

NOTES ON THE LIFE-HISTORY OF
ANTHOPHORA STANFORDIANA.BY H. H. NININGER,
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Early in June of 1916 I chanced upon a small aggregation of these large mining bees on the sunny slope of a moist clay bank in the foot hills of the San Gabriel Mountains of southern California. Their burrows were placed close together and in an almost vertical position, and over the entrances of many of them were constructed very peculiar bent-over chimneys of clay. In these particulars they fit very well the description given by Kellogg. It was a bright spring day and the warm sunshine kindled the vital spark in these insects to the greatest activity. They were scurrying in and out of their burrows and flying to and from a nearby spring in what seemed to be feverish haste, until the hundred or more individuals produced as much buzzing and humming as one would witness at the entrance of a very strong colony of honey bees.

They were engaged in digging tunnels, excavating nest-chambers, building nesting cells within the nest-chambers, depositing eggs, and provisioning nest cells. All of these activities were being pursued most industriously.

At the bottom of a tunnel five to seven inches deep, the bee excavated an oval chamber about three-fourths inch in diameter by one inch deep, and then built up within this a nest-cell to fit, made of pellets of clay and worked smooth on the inner side, after which it was coated with a thin layer of water-proofing which seemed to be a salivary secretion. The top of the cell was, of course, left open until the task of provisioning was completed. When all completed but the cover, *stanfordiana* carried pollen and made it into a very dry kind of bee bread on which an egg was laid. Then she carried from the spring several drops of water which were added to the mass without mixing. Having thus provided the entire food supply for her young, she walled the cell over and sealed it on the inner surface with the water-proofing, doubtless by inserting her long tongue through a minute pore left in the center of the lid, as evidenced by its structure, then sealed the

pore, first with water-proofing and afterwards with clay. Thus all communication with the outside world was cut off before the egg ever hatched.

I do not know how to account for Mr. Kellogg's observation that "food is carried to the young in the open cell." (*cf.* Kellogg, *American Insects*, p. 516.) I observed two hundred or more of these cells and all were sealed tightly with egg and provisions. More than a hundred of these sealed cells were kept in my laboratory until the emergence of the adult the following spring.

After provisioning one cell, the same bee probably constructed and provisioned others, as there were usually found from two to five cells at the bottom of each tunnel, some placed one above another, while others were set side by side. A large number of cells were opened and were found to contain all stages of the young insects from the egg to the almost mature larvæ. These young were kept in open cells or transferred to artificial wax cells, or, in a few cases, the mature larvæ were placed upon dry sawdust and kept in the laboratory until they matured or were destroyed by fungi. In this way their development was observed thru all of its stages. About a hundred cells were preserved unopened in a cigar box.

Upon hatching, the larvæ feed and grow rapidly for about three weeks, by which time their growth is complete. Then they enter upon a resting stage which lasts about nine months. During the early part of this period of inactivity there is a gradual and slight change in form, resulting in the partial disappearance of segmental rings in the anterior region of the body, but there is no movement exhibited during the entire nine months save a slow return of the larva to its natural form when pressed out of shape. At the end of this period or at the age of about ten months it accomplishes its first moult and enters upon the pupa stage. About seven or eight weeks later it moults again, reaching the adult stage but a few days less than a year old, whereupon the bee chews its way out of the cell.

On Angel Island, two years later, a very extensive aggregation of these bees was found by the writer but further study was at the time impossible. On a steep bank, facing south at the shore of the

bay, extending over several square rods, several thousands of these bees were nesting. The appearance of their burrows was the same as that already described.

To the writer these studies revealed some very interesting facts:

First: In their natural state these bees are subjected to from seven to twenty inches of rainfall during the winter. The majority of these cells in the laboratory were allowed to become dry within a few days after sealing and never received any moisture other than that which they could get from the air in an ordinary school room, yet these bees seemed to emerge normally and at approximately the same time as control specimens which were watered several times.

Second: Those left in broken cells, some of which were allowed to lie on dry sawdust in no cell at all, emerged normally, differing in this respect from *Xylocopa orpifex* and *X. varipuncta*, which were subjected to the same test and which failed to emerge normally when left out of contact with an enclosing cell wall.

Third: Several larvæ were left exposed during the entire season in a cabinet in which were kept chemicals, including HCl, HNO₃, and NH₄OH, and tho kept in stoppered bottles the fumes from these chemicals were plainly perceptible each time I opened the cabinet. These specimens all emerged normally in the spring.

The distribution of this species as given by Lutz and Cockerell in their forthcoming catalog is as follows:

Anthophora stanfordiana Cockerell, 1904 c, p. 32. ♀, ♂; Stanford University, California; V; Nests. Viereck, 1905, p. 314. Corvallis, Ore.; III, V, VI (Cordley). Kellogg, American Insects, 1908, p. 516. Description of Nest. Bray, Pomona Journal Zoöl., 1917, p. 93. Claremont, Calif.; V; at *Amsinckia intermedia*.

COLEOPTERA ASSOCIATED WITH *POLYPORUS* *VERSICOLOR* L. IN NEW JERSEY.

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The following notes relate to observations made during a year's collecting on the sporophores or fruiting bodies of *Polyporus versicolor* L., in various parts of New Jersey. Eighty percent of some



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