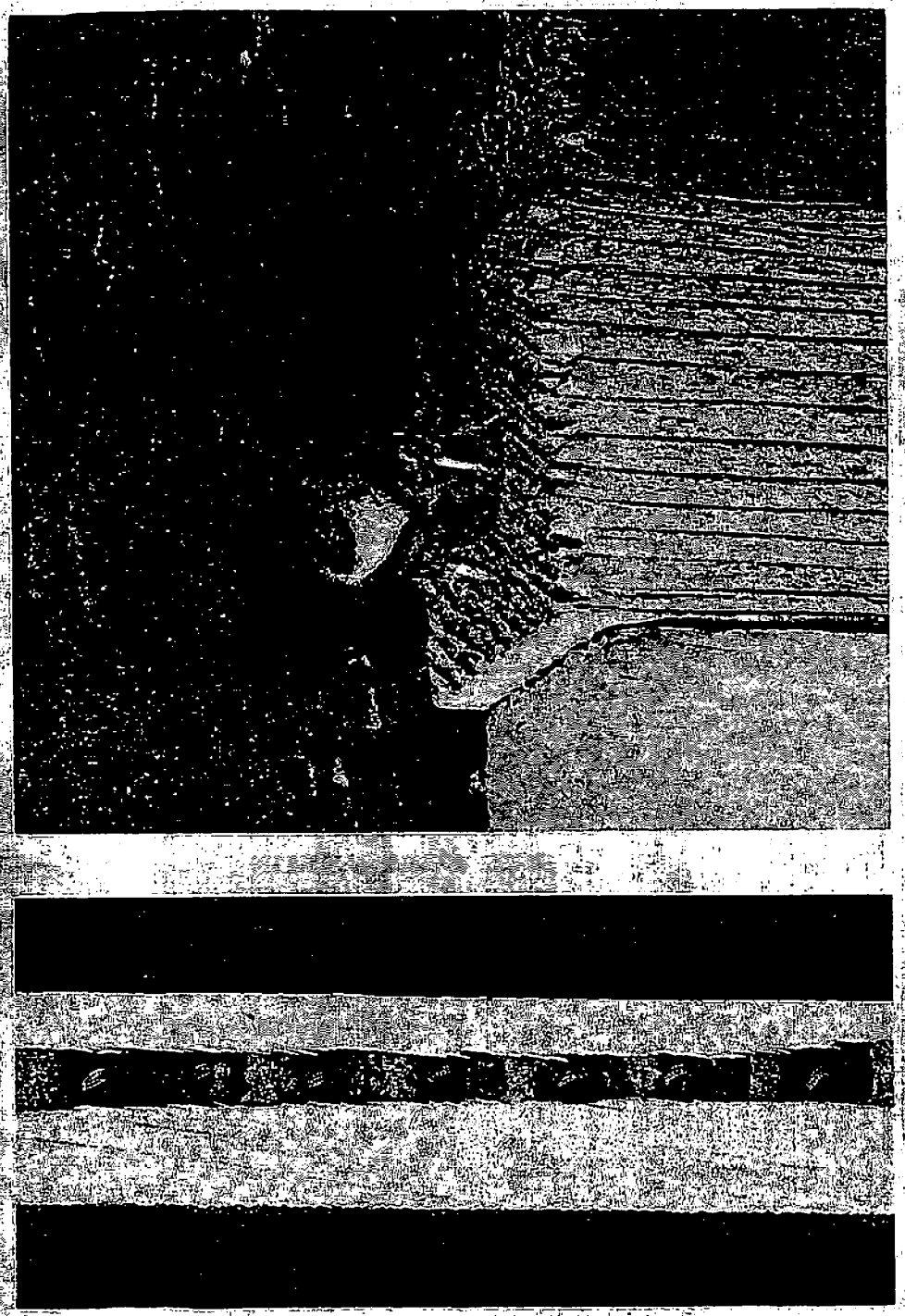

Upper, *Osmia ligniaria* bee alighting at nest entrance in wooden trap. Lower, *Osmia lignaria*

TRAP-NESTING WASPS AND BEES: LIFE HISTORIES, NESTS, AND ASSOCIATES

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garbage and later (1914, p. 57) stated that it was reared from pupae of *Taeniocampa alia* Guenée, from breeding cages containing *Lachnosterna* larvae, and from rotting sugar beets.

Balduf (1928) contributed the most detailed life history notes on *aletiae*. He found phorid eggs on the body of a possibly diseased larva of the spindle stalk-borer, *Achatodes zeae* (Harris), a noctuid borer in corn stalks. The duration of the egg stage was not observed because some larvae had already hatched when the host larva was found. He stated that the phorid larvae entered the anus of the caterpillar and fed mostly on the tissue in the posterior third of the body. The larval stage was estimated as 11-15 days and the pupal stage as 7-11 days.

Krombein (1964a, pp. 108-109) found *aletiae* to be a serious pest in nests of the hibiscus wasp, *Ectemnius paucimaculatus* (Packard), where it fed on the decomposing adult flies stored as prey by the wasp. He reported that the phorid maggots destroyed 30 of 93 provisioned cells in 18 nests. The pupal stage lasted 11 days in a nest infested in July, and 15 days in a nest infested late in September. He also reported twice observing adult phorids attending the host wasp while the latter chewed out a nest entrance through the side of the hibiscus stem.

Source material (Megaselia aletiae)
Derby, N. Y. 1958 series: R 56.
Plummers Island, Md. 1958 series: S 35.
Kill Devil Hills, N. C. 1958 series: T 40.
Lake Placid, Fla. 1959 series: V 28. 1962 series: P 8.

Identifications. Megaselia by W. W. Wirth; *Synaldis* by C. F. W. Muesebeck; host wasps by author.

Source material (Megaselia sp., probably *aletiae* (Comstock)).
Derby, N. Y. 1956 series: J 88, 107. 1957 series: G 126. 1958 series: R 65a. 1961 series: L 74.
Plummers Island, Md. 1956 series: H 2, 31, 65, 96. 1957 series: P 14, 81, 90, 95, 273. 1958 series: S 7, 50, 61, 88, 91, 92. 1959 series: Y 71. 1960 series: E 101, 102. 1961 series: K 67, 132, 135, 177, 266. 1962 series: M 54, 94, 97.
Kill Devil Hills, N. C. 1955 series: C 426, 439. 1958 series: T 213, 226.
Lake Placid, Fla. 1957 series: M 63, 188, 216, 289. 1959 series: V 41, 42, 82, 138. 1962 series: P 87, 160.

Identifications. Flies and hosts by author.

Family Conopidae

PHYSOCEPHALA MARGINATA (Say)

The discovery and rearing of this conopid from a trap nest were a matter of pure chance inasmuch as it was a parasite of the nesting bee and not of the brood. A female of the leaf-cutter bee *Megachile (Litomegachile) mendica* Cresson began a nest in a 6.4-mm. boring

suspended beneath a dead hickory limb in open woods at Kill Devil Hills, N. C., in late July or August of 1955. I picked up the nest on September 18 and opened it for study on the 26th. I found that the bee had completely stored 1 cell at the inner end of the boring and had begun to store a second cell. She died facing inward at that point. Some days or weeks later the sphecid wasp *Podium rufipes* (Fabricius) began a nest in the outer end of the boring and made a closing plug near the entrance.

A dipterous puparium filled the abdomen of the bee. I kept it in a glass vial outdoors over the winter. An adult conopid emerged from it on May 27, but its wings failed to expand properly. However, it was readily identifiable on other characters as a specimen of *P. marginata*.

Previous observations. Van Duzee (1934, p. 315) recorded *marginata* (reported as *dakotensis* Van Duzee, a synonym) as having been reared from the honey bee, *Apis mellifera* Linnaeus. There are no other rearing records for this species. Presumably the *marginata* female pounces on the host bee during flight or while it visits flowers and oviposits between 2 of the abdominal segments.

Source material.
Kill Devil Hills, N. C. 1955 series: C 382.

Identifications. Physocephala by C. W. Sabrosky; bee by the author.

Family Milichiidae

EUSIPHONA COOPERI Sabrosky

I reared some of these flies from the nest of a leaf-cutting bee, *Megachile* sp., probably *mendica* Cresson, from Plummers Island, Md., in 1959. The nest was in a 12.7-mm. boring from a station on a rafter of the cabin porch. I set out this boring on May 28, and the female bee completed her nest in it by June 4. There were 11 cells in the nest. Adult bees emerged from cells 4-11 on June 28 and escaped by cutting holes in the nylon emergence sleeve I had fastened around the nest entrance. I think it is almost certain that these bees were *mendica*, because that was the only leaf-cutter I reared from Plummers Island nests.

There had been no emergence from cells 1-3 by June 30, and so I opened them on that date. While unrolling the leaf cuttings forming the cell walls, I found a number of small dipterous puparia among them. There were 11 puparia in each of the leaf rolls of cells 1 and 3 and 13 in cell 2. The dipterous larvae had fed on the stored pollen rather than on the bee eggs or larvae, though the hosts were destroyed during the process. On July 7 I opened 1 of the puparia and found in it a live pale pupa. Late in August I opened

2 other puparia and found a live pale pupa in 1 and a dead shriveled pupa in the other. There was no emergence of adult flies from the other puparia by November 9, and so I placed all of them outdoors in a glass vial for the winter. I brought them back into my office on March 20. An adult of *cooperi* emerged from 1 of the puparia on April 29. On that date I placed 15 of the remaining puparia on damp sand and kept the other 15 in a glass jar without added moisture. On May 2, I opened 2 of the puparia; 1 contained an adult fly ready to eclose, and the contents of the other were moldy. There was no further emergence by May 18, and I found that the occupants of the other puparia were either desiccated or moldy.

In his description of this species Sabrosky (1955) gave a few life history notes made by K. W. Cooper in New York. The latter worker recovered a number of puparia and dead adult flies from the leaf rolls of a 5-celled nest of a species of *Megachile* in a wooden boring. The sixth cell was that of the vespid wasp *Ancistrocerus a. antilope* (Panzer), whose mud partitions prevented emergence of the adult flies. Cooper mentioned that all the bees perished, but he did not note whether the *Eusiphona* had fed on the bee larvae or on the pollen stored for them. His nest was stored during July, and live flies emerged in May of the following year. It was not determined whether the dead flies found in the leaf rolls had emerged the previous fall or in the spring before the nest was first opened for study on May 3.

The evidence from my nest establishes that oviposition by the mother *Eusiphona* must take place while the nest is being stored by the host bee. It will be recalled that only the innermost 3 cells of a total of 11 in my nest had been parasitized. If the fly deposited eggs after the nest was completed and sealed, then some of the outermost cells should have been infested. Also, the fact that the *cooperi* larvae in my nest fed on the stored pollen shows that they must have been active before or shortly after hatching of the host egg. The evidence from my nest also suggests that in *Eusiphona cooperi* there must be a very prolonged *pupal* diapause lasting more than 11 months.

Source material.
Plummers Island, Md. 1959 series: Y-112.

Identifications: Eusiphona by C. W. Sabrosky; bee by the author.

Family Sarcophagidae

Maggots of scavenger flies belonging to the tribe Miltogrammini infested 208 wasp nests during the course of this study. Adults were reared from 45 nests. Forty-four of the nests were infested by 3

species of *Amobia, distorta* (Allen), *erythrura* (Wulp), and *floridensis* (Townsend), and 1 nest was infested by 1 specimen of *Senotainia trilineata* (Wulp). Species of *Amobia* have been reared previously from mud nests of wasps or from nests of wasps in stems. They have never been found in nests of ground-nesting wasps. On the other hand, the species of *Senotainia* have been reared frequently from ground-nesting wasps, and, aside from my single anomalous record here, have never been found in nests in wooden borings. Probably the infestation arose because this particular trap was from a setting on a concrete block in a basement area beneath the laboratory building at the Archbold Biological Station.

I have no observational data as to how *Amobia* females locate the wasp nest. However, Chapman (1959), working on the African species *A. africa* (Curran), found that females trailed the prey-laden *Eumenes* host female back to her nest. Presumably our American species behave in a similar manner, although it is strange that such behavior has not been observed. *Amobia* females have areas of enlarged facets on the eyes which presumably make possible this "shadowing" technique.

Once a female *Amobia* locates a nest in the process of being provisioned, she darts inside and deposits a clutch of small maggots among the specimens of prey stored by the host wasp (Myers, 1927). Limited evidence suggests that the host wasp may plug the nest and abandon it if she discovers this infestation. However, ordinarily it appears that she either ignores or fails to detect the maggots among the prey and may continue to store additional cells.

Myers (1927) found that *Amobia* maggots seek out and destroy the host egg before beginning to feed on the prey stored for the host. This behavior has been observed also for several species belonging to other genera of Miltogrammini. If there is insufficient prey in the original cell, the maggots invade adjacent cells to obtain enough food. The mud or sand partitions between the cells are readily breached by the maggots. Their presence in a cell certainly results in the rapid death of the host egg or larva and of the paralyzed prey. Infested nests have the typical odor of decaying flesh, and unquestionably the maggots do most of their feeding on carrion.

In heavy infestations the contents of all the cells may be destroyed by the maggots. In lighter infestations only the outermost cells in the nest are destroyed. This suggests that the larvae usually progress from the innermost or intermediate cells toward the outermost cells. When they have completed feeding, they usually congregate at the closing plug and transform to puparia there. Rarely, they penetrate the plug and wriggle outside to pupate. The fact that without fail the maggots pupate toward the nest entrance suggests