ARTHROPODS ASSOCIATED WITH PASSION FRUIT IN WESTERN VENEZUELA

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The region east and southeast of Lake Maracaibo, Venezuela, is one of the main passion fruit (*Passiflora edulis* f. *flavicarpa* Degener) production areas in the world. The area under cultivation has increased more than 8-fold in the last ten years (Domínguez 1986, Domínguez et al. 1987). Increasing production has not been accompanied by sufficient pest management research. The arthropod fauna associated with the crop in Venezuela is not well known (Domínguez et al. 1987), with only a few reports of phytophagous insects and pollinators from central Venezuela (Haddad & Millán 1975, Brown & Fernández 1984, Osuna 1984). There is no information on natural enemies of the pests attacking passion fruit.

Without this basic knowledge, farmers may have no way of determining the pest status of any particular arthropod species, and development of an integrated pest management (IPM) program is difficult. With no IPM alternative, farmers must rely exclusively on pesticides to solve pest problems. Therefore, our objective was to initiate a faunistic survey involving identification of the most important phytophagous arthropods, natural enemies, and pollinators associated with passion fruit.

Arthropods were sampled in 60 commercial passion fruit plantings east and southeast of Lake Maracaibo, Venezuela, between May, 1986, and May, 1990. These plantings varied between 1-15 ha in size and ranged from newly established to 4-5 yr old. Individual plantings were visited 1-16 times over the 4 yr period (46 plantings were visited once, 10 were visited twice, 3 were visited 3 times, and 1 planting was visited 16 times for a total of 91 visits). Visits took place throughout the entire year and at various times of day. During each visit, growers were questioned about entomological, disease, and agronomic conditions in the orchard, and their answers were recorded. First, observations of arthropods were made in any area identified as having an arthropod problem. Then, a random survey (at least 0.5 ha over a time span of 2 h) was made to assess arthropod levels in each orchard. During this random survey, feeding behavior of phytophagous species was observed directly and presence/absence or relative abundance of all arthropods was determined by visual inspection or sweep netting (40 cm in diameter, variable number of sweeps per orchard). Immature insects were collected and reared to adults in the laboratory for identification and to characterize parasitoid occurrence. Voucher specimens have been placed in the Museo Entomológico, Facultad de Agronomía, Universidad del Zulia, Maracaibo, Venezuela.

Twenty-eight phytophagous arthropod species were found on passion fruit (Table 1). Four major groups of pests attack the fruits and foliage of passion fruit. These groups are discussed briefly in order of decreasing pest impact.

Three heliconiine caterpillar species, *Dione juno* (Cramer), *Eueides isabella* Ménétries, and *Agraulis vanillae* (L.), were the most significant pests of passion fruit. *Dione*

TABLE 1. PHYTOPHAGOUS ARTHROPODS, PLANT PART ATTACKED, PERCENT OF PLANTINGS INFESTED, AND FREQUENCY OF OCCURRENCE OF EACH SPECIES (91 TOTAL VISITS) ON PASSION FRUIT NEAR LAKE MARACAIBO, VENEZUELA, 1986-1990.

Species	Plant part attacked	% of plantings infested	Frequency of occurrence
Acari			
Tarsonemidae			
Tarsonemus stammeri Schaarschmidt	Fruits	1.7	1
Tetranychidae			
Tetranychus mexicanus (McGregor)	Leaves	23.3	18
Tenuipalpidae			
Brevipalpus sp.	Fruits	3.3	2
Isoptera			
Rhinotermitidae			
Heterotermes ?convexinotatus Snyder[1]	Roots, stems	16.7	11
Termitidae			
Microcerotermes ?arboreus Emerson[1]	Roots, stems	18.3	11
Amitermes foreli Wasmann	Roots, stems	3.3	3
Hemiptera			
Coreidae			
Holhymenia histrio (F.)	Growing tips, leaves, fruits	11.7	7
Veneza zonatus (Dallas)[2]	Growing tips, leaves, fruits	18.3	17
Fabrictilis gonagra (F.)[2]	Growing tips, leaves, fruits	6.7	5
Anisoscelis foliacea (F.) *marginella* (Dallas)	Growing tips, leaves, fruits	6.7	4
Diactor bilineatus (F.) *bogotanus* Stal	Growing tips, leaves, fruits	35.0	21
Bitta harolineata rustica (Blanchard)	Growing tips, leaves, fruits	6.7	4
Homoptera			
Coccidae			
Ceroplastes sp.	Vines	3.3	2
Coleoptera			
Elateridae			
Monocrepideus sp.	Flowers (damage uncertain)	1.7	1
Dipropus sp.	Flowers (damage uncertain)	3.3	2

Scarabaeidae			
Barybas sp.	Flowers (damage uncertain)	8.3	5
Nitidulidae			
Conotelus sp. near *substriatus* Erichson	Flowers (damage uncertain)	23.3	15
Chrysomelidae			
Nodonota sp. near *tuberculata* Lefévre	Flowers (damage uncertain)	23.3	16
Trichaltica ?bogotana Harold[1]	Leaves	1.7	1
Monomacra sp.	Flowers	5	3
Curculionidae			
Litostylus diadema (F.)(= *L. juvencus* (Olivier))	Leaves	10.0	8
Lepidoptera			
Nymphalidae			
Eueides isabella huebneri Ménétries	Leaves	18.3	20
Dione juno juno (Cramer)	Leaves	43.3	32
Agraulis vanillae (L.)	Leaves	6.7	13
Hymenoptera			
Apidae			
Trigona amalthea (Olivier)	Blossoms, flowers	13.3	8
Trigona amalthea borealis Fr.	Blossoms, flowers	8.3	5
Formicidae			
Crematogaster sp.	Stem of young plants[3]	23.3	15
Solenopsis sp.	Stem of young plants[3]	23.3	15

[1]Specific identification uncertain because genus requires revision (pers. comm., M. L. Cox and S. Bacchus, 1990).
[2]Formerly placed in the genus *Leptoglossus*; see revision of tribe by Osuna (1984).
[3]Collected at extrafloral nectaries; growers report damage to young stems.

juno was the passion fruit pest most frequently reported by growers, causing substantial foliar damage in 32 of 60 plantations, primarily at higher elevations (>400 m above sea level). It is the key pest of passion fruit in Brazil (Bortoli & Busoli 1987, Gravena 1987).

Many field-collected *D. juno* larvae died with symptoms characteristic of nuclear polyhedrosis virus (NPV) infection, and virions were subsequently detected from these larvae using light microscopy. Larvae became sluggish, and their cuticles became discolored and fragile. Before death, infected larvae climbed to the highest point available and released a green or yellow discharge from the mouth. Chacón and Rojas (1984) estimate that NPV might kill 100% of the *D. juno* population in Colombia.

The other two heliconiine defoliators, *A. vanillae* and *E. isabella*, were not a problem in most passion fruit plantings east and southeast of Lake Maracaibo, although Haddad & Millán (1975) had identified *A. vanillae* as an important pest in central Venezuela. Populations peaked during the dry season (November-January) in orchards east of Lake Maracaibo. An NPV epizootic occasionally reduces populations of these species in plantations located in the region east of Lake Maracaibo. NPV was very abundant during January and February for three consecutive years (Domínguez et al. 1989). Two *Spilochalcis* spp. (Hymenoptera: Chalcididae) were reared from field-collected larvae and pupae of both *A. vanillae* and *E. isabella*.

Six anisoscelidine coreids constituted the second most significant phytophagous group in passion fruit (Table 1). Fruit damage from one or more of these species was reported in 27 of 60 plantations. Both nymphs and adults feed on flowers and on developing and mature fruits. Damage to mature fruit included wrinkles on the surface and premature fruit drop. Young fruit developed dimple-like blemishes at the feeding sites on the fruit surface. In the laboratory, nymphs clustered and fed on leaves and growing tips. *Veneza zonatus* (Dallas) and *Fabrictilis gonagra* (F.) were more abundant in plantings at lower elevation (0-10 m above sea level), whereas the other four species were seen more frequently at higher elevation (>400 m above sea level). An unidentified scelionid wasp was reared twice from egg masses of *Diactor bilineatus* (F.) *bogotanus* Stal.

Phytophagous mites were found in 19 of 60 orchards. *Tetranychus mexicanus* (McGregor) can be a serious pest during periods of low precipitation (Jan-Feb) (Haddad & Millán 1975, Leite de Oliveira 1987). Immature and adult spider mites caused plant damage by feeding on leaves. Feeding caused fine, pale spotting or stippling that led to a gray or silvery coloration on leaves. If large numbers of mites were present, entire leaves or plants turned yellow and necrotic (Leite de Oliveira 1987). Dense populations of spider mites produced silken webs covering the undersides of leaves. Larvae and adults of *Stethorus* sp. (Coleoptera: Coccinellidae) were observed as predators of *T. mexicanus* in some plantings east of Lake Maracaibo when spider mites reached high population densities.

Thirteen of 60 orchards surveyed had problems with one or more termite species. These insects fed on roots and stems of 2-4 yr-old passion fruit plants. They penetrated and excavated the roots and continued the excavation upwards within the stem. The plants often die, and death may be associated with the presence of soil pathogens, including a *Fusarium* sp. Termites are increasingly common in passion fruit plantings but loss attributable to termites has not been quantified. Workers of two ant species, *Odontomachus bauri* Emery and *Ectatomma* sp. (Hymenoptera: Formicidae), were observed foraging for termites.

Although growers consistently reported damage by two ants, *Crematogaster* sp. and *Solenopsis* sp., we did not have any opportunity to confirm the kind or extent of damage done by these insects.

Three carpenter bees, *Xylocopa mordax* Smith, *X. scutellala* Moure, and *X. (Megaxylocopa) fimbriata* F., were the most important pollinators of passion fruit, as has been previously noted in other areas (Corbet & Willmer 1980, Gerling et al. 1989). In general, carpenter bees were most abundant in plantings southeast of Lake Maracaibo. *Xylocopa* spp. nests were observed in the wooden trellis supports in one passion fruit planting. Most flower visits occurred between 1500-1800 hours EST. *Apis mellifera* L. appears to be a less efficient pollinator of passion fruit than carpenter bees (also see Hammer 1987).

Identification of pest species can lead to studies that determine the economic injury levels for these pests. Further research on pollinators and natural enemies of passion fruit pests are also needed. Research directed toward establishment of an effective IPM program could help to reduce problems often associated with expansive production of a crop.

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