

INSECTS FEEDING AT EXTRAFLORAL NECTARIES OF *IPOMOEA CARNEA* (CONVOLVULACEAE)¹

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ABSTRACT: A list of insects observed feeding at extrafloral nectaries of *Ipomoea carnea* (Convolvulaceae), a shrubby morning glory in Guanacaste, Costa Rica, is given. Insects of more than 40 families and 77 genera were observed. Relative abundance and month observed are indicated.

Extrafloral nectaries are nectar-producing glands on a plant outside of the flower. Existing ecological evidence suggests that extrafloral nectaries function in a facultative ant-plant mutualism that is part of the plant's anti-herbivore defenses (Janzen 1966, 1967; Elias and Gelband, 1975; Bentley 1976, 1977ab; Keeler, 1977; Tilman, in press). By predation on small insects, scavenging, and excluding other insects from the area of the nectary, ants have been shown to reduce damage to the plant.

In addition to species involved in defense of the extrafloral nectaries, however, many other species feed on the extrafloral nectar. The relationship of most nectar-feeders to the plant is in general unknown. Some are herbivores of the plant, obtaining additional food (Lukefahr et al., 1965, 1966). Some are predatory insects supplementing their diets. Some may "parasitize" the mutualism, taking nectar but having no further interaction with the plant.

In this paper, the species observed at the extrafloral nectaries of *Ipomoea carnea* are reported. Such lists have not been published previously but it is considered likely that future work on the impact of extrafloral nectary bearing plants on populations of either desirable or undesirable species to agriculture may be assisted by this information (e.g. Lukefahr et al., 1965, 1966). This information likewise should be useful to future studies of the role of extrafloral nectaries in the biology of plants.

Methods and Site — Extrafloral nectary visitors to *Ipomoea carnea* Jacq., a woody tropical morning glory, were systematically observed and collected. *I. carnea* has two types of extrafloral nectaries, two at the distal end of the petiole and 5 in a ring around the pedicel. Since at the site studied the leaves are lost during the dry season when the plant is in flower, the two types of extrafloral nectaries were rarely present and functional at the same time. Chemical constituents of the two types of nectaries were slightly different but no difference was observed in the insects visiting the two, other than

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those due to seasonal appearance of the insects. For more information on *I. carnea* see Keeler 1975a, 1977.

The population of *I. carnea* studied was about a kilometer east of the Organization for Tropical Studies Palo Verde field station in Guanacaste, Costa Rica. This is tropical dry forest life zone of Holdredge (1967). The actual study site was very low-lying, tending to flood during the rainy season. The site was grazed by cattle, which do not eat *I. carnea* (pers. obs.; O'Donnell, 1952; MacBride, 1959).

Insects visiting the extrafloral nectaries of *I. carnea* were surveyed on October 30-31, November 19-20, 1973 (rainy season) and January 7-8, and 10-11, 1974 (dry season). Insects present on the nectaries of a branch when approached were recorded. Two branches per plant were surveyed when possible. Insects were also netted or captured in alcohol for identification. Collections and additional observations were made from May 1973-late Jan. 1974.

The specimens are in the California Insect Survey, the University of California, Berkeley, #190000-190784, or in a few cases, in the possession of the individual who identified them. A list of the persons who identified the specimens is given at the end of Table 1.

Results and Discussion — Insects observed are listed in Table 1. I collected 478 extrafloral nectary feeders for identification and observed 3941. Results are presented as relative abundance because the number actually seen is of little comparative value. (Numbers are reported in Keeler, 1975b). The extrafloral nectary feeders included members of 40 insect families, at least 77 genera and 100 species. Note that in only six genera were more than two species observed: *Camponotus* (4 spp), *Pseudomyrmex* (4 spp.), *Solenopsis* (3), *Polistes* (3), *Trigona* (3), and *Calopteron* (3). All but *Calopteron* are hymenoptera, and the first three are ants (Formicidae).

Diptera and other small, fast moving insects are greatly underrepresented as they were difficult both to observe and to catch. Other systematic biases are not apparent. Nocturnal visitors are not represented.

Table 1. Insects feeding at extrafloral nectaries of *Ipomoea carnea* (Convolvulaceae) at Palo Verde (Guanacaste, Costa Rica).

	Abundance	Month	Role
COLEOPTERA			
Brentidae			
<i>Taphroderus rectus</i> Sharp	R	N	
Cantharidae			
<i>Chauliognathus</i> sp.	R	Jl	P
Cerambycidae			
<i>Lissonotus flavocinctus</i> Dupont	C	D, Ja	

	Abundance	Month	Role
<i>Stenygra histrio</i> Serv.	R	N	.
Chrysomelidae			
Halicinae sp.	C	JI-Ja	H
<i>Diabrotica tripunctata</i> Fabr.	R	N	
<i>Diabrotica</i> sp. 2	R	N	
many 5mm., dark	C	O-Ja	
Coccinellidae			
<i>Cycloneda sanguinea</i> L.	C	O-Ja	
<i>Epilachna</i> sp. 1	R	JI	
<i>Epilachna</i> sp. 2	C	N-Ja	
<i>Brachycantha</i> sp.	R	JI, O	
Elateridae			
<i>Aeolus</i> sp.	VC	O, N, Ja	H
<i>Chalcolepidius</i> sp.	R	Ja	
Lampyridae			
<i>Apidosoma</i> sp. 1	C	JI-D	P
<i>Apidosoma</i> sp. 2	C	JI-D	P
sp. 3	R	JI-N	
sp. 4	R	JI-N	
Lycidae			
<i>Calopteron reticulatum</i> Fabr.	R	JI-N	
<i>Calopteron</i> sp. ns. <i>affine</i> Lucas	R	JI-N	
<i>Calopteron</i> sp. 3	R	JI-N	
<i>Calopteron</i> spp.	R	JI-N	
Ostomatidae			
<i>Temnochila</i> sp. 1	R	O	P
Tenebrionidae			
<i>Epitragus</i> sp. 1	R	N-Ja	H, S
<i>Epitragus</i> sp. 2	R	N-Ja	H, S
<i>Epitragopsis</i> sp.	R	N-Ja	H, S
HEMIPTERA			
Lygaeidae			
<i>Lygaeus pallidocinctus</i> Stal	R	Ja	
Pentatomidae			
<i>Podisus</i> sp.	R	JI-Ja	
Misc.		JI-Ja	
<i>Hypsilonotus</i> sp.	C	O-Ja	
LEPIDOPTERA			
Riodinidae	R	JI	
NEUROPTERA			
Chrysophidae			
larvae	C	JI-Ja	P
Mantispidae			
<i>Climaciella</i> sp.	R	Ja	P
DIPTERA			
Otitidae			
<i>Euxesta annonae</i> (Fabr.)	R	JI	
sp. 2	R	JI	

	Abundance	Month	Role
Platystomatidae			
<i>Amphicnephes stellatus</i> Wulp.	R	Jl	
Sciomyzidae			
<i>Protodictya hondurana</i> Steyskal	R	O	
Tabanidae			
<i>Chrysops variegata</i> Fab	R	O	
<i>Tabanus dorsiger</i> Wiedemann			
subsp. <i>modestus</i>	R	N	
<i>Tabanus</i> sp. 2	R	Jl	
<i>Lepiselaga crassipes</i> Fabr.	C	Jl-Ja	
Dolichopodidae	R	Jl	
Muscidae			
2 genera, 2 spp.	C	Jl-Ja	
Sarcophagidae			
sp. 1	C	Jl-Ja	
sp. 2	R	Jl	
sp. 3	R	Jl	
sp. 4	R	Jl	
other		Jl-Ja	
Stratiomyidae	R	N	
Sepsidae	R	O	
Tachinidae	R	Jl	
"Biblionidae"	R	Jl	
"Drosophilidae"	R	N	
HYMENOPTERA			
Apoidea			
Apidae			
<i>Apis mellifera</i> L.	R	Ja	N
Meliponidae			
<i>Trigona capitata</i> Smith	R	Jl-Ja	N
<i>Trigona</i> sp. 2	R	Jl-Ja	N
<i>Trigona</i> sp. 3	R	Jl-Ja	N
<i>Brachygastra</i> sp.	C	Jl-Ja	
Vespoidae			
Mutillidae	R	Jl	
Polibiidae			
<i>Polybia occidentalis</i> (Olivier)	C	Jl-Ja	
Polistidae			
<i>Polistes canadensis</i> (L.)	C	N-Ja	
<i>P. instabilis</i> Saussure	C	O-Ja	
<i>P. major</i> Beauvois	R	Ja	
<i>Synoecca surinama</i> (Fabr.)	R	Ja	
<i>Stelopolybia sulfureofasciata</i>			
(Ducks)	R	N	
Sphecoidea			
Sphecidae	R	N	
Philanthidae	R	O	
Psaminocharidae	R	N	
Chalcidoidea			
Chalcidae	R	Jl	P

	Abundance	Month	Role
Formicoidea			
Formicidae - Formicinae			
<i>Paratrechina</i> sp. near <i>Mexicana</i> (Forel)	R	O	
<i>Camponotus brettlesi</i> Forel	VC	O-F	
<i>C. abdominalis</i> (Fabr.)	R	Jl-D	
<i>C. substitutus</i> Emery	R	Jl-D	
<i>C. rectangularis</i> Emery	C	Mr, Je, O-Ja	
Formicidae - Dolichoderinae			
<i>Hypoclinea lutosa</i> (F. Smith)	R	Ja	
" <i>Iridomyrmex</i> " <i>pruinorum</i> (Roger)	VC	O, N	
" <i>T.</i> " <i>humilis</i> (Mayr)	R	Ja	
other		Ja	
Formicidae - Myrmicinae			
<i>Crematogaster ampla</i> Forel	C	all	S
<i>Monomorium ebinium</i> Forel	VC	O-Ja	S
<i>Paracryptocerus umbraculatus</i> (Fabr.)	R	O	S
<i>P. minutus</i> (Fabr.)	C	O, N, Ja	S
<i>Pheidole pubiventris</i> Mayr	R	O	
<i>P. pugnax</i> Dalla Torre	VC	O, N	
<i>Solenopsis geminata</i> (Fabr.)	VC	My, O, N	P, S
<i>S. littoralis</i> Creighton	C	Je, O	
<i>Solenopsis</i> sp. 3	R	O	
other		Je	
Formicidae - Pseudomyrmicinae			
<i>Pseudomyrmex belti</i> Emery	R	O-Ja	
<i>P. gracilis</i> (Fabr.)	C	O-Ja	S
<i>P. nigropilosa</i> Emery	R	N, Ja	S
<i>Pseudomyrmex</i> sp. 5	C	O-Ja	S
Formicidae - Ponerinae			
<i>Ectatomma ruidum</i> Roger	R	Je, N	P
<i>E. tuberculatum</i> (Olivier)	R	O, Ja	P
<i>Odontomachus bauri</i> Emery	C	O, N	P
other		Ja	

R - Rare 1-10

C - Common 10-100

VC - Very Common > 100

Months: Ja = Jan., Je = June, Jl = July

P = predacious

S = scavenging

H = herbivorous

N = nectar feeder

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Diptera: Tabanidae - C.B. Philip, Calif. Acad. of Sci., San Francisco, CA.

Orthoptera - D.C. Rentz, Acad. of Nat. Sci., Philadelphia, PA.

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