

The Pan-Pacific Entomologist

Vol. 44

JANUARY 1968

No. 1

Host-Parasite Associations in some Twig-Nesting Hymenoptera from Western North America. Part II

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The records used in this paper were obtained from trap stems set out in California, Idaho, Nevada, Arizona, and New Mexico during 1964 and 1965. Our trapping and rearing procedures were reported in an earlier paper (Parker and Bohart, 1966). The present account supplements but does not repeat our previous findings.

During this two-year study, we set out nearly 10,000 trap stems and recovered 78%. Strong winds and flash floods destroyed some, range cattle trampled others, but the majority were lost to the human factor (for what purpose we have not yet determined). The rate of recovery increased at localities that were isolated or from which the general public was excluded.

Of the 7843 stems recovered, 4059 contained nests in the end hole (52%). An additional 1145 nests were recovered from holes drilled at random along the sides of all the stems. These side holes were more attractive if they were placed on a scarred node than if they were placed along the internode.

One of the difficulties encountered in utilizing *Sambucus* stems for trap nests is that the pith remaining in the holes after drilling swells and blocks the entrance during rainy weather. We were able to overcome this problem by blowing the pith out of the hole with compressed air. To get the air into the bottom of the hole, we attached a long narrow piece of copper tubing to the air hose. The resulting blast of air blew out most of the loose pieces of pith.

Our study of insects nesting in twigs is still far from complete. Many areas and ecological situations have not been sampled. However, some appreciation of this fauna and the interrelationships of its components is beginning to appear. In bare outline, we collected nearly 7000 nests from 5 western States over a 7-year period. A total of 127 primary nesting species was obtained, consisting entirely of aculeate wasps and

bees. These were Apoidea, 67; Eumenidae, 37; Sphecidae, 20; and Pompilidae, 3. In addition, there were 68 secondary nesting species (parasites in the broad sense); these were Chrysididae, 21; Chalcidoidea, 11; Ichneumonidae, 8; Sapygidae, 4; Gasteruptiidae, 3; Mutillidae, 3; Trigonalidae, 1; Megachilidae, 3; Bombyliidae, 5; Sarcophagidae, 3; Meloidae, 3; Cleridae, 2; and Rhipiphoridae, 1.

Specialists not mentioned in our previous paper who identified specimens are: L. M. Walkley, Entomology Research Division, ARS, USDA (Gasteruptiidae) and W. R. Enns, University of Missouri (Meloidae). Our thanks are due to the following persons who cooperated in setting out and returning trap stems: M. A. Cazier, Arizona State University; D. S. Horning, University of Idaho; and J. R. Zimmerman, University of New Mexico.

EUMENIDAE

Ancistrocerus catskill (Saussure). Nevada: Nixon, Hazen. 39 nests. PARASITES: *Toxophora virgata* Osten Sacken; *Anthrax irroratus* Say (Bombyliidae); *Monodontomerus anthidii* (Ashmead) (Torymidae); *Photopsis* sp. (Mutillidae). **Ancistrocerus tuberculocephalus** (Saussure). Arizona: Portal. 3 nests. No parasites.

Euodynerus foraminatus scutellaris (Saussure). California: Banning, Carnelian Bay (Placer Co.), Greenfield, Arroyo Seco Camp (Monterey Co.), 15 nests. PREDATOR: *Trichodes ornatus* Say (Cleridae).

Euodynerus pratensis (Saussure). Arizona: Portal. 3 nests. No parasites.

Leptochilus chiricahua Parker. California: Brown Canyon (Inyo Co.), Palm Canyon (Riverside Co.). 3 nests. PARASITE: *Macrosiagon cruentum* (Germar) (Rhipiphoridae).

Leptochilus erubescens (Bohart). California: San Felipe Cr. (San Diego Co.). 1 nest. No parasites.

Leptochilus menkei Parker. California: Panoche Pass (San Benito Co.). 1 nest. No parasites.

Leptochilus periallis Parker. California: Banning, Brown Canyon. Nevada: Wadsworth, Nixon, Patrick. 78 nests. PARASITES: *Anthrax irroratus* Say (Bombyliidae); *Aritranis notata sierrae* Townes (Ichneumonidae); *Monodontomerus anthidii* (Ashmead) (Torymidae); *Ceratochrysis thysana* Bohart (Chrysididae); *Leucospis affinis* Say (Leucospidae).

Leptochilus tosquineti (Cameron). Nevada: Patrick. 3 nests. PARASITE: *Chrysis* n. sp. (Chrysididae).

Leptochilus washo Parker. California: Westgard Pass (Inyo Co.). Nevada: Geiger Grade (Washoe Co.), Reno Hot Springs (Washoe Co.); 28 nests. PARASITE: *Phaenacra* sp. (Pteromalidae); *Anthrax irroratus* Say (Bombyliidae); *Macrosiagon cruentum* (Germar) (Rhipiphoridae); *Chrysis pattoni* Aaron (Chrysididae); *Sphaerophthalma* sp. (Mutillidae).

Maricopodynerus sericifrons Bohart. California: 1000 Palms Canyon (Riverside Co.). 2 nests. No parasites.

Microdynerus bakerianus (Cameron). California: Brown Canyon, Banning, Westgard Pass. Nevada: Patrick, Geiger Grade, Reno Hot Springs. 31 nests. PREDATOR: *Trichodes ornatus* Say (Cleridae). PARASITE: *Toxophora virgata* Osten Sacken; *Anthrax irroratus* Say (Bombyliidae); *Chrysis pattoni* Aaron (Chrysididae).

Microdynerus singulis (Bohart). California: Scissors Crossing (San Diego Co.). 4 nests. No parasites.

Odynerus erythrogaster Bohart. California: McKittrick, Brown Canyon, Banning, Palm Canyon, Whitewater Canyon (Riverside Co.). 34 nests. PREDATOR: *Trichodes ornatus* Say (Cleridae). PARASITE: *Photopsis* sp. (Mutillidae); undetermined sp. of Sarcophagidae.

Parancistrocerus rectangulis (Viereck). Arizona: Portal. New Mexico: Las Cruces. 11 nests. PARASITE: *Toxophora virgata* Osten Sacken.

Stenodynerus blandoides Bohart. Idaho: Craters of the Moon National Monument. 1 nest. No parasites.

SPHECIDAE

Pisonopsis birkmanni Rohwer. California: Brown Canyon, Westgard Pass, Whitewater Canyon, Kramer Hills (Los Angeles Co.), Palm Canyon, San Felipe Cr. Nevada: Geiger Grade, Reno Hot Springs. Arizona: Portal. New Mexico: Las Cruces. 32 nests. PARASITE: *Photopsis* sp. (Mutillidae).

Pisonopsis clypeata Fox. Nevada: Wadsworth, Stillwater. 7 nests. PARASITE: undetermined sp. of Sarcophagidae.

Solierella blaisdelli (Bridwell). Nevada: Reno, Geiger Grade, Patrick, Stillwater. California: Borego (Coyote Creek), Scissors Crossing, McKittrick, Whitewater Canyon, Carnelian Bay, Antioch, Arroyo Seco Camp, Kramer Hills. 41 nests. PARASITE: *Hedychridium solierellae* Bohart and Brumley; *Hedychridium carriloi* Bohart and Brumley (Chrysididae).

MEGACHILIDAE

Anthidium cockerelli Schwarz. California: Deep Canyon (Riverside Co.). 1 nest. No parasites.

Anthidium mormonum Cresson. California: Carnelian Bay. 4 nests. PARASITE: undetermined sp. of Meloidae.

Anthocopa copelandica (Cockerell). California: Brown Canyon, Kramer Hills. Idaho: Craters of the Moon National Monument. 41 nests. PARASITES: *Chrysurus* sp. (Chrysididae); *Sapyga pumila* Cresson (Sapygidae); *Epistenia* sp. (Pteromalidae); *Leucospis affinis* Say (Leucospididae). PREDATOR: *Cymatodera* sp. (Cleridae).

Anthocopa hypostomalis Michener. California: Kramer Hills, Palm Canyon, Whitewater Canyon, Deep Canyon, Borego (Coyote Creek), Glamis (Imperial Co.). 65 nests. PARASITES: *Stelis* sp. (Megachilidae); *Photopsis* sp. (Mutillidae); *Leucospis affinis* Say (Leucospididae). PREDATOR: *Cymatodera* sp. (Cleridae).

Ashmeadiella bigeloviae (Cockerell). California: Brown Canyon, 1000 Palms Canyon, Kramer Hills, 18 mi. W. Blythe, Borego, North Palm Desert, Palo Verde, Scissors Crossing, Glamis. New Mexico: 5 mi. N. Las Cruces. 478 nests. PARASITE: *Leucospis affinis* Say (Leucospididae); *Nemognatha nigripennis* LeConte (Meloidae); *Anthrax irroratus* Say (Bombyliidae); *Monodontomerus*

anthidii (Ashmead) (Torymidae); *Stelis* sp. (Megachilidae); *Chrysura sonorensis* (Cameron) (Chrysididae). PREDATOR: *Trichodes ornatus* Say; *Cymatodera* sp. (Cleridae).

Ashmeadiella buconis denticulata (Cresson). California: Brown Canyon, 1000 Palms Canyon, Scissors Crossing. Nevada: Patrick, Reno Hot Springs, Nixon. 27 nests. PARASITES: *Leucospis affinis* Say (Leucospidae); *Nemognatha nigripennis* LeConte (Meloidae).

Ashmeadiella breviceps Michener. California: Brown Canyon, Kramer Hills, 1000 Palms Canyon, Whitewater Canyon, 18 mi. W. Blythe, Borego (Coyote Creek), North Palm Desert, Palo Verde, Scissors Crossing, Glamis. 92 nests. PARASITES: *Stelis* sp. (Megachilidae); *Chrysura* sp. (Chrysididae). PREDATOR: *Trichodes ornatus* Say; *Cymatodera* sp. (Cleridae).

Ashmeadiella cactorum (Cockerell). California: Westgard Pass. New Mexico: 5 mi. N. Las Cruces. 2 nests. No parasites.

Ashmeadiella californica (Ashmead). California: Canelian Bay, Greenfield, Arroyo Seco Camp. 20 nests. PARASITES: *Anthrax irroratus* Say (Bombyliidae); *Chrysura* sp. (Chrysididae); *Leucospis affinis* Say (Leucospidae).

Ashmeadiella cazieri Michener. California: Westgard Pass, Whitewater Canyon, Brown Canyon. 11 nests. PARASITES: *Nemognatha nigripennis* LeConte (Meloidae); *Stelis* sp. (Megachilidae).

Ashmeadiella cubiceps clypeata Michener. California: Brown Canyon, Kramer Hills. 22 nests. PARASITES: *Chrysura* sp. (Chrysididae); *Leucospis affinis* Say (Leucospidae); *Monodontomerus anthidii* (Ashmead) (Torymidae).

Ashmeadiella eurynorhyncha Michener. California: Whitewater Canyon. 1 nest. No parasites.

Ashmeadiella femorata Michener. California: 1000 Palms Canyon, Palm Canyon, 18 mi. W. Blythe. 3 nests. PREDATOR: *Cymatodera* sp. (Cleridae).

Ashmeadiella gillettei Titus. California: Brown Canyon, Kramer Hills, North Palm Desert, 18 mi. W. Blythe, Borego, Scissors Crossing, Glamis. Nevada: Patrick, Wadsworth, Nixon, Hazen, Stillwater. 113 nests. PARASITES: *Leucospis affinis* Say (Leucospidae); *Anthrax irroratus* Say (Bombyliidae); *Stelis* sp. (Megachilidae); *Chrysura* sp. (Chrysididae). PREDATORS: *Cymatodera* sp. (Cleridae).

Ashmeadiella meliloti Cockerell. California: Westgard Pass, Whitewater Canyon, Deep Canyon, North Palm Desert, 1000 Palms Canyon. Nevada: Wadsworth, Patrick, Reno Hot Springs, Nixon, Hazen. New Mexico: 5 mi. N. Las Cruces. 100 nests. PARASITES: *Stelis* sp. (Megachilidae); *Leucospis affinis* Say (Leucospidae); *Anthrax irroratus* Say (Bombyliidae); *Sapyga pumila* Cresson (Sapygidae); *Chrysura* sp. (Chrysididae); *Nemognatha nigripennis* LeConte (Meloidae); *Epistenia* sp. (Pteromalidae). PREDATOR: *Cymatodera* sp. (Cleridae).

Ashmeadiella occipitalis Michener. Arizona: Portal. 1 nest. No parasites.

Ashmeadiella opuntiae (Cockerell). California: North Palm Desert, Deep Canyon, 1000 Palms Canyon, Palm Canyon. 14 nests. PARASITES: *Anthrax irroratus* Say (Bombyliidae); *Leucospis affinis* Say (Leucospidae); *Chrysura* sp. (Chrysididae). PREDATOR: *Cymatodera* sp. (Cleridae).

Ashmeadiella prosopidis (Cockerell). California: Borego, Palo Verde, 1000 Palms Canyon. 8 nests. No parasites.

- Ashmeadiella rufipes** Titus. California: Kramer Hills, 1000 Palms Canyon, 18 mi. W. Blythe, Glamis. Nevada: Nixon. 58 nests. PARASITES: *Monodontomerus anthidii* (Ashmead) (Torymidae); *Stelis* sp. (Megachilidae).
- Ashmeadiella salviae** Michener. California: Westgard Pass, Arroyo Seco Camp. 2 nests. No parasites.
- Ashmeadiella sonora** Michener. California: Deep Canyon. 1 nest. No parasites.
- Ashmeadiella timberlakei** Michener. California: Banning, Kramer Hills, Warner Springs (San Diego Co.). Idaho: Craters of the Moon National Monument. 55 nests. PARASITES: *Chrysura* sp. (Chrysididae); *Nemognatha nigripennis* LeConte (Meloidae); *Rhydinofoenus* sp. (Gasteruptiidae); *Anthrax irroratus* Say (Bombyliidae); *Stelis* sp. (Megachilidae); *Leucospis affinis* Say (Leucospididae).
- Chalicodoma disorhina** Cockerell. California: Brown Canyon, Deep Canyon, Palo Verde, 1000 Palms Canyon, Palm Canyon. 9 nests. PARASITE: *Leucospis affinis* Say (Leucospididae).
- Chalicodoma spinotulata** Mitchell. New Mexico: 5 mi. N. Las Cruces. 4 nests. PARASITE: *Leucospis affinis* Say (Leucospididae).
- Hoplitis albifrons maura** (Cresson). California: Arroyo Seco Camp. Idaho: Craters of the Moon National Monument. 10 nests. PARASITE: *Stelis* sp. (Megachilidae).
- Hoplitis biscutellae** (Cockerell). California: Brown Canyon, 1000 Palms, Whitewater Canyon, Deep Canyon, Kramer Hills, 1000 Palms Canyon. New Mexico: 5 mi. N. Las Cruces. 175 nests. PARASITES: *Anthrax irroratus* Say (Bombyliidae); *Stelis* sp. (Megachilidae). PREDATORS: *Trichodes ornatus* Say; *Cymatodera* sp. (Cleridae); Woodpeckers.
- Hoplitis fulgida** (Cresson). California: Banning, San Felipe Cr., McKittrick. Idaho: Craters of the Moon National Monument. 42 nests. PARASITES: *Aritranis imitator ruficauda* Townes (Ichneumonidae); *Tricrania stansburyi* (Haldeman) (Meloidae); *Stelis* sp. (Megachilidae); *Photopsis* sp. (Mutillidae). PREDATOR: *Trichodes ornatus* Say (Cleridae).
- Hoplitis hypocrita** (Cockerell). California: Banning. Idaho: Craters of the Moon National Monument. 24 nests. PARASITES: *Tricrania stansburyi* (Haldeman) (Meloidae); *Sapyga aculeata* Cresson (Sapygidae).
- Hoplitis producta** (Cresson). California: Westgard Pass. Idaho: Craters of the Moon National Monument. 8 nests. PARASITES: *Anthrax irroratus* Say (Bombyliidae); *Nemognatha nigripennis* LeConte (Meloidae).
- Hoplitis sambuci** Titus. California: Banning, Whitewater Canyon, San Felipe Cr. Idaho: Craters of the Moon National Monument. 20 nests. PARASITES: *Anthrax irroratus* Say (Bombyliidae); *Nemognatha nigripennis* LeConte (Meloidae); *Photopsis* sp. (Mutillidae); *Stelis* sp. (Megachilidae); *Sapyga aculeata* Cresson (Sapygidae).
- Hoplitis uvulalis** (Cockerell). California: Carnelian Bay. 3 nests. PARASITE: *Nemognatha* sp. (Meloidae).
- Hoplitis viridimicans** (Cockerell). Idaho: Craters of the Moon National Monument. 3 nests. No parasites.
- Proteriades bidenticauda** Timberlake and Michener. California: Brown Canyon. 1 nest. No parasites.
- Proteriades bullifacies** (Michener). California: 1000 Palms Canyon, Kramer Hills. Nevada: Patrick, Nixon, Stillwater. 234 nests. PARASITES: *Photopsis* sp.

(Mutillidae); *Leucospis affinis* Say (Leucospididae). PREDATOR: *Trichodes ornatus* Say (Cleridae).

Proteriades cryptanthae Timberlake and Michener. California: Warner Springs. 2 nests. No parasites.

Proteriades howardi (Cockerell). California: San Felipe Cr. 1 nest. PARASITE: *Stelis* sp. (Megachilidae).

Proteriades mazourka Michener. California: Brown Canyon. Nevada: Nixon (from gall on *Tetradymia*). 2 nests. No parasites.

Proteriades palmarum (Cockerell). California: Glamis. 10 nests. No parasites.

Proteriades pygmaea Timberlake and Michener. California: Deep Canyon. 1 nest. No parasites.

Proteriades xerophila (Cockerell). California: 1000 Palms Canyon, Kramer Hills, 18 mi. W. Blythe, Borego (Coyote Creek), Palo Verde, Glamis. 20 nests. PARASITE: *Nemognatha scutellaris* LeConte (Meloidae). PREDATOR: *Cymatodera* sp. (Cleridae).

APIDAE

Ceratina pacifica Smith. California: Westgard Pass. 5 nests. PARASITE: *Rhydinofoenus kaweahensis* Bradley (Gasteruptiidae).

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