

Short scientific noteSubmitted: May 19th, 2018 - Accepted: June 14th, 2018 - Published: June 29th, 2018**Flower visitation of *Passiflora apetala*, *P. auriculata* and *P. holosericea* (Passifloraceae) by *Pepsis aquila* (Hymenoptera: Pompilidae)**William RAMÍREZ-BENAVIDES^{1,*}, Sergio JANSEN-GONZÁLEZ²¹ Universidad de Costa Rica, Facultad de Ciencias Agroalimentarias, Escuela de Agronomía - 2060 San José, Costa Rica
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Abstract

Pepsis aquila (Hymenoptera: Pompilidae) is reported as an assiduous flower visitor and possible pollinator of *Passiflora apetala*, *P. auriculata* and *P. holosericea* in Costa Rica. The vertex and scutellum of *P. aquila* becomes abundantly covered with pollen while collecting the nectar from the cup nectaries of *Passiflora*. The *Passiflora* visited by *P. aquila* share some floral characteristics with previously reported plants pollinated by pompilids in Africa.

Key words: pollination, *Pepsis*, *Passiflora* spp.**Introduction**

The Passifloraceae comprises ca. 660 species, with 51 native species in Costa Rica (Estrada & Rodríguez 2009). The genus *Passiflora* is the most diverse comprising about 75% of the species in the family. With bisexual, usually very colorful flowers, many are visited by the females of the bees *Centris*, *Eulaema*, *Euglossa*, *Xylocopa*, *Bombus*, *Apis* (Janzen 1968), *Melipona* (McGregor 1976) and *Trigona* (W. R.-B. pers. obs.). Some species are pollinated by hummingbirds (Janzen 1968) and few by bats (Sazima & Sazima 1978; Buzato & Franco 1992). No reports that we are aware of Pompilidae as flower visitors of Passifloraceae.

The Pompilidae (Hymenoptera) are small to very large wasps (3-35mm long), with around 230 species reported for Costa Rica (Hanson & Gauld 2006). The larva is carnivorous and feeds on spiders captured by the adult female (Hanson & Gauld 2006). Many adult pompilids feed on flower nectar and visit a great variety of flowers. The genus *Pepsis* is reported to visit flowers of Agavaceae, Asclepiadaceae, Cuscutaceae and Mimosoideae (Hanson & Gauld 2006 and references therein). Shuttleworth & Johnson (2012) reported 22 species of plants pollinated by wasps of the genus *Hemipepsis* (Hymenoptera: Pompilidae), grouped into the families Apocynaceae, Asparagaceae and Orchidaceae. The species pollinated by *Hemipepsis* share unique characteristics when compared with species not pollinated by the wasps (Shuttleworth & Johnson

2012). Our study informs about the assiduous visitation of *Pepsis aquila* (Hymenoptera: Pompilidae) to the flowers of three species of *Passiflora*.

Plants of *Passiflora apetala* Killip 1922, *Passiflora auriculata* Kunth 1817 and *Passiflora holosericea* L. 1753 were planted in the garden of W.R.-B. in Sto Tomás, Sto. Domingo, Heredia, Costa Rica (9° 58' 46.23" N, 84° 4' 52.14"W) and grew intermixed on an iron fence. Wasps identified as *Pepsis aquila* Lucas 1894 were observed while visiting the flowers of the aforementioned *Passiflora* and their behavior observed while visiting the flowers. The wasps were identified as *P. aquila* by Paul E. Hanson while the *Passiflora* species were identified by David Mena-Castellanos and W. R.-B.

Female and male *P. aquila* were common visitors of *P. apetala*, *P. auriculata* and *P. holosericea* (Figs 1-2). The visiting wasps were not very accurate in finding the flowers, did not hover or landed directly into the flowers, but flew around the plants and landed any place nearby and then walked along to find flowers. They introduced the head between the crown and the operculum of the flowers to reach the nectar (Fig. 1a-c), and moved around the flower. Pollen became abundantly deposited on the dorsal side of the head (vertex) and the scutellum of the wasp; anthers and pistils had evident contact with head, scutellum and antenna as wasps forced themselves inside the nectar cup (Figs 1a-b, 2a-b). The flowers of all three *Passiflora* were remarkably attractive to *P. aquila* in such a way that in some cases we observed more than one wasp accessing



Fig. 1 – **a**, *Pepsis aquila* reaching a flower of *Passiflora holosericea*; head and antenna in contact with anther and stigma; **b**, *Pepsis aquila* collecting nectar in a flower of *Passiflora holosericea*; scutellum in contact with stigma; **c**, two individuals of *Pepsis aquila* visiting the same flower of *Passiflora holosericea*; **d**, developed fruits of *Passiflora holosericea*, possibly pollinated by *Pepsis aquila*.

each flower at a time (Fig. 1c). Wasps tried to remove most of the pollen using the front legs once they left the flowers. *P. aquila* wasps did not eat pollen, and did not visit extrafloral nectaries. The three species of *Passiflora* visited by *P. aquila* were very aromatic during early morning. *P. aquila* visited the flowers of these three *Passiflora* species from 07:00 AM to midday and later after 2:00 PM. *P. aq-*

uila did not visit flowers of other *Passiflora* that bloomed contemporarily: *P. ambigua* and *P. angularis*. Other common visitors of *P. apetala*, *P. auriculata* and *P. holosericea* were: *Trigona corvina*, *Apis mellifera*, *Centris* sp. and *Epicharis* sp.; some unidentified Scoliidae also visited occasionally the flowers of *P. auriculata*.

P. apetala, as well as *P. auriculata* have small, gemi-



Fig. 2 – **a**, *Pepsis aquila* visiting a flower of *Passiflora auriculata*, head with pollen; **b**, *P. aquila* reaching nectar cup of *P. auriculata*; **c**, synchronous blooming of *Passiflora auriculata*.

nate, axillary inflorescences with relatively small flowers (2-5 cm diameter), with yellowish-green or pale green sepals and petals (petals absent in *P. apetala*). The crown filaments are green to yellowish in *P. apetala* and *P. auriculata* (Fig. 2c), with purple at the base in some cases for *P. auriculata* (Estrada & Rodríguez 2009). *P. holosericea* has large axillary inflorescences with 1-2(-4) flowers; the flowers have greenish white petals and the crown filaments in two series, purple red at the base and yellow at the apex (Fig. 1a-c); there was abundant fruit set in this last species (Fig. 1d). All the three species of *Passiflora* studied had relatively short floral caps containing nectar, and short columns. *P. apetala* and *P. auriculata* presented a quite synchronous blooming (Fig. 2c) while in *P. holosericea* it was less synchronous.

The spider wasps of the genus *Pepsis* are usually large and poor flyers. However, they were found to be assiduous visitors of three species of *Passiflora* and of the mistletoe *S. cansjerifolius* in Costa Rica. There are no reports that we know about pompilids wasps as pollinators of Passifloraceae and Loranthaceae in the New World. The three *Passiflora* species visited by *Pepsis aquila* have relatively small flowers, whitish or yellow-greenish color, shallow nectar cups, short columns, abundant attracting odors and a certain level of synchronicity in their blooming. Some of these characteristics in *Passiflora* visited by *P. aquila* are shared with those found in several species of plants (Apocynaceae, Asparagaceae and Orchidaceae) pollinated by *Hemipepsis* in South Africa (Shuttleworth & Johnson 2012). The fact that contemporary flowers of other *Passiflora* species with more colorful, bigger flowers were not visited by *P. aquila* reinforces the idea that yellow-greenish coloration with purple patterns in petals, sepals and crown filaments in the *Passiflora* flowers might be associated with pompilid pollination.

Although we did not demonstrate experimentally that *P. aquila* pollinates the three species of *Passiflora*, it was evident that the wasps get covered with pollen and have

contact with both anthers and pistyle when accessing the nectar cup of the flower. The *Passiflora* visited by *P. aquila* also produced abundant fruits, indicating that *P. aquila* might be an important pollinator. We expect this report to be a first step for many more deciphering the nature of this interaction of spider-hawk wasps with Passifloraceae, as well as establishing common traits with its African counterparts.

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