NESTS AND PREY OF TWO SPECIES OF PHILANTHUS IN JACKSON HOLE, WYOMING (HYMENOPTERA, SPHECIDAE)

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During the summer of 1964, I made a preliminary study of the ecology and nesting behavior of digger wasps occurring in restricted areas of sandy soil along the Snake River, in Jackson Hole, Wyoming. In some of these areas, many species nested in close proximity, for the most part exhibiting little or no interspecific aggression or competition for prey. A notable exception was provided by several species of *Philanthus*, which preyed upon various bees and wasps, many of which nested in these same sandy areas. The present report is concerned with two of these species, *P. pulcher* Dalla Torre and *P. zebratus nitens* Banks. Both of these forms are widely distributed in the western states, but neither has been studied previously. *P. pulcher* has often been regarded as a subspecies of the eastern *politus* Say, but I regard it as specifically distinct. On the other hand, *nitens* has generally been ranked as a full species, but G. R. Ferguson, who is currently revising *Philanthus*, informs me that he regards it as a subspecies of *zebratus* Cresson.

Philanthus pulcher Dalla Torre

This is a very common wasp in sandy places along the Snake River, appearing in late June or early July and remaining active into early August. The females nest in fine-grained sand or powdery sandy loam; in suitable spots nests may be separated by only 5-10 cm, and as many as 15-40 nests may occur per square meter. Males may often be observed in the nesting areas, either flying about irregularly or resting on low herbs and grass near active nests.

The digging of the nest is very similar to that of the closely related species *politus*, as described by Evans and Lin (1959). During and more especially following digging of the burrow, the mound of earth at the entrance is dispersed by a pattern of scraping movements similar to that of *politus*. One mound measured 4 X 6 X 1 cm prior to dispersal, approximately 8 X 12 X 0.1 cm following dispersal. The burrow enters the soil at an angle of 20-40° with the surface, but after a few cm dips down sharply, the major part of the burrow forming an angle of 50-70° with the surface. As is common in *Philanthus*, the terminus of the burrow is expanded slightly to form a storage place for prey; only after several prey have accumulated

1. Museum of Comparative Zoology, Cambridge, Mass. I wish to express my thanks to the director and staff of the Jackson Hole Biological Research Station, Moran, Wyoming, for providing a pleasant and effective base of operations for these studies; also to the authorities of Grand Teton National Park for permitting me to collect specimens for identification. I am indebted to P. H. Timberlake for identifying the bees and to R. M. Bohart and K. V. Krombein for assistance with some of the wasps.

here is a cell prepared to hold them permanently. The storage chamber is at a vertical depth of 4-8 cm (burrow length 8-10 cm). The cells are constructed from the ends of short burrows which are closed off as soon as the cell is provisioned. The 8 cells found in the three nests studied in detail varied in depth from 5 to 10 cm; the maximum number of cells found in one nest was five (Fig. 1).

Females often bring in prey very rapidly for short periods, then remain within the nest for a considerable time, presumably preparing a new cell, moving the prey to the cell, and laying the egg. The prey is carried in flight and held by the middle legs, as usual in this genus. The nest entrance is closed from the outside while the female is hunting and from the inside while she is inside the nest. From 8 to 14 prey are used per cell. The egg is laid longitudinally on the venter of one of the top prey, in the common *Philanthus* manner. I observed females hunting on the flowers of *Eriogonum* on several occasions. They appeared to approach the flowers from downwind and to strike at the prey in much the manner described by Tinbergen (1935) for *P. triangulum* Fabricius.

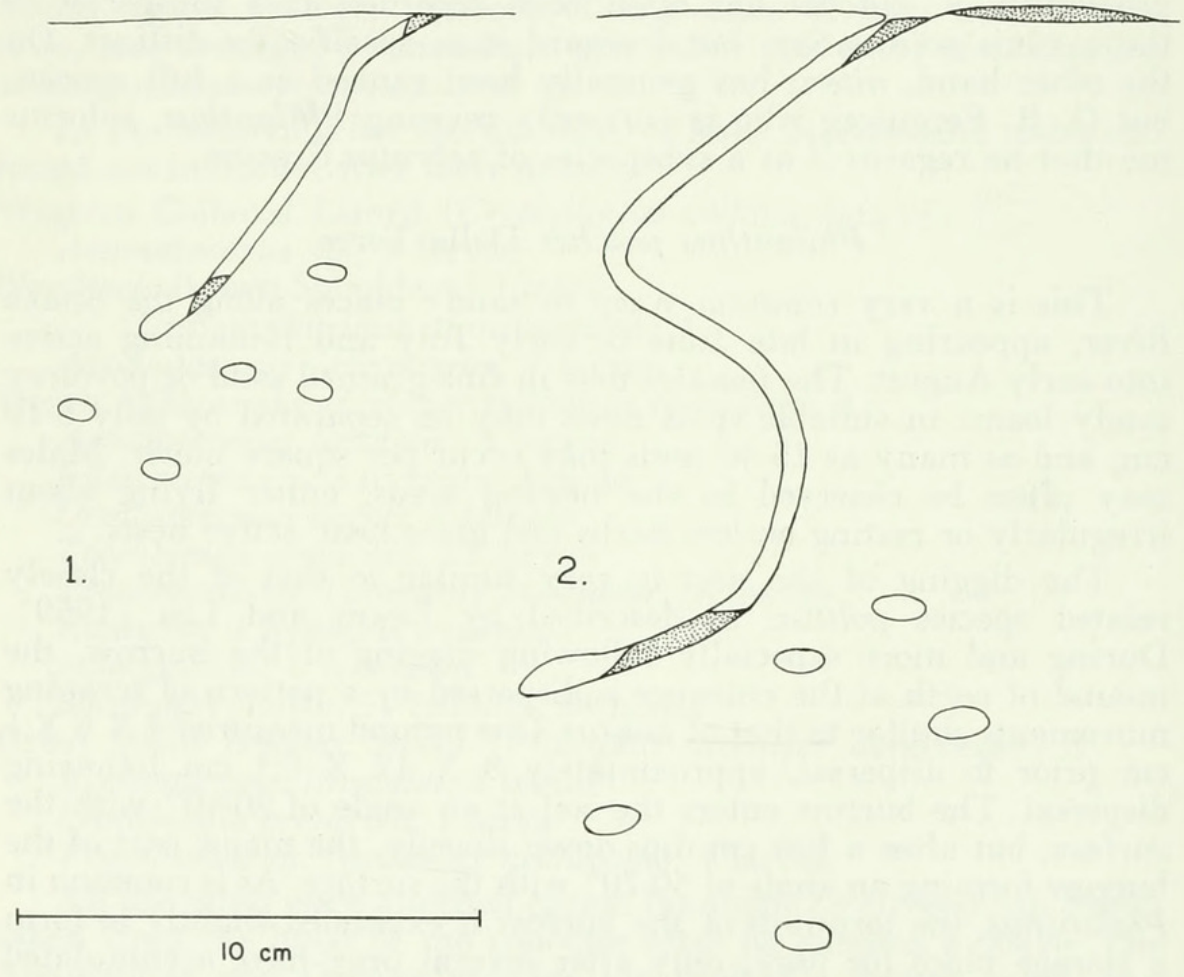

Figure 1. Nest of *Philanthus pulcher* Dalla Torre, note no. 1982, Moran, Wyo., July 11, 1964.

Figure 2. Nest of *P. zebratus nitens* Banks, note no. 2032, 5 mi. south of Elk, Wyo., Aug. 4, 1964.

In many cases *P. pulcher* females utilized as prey various wasps and bees which nested in close proximity to them, for example, small aphid predators of the genus *Xylocelia*, grasshopper predators of the genus *Tachysphex*, and female *Stenodynerus papagorum*, a vespid predator on caterpillars which is approximately as large as *Philanthus pulcher*. Probably these were captured on flowers, although it is possible that they were sometimes captured at the entrances of their nests. In all, I took 87 prey from *pulcher* nests; 50 were bees and 37 were wasps; 17 species of wasps were represented as compared to 20 species of bees. The complete list is as follows:

CHRYSIDIDAE (Cuckoo wasps)

Hedychridium fletcheri Bod. - 3 ♂ ♂
Holopyga ventralis Say - 1 ♀
Omalus aeneus Fabr. - 1 ♀

VESPIDAE (Mason wasps)

Ancistrocerus catskill albophaleratus Sauss. - 1 ♂
Stenodynerus papagorum Viereck - 1 ♀

SPHECIDAE (Digger wasps)

Belomicrus forbesi Robt. - 2 ♀ ♀, 2 ♂ ♂
Crabro florissantensis Rohwer - 1 ♂
Dienoplus pictifrons Fox - 1 ♀, 7 ♂ ♂
Ectemnius dives Lep. and Br. - 1 ♂
Mimumesa mixta Fox - 1 ♂
Passaloecus mandibularis Cress. - 1 ♀
Passaloecus sp. - 1 ♂
Tachysphex aethiops Cress. - 1 ♂
Tachysphex tarsatus Say - 7 ♂ ♂
Trypoxylon aldrichi Sand. - 1 ♂
Xylocelia gillettei Fox - 1 ♂
Xylocelia sp. - 1 ♀, 2 ♂ ♂

COLLETIDAE (Colletid bees)

Colletes nigrifrons Titus - 3 ♂ ♂
Hylaeus ellipticus Kirby - 1 ♀, 4 ♂ ♂

ANDRENIDAE (Andrenid bees)

Andrena melanochroa Ckll. - 1 ♀
Panurginus atriceps Cresson - 7 ♀ ♀, 3 ♂ ♂
Panurginus cressoniellus Ckll. - 3 ♂ ♂

HALICTIDAE (Sweat bees)

Dialictus (7 spp.) - 18 ♀ ♀
Halictus tripartitus Cresson - 3 ♀ ♀
Sphecodes sp. - 2 ♀ ♀

MEGACHILIDAE (Leaf-cutter bees)

Hoplitis clypeata Sladen - 1 ♀

Hoplitis producta Cresson - 1 ♂
Osmia sp. - 1 ♂
Stelis lateralis Cresson - 1 ♂

ANTHOPHORIDAE (Anthophorid bees)
Nomada spp. - 2 ♂ ♂

On several occasions I observed miltogrammine flies following females carrying prey. Several specimens were collected and found to be *Senotainia trilineata* (Wulp), a species known to parasitize other species of *Philanthus*, as well as many other digger wasps. I did not find fly maggots in any of the cells excavated.

Philanthus zebratus nitens (Banks)

This is a much larger species than *pulcher* and is quite unrelated to it, often being placed in a separate subgenus. I found only one nesting aggregation of this species, on a sandy road near the Snake River about 5 miles south of the Elk post office. About 20-30 females nested in coarse sandy loam in the center strip of an otherwise hard-packed road. No males were observed. I discovered this colony on August 4, and dug out only one nest. I returned on August 13 hoping to study the species further, but I could find none at all.

The entrances to the nests are conspicuous, since the burrow opening is large, 7-8 cm in diameter, and the soil at the entrance is not dispersed; the mound tends to be spread out fan-like in front of the hole, with one or more grooves leading from the entrance. The entrance is closed at all times when the female is away from the nest. The burrow is much deeper and more sinuous than in *pulcher*, but as in that species it terminates in a storage chamber. The cells are constructed from side-burrows from the lower part of the main burrow; they measure about 1 X 1.5 cm and are spaced 2-4 cm apart. There were five cells in the one nest excavated, these cells varying in depth from 15 to 20 cm (Fig. 2). The two cells farthest from the burrow (the deepest cell and the cell farthest right in figure 2) contained moldy prey and a wasp larva, respectively, and appear to have been the first two cells to have been constructed. One cell close to the burrow contained an egg laid longitudianlly on the venter of a bee; another contained a small wasp larva; and a third contained two fly maggots which had destroyed the cell contents. These maggots soon formed their puparia, and on May 15, 1965, two *Senotainia trilineata* (Wulp) emerged from these puparia. This same species of fly was observed following prey-laden females in the field. *Phrosinella pilosifrons* Allen was also observed digging at closed nest entrances.

A total of 26 prey were recovered from this nest or from provisioning females. Of these, 12 were wasps and 14 were bees. Some of these were relatively large; for example, the *Spilichneumon* and *Ammophila* exceed the *Philanthus* in length, and the *Megachile* and *Epeolus* are quite bulky. *Ammophila azteca* and probably

several of the other wasps and bees nested in the soil in the same area. The complete list is as follows:

ICHNEUMONIDAE (Ichneumon wasps)

Dusona sp. - 1 ♀
Spilichneumon spp. - 1 ♀, 3 ♂ ♂

VESPIDAE (Mason wasps)

Euodynerus castigatus Sauss. - 1 ♂
Stenodynerus taos Cresson - 1 ♀

SPHECIDAE (Digger wasps)

Ammophila azteca Cameron -2 ♀ ♀
Astata nubecula Cresson - 1 ♀
Palmodes carbo Boh. and Men. - 1 ♂

ANDRENIDAE (Andrenid bees)

Andrena cyanophila Ckll. - 2 ♀ ♀
Andrena eriogoni Ckll. - 1 ♀

HALICTIDAE (Sweat bees)

Lasioglossum trizonatum Cresson - 1 ♀
Nomia sp. - 1 ♂

MEGACHILIDAE (Leaf-cutter bees)

Hoplitis fulgida Cresson - 1 ♀
Megachile brevis Say - 1 ♂
Osmia tersula Ckll. - 5 ♀ ♀
Stelis monticola Cresson - 1 ♀

ANTHOPHORIDAE (Anthophorid bees)

Epeolus gabrielis Ckll. - 1 ♀

Discussion

The use of wasps as prey by species of *Philanthus* is not unusual, but the use of wasps in large numbers, including females of relatively large species nesting nearby, is of considerable interest. It is also worthy of note that both *P. pulcher* and *P. zebratus nitens* utilize parasitic bees, including genera such as *Sphecodes*, *Nomada*, *Epeolus*, and *Stelis*, which are rarely reported as prey of *Philanthus*.

It is also of interest to note that at least five species of *Philanthus* are able to nest together in Jackson Hole, thus paralleling the situation in the eastern states (Evans, 1964), although all five species are different. One of the five species in Jackson Hole, *bicinctus* (Mickel), has been studied in Yellowstone (Armitage, 1965), while another, *pacificus* Cresson, has been studied in California (Powell and Chemsak, 1959). I have studied the remaining species, *crabroniformis* Smith, only very briefly, and I shall hold on to my data in the hope of making a more complete study in the future. *Philanthus*