OBSERVATIONS ON THE WHITE-FACED WASP
DOLICHOVESPULA MACULATA (LINN)
(Vespidae, Hymenoptera)

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Opportunities to peer through a glass window into a nest while it is inhabited by living white-faced wasps are doubtlessly rare. Such an occasion was afforded us at Eaglesnest Lake, near Tower and Ely, in northern Minnesota in the summer of 1952. The nest was attached to a vertical glass window on the west side of a cabin owned by our neighbor friends, Mr. and Mrs. Edgar C. Love, of Orion, Illinois, and their daughter Katherine, of New York City.

When our friends arrived to start their vacation on August 5, and discovered a lively colony of stinging creatures inconveniently placed only 12 feet from their only cabin door, their impulse was not to destroy but to retain it for observation. Thus, the results given below are made possible by their attitude of tolerance and appreciation. I am happily indebted also to Edgar and Katherine for a series of excellent photographs. Some of the pictures are selected to illustrate this report and all of them were employed in describing the architecture of the nest.

STRUCTURE AND GROWTH OF THE NEST

This nest was unusual chiefly in that its posterior wall consisted of transparent window glass instead of the usual opaque wasp-made paper. The hind edges of the paper envelope or wall adhered to the glass, and the top to the transverse wooden piece that formed the upper frame of the window. The hind edges of the upper and intermediate combs were straight where they contacted the glass. We were thus able to observe some of the activities of the adult and larval wasps within the nest through the glass posterior wall, and also the progressive modifications in the structure of the nest wall and the combs. This, like other nests of D. maculata, consisted essentially of two structural parts, (1) the subspherical to oval wall or envelope, formed of several layers separated by interspaces, and (2) the horizontally-placed tiers or combs of brood-rearing cells that are open below.

Measurements of the nest were made at somewhat regular time intervals from August 5 to September 22, and photographs were taken periodically. Mensurational and photographic data are tabulated below (Table I), and form a part of the basis for the description of the structure and enlargement of the nest.

The incipient nest of this species is scarcely the size of a tennis ball, and increases many times in volume during the normal life of the colony. The process of growth, or enlargement, is simple and was clearly observed in the present case. Two distinct operations are involved. First, the envelope or nest wall, composed of a series of more or less
parallel thin layers of wasp-paper approximately 5.0 mm. apart, is enlarged by the simple device of tearing out, bit by bit, the smallest, oldest inner layers adjacent to the combs, and utilizing the material thus salvaged to build new and larger layers on the outer surface of the wall. Second, the combs are not torn down, as the wall layers are, but gradually increased in diameter by the addition of new cells to their peripheries.

### TABLE I

**Data Pertaining to the Structure and Growth of Nest**

<table>
<thead>
<tr>
<th>When measured</th>
<th>Measurements</th>
<th>Transverse Diameters of</th>
<th>Photographs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transverse diameters</td>
<td>Longitudinal diameters</td>
<td>Top comb</td>
</tr>
<tr>
<td>Aug. 5</td>
<td>9.0</td>
<td>7.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Aug. 8</td>
<td>10.8</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Aug. 10</td>
<td>11.8</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td>Aug. 12</td>
<td>12.4</td>
<td>10.0</td>
<td>4.1</td>
</tr>
<tr>
<td>Aug. 14</td>
<td>12.6</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>Aug. 16</td>
<td>13.7</td>
<td>11.0</td>
<td>7.5</td>
</tr>
<tr>
<td>Aug. 19</td>
<td>15.7</td>
<td>12.7</td>
<td>8.3</td>
</tr>
<tr>
<td>Aug. 23</td>
<td>17.6</td>
<td>14.0</td>
<td>8.6</td>
</tr>
<tr>
<td>Aug. 26</td>
<td>19.0</td>
<td>16.6</td>
<td>9.5</td>
</tr>
<tr>
<td>Aug. 29</td>
<td>20.4</td>
<td>16.6</td>
<td>10.3</td>
</tr>
<tr>
<td>Aug. 31</td>
<td>20.4</td>
<td>16.6</td>
<td>10.8</td>
</tr>
<tr>
<td>Sept. 5</td>
<td>20.4</td>
<td>16.6</td>
<td>11.2</td>
</tr>
<tr>
<td>Sept. 10</td>
<td>21.3</td>
<td>17.2</td>
<td>11.4</td>
</tr>
<tr>
<td>Sept. 22</td>
<td>21.3</td>
<td>17.3</td>
<td>11.4</td>
</tr>
</tbody>
</table>

*Started August 11. **Started August 25.

While the nest is at first subspherical, it undergoes a transition to a more conical form as it grows. This gradual change in shape appears to result from two sources. First, the original, topmost comb is largest in diameter, and the second, attached to the venter of the first, is smaller, and the third and others are successively smaller than the preceding. Thus the nest wall takes on a conical shape since it conforms to the diameters and circumferences of the combs. Second, as the season advances, the workers construct cupalos or dormers over the upper portion of the nest. Usually these are vertically short and horizontally broad, with the open ends mostly directed downward. As time passes, other dormers are built over previous dormers. Thereby, the diameter of the upper part of the nest increases at a faster rate than does that of the lower part, which lacks these incipient wall layers, with the result that the nest becomes more conical in shape (Plate III, fig. 1).

Dormers suggest three other subjects for brief comment. First, addition of one dormer upon or between others, provides a light fluffy
nest wall containing many air spaces, some sealed off from the outside, which may tend to level off the fluctuation in temperature and humidity. Second, how may the wasps determine the location, angle, size and shape of the dormers? While the surface of the nest is convex, it differs in degree of convexity at various points of place and time. Observations suggested that the dormers may be a device whereby the wasps produce a more or less uniform degree of surfacial roundness, and that, therefore, they construct dormers in locales where the surface chances to be depressed. This suggestion implies that the workers have a means of measuring degrees of roundness, i.e., a sense of contour. Since such an “ability” is probably tropismic, it may reside simply in the natural, somewhat arcuate posture or form of the body contacting the substratum through the agency of the tarsi. Third, some of these dormers were extended far downward over the front and sides of the nest, and thus became integral parts of the nest wall. Reference to Plate I, fig. 1 will show two such prolonged dormers extending to the level of the nest opening; yet these retained their identities in that their edges turned inward to contact the underlying layer. When the nest wall is seen in cross-section these prolonged dormers appear as biramous forking of single layers. Plates I to III, fig. 2, show such branched layers in the upper left and right sectors of the nest wall. This biramous type of structure is a departure from the predominating concentric layers forming the nest wall, and may be an outgrowth of the alleged sense of contour of the worker. The pictures also reveal that the wasps employ a few cross bars of paper that join and possibly reinforce adjacent layers of the wall.

The number of layers forming the wall is not uniform throughout the nest life. The data in the column headed “Photographs” in Table I indicate an increase despite the removal of inner layers as the nest grows. The figures cited pertain only to those layers which seemed entire, not including tattered remnants of the innermost layers left by the wasps on the window. Combining with this numerical increase in layers the fact that the outer layers are larger than the inner ones, compels the conclusion that the builder-workers constantly and liberally supplement the paper salvaged from the nest with raw materials secured in the outdoors.

The measurements of nest and combs (Table I) indicate an irregular rate of construction during the season. The width and length of the nest was approximately doubled in the 18 days between August 5 and 23, whereas it was enlarged but little in the 27 days following August 29. In the first 18 days, the top or first comb grew from 2.0 to 10.0 cm. in diameter, but only two in subsequent 27 days. By contrast, the smaller second and third combs, which were initiated on August 11 and 25, respectively, continued growing significantly in the same 27 days. The deceleration seems to reflect a reduction in number of workers produced, and the advent of young females and males in their stead.

All the new layers of our nest, except those originating as dormers, were begun along the upper and posterior edges, and extended forward and downward. Workers emerging from the nest bearing building material moved deliberately. The subspherical mass of plastic, mostly
grayish, brown substance appeared to be held between the posterior side of the head, or labium, and the base of the fore legs and the prosternum. On reaching the outer surface, the pulp-bearing workers proceeded variously, sometimes delaying momentarily near the exit, sometimes wandering as if uncertain where to go or which of several building sites to adopt, and again they advanced directly to a place and began their work without delay. The free edges of incomplete dormers or wall layers to which the pulp is added are mostly horizontal, but may be vertical or oblique. As a result, the worker hangs (1) either from the free edge only, or (2) may hold fast to this edge with legs of one side while those of the other rest on the previously-built layer below.

In applying the pulpy mixture of salivary secretion and masticated plant fiber, the wasp invariably crawls backward, and, in doing so, her mouthparts appear to clip off bits from the anterior side of the adhesive mass and simultaneously to apply the bits to the edge of the layer or dormer. One such mass suffices to extend a segment of edge about 30 mm. long. Having thus disposed of the load, the worker next crawls briskly forward to the starting point of the newly-added segment and again retrogresses over it but now compressing and further broadening the still pastic pulp by pinching it between the mandibles. A single lump serves to enlarge the layer or dormer one to three mm. The entire operation is performed briskly and precisely. Newly built-up sectors remain recognizable for some time by their comparatively dark color. However, the material employed, as seen when dry, is not uniform in color. While grey predominates, white, suggesting birch bark, is common, and lesser areas of yellowish-brown are interspersed. As many as six builders worked simultaneously, some at edges of dormers, others at wall layers. One worker, identified by red pigment daubed on a wing, was seen to apply one pulp mass to an incomplete layer, and was next discovered adding to the edge of a comb in the nest.

The right and left wings (see figs.) of a new layer were commonly built at the same rate, with the result that the wings met at or near the entrance, but they sometimes grew at different rates; or at times two layers of different length proceeded down one side of the nest while one layer of still another length extended down the other side.

THE COMBS AND INTERSPACES

The internal structure of the nest was observed through the window and later also analysed when the colony had been artificially inactivated. The large upper comb grew from about 2.0 cm. on August 5 to 11.4 cm.

EXPLANATION OF PLATE I

Top. Front view of nest, photographed August 14. Only a few dormers occur. The workers are adding strips to the margins of the dormers. Note the incomplete wall layer at right below, and spiral arrangement of strips around oval entrance.

Bottom. Posterior view of nest, photographed August 11. Note three forked layers at upper left. Only comb 1 is visible. The suspensorium of comb 2 was built this day, but cannot be seen. Many cells bear white caps of silk. The innermost layers of the wall are tattered; workers have chewed all but remnants off. Note the incomplete wall layer at left below.
Biology of Dolichovespula
W. V. Balduf

Plate I

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in diameter by September 22 (Table I). It was found to be attached to the center of the ceiling by a multiple suspensorium composed of several hard angular paper ribs of various sizes. The second comb was initiated on August 11 in the form of a single suspensorium attached behind the center of the venter of the first comb. The second comb grew promptly and steadily by addition of rings of cells around the distal third or fourth of the suspensorium. By September 22 it had grown to 9.7 cm. diameter. On August 25 the third comb was begun in the same manner as the second, and attained a diameter of 5.0 cm. by September 22. The three combs are visible in fig. 2 of Plate III.

By constructing the first cells of each comb near the apices of the new suspensoria, the workers reserve sufficient space between the several combs to permit them free access to all cells of the combs. This spatial achievement cannot reasonably be assigned to chance, and suggests the wasps possess a means of measuring the depth of the space between adjacent combs. Wherein this means resides is certainly not clear, but may consist of the height of the wasps as they stand or move. Should combs be too close together at any point, the mandibles might be employed to chew the obstruction away. Similar corridors, of course, occur between the edges of the combs and the nest wall, and between the layers of the wall, which average about 5 mm. apart. The aperture of the nest opens upon a runway that extends obliquely upward and backward into the nest, and provides access not only to the central comb chamber but to the interspaces between the wall layers. The size and shape of the aperture vary from time to time as the new layers are built down around it. Paper may be chewed away from the edges, should the aperture become too narrow for the convenience of passing traffic. On one occasion the hole measured 16 mm. in diameter at 2:00 p.m., and was enlarged to 22 mm. by 5:00 o'clock. This took place on August 29 when the colony demonstrated unusual irritability and the inmates sometimes created momentary traffic jams at the aperture.

Although the combs hang horizontally and thus parallel to one another, the surfaces of the combs individually are not flat. The larger first and second combs of our nest were manifestly concave on their closed upper sides, convex on the open ventral sides. How is this form of the comb achieved? It results from a combination of various structural principles. First, the individual cells are not cylindrical but subconical, being narrow, round and cupshaped at the base, and flare out to a transversely hexagonal form at the apex. Second, as a result of their subconical form, the cells do not hang vertically but take a more and more oblique position from the center to the periphery.

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**EXPLANATION OF PLATE II**

**Top.** Front view of nest. The workers in upper center are extending a dormer; another below seems to be adding to edge of entrance. There are still but few dormers above, and new wall layers at right, above and below, but none on left.

**Bottom.** Posterior view of nest. Note that only the outermost of three forked layers shown on Plate I, fig. 2, remains here; the rest were chewed away as comb cavity was enlarged. Comb 2 shows clearly, has had no capped cells yet. The suspensorium of comb 3 was built August 25, but does not show in picture. Remnants of inner layers persist between combs 1 and 2.
Photographs taken August 26
of the comb. Third, the cells are not straight lengthwise, but curved toward the center of the comb, the degree of curvature increasing from center to margin, and thus tends to compensate for the subconical form of the cells. Were the cells longitudinally straight, the comb might conceivably attain a hemispherical shape. Fourth, the several cells are approximately uniform in length; if the cells of each additional ring were slightly longer than the preceding, the combs could be flat above. Therefore, although the curved form of the cells tends to achieve a flat surface, it fails when combined with uniformity in length of cell. From a functional standpoint, the conical shape and somewhat oblique posture of the cells possibly enable the larva, hanging head downward as it does, to retain its position in the cell.

FORAGING AND FEEDING

Workers were often seen hovering searchingly over tops of parked cars and buzzing deliberately along the wooden walls and the screens of cabins. Any minute spot, clearly defined by its form or color, was investigated by the wasps by darting vigorously upon it. They obviously were unable to distinguish between inedible inanimate objects, such as small brown knots or rusty nail heads in the side walls of my cabin and living flies or spiders resting on the same walls. The frequency of such errors indicates their visual perception of form and color is poorly developed. On cloudy, rainy days, muscoid flies resting on a dark porch screen appeared invisible to prey-seeking wasps that flew past about a foot away. On sunny, warm days, the errors and failures are probably fewer, for the prosperity of our colony indicated success in securing prey, despite visual limitations. No attempts were made to intercept the field workers to determine the prey. The color and form of objects in their possession suggested they commonly captured spiders and large flies.

Food-bearing workers entering the nest sometimes came face to face with other adults and appeared to share their prey with them. Whether the recipient then consumed the morsel or divided it among the larvae was not determined. Individuals concerned were soon lost in the welter of workers or obscured by intervening combs or nest wall. In some cases, the field worker personally parcelled the prey to the larvae in the cells. This process was clearly observable where larger larvae were fed because their cephalic ends protruded prominently from their cells as they stretched and explored in apparent eagerness to be fed. The worker passed from one larva to another inhabiting adjacent cells, pausing momentarily over each, presumably imparting a bit of food. In the most clearly observed instances, one load brought

EXPLANATION OF PLATE III

Top. Front view of nest. Many dormers have been added since August 26, and two are extended broadly downward over the front, in lieu of the customary concentric wall layer. An incomplete wall layer at left, and one at right.

Bottom. Posterior view of nest. Note that forked type of construction persists at left above, less at upper right. Several cross braces between layers are visible here. The small third comb and its suspensorium show through remnants of inner layers glued to window. The wasps clustered between combs 1 and 2 are largely, if not all, males.
PHOTOGRAPHS TAKEN SEPT. 22, A FEW HOURS BEFORE COLONY WAS KILLED ARTIFICIALLY
in from the field was divided among three or four large larvae. The act of imparting food seemed to involve use of the mandibles of both the worker and the larvae, and the two sometimes seemed to tear the substance apart by pulling in opposite directions.

However, feeding and other services of worker to larva appear to discontinue once the larva is not in the usual place, its cell. Several large larvae fell from their cells to the floor of the comb chamber. These were probably accidents, possibly incidental to spinning cocoons or cells unfavorably located contiguous with the window. The fate of one such plump grub was observed on September 4. As it lay on the nest floor, a worker approached and seemed to lick it or chew its cuticle for a moment, then departed. Soon thereafter, this, or possibly another, worker came upon the displaced larva, and at once seized it with her mandibles and half-dragged, half-carried it to the outside of the nest. For several seconds she stood at the side of the exit, holding to the nest wall by the hind legs only, while the bulky larva, still alive, dangled from her mouthparts until she dropped it to the ground. This larva, on which workers previously expended much care, was now treated as rubbish. Such is one expression of instinctive behavior.

**REACTIONS TO WEATHER CONDITIONS**

Activity was obviously at its peak on warm sunny days. Many trips were made to and from the nest, from early morning to dusk of evening. But moderate steady, all-day rains did not inhibit field work completely; a few wasps were seen searching for prey 150 feet from the nest on such a day. When temperatures fell into the 50's, the amount of movement was clearly reduced. The adults then gathered in the hind part of the nest near the window warmed artificially by heat within the cabin, occupying both the comb chamber and the interspaces of the nest wall. Two workers, engaged in building a new wall layer on August 29, when the outside temperature was 60° F., had enjoyed higher temperature inside the nest where their paper pulp was obtained. When the thermometer registered 90°, due to heat from a gas burner located near the nest, one or two wasps, on several occasions, stood in or just outside the aperture vibrating their wings rapidly. This behavior possibly signified attempts to set up air currents to cool the interior.

The workers were docile and well-behaved at almost all times so long as they and their nest were treated with consideration. They permitted us to stand, as we often did, within inches of the aperture for observation and photography. We stood or moved directly in their fly way, and they detoured around us without becoming perturbed. They appeared preoccupied with foraging and building, and seemed accustomed to our presence. In the six weeks the colony was observed, observers or visitors were stung only four or five times. While the pain from stings was at first intense, it soon abated with but minor swelling. But the peaceful conduct was interrupted on August 29. At 1:50 p.m. of a clear day, Katherine Love reported unusual behavior. A swarm of workers buzzed excitedly around the nest, and many individuals collided sharply with the nest and also the window that supported the nest. As they came into and from the nest, the wasps
often partly jammed the entrance, but none attempted to sting others. This performance was repeated a number of times during the afternoon, with intervals of relative quiet, in which a few individuals crawled about over the nest near the entrance, as if on guard. A bit of experimentation showed that the wasps swarmed when a screen door 12 feet from the nest was allowed to slam. But since vibrations from that source were frequent in previous weeks and had produced no such angry demonstrations, this seemed obviously not to be the basic stimulus of the wild behavior. Although August 29 was apparently a clear day, rain began to fall before daylight of August 30 and continued all day long and the wasps continued to be irritable and combative. By noon of August 31, the sun warmed the atmosphere and the wasps had resumed their usual contented mood and activity. A barometer would probably have indicated a marked change in atmospheric pressure during August 29 to 31. This suggests what was perhaps the basic stimulus of the recent swarmings.

OVIPOSITION AND DURATION OF THE STAGES

We secured several data pertinent to the duration of developmental stages. Katherine Love saw the queen place an egg in the first incipient cell of comb 2 on August 12. I plainly saw this egg later; it was elongate and white, and attached to the inner side wall. On August 26, Katherine discovered the queen ovipositing in an incomplete cell of comb 3, which was initiated on August 25; workers removed and destroyed this egg, whereupon a second was inserted, and left unharmed. These instances confirm published statements to the effect that oviposition occurs in incipient cells. They also serve as starting points in determining the duration of stages. The egg laid on August 12 resulted as a mature larva found spinning itself in on August 26; that laid on August 25 had become a full-grown, spinning larva on September 12. The intervals of 14 and 17 days in these two instances represent the duration of the combined embryonic and larval stages.

Another means of obtaining facts on length of stages was to mark certain cells, built against the glass wall of the nest. Two mature larvae spun themselves in on August 10, a third on August 16. Adults chewed exit holes in the silken caps of these cells and issued; the first two on August 13, the third on August 27. The pupal periods therefore were 13 days and 12 days, respectively. Combining the above data we learn that development through the embryonic, larval and pupal stages to adulthood during August 12 to September 12 required 26 to 30 days. Temperatures were above average for this season. The killing frosts that commonly occur there by August 31 did not appear until after September 12; and September 10 was uncomfortably warm.

DETERIORATION OF THE COLONY

Katherine Love first noted evidences of obvious slackening in activity in and out of the nest on September 13 and 14. There were still many wasps in the nest, but the nights were colder, and the wasps lay still or barely moved about in the morning in sharp contrast with their usual previous busy activities. No more construction work was being done on the combs or the walls, and while some flew from and to
the nest, movement in the nest was listless. On the cold morning of September 15, she saw two plump, almost mature larvae had fallen from their cells, and gravitated to the floor of the comb chamber. On later days before September 22, other larvae dropped from the combs, but these had died and blackened in their cells, which indicated failure of the workers to feed them for several days previously. The wasps crawled over and around all fallen larvae, gave them no attention, not even casting them from the nest. The lassitude of workers may explain some of this inattention, but identification of the dead adults present in the nest and packing box, in which Edgar Love brought the nest to me in October, shows that almost all were males. Males presumably lack the instinct to care for the nest and its immature occupants. It therefore appears that most of the workers had died by mid-September.

CASTES AND POPULATION OF THE COLONY

Here I consider fertilized eggs, larvae, pupae and adults as wasps. If we may assume that all open cells, both incomplete and complete, contained fertilized eggs or larvae on September 22, the population yielded in the history of the nest can be determined quite accurately. The results of the examination of the inactivated nest in November are presented in Table II.

TABLE II

<table>
<thead>
<tr>
<th>Stages</th>
<th>Comb 1</th>
<th>Comb 2</th>
<th>Comb 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs or larvae in open cells—</td>
<td>150</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>Prepupae removed from capped cells...</td>
<td>2</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Pupae removed from capped cells......</td>
<td>36</td>
<td>50</td>
<td>11</td>
</tr>
<tr>
<td>Adults issued from capped cells.......</td>
<td>222</td>
<td>83</td>
<td>0</td>
</tr>
<tr>
<td>Total individuals</td>
<td>410</td>
<td>164</td>
<td>69</td>
</tr>
</tbody>
</table>

A few comments are essential to make the data intelligible. The 164 individuals of comb 2 were produced between August 11, when the comb was initiated, and September 22, when the life of the colony was terminated artificially. Comb 3 yielded no adults; this was evident from the fact that all the capped cells occurred in the central or oldest area of the comb and no caps had been perforated. Comb 2 produced 83 adults, all having emerged from capped cells in the discal area. The oldest and largest comb 1 yielded 222 adults, as follows: the discal area around the suspensorium produced two separate lots of 47 each, or a total of 96; the remaining 126 developed in 126 cells of the area intermediate between the central and submarginal areas. Comb 1 also bore 38 cells with silken caps that were intact; of these, two
contained prepupae that still retained the body form of larvae, while 36 contained full formed pupae. Thirty of the pupae had advanced to the black subadult state, whereas 6 remained more or less white. Of the 38 capped cells, 23 were situated on the central area, 15 on the submarginal portion of the comb. The 126 now open cells of the intermediate area of the comb, and 24 incomplete cells at the periphery, are considered as having housed eggs or larvae on September 22, a total of 150 cells.

### TABLE III

<table>
<thead>
<tr>
<th>Comb number</th>
<th>Number removed from cells</th>
<th>Prepupae or pupae not identifiable</th>
<th>Pupae identifiable number</th>
<th>Pupae identifiable castes</th>
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<tbody>
<tr>
<td>1</td>
<td>38</td>
<td>5</td>
<td>33</td>
<td>male</td>
</tr>
<tr>
<td>2</td>
<td>51</td>
<td>7</td>
<td>44</td>
<td>male</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
<td>8</td>
<td>11</td>
<td>male</td>
</tr>
</tbody>
</table>

Referring to Table III, I classify as pupae all individuals having legs, wings, antennae and mouthparts fully everted and the body regions clearly defined. "Prepupa" has reference to individuals retaining the external form of larvae, also those with no legs but head and wings everted in part. Some pupae were soft, white, with antennal segments somewhat annulated and readily deformed when manipulated, so that caste was not positively identifiable. Most pupae were firm and black, i.e. subadult, hence castes were determinable with certainty, the males by the genitalia and the 13-segmented antennae, the females by their stingers and 12-segmented antennae. Since 88 of the 105 individuals removed from the cells, as of September 22, were males, the remaining 20 also may be presumed to have been males. This belief is strengthened by the fact that 42 of the 45 dead adults found associated with the inert nest also were males. The remaining 3 were small females, i.e. workers. It is of interest that only 45 adults of the 305 (table 2) known to have developed in this nest remained on September 22, when the colony was artificially terminated. The young queens that presumably had developed, had left the nest. Also the old queen had departed.

**POSTSCRIPT**

After the above description of the "Love" wasps was completed, Doctor Garland T. Riegel, Eastern State Teachers College, Charleston, Illinois, told me of a similar nest. He recalled seeing an article and a photograph in the Chicago News. The account proved to be in a State Edition, dated Wed., Sept. 28, 1948. Through the clipping he sent me, I learned that this nest was built on a window of the farm home of Mr. and Mrs. Irwin Edgerton, near Albany in northwestern Illinois. The Edgertons, now residing in Clinton, Iowa, mailed me clippings of articles and photographs published in the Clinton Herald.
The photographs and Mrs. Edgerton’s descriptions show beyond doubt that the nest was that of *D. maculata*. The home is surrounded by many large trees, and the queen chose an upper corner of a sitting room window at the southwest side of the house to begin her nest. It was initiated about the last week of April; the spring of 1949 was warm. Building continued until the advent of cool weather, and a few wasps remained at frost time in October. At its maximum, the nest was about 18 inches wide and 24 inches in vertical dimension, irregularly conical in form, and extended several inches beyond the left and upper wooden frames of the supporting window. However, the entire interior, or comb chamber, remained visible through the window glass that constituted the back wall of the nest. In all, 23 paper layers had been constructed in forming the nest wall or envelope. The characteristic dormers, aptly described by the Moline reporter as “rainproof louvers” were numerous at the top of the nest. Four combs of brood-rearing cells occurred at the peak of the season. The Edgertons observed the workers carry materials into the nest, saw them renovate the cells after young adults had emerged from them, and noticed some of them pause at the entrance to fan their wings as if to ventilate the nest. The wasps were excitable only when the window was tapped or a near-by door allowed to slam. The presence of this colony afforded the Edgertons and their friends a unique and pleasurable experience.

**REFERENCE CITED**


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Butler has provided a real contribution in his “The World of the Honeybee”. This is an authoritative text written in a popular style. It should be of interest to the beekeeper, to the entomologist and to anyone else interested in natural history.

Dr. Butler has presented an excellent account of the biology of the honeybees. His book is written in a popular vein which makes its reading very enjoyable. As a result of first hand studies in Ceylon, Butler has presented an outstanding discussion of the honeybees of Asia and their relationship to the common honeybee. His discussion of the development of the social habits of the honeybees appears to be very logical.

A fundamental discovery reported in the text is a material known as the “queen substance”. According to Butler the presence or absence of this material contributes greatly to the morale of the colony.

F. R. SHAW