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## Primer registro de *Anastrepha pseudoparallela* Loew (Diptera: Tephritidae) infestando pasifloras en Perú

### First record of *Anastrepha pseudoparallela* Loew (Diptera: Tephritidae) infesting passion flowers in Peru

#### Resumen

Diversas especies del género *Anastrepha* Schiner están asociadas a diferentes hospederos y tienen gran importancia económica en la fruticultura de la región Neotropical. Frutos maduros e inmaduros de seis especies de *Passiflora* L. fueron colectados en Oxapampa durante el 2016 y 2018. Larvas de *Anastrepha pseudoparallela* Loew (Diptera: Tephritidae) fueron encontradas infestando frutos de *Passiflora ambigua* Hemsl y *Passiflora quadrangularis* L. Por primera vez, esta especie de mosca es registrada atacando frutos de pasifloras en el Perú.

#### Abstract

Several species of the genus *Anastrepha* Schiner are associated to different hosts and have a great economic importance in fruit crops of the Neotropical region. Ripe and unripe fruits of six passion flowers species were sampled in Oxapampa during 2016 and 2018. Larvae of *Anastrepha pseudoparallela* Loew (Diptera: Tephritidae) were detected infesting fruits of *Passiflora ambigua* Hemsl and *Passiflora quadrangularis* L. For the first time, this fruit fly species is recorded attacking fruits of passion flowers in Peru.

#### Palabras clave:

*Anastrepha*; Tephritidae; Passifloraceae; moscas de la fruta; insectos peste; nuevos registros.

#### Keywords:

*Anastrepha*; Tephritidae; Passifloraceae; fruit flies; insect pest; new record.

The passion flowers belong to genus *Passiflora* L. and are the most representative and abundant of the family Passifloraceae (Feuillet & McDougal 2007). Passion flowers include more than 500 described species and are distributed in tropical and sub-tropical areas around the world (Vanderplank 2000). Some species of this genus as *Passiflora edulis* f. *flavicarpa* Deneger (yellow passion fruit) and *Passiflora edulis* f. *edulis* Sims (purple passion fruit) are economically important worldwide (Martin & Nakasone 1994). Whereas, species as *Passiflora ligularis* Juss (sweet granadilla) and *Passiflora quadrangularis* L. (giant granadilla) are cultivated mainly in the Andean regions (Kluge 1998). In Peru, the purple passion fruit and sweet granadilla are the principal passion flowers cultivated, with an estimated production reaching 20000 tm in 5000 hectares and 50000 tm in 5800 hectares, respectively (Carrasco 2018, Ramos 2018). In this country, the province of Oxapampa (Pasco region) stands out as the main sweet granadilla producing area, with one third of the total national production (Mendieta 2015). Moreover, such province also has several favorable ecological conditions for the production of other passion flowers species.

Fruit flies (Diptera: Tephritidae) comprise a series of polyphagous species which cause damage in fruits and loss of export markets due to quarantine restrictions by fruit importing countries. In this family, the genus *Anastrepha* Schiner is the most diverse and economically important fruit fly species in the Neotropical region, including a large number of major fruit pests (Aluja 1994, Norrbom et al. 1999). In Peru, the main species associated with damage on cultivated host plants are *Anastrepha fraterculus* (Wiedemann), *Anastrepha distincta* Greene, *Anastrepha obliqua* (Macquart), *Anastrepha serpentina* (Wiedemann), *Anastrepha striata* (Schiner) and *Anastrepha chichlayae* (Greene) (Korytkowski 2001). However, reports of *Anastrepha* infesting passion flowers are not documented in Peru. Therefore, the aim of this study was to evaluate the presence of *Anastrepha* in fruits of passion flowers cultivated in Peru.

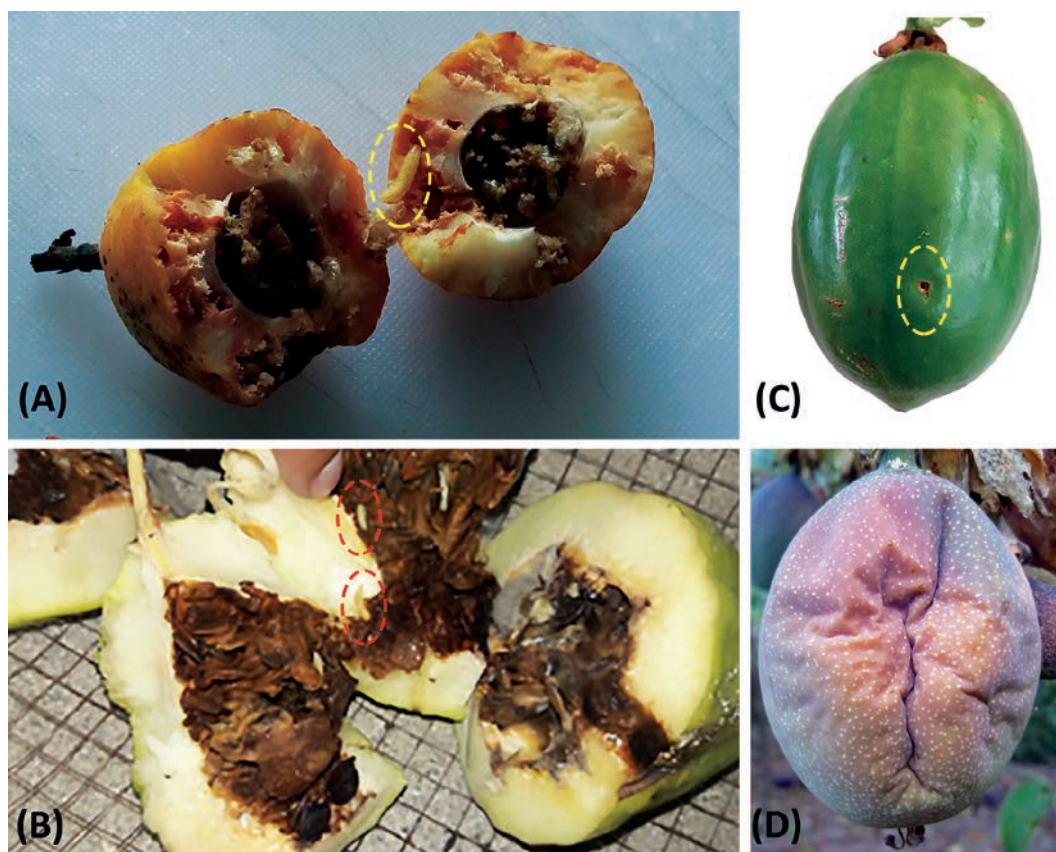
During September to December 2016 and January to August 2018 samples of ripe and unripe fruits from six species of passion flower was systematically collected in ten commercial orchards and in nearby areas in the understory, within province of Oxapampa (Table 1). The number of collected fruits flies varied according to the fructification season of each host species as well as fruit availability. In 2016, fruits were taken to Entomology Laboratory of Servicio Nacional de Sanidad Agraria (SENASA) of Oxapampa, while in 2018 the samples were taken to the Entomology Laboratory of Universidad Nacional Daniel Alcides Carrión (UNDAC). In these places, fruits were weighed and deposited for 48-96 h in trays containing sand and covered by organza voile. Puparia were placed on pots containing sand and closed with fabric for the emergence of adults. The adult flies of Tephritidae and

Lonchaeidae were identified at species level using a stereomicroscope and biological microscope (Norrbom and McAlpine 1997, Zucchi 2000). Specimens were deposited in the collection of Fruit Fly Taxonomy Laboratory of Agrarian National Health Service (register in Sistema Integrado de Información de Mosca de la Fruta – SIIMF, SENASA), personal collection of P.C Strikis and the entomological collection of the UNDAC filial Oxapampa. In addition, samples of passion flowers were taken to Herbaria Oxapampa (Hoxa) for confirmation at the species level.

A total of 205 fruits (18.3 kg) of six passion flowers species were sampled, and we found three species that showed damage caused by frugivorous flies. *Anastrepha pseudoparallela* (Diptera: Tephritidae) caused infestation in unripe (8♂, 13♀) and ripe (7♂, 13♀) *Passiflora ambigua* fruits and *P. quadrangularis* unripe fruits (7♂, 2♀) (Table 1). In both cases, the larvae damaged the fruit by feeding the pulp stimulating rot and contamination with microorganisms owing to their excrements (Fig. 1A - B). Unripe and ripe fruits of *P. ambigua* were infested, while, these larvae bored until the mesocarp in high infestations (Fig. 1B). *Passiflora quadrangularis* evidenced damage caused by larvae only in unripe fruits; besides, the fruit skin showed oviposition puncture produced by female to lay eggs (Fig. 1C). Damages on *P. ligularis* were caused by *Dasiops frieseni* Norrbom & McAlpine (Diptera: Lonchaeidae) (16♂, 19♀), evidenced by the wrinkling aspect in unripe fruits and pulp rot as the main trace (Fig. 1D) according to Salazar Mendoza et al. (2019). Nevertheless, *P. alata*, *P. edulis* f. *edulis* and *P. edulis* f. *flavicarpa* showed no evidence of larvae inside or any other damage caused by frugivorous flies.

**Table 1.** Flies detected infesting fruits of passion flower in Oxapampa during 2016 and 2018.

Geographic location	Host	maturity level	Fruits		Puparia	Emerged species
			n	weight		
10°36'03"S, 75°27'36"W, 1842 m; 10°37'28"S, 75°20'22"W, 2049 m.	<i>Passiflora ambigua</i>	unripe	20	0.7	39	<i>Anastrepha pseudoparallela</i> (8♂, 13♀)
		ripe	15	0.6	28	<i>Anastrepha pseudoparallela</i> (7♂, 13♀)
10°36'33"S, 75°29'28"W, 1893 m; 10°34'11"S, 75°23'18"W, 1968 m.	<i>Passiflora alata</i>	unripe	20	2.1	0	
		ripe	15	2	0	
10°36'09"S, 75°25'06"W, 1821 m; 10°37'28"S, 75°20'22"W, 2049 m; 10°28'57"S, 75°27'53"W, 1844 m.	<i>Passiflora ligularis</i>	unripe	20	1.2	45	<i>Dasiops frieseni</i> (16♂, 19♀)
		ripe	20	1.1	0	
10°28'57"S, 75°27'53"W, 1844 m.	<i>Passiflora edulis</i> f. <i>edulis</i>	unripe	20	1.5	0	
		ripe	15	1.5	0	
10°47'44"S, 75°20'19"W, 968 m; 10°49'28"S, 75°18'46"W, 875 m.	<i>Passiflora edulis</i> f. <i>flavicarpa</i>	unripe	15	1.8	0	
		ripe	20	2.1	0	
10°29'40"S, 75°27'35"W, 1760 m; 10°36'03"S, 75°27'36"W, 1842 m.	<i>Passiflora quadrangularis</i>	unripe	15	2.2	14	<i>Anastrepha pseudoparallela</i> (7♂, 2♀)
		ripe	10	1.5	0	



**Figure 1.** Damage of flies on passion flowers fruits. (A) *Passiflora ambigua* infested by *Anastrepha pseudoparallela* larvae. (B) *Passiflora quadrangularis* infested by *Anastrepha pseudoparallela* larvae. (C) Oviposition puncture of *Anastrepha pseudoparallela* on *Passiflora quadrangularis*. (D) Wrinkling aspect in unripe fruits of *Passiflora ligularis* caused by *Dasiops frieseni*.

*Anastrepha pseudoparallela* is considered endemic to the South America Tropics (Hernández-Ortiz & Aluja 1993) and was reported infesting *Passiflora alata* Dryand (sweet passion fruit) in the Southeastern of Brazil (Aguiar-Menezes 2004). In Peru, there is no documented damage caused by *A. pseudoparallela* in host plants, but only catch of adults in traps baited with hydrolyzed protein (Korytkowski & Peña 1968) are related. Species of Passifloraceae are commonly recognized for having cyanogenic compounds, flavonoids and phenolics in various parts of the plant (Dhawan et al. 2004) which are used as a mechanism of defense against the attack of insect herbivory (Lindroth & Batzli 1984, Freeman & Beattie 2008, War et al. 2012). The success in the larval development of *A. pseudoparallela* inside the fruits showed the ability of this species to tolerate such chemical defenses and indicated a high degree of specialization in some passion flowers (Stefani & Morgante 1996).

Species of genus *Dasiops* Rondani has been frequently associated to damage in fruits of *Passiflora*, and are considered important herbivore of passion flowers crops (Conpes 2008, Wyckhuys 2011). In Brazil, *D. frieseni* was reported infesting fruits of *P. alata* (Aguiar-Menezes et al. 2004) and *P. edulis* f. *flavicarpa* (Strikis et al. 2011). Galindo et al. (2014) found association and des-

cribed the damage of *Dasiops yepezi* Steyskal, *Dasiops gracilis* Norrbom & McAlpine and *Dasiops caustonae* Norrbom & McAlpine in fruits of four passion flowers cultivated in Colombia: *P. ligularis*, *P. mollissima*, *P. edulis* f. *edulis* and *P. edulis* f. *flavicarpa*. On the other hand, *Dasiops* sp and *D. frieseni* were associated with fruit damage to *P. ligularis* in Peru (Salazar-Mendoza & Romero-Rivas 2016, Salazar-Mendoza et al. 2019). Through our study, we found that *P. ligularis* is not a host of fruit flies of the family Tephritidae.

Therefore, this is the first report of *A. pseudoparallela* infesting host fruits in Peru and the first time that a species of Tephritidae is associated to damage of passion flowers cultivated in Andean regions. More studies must be developed to understand the biology, ecology and behavior this species which could have important effects on some passion flowers production in this region.

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The authors declare no conflict of interest.

**Rol de los autores / Authors Roles:**

PSM and ANC collected fruits and rearing insects; PSM wrote the manuscript; CG identified specimens of Tephritidae; PCS identified specimens of Lonchaeidae; ANC, CG and PCS revised and approved the manuscript.

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