

*I. hirsuta* and *Crotalaria pallida* Aiton apparently serve as sources of *P. guildinii* attacking soybean (Hallman 1979). Because *I. hirsuta* and *C. lanceolata* are commonly found in Alachua County, they could be two important wild host plants of *P. guildinii* in the fall in this area. Florida Agricultural Experiment Station Journal Series No. 5720. We thank D. Hall for identifying the plants, and D. Herzog, S. Passoa and R. Sailer for reviewing an early draft of this note.

## REFERENCES CITED

- HALLMAN, G. 1979. Importancia de algunas relaciones naturales plantas-artropodos en la agricultura de la zona calida del Tolima Central. Rev. Colomb. Entomol. 5: 19-26.
- HARRIS, V. E., AND J. W. TODD. 1980. Duration of the immature stages of the southern green stink bug, *Nezara viridula* (L.), with a comparative review of previous studies. J. Georgia Entomol. Soc. 15: 114-124.
- MENEZES, E. B. 1981. Population dynamics of the stink bug (Hemiptera: Pentatomidae) complex on soybean and comparison of two relative methods of sampling. Ph.D. dissertation, Univ. Fla., Gainesville, Fla. 259 pp.
- MONTE, O. 1939. Hemipteros fitófagos. IV-V. Pentatomidae. O Campo 10: 51-56.
- PANIZZI, A. R., AND F. SLANSKY JR. 1985a. Review of phytophagous pentatomids (Hemiptera: Pentatomidae) associated with soybean in the Americas. Fla. Entomol. 68. 000-000.
- PANIZZI, A. R., AND F. SLANSKY JR. 1985b. Legume host impact on performance of adult *Piezodorus guildinii* (Westwood) (Hemiptera: Pentatomidae). Environ. Entomol., in press.

# MATING BY KLEPTOPARASITIC FLIES (DIPTERA: CHLOROPIDAE) ON A SPIDER HOST

JOHN SIVINSKI

Insect Attractants, Behavior, and Basic Biology Research Laboratory,  
Agricultural Research Service, U. S. Department of Agriculture,  
Gainesville, Florida 32604

Some small Diptera are kleptoparasites (food thieves) of spiders and other predaceous arthropods. These rarely encountered flies are nearly always female (Table 1). It has been suggested that males, particularly those of phoretic species, are absent not only because of possibly different feeding habits, but also because of sexual tactics (Sivinski and Stowe 1980). That is, the probability of successfully anticipating the arrival of a rare female fly on or in the vicinity of any one of the relatively more abundant hosts is so low that males are constrained to participate in off-host mating systems such as swarming/lekking and patrolling of emergence sites. However, should fly density increase, then waiting or searching at hosts might become a profitable means of finding mates (see discussion of on-host mating in haematophagous Diptera in Sivinski 1984). It is of interest then, that for apparently the first time, on-host kleptoparasite copulations have been observed and that these occurred in a very dense "infestation" of flies.

TABLE 1. DIPTERAN KLEPTOPARASITES OF PREDACEOUS ARTHROPODS. KLEPTOPARASITISM REFERS TO STEALING PREY AND IS DISTINCT FROM STEALING THE SOLICITED REGURGITANTS OF SOCIAL INSECTS. NUMBERS INDICATE THE QUANTITY OF EACH SEX TAKEN FROM HOST OR PREY. SPECIES ARE ARRANGED BY FAMILY. A + REFERS TO PHORETIC SPECIES. AN \* MARKS SPECIES THAT ARE SUSPECTED BUT NOT PROVEN TO BE KLEPTOPARASITES. (NOTE THAT PREY ARE OFTEN HEMIPTERA AND THAT IT IS AN IMPRESSION THAT FLIES ARE ATTRACTED TO THE DEFENSIVE CHEMICALS EMITTED BY A BUG UNDER ATTACK.)

Order	Insect	Host	Male	Female	Phoretic	Reference
Cecidomyiidae	<i>Didactylomyia longimana</i> (Felt)	Araneae	0	30	—	Sivinski and Stowe 1980
Ceratopogonidae	* <i>Culicoides bauri</i> Hoffman	Araneae	0	7	—	Ibid.
	<i>Atrichopogon</i> sp.	Araneae	0	"all"	—	Downes and Smith 1969
Empididae	<i>Microphorus obscurus</i> Coq.	Araneae	0	8	—	Ibid.
	<i>M. crassipes</i> MacQuart	Araneae	0	23	—	Laurence 1948
Phoridae	* <i>Megaselia</i> sp.	Araneae	0	7	—	Sivinski and Stowe 1980
Milichiidae	<i>Phyllomyza</i> sp. near <i>securicornis</i>	Araneidae:	0	1	+	Ibid.
	<i>Phyllomyza</i> sp.	Araneidae:	0	11	+	Robinson and Robinson 1977

Sivinski, 1985

TABLE 1. (Continued)

Order	Insect	Host	Male	Female	Phoretic	Reference
	<i>Desmometopa minutissima</i> (V.O.)	Asilidae: <i>Ommatius minor</i>	—	—	+	Mik 1898 Biro 1899
	<i>D. m-atrum</i> (Meig.)	Araneae Reduviidae	—	—	—	Mik 1898 Biro 1899
	<i>D. singaporensis</i> (Kertész)	Arameae Reduviidae	—	—	—	Ibid.
	<i>D. m-nigrum</i> (Zetterstedt)	Thomisidae: <i>Thomisus onustus</i>	—	—	—	Lundstrom in Knab 1915
	<i>D. sordida</i> (Fallen)	Thomisidae: <i>Misumena vatia</i>	1	8	+	Richards 1953
		Reduviidae: <i>Rhinocoris cuspidatus</i>				
		Araneidae: <i>Argiope bruennichii</i>				
	<i>D. latipes</i> Meig.	Salticidae: <i>Phidippus multiformis</i>	—	—	—	Frost 1913

TABLE 1. (Continued)

Order	Insect	Host	Male	Female	Phoretic	Reference
	<i>Paramyia nitens</i> (Loew)	Araneidae	0	5	—	Sivinski and Stowe 1980
	<i>Neophyllomyza</i> sp. A	Araneidae: <i>Nephila clavipes</i>	0	2	—	Ibid.
	<i>Neophyllomyza</i> sp. B	Ibid	0	2	—	Ibid.
	2 <i>Neophyllomyza</i> spp.	Reduviidae: <i>Zelus trimaculatus</i>	—	—	—	Robinson and Robinson 1977
	2 Unidentified milichiids	Araneidae	0	5	—	Pers. observation
	<i>Milichiella</i> sp.	Araneidae: <i>Nephila clavipes</i> Araneidae:	0	1	—	This publication
Chloropidae	<i>Conioscinella</i> sp.	<i>Argiope argentata</i>	0	2	—	Robinson and Robinson 1977
		Scolopendromorpha: <i>Scolopendra viridis</i>	0	3	+	Pers. observation
	<i>Gaurax</i> sp. (perhaps a parasitoid)	Araneae	—	—	+	Bristowe 1941

TABLE 1. (Continued)

Order	Insect	Host	Male	Female	Phoretic	Reference
	<i>Anomoceros punctulatus</i> (Bekker)	Araneidae	0	7	+	Ismay 1977
	<i>Trachysiphonella</i> port Harkness & Ismay	Zodariidae: <i>Zodarium frenatum</i>	—	—	—	Harkness and Ismay 1975
	<i>Olcella trigramma</i> (LW)	Reduviidae	0	4	—	Pers. observation
	<i>Olcella cinerea</i> (LW)	Aranidae: <i>Nephila clavipes</i>	8	18	—	This publication
		Reduviidae	0	1	—	Pers. observation

Dozens of the chloropid *Olcella cinerea* (LW) landed on the body and prey of a golden orb web spider, *Nephila clavipes* (Linn.), moments after it attacked and began consuming a coreid bug. After a number of replete flies had departed, 8 males and 18 females were captured along with the spider (Dade County, FL 15-IX-83 in a guava orchard). The abdomens of the males were not as distended as the nearly globose abdomens of fed females so that males apparently either did not feed or did not eat as much. A female fly was trapped in the web as it left, reemphasizing the dangers of kleptoparasitism (see Sivinski and Stowe 1980). Several couplings were observed on the spider's abdomen. Males mounted the females' dorsum from behind and no obvious courtship was noted (see Burk 1981 for a review of the relationship between courtship complexity and resource distribution).

The rapidity of the flies' response to prey capture and the failure of another *N. clavipes* 20 m away and feeding on an identical bug to attract any flies after 1 h, suggests that the male and female chloropids and a single female milichiid (*Milichiella* sp.) were intimately connected with this particular spider, perhaps resting on adjacent foliage. If so, such behavior is similar to phoretic associations where flies sit upon a host and wait for it to capture a meal.

The co-occurrence of large numbers of females and on-host matings is perhaps consistent with the previously stated density dependent mate search argument. If we suppose that the unusual abundance of flies on the one host was indicative of a relatively dense population, then an unusually large number of spiders might have associated parasites and it might benefit males to wait or search for mates in the vicinity of hosts. I thank K. Barber, J. F. McAlpine and C. W. Sabrowsky for identification of flies.

## REFERENCES CITED

- BIRO, L. 1899. Commensalismus bei fliegen. Termes Fuzetek. 22: 196-204.  
 BRISTOWE, W. S. 1941. The Comity of Spiders, Vol. II. Ray Society, London.  
 BURK, T. 1981. Signaling and sex in acalypterate flies. Fla. Ent. 64: 30-43.  
 DOWNES, J. A., AND S. M. SMITH. 1969. New or little known feeding habits in Empididae (Diptera). Canadian Ent. 101: 404-408.  
 FROST, C. A., 1913. Peculiar habits of small Diptera, *Desmometopa latipes* Meig. Psyche 20: 37.  
 HARNES, R. D., AND J. W. ISMAY. 1975. A new species of *Trachysiphonella* (Dipt.: Chloropidae) from Greece associated with ant *Cataglyphis bicolor* (F.) Hym. Formicidae. Ent. Mon. Mag. 111: 205-209.  
 ISMAY, J. W. 1977. *Anomoceros punctulatus* (Bekker) (Dipt.: Chloropidae) associated with spiders. Ent. Mon. Mag. 113: 248.  
 KNAB, F. 1915. Commensalism in *Desmometopa*. Proc. Ent. Soc. Washington 17: 117-121.  
 LAURENCE, B. R. 1948. Observations on *Microphorous crasipes* MacQuart (Dipt.: Empididae). Ent. Mon. Mag. 84: 282-283.  
 MIK, J. 1898. Merkwürdige Beziehungen zwischen *Desmometopa m-atrum* Meig. aus Europa und *Agromyza minutissima* v.d. Wulp aus Neu-Guinea. Wiener Ent. Zett. 17: 146-151.  
 RICHARDS, O. W. 1953. A communication on commensalism of *Desmometopa* (Diptera: Milichiidae) with predaceous insects and spiders. Proc. Royal Ent. Soc. London 18: 55-56.  
 ROBINSON, M. H., AND B. ROBINSON. 1977. Associations between flies and spiders: bibliocommensalism and dino-parasitism. Psyche 84: 150-157.

SIVINSKI, J. 1984. The behavioral ecology of vermin. Fla. Ent. 67: 57-67.  
 SIVINSKI, J., AND M. STOWE. 1980. A kleptoparasitic cecidomyiid and other flies associated with spiders. Psyche 87: 337-348.

# EVALUATION OF SELECTED CITRUS SPP. AND RELATIVES FOR SUSCEPTIBILITY TO ROOT INJURY BY DIAPREPES ABBREVIATUS LARVAE (COLEOPTERA: CURCULIONIDAE)

J. B. BEAVERS AND D. J. HUTCHISON  
 USDA, ARS, Horticultural Research Laboratory  
 Orlando, FL 32803, U.S.A.

The 5 major citrus rootstocks grown in Florida, rough lemon (*Citrus limon* (L.) Burm. f.), sour orange (*C. aurantium* L.), Carrizo citrange (*C. sinensis* (L.) Osb. X *Poncirus trifoliata* (L.) Raf.), Milam lemon (*C. limon* hybrid), and Cleopatra mandarin (*C. reticulata* Blanco), indicated susceptibility to *D. abbreviatus* larval feeding in field tests (Norman et al. 1974). Nine of 65 ornamental-nursery and 1 of 6 native-plant species were found to be susceptible to feeding injury in a screenhouse study (Schroeder et al. 1979), suggesting that larvae are more host specific than previously indicated. Selected *Citrus* spp., citrus relatives, and the 5 major Florida citrus rootstocks were evaluated for susceptibility to *D. abbreviatus* larval feeding in a screenhouse study, and results are reported in this paper.

The citrus rootstock seedling selections utilized in this study are shown in Table 1. Plants (10-96 cm tall when planted) were grown in individual 15-cm-diam containers in soil medium consisting of 1 Florida peat:1 masonry sand and maintained on raised screenhouse benches for ca. 1 year. Neonate larvae obtained from eggs of field-collected adults were placed on the soil surface of 10 containers at a rate of 100 larvae/plant (ca. equal to 1 egg mass). Plants were removed from the containers after 8 weeks, the roots washed and examined for larval feeding injury, and the number of recovered larvae were recorded. A numerical classification of root damage was made on a basis of 1-5, where severe injury (epidermal layer of roots completely devoured to soil surface) = 1, and no injury (no visible evidence of larval feeding injury) = 5.

Twenty-four of the 25 selections tested were found to be highly susceptible to root injury caused by feeding of *D. abbreviatus* larvae. One selection, a hybrid of *Poncirus trifoliata* X *C. grandis* (L.) Osb., showed the least amount of root injury with an average rating of 3.4 (Table 1). All other selections, with the exception of the Large Flower trifoliolate orange (*P. trifoliata*) with a root injury rating of 2.2, had severe ratings of less than 2.0. With the possible exception of the *P. trifoliata* X *C. grandis* hybrid, all plants in this study are highly susceptible to *D. abbreviatus* injury, indicating that citrus is a primary host for this insect pest in Florida.

TABLE 1. ROOT DAMAGE OF *Citrus* SPECIES AND RELATIVES BY *Diaprepes abbreviatus* LARVAE.

Selections	I.D. <sup>a</sup>	Root injury <sup>b</sup> mean/10 replicates	Larvae recovered mean/10 replicates
<i>Citrus aurantium</i> L.	76-9	1.1	5
<i>C. limon</i> (L.) Burm. f.			
Columbia sweet lime	78-258	1.0	3
Milam lemon	76-278	1.2	14
Rough lemon	76-644	1.0	4
Vangasay lemon	77-460	1.0	7
Volkamer lemon	76-548	1.2	22
<i>C. macrophylla</i> Wester	76-646	1.0	3
<i>C. reticulata</i> Blanco			
Cleopatra	76-522	1.5	7
Miaray	78-260	1.0	4
<i>C. reticulata</i> var. <i>austera</i> Swing.			
Rangpur lime	78-259	1.0	3
<i>C. sinensis</i> (L.) Osb.			
Lab sweet orange	76-647	1.9	7
<i>Microcitrus australasica</i> (F. Muell.)			
Swing.			
Australian finger lime	76-586	1.0	6
Australian finger lime	76-587	1.0	5
<i>M. hybrids</i>			
Sydney hybrid	76-482	1.0	4
Sydney hybrid	77-427	1.0	6
<i>Poncirus trifoliata</i> (L.) Raf.			
Large Flower trifoliolate orange	76-448	2.2	10
<i>P. trifoliata</i> hybrids			
<i>C. grandis</i> (L.) Osb. X <i>P. trifoliata</i>	76-490	3.4	7
<i>C. limon</i> X <i>P. trifoliata</i>	78-261	1.0	4
<i>C. paradisi</i> Macf. X <i>P. trifoliata</i>			
Swingle citrumelo	76-480	1.7	9
<i>C. reticulata</i> X <i>P. trifoliata</i>	76-239	1.2	6
<i>C. reticulata</i> var. <i>austera</i> X			
( <i>C. sinensis</i> X <i>P. trifoliata</i> )	76-492	1.0	5
<i>C. sinensis</i> X <i>P. trifoliata</i>			
Carrizo citrange	76-508	1.0	3
	76-428	1.1	8
	76-648	1.0	4
Troyer citrange	78-257	1.0	5
<i>Severinia buxifolia</i> (Poir.) Ten.			

<sup>a</sup>USDA accession number at Orlando, Florida.  
<sup>b</sup>1 = serious injury; 5 = no injury.

## REFERENCES CITED

- NORMAN, P. A., A. G. SELHIME, AND R. A. SUTTON. 1974. Feeding damage to five citrus rootstocks by larvae of *Diaprepes abbreviatus* (Coleoptera: Curculionidae). Fla. Ent. 57: 296.  
 SCHROEDER, W. J., R. A. HAMLEN, AND J. B. BEAVERS. 1979. Survival of *Diaprepes abbreviatus* larvae on selected native and ornamental Florida plants. Fla. Ent. 62: 309-312.