

FLOWER FORAGING BEHAVIOR OF THE AUSTRALIAN SPECIES *ELEALE ASPERA* (NEWMAN) (COLEOPTERA: CLERIDAE: CLERINAE)

WESTON OPITZ

Kansas Wesleyan University, Department of Biology
100 East Claflin Ave.,
Salina, Kansas 67401-6196 U.S.A.
opitz@kwu.edu

Abstract

Checkered beetles are infrequently encountered in large numbers, perhaps a manifestation of their biologic ties with floral periodicity, prey population density, or climatic factors. What is published about Cleridae biology deals mostly with adult emergence from woody plants and predatory activity of immatures on lignicolous insects. Very little is known about plant foraging behavior of these beetles. They are known to visit flowers to aggregate for mating, secure pollen, or to feed on entomophagous insects. Field and laboratory observations that involve the speciose Australian genus *Eleale* indicate that *E. aspera* (Newman) visits flowers to mate, to fortuitously gather pollen for food, and to utilize the flower of *Pyracantha crenulata* (Roxb. Roemer) as a “watering hole.” *Eleale aspera* beetles and relatives immerse their forebodies deeply into the corolla of the flower to reach nectaries which provide essential moisture when water is at a premium during the Australian dry season.

Checkered beetles are rarely collected in great numbers even by the most ardent field entomologists, particularly in tropical environments. Perhaps their apparent paucity is a manifestation of the beetles’ biologic ties with floral periodicity (anthophilic species), prey-density (predators of lignicolous species), insufficient collecting activities, or simply a question of timing associated with climatic factors.

My encounter with many live members of *Eleale* occurred on the southeastern slope of Black Mountain in a shrubby habitat adjacent to the Entomological Laboratory in Canberra, Australia. The field observations were made over a period of three hot and dry days during the Australian summer (November 24–26, 1999). I collected two species of *Eleale*, 50 specimens (31 males, 19 females) of *E. aspera* (Newman) and five of *E. pulchra* (Newman) (all males). Members of *E. aspera*, and to a lesser extent those of *E. pulchra* (Newman), were most commonly found on shrubs of *Pyracantha crenulata* (Roxb. Roemer). There were several specimens of this plant in the vicinity in various stages of bloom. It soon became apparent that the clerids gravitated to the bushes in fullest, most recent, bloom. It seems reasonable to assume that the beetles in question were lured by the fragrance that permeated from the *P. crenulata* flowering bush. Synchronization of the life cycle of insects with the emission of fragrances from flowers is commonly observed in nature and is thought to have been a major driving force in the evolution of insect-angiosperm diversification (van der Pijl 1960; Pellyr and Thiem 1986). When I realized that I had come upon one of those relatively rare occasions when a checkered beetle species is observable in substantial numbers in the field I began to observe the flower foraging behavior of *E. aspera*, the most abundantly encountered checkered beetle on the aforementioned plant.



Figs. 1–2. Specimens of *E. aspera* foraging on *Pyracantha crenulata* (Ooxb.) Roemer.

Literature Review

There are few published accounts concerned with the interactions between checkered beetles and plants. Most of the early contributions describe the oviposition behavior of females near the galleries of lignicolous insects and the subsequent emergence of adult clerids from various species of wood (Boving and Champlain 1920:624; Balduf 1935:107; Clausen 1962:545; Mawdsley 1999:39), or involve descriptions of checkered beetle predation of insects congregated on plants (Linsley 1936:267; Rifkind 1993:75). Foster (1971:172) described some interesting biologic observations concerning specimens of *Enoclerus abdominalis* (Chevrolat) [= *E. spinolae* (LeConte)] and *E. opifex* (Gorham) on xerophilous plants of the American Southwest. Members of the predominantly Holarctic genus *Trichodes* are frequently found on flowers. At least some *Trichodes* females oviposit on flowers frequented by bees (Foster 1976:64). As bees forage for pollen and nectar they fortuitously transport clerid eggs to their hives and thereby facilitate the predaceous habits of the clerid larvae. Mayer (1976:2) studied the biology of the checkered flower beetle *Trichodes ornatus* Say and found that the females "lay their eggs directly into the bees nests." Crowson (1964:303) correctly interpreted the morphology of *Eleale* as being relevant to feeding in flowers; a supposition subsequently verified by Hawkeswood (1982:31). Further, Hawkeswood (1981:125) noted pollen and nectar feeding by a species of *Scrobiger* on the flowers of *Angophora woodsiiana* F. M. Bail. To my knowledge this is the first detailed documentation concerned with the anthophilic behavior of any member of the Australian genus *Eleale*.

Field and Laboratory Observations

The general consensus in the literature is that clerids visit flowers primarily to mate and feed on pollen, although Foster (1971:128) observed individuals of *E. opifex* (Gorham) to "feed primarily on the tissues and fluids of the host plant." My field and laboratory observations of specimens of *E. aspera* (Newman) suggest that the members of this species utilize the blooming bush of *P. crenulata* as an aggregation site to mate, procure nutrition from pollen, and secure moisture from the nectaries deep within the flowers. During three days of field observations I noted that the beetles arrived in time interval fashion, especially during the early sunlight, and were observed to hover above and align onto blossoms. Whenever a newcomer encountered a specimen already present in the flower there was an immediate attempt to mate. Often the mating attempt was terminated very quickly—presumably the result of a same-sex encounter between two males. Next, I observed (without exception) that the beetles would scurry from flower to flower and during each encounter with a blossom would submerge the forebody deep into the corolla as if to seek out morsels of food.

My first impression of this foraging behavior was that the clerids were feeding on small flower-visiting insects, as numerous small mordellids and a few immature thrips were found in the blooms of *P. crenulata*. To test the feeding behavior of the *E. aspera* beetles I brought 20 specimens into the laboratory and confined them in a transparent plastic container lined with damp tissue paper. After leaving the beetles 12 h without food, I introduced a leaf section of *P. crenulata* upon which were eight early instar thrips of *Imaginis bagnall*. Immediately, the beetles scurried to the freshly cut edge of the leaf as if to secure leaf moisture. The beetles did not consume the thrips, but erratically

flew against the plastic container. I then introduced numerous blooms of *P. crenulata* into the container and almost immediately the insects abandoned their frantic escape behavior and settled onto the flowers to forage.

Confining my subjects in a transparent container made it possible for me to study these beetles under a microscope. I observed the beetles' foraging behavior on the *P. crenulata* blooms. Here, as observed in the field, they scurried from blossom to blossom immersing themselves deep into the flower and in the process, became covered with pollen which they ate while elaborately grooming their appendages.

I thus confirmed that pollen forms part of the diet of *E. aspera*. However, when first entering the flower the beetles did not concentrate on gathering pollen, but seemed to passively accumulate the pollen on their integument while moving in the corolla of the flower. Once in the corolla they frequently attained a still posture for some 10–15 sec. After further observations of this "still behavior" in the field and laboratory, I proceeded to disarticulate the flowers under magnification and in so doing discovered a substantial bead of nectar at the base of the petals. In aggregate these nectar beads form a substantial supply of moisture and carbohydrates.

Conclusions

From these observations, I conclude that the blooming cycle of *P. crenulata* forms an integral component in the life cycle of *E. aspera*. Finally, I conclude that this species of Cleridae, and probably others of *Eleale* and related genera, utilize plants that flower in the dry season as gathering sites for mating, to obtain nutritious nectar, and to procure pollen for protein. In essence, the blooms of *P. crenulata* are used by *E. aspera* beetles as a "watering hole" during the time when moisture is minimally available, but conveniently found in the fragrant oasis of a *P. crenulata* flowering bush.

Acknowledgments

I am indebted to Maxwell V. L. Barclay for reviewing the manuscript and to Lawrence Mound for the identification of the thrips in flowers of *P. crenulata*. David Rentz kindly photographed specimens of *Eleale aspera* (Newman) with his self designed "cats meow" photographic unit.

Literature Cited

- Balduf, W. V. 1935.** The bionomics of entomophagous Coleoptera. John S. Swift Co. Inc., New York. 220 pp.
- Boving, A. G., and A. B. Champlain. 1922.** Larvae of Cleridae [pp. 575–562, pls. 42–53]. *In:* North American beetles of the Family Cleridae (A. G. Boving and A. B. Champlain, editors). Proceedings of the United States National Museum no. 2323, 57:575–649.
- Clausen, C. P. 1962.** Cleridae [pp. 545–548]. *In:* Entomophagous insects (C.P. Clausen, editor). Hafner Publishing Company. New York, NY. 688 pp.
- Crowson, R. A. 1964.** A review of the classification of Cleroidea (Coleoptera), with description of two new genera of Peltidae and several new larval types. Transactions of the Royal Entomological Society London 116(12):275–327.
- Foster, D. E. 1971.** Observation on the biologies of *Enoclerus abdominalis* (Chevrolat) and *Enoclerus opifex* (Gorham) (Coleoptera: Cleridae). Coleopterists Bulletin 25: 127–129.
- Foster, D. E. 1973.** Revision of North American *Trichodes* (Herbst) (Coleoptera: Cler-

- idae). Special Publications of the Museum of Texas Tech University, no. 11. 86 pp.
- Hawkeswood, T. J. 1981.** Insect pollination of *Angophora woodsiana* F. M. Bail. (Myrtaceae) at Burbank, South-east Queensland. *Victorian Naturalist* 98:120–129.
- Hawkeswood, T. J. 1982.** Notes on insect pollination of two species of *Eucalyptus* (Myrtaceae) from South-west Western Australia. *Victorian Naturalist* 99:28–37.
- Linsley, E. G. 1936.** Studies in the genus *Aulicus* Spinola (Coleoptera-Cleridae). *Univ. California Publications in Entomology* 6(9):249–262.
- Mayer, D. 1976.** Checkered flower beetle: A destructive predator of the alfalfa leafcutting bee. Insect answers. December 1976. Cooperative Extension Service. College of Agriculture. Washington State University, Pullman, Washington.
- Mawdsley, J. R. 1999.** New records and biological notes on species of Cleridae (Coleoptera) from the Adirondack Park, New York. *Great Lakes Entomol.* 32(1 and 2):39–45.
- Pellmyr, O., and L. B. Thien. 1986.** Insect reproduction and floral fragrances: keys to the evolution of the angiosperms. *Taxonomy* 35(1):76–85.
- Rifkind, J. 1993.** First record of feeding habits of *Aulicus bicinctus* Linsley (Coleoptera: Cleridae) with a note on local abundance. *Coleopterists Bulletin* 47:75–76.
- van der Pijl, L. 1960.** Ecological aspects of flower evolution. I. Phyletic evolution. *Evolution* 14:403–416.

(Received 20 September 2000; accepted 9 March 2001)