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THE HABITS OF CALIFORNIAN BEES AND WASPS.*Anthidium emarginatum*, its Life-history and Parasites.

By ANSTRUTHER DAVIDSON, M. D., Los Angeles, Cal.

It is doubtful if they ever dig the hole wherein they nest. I find them in so many different places that I incline to believe they occupy whatsoever hole they find convenient. I have found them most frequently in short tunnels in the bare adobe banks, or in the soft sandstone rocks that form the walls of excavations and cuttings. These tunnels were originally the nesting sites of a species of *Anthophora*. While this may be considered the normal nesting place of this species of *Anthidium*, they are disposed to occupy any medium-sized hole, either in the ground or in a hollow stem; one built in the key-hole of a door. The hole or tunnel chosen is lined with the wool gathered from the foliage of *Gnaphalium chilense*, and *G. microcephalum*, our western species of everlasting. In this the pollen mass and egg destined to form each cell are deposited, the interval between each mass being composed of the same woolly material firmly compacted. The cells in each hole seem to be regulated solely by its depth and vary accordingly from one to seven. Usually the holes are not more than a few inches deep, but no matter what the depth she almost invariably fills the cavity to the top with this flocculent vegetable down, firmly compacted together. The object of this is doubtless to prevent the rain soaking into the cavity and endangering the vitality of the larvæ, for which purpose it is most admirably adapted being impervious to, and non-absorbent of water.

The eggs are deposited in the usual manner and the larvæ about the end of August spin their cocoons. These when stripped of the woolly covering and the larval excrement adhering to it, present a smooth chestnut-colored surface. They are oblong in shape with blunt ends, and average 6 to 8 lines in length and 3 to 4 in width. On the one end is a small mammillary projection showing on the outside a hollow tip. The cocoon on section appears to be slightly thinner towards the mammillated end, and is smooth and glossy silvery internally except opposite the tubercle, where the individual threads are more distinct. The papilla on section shows the external part hollow and coriaceous in texture, the internal lining is here less

dense than that of the remainder of the cell and the interval between is an open meshwork of fibres. Whether or not this is to be considered as an air hole or breathing tube, it is doubtless analogous to the structures described by Prof. Riley as occurring in the *Sphecius speciosus* ("Insect Life" vol. iv, 252).

Its capability to supply air must, from the nature of the interior lining, be limited indeed, yet probably this is its purpose. The remainder of the cell with its surfaces polished externally and internally seems totally impervious to air. Why the air-holes in the cocoon of *Sphecius speciosus* should be made to project above the surface I do not understand, but the necessity of their so doing in this instance is apparent on superficial examination. As I have already observed, the cocoons are covered over with a layer of excrementitious matter, so that unless the air-hole projected above the surface it too would become cemented over in the process of spinning the cocoon. The air-hole is always on the end nearest the outlet, and the larva always lies with its head toward that end.

Of the forty specimens of cells in my collection that appear on superficial examination to be identical, and were presumably built by this *Anthidium*, five prove to be constructed by an *Anthidium* of a larger size and brighter color than the one under review. Among the remainder were seven cells of the typical shape, but of smaller size, and thicker walled, the increased thickness being due to another layer uniformly disposed internally and forming in reality a double walled cocoon the interior of which was less glossy than the type.* These larvæ on hatching proved to be of an entirely different species, and have been identified for me (doubtfully, I fear) as *Megachile brevis*, Say.

Nine of the cells were occupied by parasites Of these

Leucospis affinis occupied three.

Pholopsis unicolor Cress. occupied three.

Sphærophthalma sp.? occupied one.

Monodontomerus montivagus Ashm. occupied one.

Physocephalus affinis Will. occupied one.

This last was found in the cell adjoining that which contained the *Sphærophthalma*, both of which were discovered in a nest constructed in the empty retreat of a trap-door spider.

* This species build their nests in June and July, and after spinning their cocoons remain in the larval state throughout the Winter, pupating shortly before making their exit in the first week of June.