

Aggregations of *Chalybion californicum* (Saussure) (Hymenoptera:
Sphecidae) near Centerville, Wayne County, Indiana

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Abstract

Observations over a 5-year period of aggregations of *Chalybion californicum* (Saussure) near Centerville, Indiana, indicate a preference by this wasp for a western exposure on wooden buildings. The wasps were found at the nighttime roost sites, in varying numbers from about June 1 to September 30. A peak in numbers was reached between June 14 and June 28, with a second, but much lower peak coming from 6 to 22 days later. The highest number counted was 260 on June 26, 1971.

Introduction

Clusters of animals are of interest to biologists for several reasons. Sleeping aggregations permit easy population censusing. Aggregation is of interest as a precursor of social development, of particular significance when occurring in an otherwise solitary species. Finally, there is little understanding of the stimuli which initiate grouping and which hold groups together.

Aggregations of the blue wasp, *Chalybion californicum* (Saussure), were observed over the 5-year period from 1967 through 1971 near Centerville, Wayne County, Indiana. Observations extended from June 1 to October 1.

Over the years, several explanations have been offered for clusters of animals. In 1916, Fabre (5) thought that the cluster of several hundred wasps, *Podalonia hirsuta* (Scopoli), which he found sheltering under a stone might be resting migrants. After studying the sleeping habits of a Florida butterfly, *Heliconius charitonius* L. (= *H. charithonia* L.), Jones (7) argued the pros and cons of group protection. He observed that when one insect was disturbed the whole group was warned, but also found that a predator could gorge on the collected insects if they were unwary or slow to move. He saw no sexual significance in grouping. Evans and Linsley (4), observing bees and wasps of several species, found no clear adaptive value in sleeping aggregations. However, in clusters of the digger wasp, *Steniolia obliqua* (Cresson), which Evans and Gillaspay (3) observed for 5 years, mating behavior was evident. Evans believed that the clustering served a social function leading to mating.

Allee's (1) interest in aggregations is well known. After referring to some accidental animal groupings such as New England corals and the animals on a wharf piling he said, "Other close aggregations occur as a result of the less spectacular trial and error reactions, in which the animals wander here and there, more or less vaguely stimulated by internal physiological states or external conditions, and so come to collect in favorable locations." The effect of one external condition,

temperature, on the choice of an aggregation site was described by El Rayah (2) for 2 tenebrionid beetles, *Adesmia antiqua* Klug and *Pimelia grandis* Fabricius. He found that *A. antiqua* aggregated in a zone of 34-38°C and *P. grandis* gathered in a zone of 28-34°C. *Chalybion zimmermanni* Dahlbom which P. Rau (10) saw in Mexico may have been responding to temperature. Rau found about 20 of these blue wasps clustered on a piece of rope in a shed where a 75-watt incandescent lamp burned until midnight.

Hamilton *et al.* (6), after studying an aggregation of starlings (*Sturnus vulgaris* L.), devised a model of a refuge with a core at the center representing the nighttime roost, and two dispersal areas around it. They believed that the expenditure of time and energy required to fly from the core to the outer range was balanced by the lack of competition in that area. Applying this model to *C. californicum*, the nighttime roost is the core, the nest area lies in the inner dispersal area, and the feeding area is the outermost range.

An aggregation pheromone was isolated from the southern pine beetle, *Dendroctonus frontalis* Zimmermann, by Payne (8). He found that the chemical was emitted in the frass by female beetles and was attractive to both males and females of the same species.

Variations in the numbers of *Chalybion californicum* at nighttime roosts were reported by Rau and Rau (11) and by P. Rau (9) from Missouri and Kansas. For example, 30 wasps were found on the underside of an overhanging rock near the Meramec River in the vicinity of St. Louis, and 100 or more wasps were found in an open cow shed in the middle of July at Lake View, Kansas (11). Near Wickes, Missouri, a group of more than a thousand were in the eaves of an abandoned house. Another group slept in a niche of a pillar and a third group entered a hollow tile on top of a brick chimney (9).

In New Jersey, Weiss (12) found a group of *C. californicum* clustered at night on the same inside corner of a cloth awning for 5 summers. These were on the southwest side of a dwelling (personal communication). Leland Chandler (personal communication) reported that a group of *C. californicum* roosted on the west-facing side of a shed near Otterbein, Indiana.

It seems possible that the initial choice of a roost or refuge by *C. californicum* may be based on temperature. The continued use of a roost then may be reinforced by a pheromone or some other odor-producing material.

Results of Observations

The wasps started gathering at the main roost site in east-central Indiana about June 1 and several could be found there until the middle of September. Roosting began about 2 hours before sunset, and the last wasps had settled by about an hour after sunset. During the period of settling they would fly off if an observer approached within 3 feet. Counts were made after dark when the wasps were not disturbed by

the beam of a flashlight. In the morning the wasps were often still in place until 2 or 3 hours after sunrise. They were active earlier on warm, sunny days than on cool, cloudy days.

At one favorite roost site, an old privy, a Fahrenheit thermometer was fastened close to where the wasps spent the night. Temperature was recorded each time a count was made. When temperature at the roost site was compared with that on the north side of a nearby building, the roost site was warmer by 4°F.

Over the 5-year period several roost sites were used. The main site favored by most of the wasps changed from the west side of the privy to the west side of a tool shed (Fig. 1). The tool shed was about 7 feet east of the privy and the roost site under the eaves was about 4 feet higher than the former site. Sunlight reached the new site for several minutes longer each day.

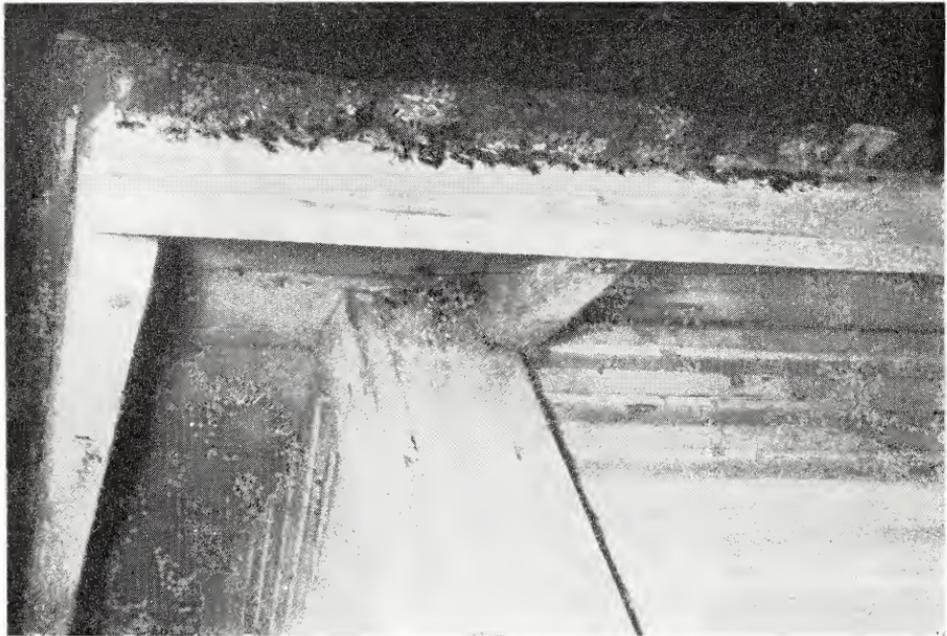


FIGURE 1. *Aggregation of Chalybion californicum (Saussure) on west side of tool shed near Centerville, Indiana, on night of June 15, 1970.*

Early in June 1971 a few wasps were found on the north side of the tool shed just under the peak of the roof, and a few were on the southeast corner of the shed. As the summer progressed wasps disappeared from these sites and more accumulated on the west side. A few also appeared around a seldom-used light socket on a porch ceiling and also under a loose shingle on the south side of a building about 5 feet north of the tool shed. The shingle gave some protection from the weather and, at the end of the summer, wasps were found here in small

numbers after they had disappeared from the main site. For example, the last wasps were seen on the west side of the tool shed on September 9, 1971, but one was found under the shingle as late as October 1, 1971.

Two peaks in numbers of wasps occurred in each of the 5 years. Except in 1969, the first appeared in June and the second in July. In 1969, both peaks were in June. During the study, time between peaks varied from 6 to 22 days (Table 1). During 3 summers, counts were made of female *C. californicum* working on nests in the tool shed and other buildings, but there was no correlation of these counts with counts of the roosting wasps. The number of nesting wasps was always low, about 5 to 10.

TABLE 1. Numbers of roosting *Chalybion californicum* (Saussure) near Centerville, Indiana, 1967-1971.

Year	First peak	Date	Second peak	Date	Days between peaks
1967	100	June 28	60	July 4	6
1968	50	June 21	30	July 8	17
1969	16	June 7, 8, 9	13	June 25	16
1970	132	June 14	54	July 2	18
1971	260	June 26	45	July 18	22

No predation on the wasps by birds was observed at the roost sites over the 5-year period, although birds which are known to eat wasps were in the vicinity. The extent of predation away from the roost site was not investigated.

Aggregations were made up of both males and females. No mating behavior was observed at the roost sites.

Small deposits of fecal matter were found at the roost sites. These were not tested for presence of a pheromone because techniques for the analysis of such small amounts of material were not accessible.

Conclusions

1) It is believed that the warmer temperature at the main roost sites on the west sides of 2 wooden buildings was the initial stimulus for choice of sites.

2) Peaks in numbers of wasps at the roost sites occurred from 7 to 28 June, over a 5-year period.

3) Peak numbers of wasps varied from 16 to 260. Second but lower peaks varied from 13 to 16 and followed from 6 to 22 days later. Some of the second peaks were higher than some of the first peaks of other years.

4) Neither mating behavior nor predation by birds was observed at the roost sites.

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