20-I-1988, G. Spinelli, 3 males, 2 females; Parque Nacional Los Alerces, El Alerzal, 22-I-1988, G. Spinelli, 1 male, 1 female; same data except 23-I-1988, 4 females, CDC light trap; Cerro Galera, 2/4-XII-2002, G. Spinelli, 1 female, Malaise trap; Parque Nacional Los Alerces, Lago Menendez, Puerto Chucao, 3-XII-2003, G. Spinelli, 10 females, CDC light trap; Lago Epuyen, arroyo s/n, acceso a Puerto Patriada, 42°08′17′′S 71°31′56′′W,

500 m, P. Pessacq, 21-XII-2007/3-I-2008, 2 females, Malaise trap. **Santa Cruz**: Lago del Desierto, 9-XII-1996, G. Spinelli, 1 male, 10 females, at light; same data except 9/11-XII-1996, 2 females, Malaise trap; same data except 11-XII-1996, 1 male, sweep net; Lago San Martín, Estancia La Maipú, 7-XII-2002, G. Spinelli, 1 male, 1 female, CDC light trap. **Tierra del Fuego**: ruta complementaria 8 (ex ruta compl. B), 44 km W, Río Grande 53°55'17.8''S 68°20'58.6''W, 2-XII-2005, G. Spinelli, 4 males, 1 female, sweep net; ruta complementaria 33 (ex ruta compl. J), 73.5 km, 54°55'36''S 66°57'28.6''W, 113 m, 2/6-XII-2008, G. Spinelli-M. Donato, 1 female, Malaise trap; Parque Nacional Tierra del Fuego, mallín s/n, 54°51'23.6''S 68°35'37.3''W, 31 m, ¼-XII-2008, G. Spinelli-M. Donato, 2 females, Malaise trap; same data except 4/7-XII-2008, 2 females.

CHILE, **Valparaiso**: 6 km SE Quintero (dunas), 20-IX-1966, E. Schlinger, 1 male. **Ñuble**: Alto Tregualemu, SE Chovellen, 500 m, 26-I-1979, Davis & Akerbergs, 1 male. **Osorno**: Parque Nacional Puyehue, Aguas Calientes 600 m, 10-II-1979, Davis & Akerbergs, 1 female; Pucatrihue, 30-XI-1992, G. Spinelli, 2 females; Parque Nacional Vicente Pérez Rosales, Casa Pangue, arroyo s/n, 41°02´55.0"S 71°52´31.2"W, 366 m, 18-II-2008, M. Donato, 2 females, Malaise trap. **Provincia Antártica Chilena**: isla Deceit, 19/27-XI-1982, D. Lanfranco, 1 male, 2 females, Malaise trap.

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