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Notes on the Biology and Larval Morphology of Xenoglossa strenua (Hymenoptera: Apoidea)

George E. Bohart
USDA, ARS

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Entomology Research Division, Agric. Res. Serv., U. S. Department of Agriculture, Logan, Utah

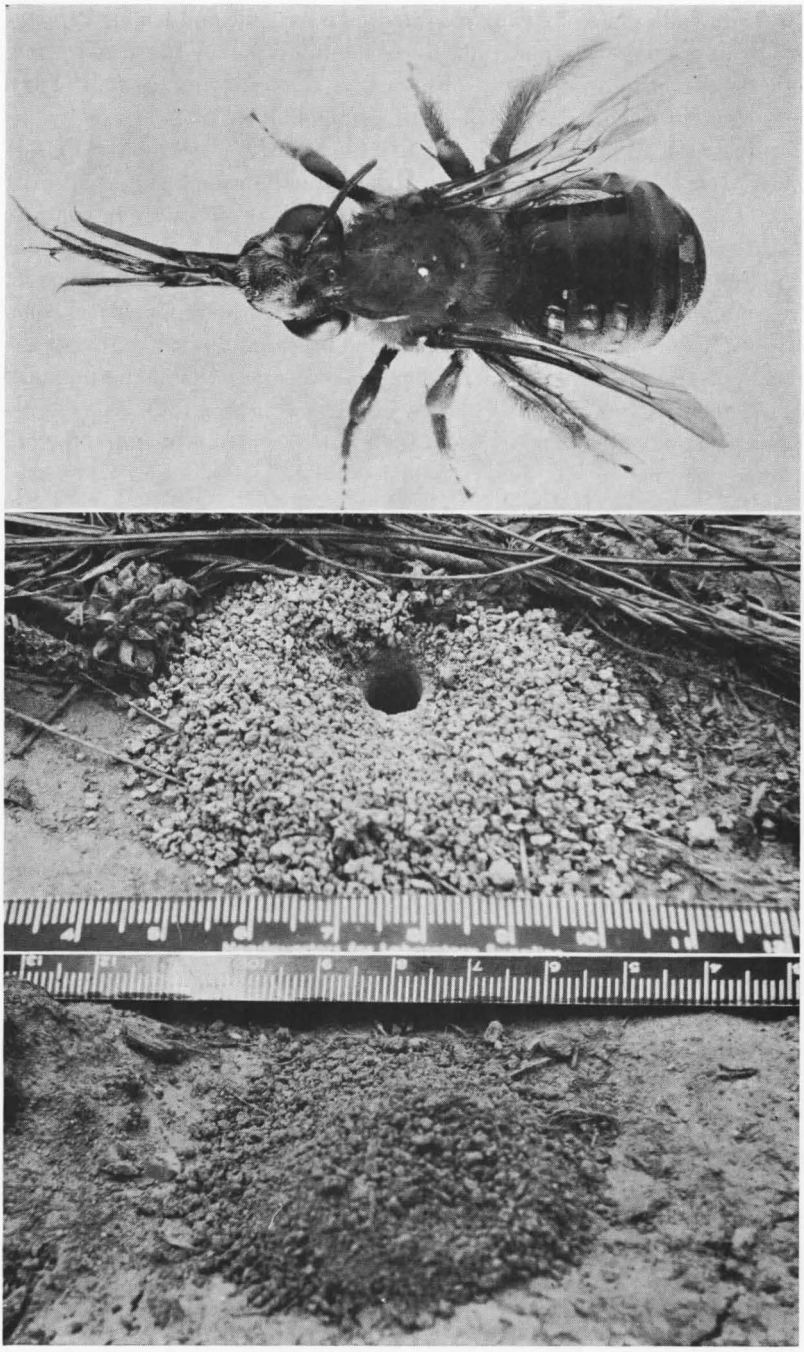
Xenoglossa strenua (Cresson) (Fig. 1) is tawny in color and slightly larger than the honey bee. It ranges across the United States at low elevations. Its pollen collecting is limited to the genus *Cucurbita* of which the cultivated pumpkins and squashes, *Cucurbita pepo* L. and *C. maxima* Duchesne, are usually the only representatives present. Although abundant on squash and pumpkin patches in many states, it is seldom observed or collected because of its matinal flight period (Cockerell, 1896). Other species of the genus also visit *Cucurbita* and have similar flight periods (Linsley, MacSwain, and Smith, 1955). The following observations were made in a squash patch at the Agricultural Research Center at Beltsville, Maryland.

During August 1957, when the following observations were made, *Xenoglossa strenua* was visiting squash and pumpkin flowers in company with *Peponapis pruinosa pruinosa* (Say), a slightly smaller bee in the same tribe, which is also restricted to *Cucurbita*. Both sexes of *Xenoglossa strenua* were present on the flowers at 6 a.m., the earliest time observations were made. The early rays of the sun were beginning to shine through some pine trees and the temperature was recorded at 72° F. The female bees worked very rapidly, visiting both sexes of squash flowers, but usually going to a female flower only after several consecutive trips to male flowers. They sometimes visited the male flowers exclusively for pollen but occasionally tarried to probe them for nectar as well. Usually they scraped pollen from the stamens only, but some individuals also tried with some success to collect pollen that had been knocked to the base of the anthers by previous visitors. Males visited both flower sexes for nectar indiscriminately.

By 7:30 a.m., when the sun was above the trees, the females were scarce although males and both sexes of *Peponapis pruinosa* were still flying.

EXPLANATION OF FIGURES →

Fig. 1 (upper). Adult female. Fig. 2 (middle). Nest entrance and tumulus. Fig. 3 (lower). Nest entrance closed for the night.



By 8 a.m. both sexes of *Xenoglossa strenua* were gone and female *Peponapis pruinosa* were disappearing. By 9 a.m. only honey bees, and a few other bees that were not host specific, such as *Agapostemon radiatus* (Say) and *Halictus ligatus* (Say), could still be found.

Some nests were found at the edge of the squash vines or several yards away from them. They were in flat, bare ground or against a small drift line of pine needles and other litter (Fig. 2). These sites were in contrast to those of the nests of *Xenoglossa fulva* Smith, which Linsley, MacSwain, and Smith (1955) found nesting in dense, close-cropped grass in Mexico. The tumulus of *Xenoglossa strenua* was in the form of a symmetrical cone, about 1½ cm high, 6 to 7 cm across at the base, and 2½ cm across at the summit. The conical crater was about one-third as deep as the tumulus. When the nest was open, the burrow entrance was seen to be sharply defined and smoothly walled. When the tumulus was blown away, the entrance remained as a chimney about 1 cm high. The burrow was 7 mm in diameter and not constricted toward the entrance.

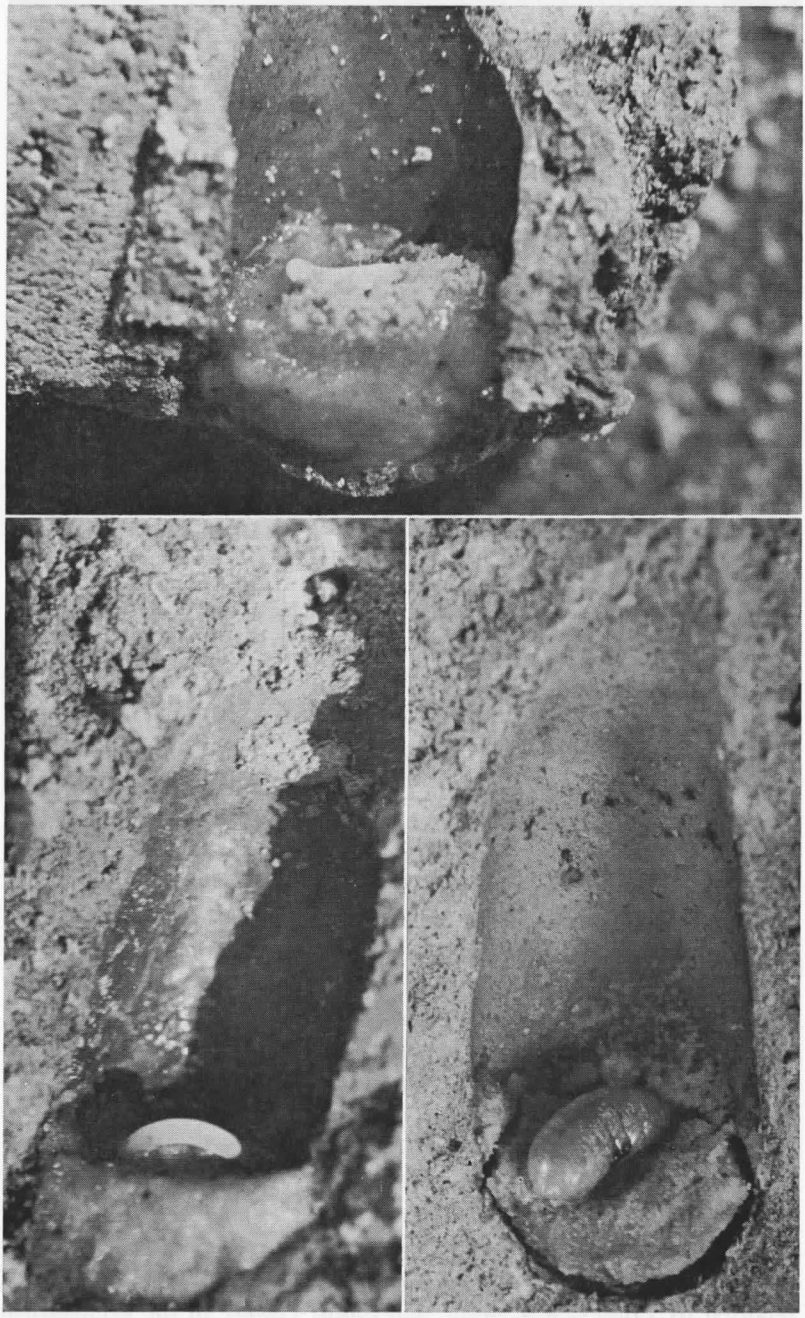
The bees left their burrows open while foraging but closed them a few millimeters below the surface when they returned from the field for the last time in the morning. During the night they pushed more soil into the entrance, closing the crater (Fig. 3).

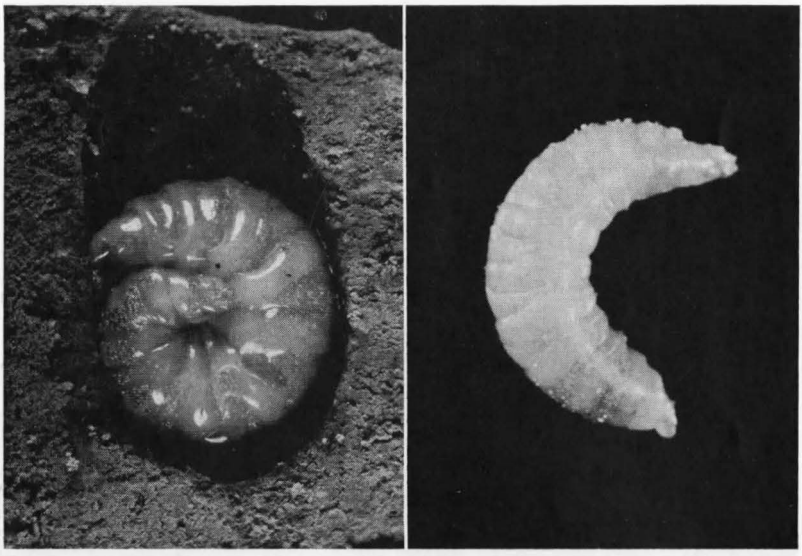
In three nests that were excavated completely, the main burrow followed a steep, gradually spiralling course. The depth of the uppermost cell ranged from 22 to 26 cm. Several cells were usually found at almost the same depth, about 3 cm from the main burrow and forming a roughly triangular or quadrangular pattern. The branch burrows slanted at a 30° to 45° angle from horizontal and were completely plugged with earth. The cells, 18 mm long by 10 mm wide, were vertical or nearly so and had a spiral ceiling where the slanting burrow joined the vertical cell. Their walls had a distinct waterproof coating, more pronounced toward the bottom of the cell but still visible near the ceiling. Their form is shown in Fig. 15 and the coating in Fig. 5. The cell walls were composed of uniform, fine materials, showing that they were applied to a previously excavated cavity. However, the walls graded almost imperceptibly into the surrounding soil and the cells were very fragile.

Beyond the first group of cells the main burrow was almost horizontal.

EXPLANATION OF FIGURES →

Fig. 4 (upper). Provisions with dry "crumbs" on top (egg damaged). Fig. 5 (lower left). Egg on provisions after moistening and consolidation of crumbs. Fig. 6. (lower right). Third instar larva in horizontal position.





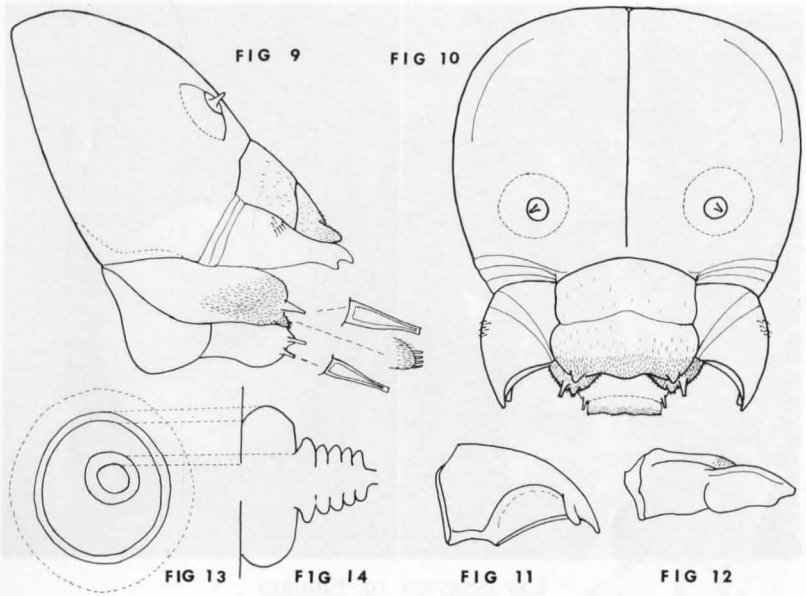
EXPLANATION OF FIGURES

Fig. 7 (left). Full-grown larva ready to deposit feces. Fig. 8 (right). Full-grown larva showing extended prothorax and divided caudal segment.

In one nest the second group consisted of three cells 8 cm from the first group and only 4 cm deeper. They were only 2 cm apart and on the same level. Another cell was 12 cm in back of the second group and 2 cm deeper. Still another group of three cells was 8 cm in front of the second group. Finally, another group of three cells was only slightly deeper and about 9 cm away. The nest had 13 cells in all and the bee was still provisioning one of the cells in the uppermost group. Beyond the uppermost group the main burrow was almost completely plugged. Plugging indicated a general progression in cell building from the end of the main burrow backward toward the entrance. However, development of the larvae in the various cells indicated that the third group from the entrance was prepared and provisioned before the fourth group. This nest is illustrated by Fig. 17.

In another nest the main burrow tended to follow a horizontal, circular course after it passed the first group of cells so that the farthest point became, in fact, closer to the first group of cells than some of the others. This nest had nine cells and was still under construction.

The *Xenoglossa strenua* nests observed resembled those of *X. fulva* reported by Linsley, MacSwain, and Smith (1955) in the symmetrical



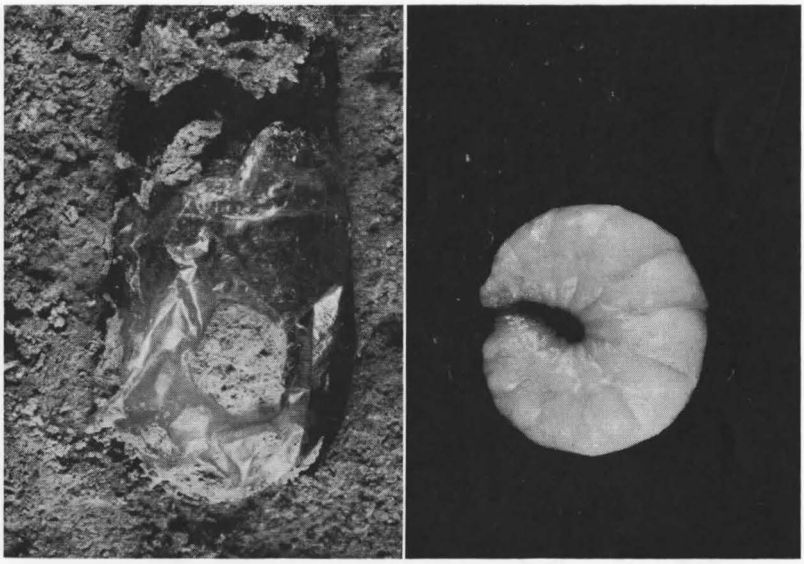
EXPLANATION OF FIGURES

Fig. 9. Head capsule of fourth instar larva (lateral view). Fig. 10. Head capsule of fourth instar larva (anterior view). Fig. 11. Mandible of fourth instar larva (ventral view). Fig. 12. Mandible of fourth instar larva (inner view). Fig. 13. Spiracle of fourth instar larva (surface view). Fig. 14. Spiracle, atrium, and subatrium of fourth instar larva (longitudinal section).

mound, spiral main burrow, and short branches leading in random directions to individual, vertical cells that lack an outer wall. They differ in being less than half as deep. The cells also differed in having the walls of the upper three-fourths gradually converging above.

The provisions, packed into the bottom third of the cells, were composed of a jellylike mass of pollen and nectar surmounted by a partial layer of "crumbs" composed of loosely adhering pollen masses (Fig. 4). Before the eggs hatched these crumbs usually consolidated with the moist mass below (Fig. 5). The absence of a definite layer of liquid on top of the pollen contrasted with the presence of such a layer in the cells of *X. fulva* (Linsley, MacSwain, and Smith, 1955).

The eggs, measuring 4½ by 1 mm, were attached at both ends to the pollen and arched away from it at the middle (Fig. 5). The anterior end was slightly larger and almost imperceptibly flattened at the point of contact.



EXPLANATION OF FIGURES

Fig. 15 (left). Cocoon in cell showing fecal pellets under ceiling. Fig. 16 (right). Prepupa in normal upside-down, C-shaped position.

The larvae fed on top of the pollen mass and in a horizontal and nearly straight position until they reached the last instar (Fig. 6), after which they fed downward and finally curled around the remaining pollen mass in a vertical plane. Fecal pellets were not deposited until the food was consumed and a few threads of silk had been spun a few millimeters below the ceiling. At this time the full-grown larva assumed the upside-down position shown in Fig. 7, raising and extending its anterior segments when spinning silk for the upper part of the cocoon and extending its posterior end when depositing feces. Before depositing feces the larva was smooth and shining, somewhat turgid, and capable of quick movements. The head capsule was depressed in relation to the thoracic segments and more prognathus than most bee larvae (Figs. 7 and 8). The posterior half of the terminal abdominal segment was small, conical, and quite distinct from the anterior half (Fig. 8). The creamy fat bodies in the thorax and abdomen showed clearly through the transparent skin (Fig. 7).

The head capsule of the fourth instar larva (Figs. 9, 10, 11, 12) was similar to that of *Melissodes* sp., figured by Michener (1953). It differed in having a smoother frontoclypeal profile, apically truncate palpi, a ventral tubercle below the maxillary palpus with modified setae, and in

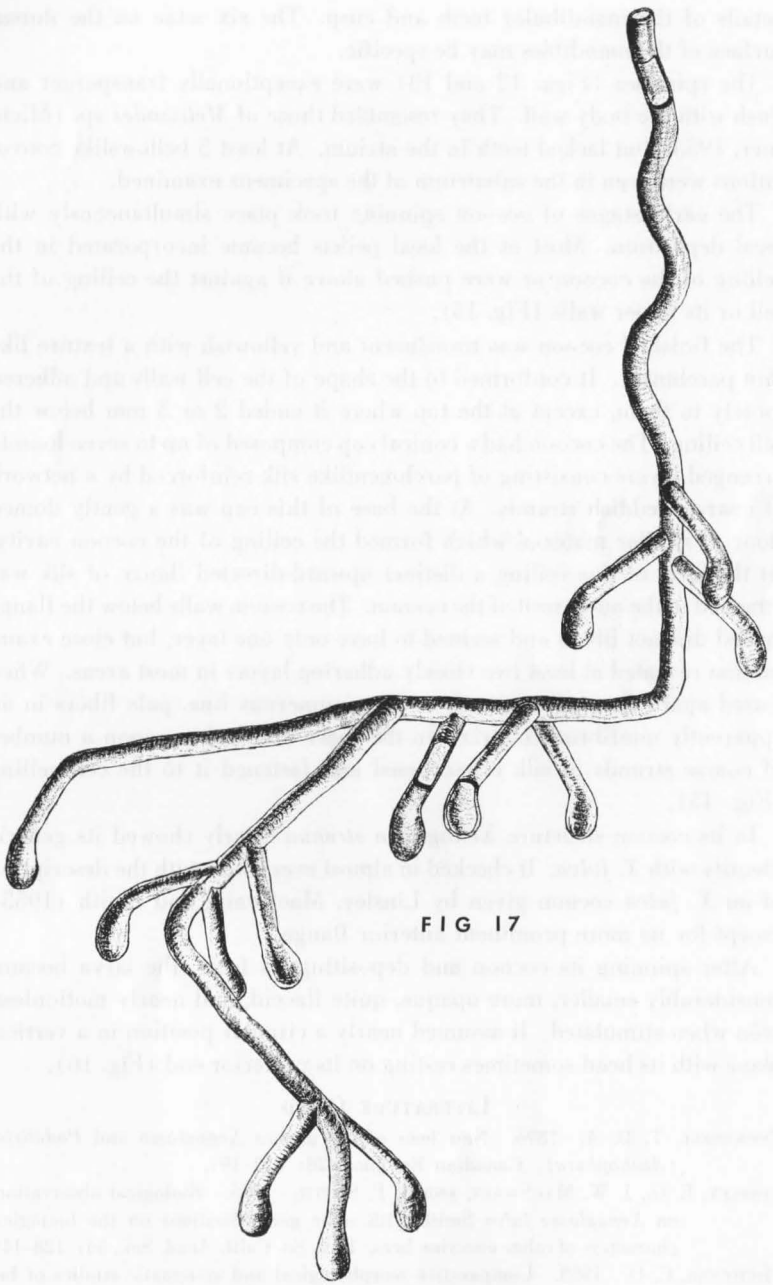


FIG 17

EXPLANATION OF FIGURE

Fig. 17. Sketch of complete nest described in text.

details of the mandibular teeth and cusp. The six setae on the dorsal surface of the mandibles may be specific.

The spiracles (Figs. 12 and 13) were exceptionally transparent and flush with the body wall. They resembled those of *Melissodes* sp. (Michener, 1953) but lacked teeth in the atrium. At least 5 bellowslike convolutions were seen in the subatrium of the specimens examined.

The early stages of cocoon spinning took place simultaneously with fecal deposition. Most of the fecal pellets became incorporated in the ceiling of the cocoon or were pushed above it against the ceiling of the cell or its upper walls (Fig. 15).

The finished cocoon was translucent and yellowish with a texture like thin parchment. It conformed to the shape of the cell walls and adhered loosely to them, except at the top where it ended 2 or 3 mm below the cell ceiling. The cocoon had a conical cap composed of up to seven loosely arranged layers consisting of parchmentlike silk reinforced by a network of coarse, reddish strands. At the base of this cap was a gently domed floor of similar material which formed the ceiling of the cocoon cavity. At the level of this ceiling a distinct upward-directed flange of silk was attached to the outer wall of the cocoon. The cocoon walls below the flange lacked distinct fibers and seemed to have only one layer, but close examination revealed at least two closely adhering layers in most areas. When teased apart, the wall was seen to have numerous fine, pale fibers in an apparently nonfibrous matrix. In the space above the cocoon a number of coarse strands of silk crisscrossed and fastened it to the cell ceiling (Fig. 15).

In its cocoon structure *Xenoglossa strenua* clearly showed its generic identity with *X. fulva*. It checked in almost every way with the description of an *X. fulva* cocoon given by Linsley, MacSwain, and Smith (1955) except for its more prominent anterior flange.

After spinning its cocoon and depositing its feces, the larva became considerably smaller, more opaque, quite flaccid, and nearly motionless, even when stimulated. It assumed nearly a circular position in a vertical plane with its head sometimes resting on its posterior end (Fig. 16).

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