

# HABITAT RELATIONSHIP AND SEASONAL ABUNDANCE OF FOUR SPECIES OF *EVARTHUS* (COLEOPTERA: CARABIDAE)<sup>1</sup>

D. L. HARRIS AND W. H. WHITCOMB

Tall Timbers Research Station,  
Rt. 1, Box 160, Tallahassee, Florida, and  
Department of Entomology and Nematology  
University of Florida, Gainesville, Florida, respectively

## ABSTRACT

Seasonal occurrence and habitat preference of 4 species of *Evarthrus* ground beetles were studied during 1969-70 at Tall Timbers Research Station, Leon County, Florida. Pitfall traps, used to sample populations, indicated that the 4 species had a definite preference for a leaf-litter habitat. *Evarthrus ovulum* (Chaudoir) was the least specific in habitat preference and was the species most commonly collected during the winter months. All species showed definite seasonal patterns: *E. morio* (Dejean) probably overwinters as both larvae and adults; *E. ovulum* (Chaudoir) typically overwinters as adults; *E. sigillatus* (Say) and *E. laevipennis* (LeConte) typically overwinter as larvae.

## INTRODUCTION

The genus *Evarthrus* LeConte, of the tribe Pterostichini, is North American in distribution; according to Ball (1960) it occurs in northern Mexico, southwestern and eastern United States, and southernmost Ontario. Members of this genus are some of the most commonly collected carabids in northern Florida. Although comparatively well-known taxonomically due to the work of Freitag (1969), there is little information on their habits. To meet this need, an ecological study was begun at the Tall Timbers Research Station, northern Leon County, Florida, in mid-1969. Seasonal distribution, habitat preference, and the effects of various factors on abundance were emphasized.

All species of the genus *Evarthrus* are flightless, having the hind wings atrophied and the elytra fused along the suture. Therefore, as indicated by Freitag (1969), most species have restricted ranges and are often allopatric. Of the 43 known species, 5 were taken in the collecting area at Tall Timbers; these were *Evarthrus morio* (Dejean), *E. laevipennis* (LeConte), *E. ovulum* (Chaudoir), *E. faber* (Germar), and *E. sigillatus* (Say). *E. faber* was taken only once at Tall Timbers and once near Monticello, Florida; the other 4 species were abundant enough in the collecting area to obtain ecological data.

According to the literature, ground beetles of this genus generally occur in dry woodlands and open fields at low altitude. Blatchley (1910) reported *Evarthrus seximpressus* (LeConte) occurring on dry, wooded slopes beneath logs and stones. Whitcomb and Bell (1964) reported *E. sigillatus*, *E. seximpressus*, and *E. sodalis* (LeConte) as predators in cotton fields. Kirk (1971) occasionally or rarely trapped *E. constrictus* (Say), *E. incisus* LeConte, *E. iowensis* Freitag, *E. substriatus* LeConte, and *E. torvus torvus*

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LeConte in cropland in North Dakota. Freitag (1969) reported at least 15 species of *Evarthrus* in leaf litter, 6 in open places under cover, 4 in cornfields, and 1, *E. heros* (Say), in cotton fields. *E. blatchleyi* Casey was collected by Ball in a pitfall trap in an orange grove (Freitag 1969).

Almost nothing is known about the feeding habits of this genus. Freitag (1969) stated that most species are probably omnivorous. He found ant remains in *E. sodalis colossus* (LeConte) and spores of fungi in *E. faber*. Forbes (1883) dissected 7 specimens of *Evarthrus* and found that cankerworms, *Paleacrita vernata* (Peck), and other lepidopterous larvae formed 93% of the food present. Shough (1940) observed the feeding behavior of *E. sodalis* under caged conditions. He reported that they fought viciously with each other over bits of food thrown into the cage and often abandoned the food altogether while fighting. The beetles fed on small grasshopper nymphs, leafhoppers, stink bugs, and were very cannibalistic. The pentatomids were grasped at the corner of the pronotum and were completely consumed (with the exception of the elytra, wings, legs, and harder skeletal parts).

#### METHODS AND MATERIALS

Pitfall traps are useful in determining abundance in a particular habitat and seasonal occurrence (Johnson, Lawrence, and Ellis 1966, Kirk 1971) but are ineffective for population estimates (Gilbert 1956, Greenslade 1964). With this in mind, a pitfall trapping study was begun in October, 1969, at Tall Timbers Research Station, northern Leon County, Florida. Each pitfall trap consisted of a 5 gal can buried to ground level and fitted with a narrow-rimmed funnel resting flush with the ground. The trap was 79.8 cm in circumference and 25.4 cm in diameter. A metal shield above excluded rain and debris. A pint jar (half-filled with 70% isopropyl alcohol) was used as a collecting container in the bottom of the can. This design permitted emptying the trap quickly with minor disturbance to the soil and vegetation surrounding it. The traps were emptied weekly. All samples were sorted as quickly as possible, and carabids were pinned and labeled.

In this region of north Florida, mixed forests of loblolly pine *Pinus taeda*; shortleaf pine, *P. echinata*; and longleaf pine, *P. palustris*, are annually burned as a management practice. Sections from which fire is excluded quickly change from open pine forests to dense growths of hardwood. Areas undisturbed for 60 years or longer tend to climax in beech-magnolia mesic forests or hammocks. This situation presents a wide variety of habitats. Two traps (15.2 m apart) were placed in each of 9 habitats. The 9 sampled areas included:

(A) Annually burned pine forest with herbaceous undergrowth approximately 1.5 m in height, characterized by *Desmodium* spp., *Cassia* spp., and related plants, with several composites present, especially *Solidago* spp.

(B) Annually burned pine forest with a grassy undergrowth approximately 1 ft high. The following plants were common: *Andropogon virginicus* Linn., *A. tener* (Nees) Kunth, *A. divergens* (Hack.) Anderss. ex Hitchc., and *Sorghastrum* sp.



(C) Biannually burned pine forest with a mixture of herbs and hardwood brush including oak, *Quercus* spp.; sassafras, *Sassafras albidum* (Nutt.) Nees; and sweet gum, *Liquidambar styraciflua* Linn.

(D) Pine forest unburned for 10 years, located on poor soil, and characterized by a sparse growth of hardwoods (oak, sweet gum, and hickory, *Carya* spp.) with some pines, both old and young. The canopy was somewhat open, with scattered grass among the leaf litter and pine needles.

(E) Pine forest unburned for 10 years, with a dense growth of loblolly pine saplings, a few hardwoods present, and blackberry vines, *Rubus* spp., common. The ground was heavily covered with a mat of pine needles.

(F) Pine forest unburned for 10 years, with a few scattered pine trees but consisting mostly of a thicket of young oaks; hickory; sassafras; dogwood, *Cornus florida* Linn.; and *Vaccinium* spp., with a closed canopy and the ground covered with heavy leaf litter.

(G) A mature mesic forest or hammock with a stand of magnolia, *Magnolia grandiflora* Linn.; beech, *Fagus grandifolia* Ehrh.; black gum, *Nyssa sylvatica* Marsh.; spruce pine, *Pinus glabra* Walt.; hornbeam, *Carpinus caroliniana* Walt.; and swamp chestnut oak, *Quercus michauxii* Nutt. Several species of fern were present; *Vitis* spp. and *Smilax* spp. lianas were numerous. The leaf litter which covered the ground consisted mostly of beech and magnolia leaves, with scattered rotting branches and logs.

(H) An abandoned cornfield planted in 1969 and harvested just before the first trapping; the weedy growth, which was heavy in 1970, consisted mostly of poorjoe, *Diodia teres* Walt.; pinweed, *Lechea villosa* Ell.; pine-weed, *Hypericum gentianoides* (Linn.) BSP.; and horseweed, *Conyza canadensis* Linn. Other weeds included everlasting, *Gnaphalium obtusifolium* Linn., and goldenbush, *Haplopappus divaricatus* (Nutt.) Gray.

(I) An old field situation with a heavy growth of *Andropogon virginicus* Linn. and *Rubus* spp.

## RESULTS

**HABITAT SPECIFICITY:** The 4 species of *Evarthrus* showed definite habitat preferences (Fig. 1), the number of each species varying sharply from one habitat to another. A total of 586 specimens was collected. All species were taken in more than 1 location: *E. ovulum* was taken in all 9 habitats; *E. morio* in 8; *E. sigillatus* in 4; and *E. laevipennis* in 3.

*E. morio* was particularly abundant in the 10-year unburned plot which had a thick growth of young hardwoods with heavy leaf litter on the ground; 132 *E. morio* were taken in this plot compared with a total of 23 from all other locations. None were taken in the abandoned cornfield; there was little difference in numbers of *E. morio* taken in the other 7 habitats.

*E. laevipennis* was abundant only in hardwood leaf-litter habitats. It was taken in numbers in the young hardwood areas, in the mature hammock, and in the unburned pine forest on poor soil; it was slightly less numerous in the latter. It was not taken in the unburned pine forest, where the ground cover was pine needles instead of hardwood leaf litter, or in any of the other locations.

Of the 4 species, *E. ovulum* showed the least habitat preference; several were taken in all areas sampled. The greatest numbers were taken in the



areas unburned for 10 years; however, they were not abundant in the mature hammock but were numerous in the annually burned pine forest with a herbaceous undergrowth.

*E. sigillatus* showed a definite preference for hardwood leaf-litter habitats; it was taken in only 4 of the areas sampled. This species was numerous in the unburned plot with a thick growth of young hardwoods and in the mature hammock; 1 specimen was taken in the annually burned pine forest with a grassy undergrowth.

**SEASONAL ABUNDANCE:** The 4 species of *Evarthrus* had definite seasonal patterns of activity. Fig. 2 is a compilation of the numbers taken in all 18 pitfall traps in the 9 habitats and shows the numbers of each species taken each month of the year.

Carabids typically have one generation per year (Gilbert 1956, 1957). European carabids are broadly divided on the basis of overwintering as larvae or overwintering as adults (Lindroth 1949). This division may not apply to North America (Gilbert 1957).

Since teneral adults of *E. morio* were taken in large numbers in the spring peak and in smaller numbers in the fall peak, the possibility of 2 generations per year is indicated. Although *E. morio* is typically a larval overwinterer, a few adults may emerge in the fall and overwinter.

*E. sigillatus* had a similar seasonal pattern, but teneral adults were

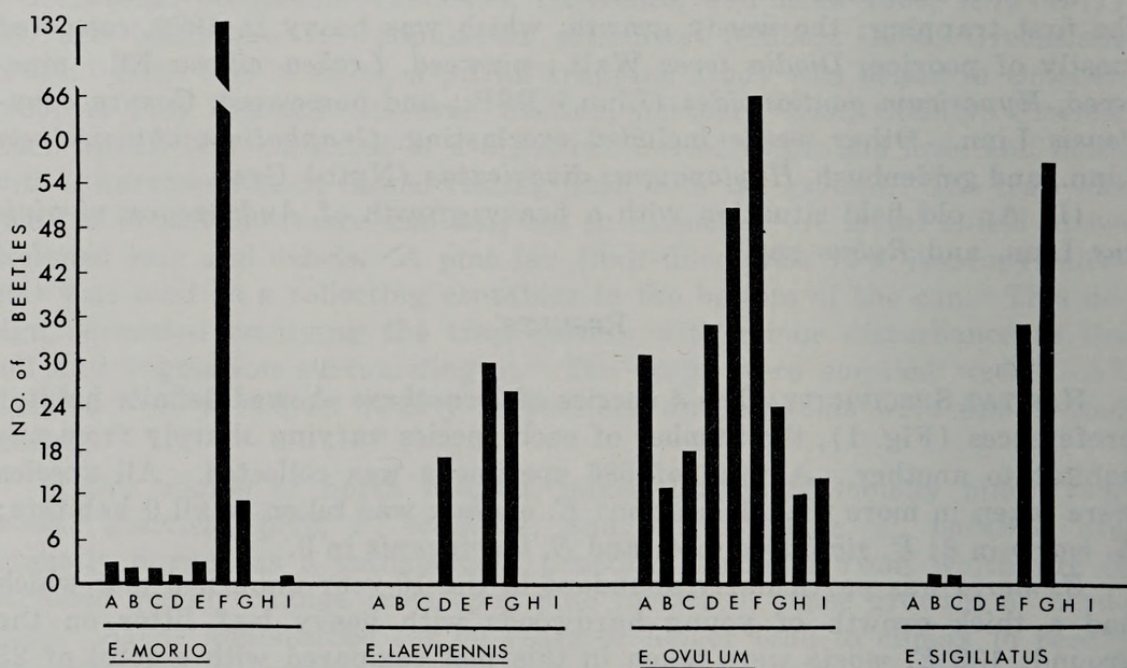


Fig. 1. Numbers of 4 species of *Evarthrus* trapped in different habitats (Oct., 1969-Sept., 1970), Tall Timbers Research Station, Leon Co., Fla. A. Annually burned pine forest; heavy growth of understory, especially weeds and legumes. B. Annually burned pine forest with low, grassy undergrowth. C. Biannually burned pine forest with a mixture of herbs and hardwoods. D. Pine forest unburned for 10 years on poor soil with a light growth of hardwoods, with light leaf litter. E. Pine forest unburned for 10 years with a heavy growth of young pines, few hardwoods, and pine needle ground cover. F. Pine forest unburned for 10 years, with heavy growth of young hardwoods and heavy leaf litter. G. Beech-magnolia hammock unburned for many years. H. Abandoned cornfield planted in 1969. I. An old field situation with a heavy growth of *Andropogon virginicus* Linn. and *Rubus* spp.



captured only in the spring. This suggests that they are mainly larval overwinterers, with a few adults living through the winter.

*E. ovulum* adults were absent during the entire summer. Teneral adults were taken from October into March, indicating that most overwinter as adults, with the possibility of a few "out of step" with the rest and emerging in the winter and spring.

Beginning in March, there was a steady increase in numbers of *E. laevipennis*, with a peak in July. Numbers of teneral adults followed the same pattern. One teneral adult was found in October and 1 in January. Probably only 1 generation per year occurs, although there is evidence of a more complex pattern of activity and of overwintering stages.

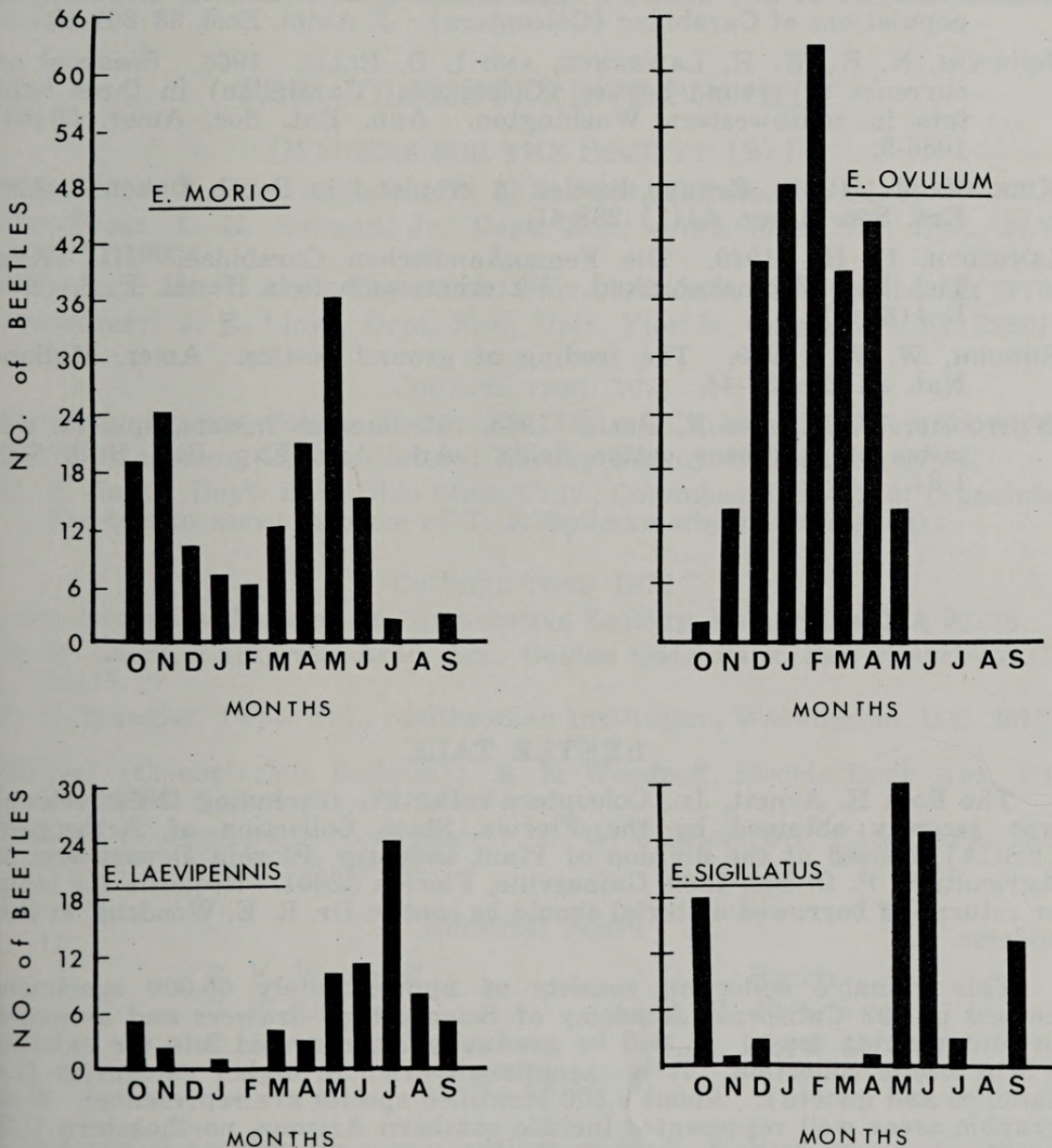


Fig. 2. Seasonal occurrence of 4 species of *Evarthrus* trapped in different habitats (Oct., 1969-Sept., 1970), Tall Timbers Research Station, Leon Co., Fla.



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## BEETLE TALK

The Ross H. Arnett, Jr., Coleoptera collection (excluding Oedemeridae) was recently obtained by the Florida State Collection of Arthropods [FSCA], housed at the division of Plant Industry, Florida Department of Agriculture, P. O. Box 1269, Gainesville, Florida 32601. Requests for loans or returns of borrowed material should be sent to Dr. R. E. Woodruff at this address.

This valuable collection consists of approximately 60,000 specimens housed in 192 California Academy of Science type drawers and arranged in unit pinning trays. It will be gradually incorporated into the existing FSCA beetle collection. It is exceptionally rich in higher categories (i.e. families and genera). About 3,500 identified species are represented. Geographic areas well represented include southern Arizona, northeastern U.S. (particularly New York, Maryland, Virginia, and Indiana), Oklahoma, Ecuador and Galapagos Islands, and some of the West Indies. The private collections of J. Cottle (mainly California), J. N. Belkin, J. G. Franclemont, and E. D. McDonald are included. (R. E. Woodruff).



Harris, D L and Whitcomb, W H. 1971. "Habitat Relationship and Seasonal Abundance of Four Species of Evarthrus (Coleoptera: Carabidae)." *The Coleopterists' Bulletin* 25(2), 67-72.

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