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FIRST REPORT OF *JUGLANS AUSTRALIS* (JUGLANDACEAE) AS A NATURAL HOST PLANT FOR *ANASTREPHA SCHULTZI* (DIPTERA: TEPHRITIDAE) WITH NOTES ON PROBABLE PARASITISM BY *DORYCTOBRACON AREOLATUS*, *D. BRASILIENSIS*, *OPIUS BELLUS* (BRACONIDAE) AND *AGANASPIS PELLERANOI* (FIGITIDAE)

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Anastrepha schultzi Blanchard (1938) (Diptera: Tephritidae) has so far only been found in Peru (province of Cuzco) and Argentina (Norrbom et al. 1999a). In Argentina, its presence was reported in the NW provinces of Salta (localities of La Caldera, Cerrillos, Campo Santo and Rosario de Lerma; Rosillo 1953; Blanchard 1961), Jujuy (localities of León, Tumbaya, Maimará and Jueya; Blanchard 1961; Manero et al. 1989), Tucumán, Catamarca and in the NE province of Misiones (Blanchard 1961). With the possible exception of Blanchard (1961), the latter reports stem from adults collected in liquid-based traps placed in *Psidium guajava* L. (Myrtaceae), *Prunus persica* (L.) Batch, *Prunus domestica* L. (Rosaceae) and *Citrus* spp. (Rutaceae) trees. *Anastrepha schultzi* belongs to the *fraterculus* species group (Norrbom et al. 1999b) and differs from *A. fraterculus* (Wiedemann) and also from *A. distincta* (Greene) by its longer, broader, and less serrate aculeus tip (length 0.43-0.59 mm vs. 0.34-0.43 mm in *A. distincta* and 0.21-0.30 mm in *A. fraterculus*; width 0.16-0.18 mm vs. 0.12-0.16 mm in *A. distincta* and 0.12-0.15 mm in *A. fraterculus*; and non-serrate or at most with distal 0.25 finely serrate, vs. distal 0.41-0.56 serrate in *A. distincta* and distal 0.50-0.67 serrate in *A. fraterculus*). *Anastrepha schultzi* further differs from *A. fraterculus* by its longer oviscape and aculeus (2.44-3.30 mm and 2.28-3.00 mm vs. 1.65-2.15 mm and 1.50-1.95 mm in *A. fraterculus*), and from *A. distincta* in consistently having the sides of the subscutellum dark brown (*A. distincta* is variable for this character, but more commonly has the subscutellum entirely orange). Blanchard (1961) reported that the host plants of *A. schultzi* were purportedly *Citrus* spp., *P. guajava*, and "peaches" ("duraznos").

Here we report for the first time field infestations by *A. schultzi* in *Juglans australis* Grisebach (locally known as "nogal criollo") (Juglandaceae) and confirm field infestations in *P. guajava* (locally known as "guayaba"). *Juglans australis* is a tree that reaches 10-20 m in height with the tree trunk measuring 40-50 cm in diameter when fully grown. The fruit is a subglobose drupe, with a fleshy mesocarp, measuring 3-4 cm when fully ripe (Digilio & Legname 1966). In Argentina, it is found at altitudes of 500-1500 meters above sea level and is distributed in the NW provinces of Jujuy, Salta, and Tucumán, where it forms part of the "Yungas" forests (also known as "Nuboselva" or Montane Cloud Forest). According to Digilio & Legname (1966) the fruiting period starts in February, but here we found that it spanned from mid December until mid February (details in Ovruski et al. 2003). *Psidium guajava* grows wild in perturbed patches of "Yungas" forests and it can be commonly found growing next to or near *J. australis* trees. In the study area, its fruiting period spans from February to April (Ovruski et al. 2003).

Our study site covered an area of 12 km^2 in the locality of Horco Molle, province of Tucumán located between 500 and 800 meters above sea level at 26°45' to 26°49'S latitude and 65°20' to 65°18'W longitude. The selected area belongs to what is locally known as "primer piso de la Selva Montana Basal de Las Yungas en el Distrito Pedemontano" (Brown 1995). We collected fallen fruit from the ground between December 27, 2001 and February 13, 2002 under the canopies of 15 *J. australis* trees and between March 7, 2001 and April 28, 2001 under the canopies of 20 *P. guajava* trees on a weekly basis. Between 8 and 10 *J. australis* fruit were collected and transported to the laboratory where they were individually measured, weighed and placed in ½-liter plastic containers covered with Organdi cloth. Each container had a 5-cm layer of moistened sand as a pupating medium. Fruit of *J. australis* weighed (mean ± SE) 27.7 ± 9.2 g and measured 12.0 ± 1.3 cm in diameter. Some late second and early third instars stemming from *J. australis* were separated to measure and weigh them. Mean ± SE size and weight were 8.0 ± 0.7 mm and 20 ± 5 mg, respec-

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tively (n = 21). All pupae stemming from *J. australis* also were weighed and measured and then individually placed in 30-ml plastic containers covered with Organdi cloth and with moistened vermiculite on the bottom. Mean ± SE pupal weight was 13.0 ± 0.3 mg (n = 58). Once adults emerged, they were fed with a mixture of sugar and hydrolyzed protein plus water *ad libitum* to allow for full wing and body coloration.

We collected a total of 98 *J. australis* and 1,854 *P. guajava* fruit, weighing 2.7 and 75.1 kg, respectively, from which 854 and 36,919 *Anastrepha* spp. pupae, respectively, were recovered. Infestation rates were 318.5 and 492.6 larvae per kg of fruit in *J. australis* and *P. guajava*, respectively. Of the 430 *Anastrepha* adults that emerged from *J. australis* (50.4% emergence rate), 332 (142 ♀ and 190 ♂) were *A. schultzi*, and 98 (46 ♀ and 52 ♂), *A. fraterculus*. From 389 (45.6%) of the remaining 424 *Anastrepha* pupae nothing emerged, and from the remainder (n = 35) we recovered 4 (3 ♀ and 1 ♂) *Aganaspis pelleranoi* (Bréthes) (Hymenoptera: Figitidae), 2 (both ♀) *Doryctobracon areolatus* (Szépligeti) (Hymenoptera: Braconidae), 27 (15 ♀ and 12 ♂) *D. brasiliensis* (Szépligeti) (Hymenoptera: Braconidae), and 2 (1 ♀ and 1 ♂) *Opius bellus* Gahan (Hymenoptera: Braconidae) adults. Given that we were unable to distinguish *A. schultzi* and *A. fraterculus* at the pupal stage, we are not certain if the above mentioned parasitoids attack both *Anastrepha* species in our study area. We also recovered 5 *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae) pupae, from which 2 (both ♀) adults emerged.

Of the 18,901 *Anastrepha* adults that emerged from *P. guajava* (51.2% emergence rate), 152 (128 ♀ and 24 ♂) were *A. schultzi* and 18,749 (10,123 ♀ and 8,626 ♂), *A. fraterculus*. From 16,103 (43.6%) of the remaining 18,018 *Anastrepha* pupae nothing emerged, and from the remainder (N = 1,915) we recovered 705 (351 ♀ and 354 ♂) *A. pelleranoi*, 713 (368 ♀ and 346 ♂) *D. areolatus*, 226 (97 ♀ and 128 ♂) *D. brasiliensis*, 246 (141 ♀ and 106 ♂) *Utetes anastrephae* (Viereck) (Braconidae), and 25 (19 ♀ and 6 ♂) *O. bellus* adults. We also recovered 669 *C. capitata* pupae, from which 379 (222 ♀ and 157 ♂) adults emerged. As was the case with *J. australis*, we do not know which of the latter parasitoid species attack *A. schultzi* and *A. fraterculus*. Nevertheless, we were able to ascertain that only *A. pelleranoi* (none of the braconid parasitoids did so) attacked *C. capitata* given that the pupae of this species are clearly distinguishable from the pupae of both *Anastrepha schultzi* and *A. fraterculus*.

Our finding that *A. schultzi* infests *J. australis* and that it shares this resource with *A. fraterculus* is interesting from an ecological perspective given the fact that fruit within the Juglandaceae are usually infested by flies in the genus *Rhagoletis* (Smith & Bush 1999). Thus, this apparently represents a novel host shift that probably required adaptation to a unique chemical environment. We are in the process of studying the interaction of *A. schultzi* and *A. fraterculus* in *J. australis* in nature and also are trying to determine to what extent fruit from this tree differs chemically from *P. guajava*. Our finding of infestations of *P. guajava* by *A. schultzi* under natural conditions confirms the early report by Blanchard (1961). Elsewhere (Ovruski et al. 2003, 2004), we report on extensive collections (>20,000 fruit) of *Citrus aurantium* L., *C. paradisi* Macfad., *C. sinensis* (L.) Osbeck, *Prunus armeniaca* L., *P. domestica* and *P. persica* over a 5-year period (1991-1995) in NW Argentina that did not yield a single *A. schultzi* individual. Furthermore, between September 1999 and August 2002, we collected 5,665 *C. aurantium* (= 737.9 kg) and 5,974 *P. persica* fruit (= 209.9 kg) in the same study area, from which no *A. schultzi* emerged. We therefore believe that the *Citrus* spp. and "peach" host records by Blanchard (1961) need to be handled judiciously until confirmed. We consider them doubtful.

Anastrepha schultzi and *A. fraterculus* adults were identified by A. L. Norrbom using morphological characters. Voucher specimens were placed in the National Museum of Natural History, Washington, DC, USA, and Fundación Miguel Lillo (Tucumán, Argentina) entomological collections. *Juglans australis* and *P. guajava* were identified by the expert plant taxonomist Cristina Martín (Cátedra de Fanerógamas, Facultad de Ciencias Naturales e Instituto Miguel Lillo, Universidad Nacional de Tucumán). Voucher specimens of *J. australis* were placed in the herbarium of Fundación Miguel Lillo, San Miguel de Tucumán, Argentina. *Aganaspis pelleranoi*, *Doryctobracon areolatus*, *D. brasiliensis* and *Opius bellus* adults were identified by S. Ovruski using morphological characters. Voucher specimens were placed in the entomological collection of the Fundación Miguel Lillo (Tucumán, Argentina). This work was financed by the Agencia Nacional de Promoción Científica y Tecnológica de Argentina through the Fondo Nacional de Ciencia y Tecnología (FONCyT), Consejo Nacional de Investigaciones Científicas y Técnicas de Argentina (CONICET, grant PIP No. 4973/97), and the Instituto Superior de Entomología "Dr. Abraham Willink" (INSUE)—Facultad de Ciencias Naturales e Instituto Miguel Lillo—Universidad Nacional de Tucumán. Martín Aluja acknowledges financial support by the Mexican Campaña Nacional contra Moscas de la Fruta (Dirección General de Sanidad Vegetal—Secretaria de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación).

Summary

We document for the first time that *J. australis* is a natural host plant of *Anastrepha schultzi*

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Blanchard, a species belonging to the *fraterculus* group. We also confirm earlier reports indicating that *A. schultzi* infests *P. guajava*. Fruit were collected in the locality of Horco Molle, province of Tucumán in NW Argentina, in a perturbed "Yungas" forest (Montane Cloud Forest). Infestation rates were 318.5 and 492.6 larvae per kg of fruit in *J. australis* and *P. guajava*, respectively. We also report that *A. schultzi* and *A. fraterculus* are attacked by the larval-pupal hymenopterous parasitoids *Aganaspis pelleranoi* (Figitidae), *Doryctobracon areolatus*, *D. brasiliensis* and *Opius bellus* (all Braconidae) in the study region.

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