

Ventralseite eingeschlagenen Seitenteilen, auf letzteren hart an der umgeschlagenen Kante liegen die Stigmata. Die 9. D. S. vollkommen in 2 Hälften geteilt, welche durch den intakten Grundring zusammengehalten werden. Von dessen seitlichen Ecken erhebt sich ein spangenartiges, durch Nähte abgegrenztes Chitinstück, mit dem der anderen Seite und einem mittleren, ebenfalls durch Nähte abgesonderten Verbindungsstück zu einem hochgewölbten Halbkreisbogen sich vereinigend dem G. B., der hier als vollständig zu bezeichnen ist. Auf ihm ruht die P. K. oder mit anderen Worten: von der Ventralseite ausgehend stösst man zuerst auf den G. B., dann auf die P. K. 10 D. S. klein, dreieckig, mit abgestutzter Spitze, der Spitzenrand jederseits lateralwärts etwas ausgezackt und in der Mitte mit 2 Härchen besetzt, an den seitlichen Rändern etwas eingeschlagen, in der Mitte unterhalb mit einer seichten Rinne für das Rectum. 9. V. S. rautenförmig, wenig chitinisiert, an der Spitze mit 4 Haaren besetzt, an den Seiten seiner ganzen Länge nach umgeschlagen, in der Mitte mit einem langen, stärker chitinierten Streifen. Die P. K. besteht aus 2 Abschnitten, welche durch eine sehr deutliche elliptische Linie getrennt sind, aus einem vorderen halbkugelförmigen und einem hinteren, einem abgestumpften Kegel gleichenden. In dem vorderen, basalen Teil liegt eine geschlängelte, längliche Drüse. Ein eigentlicher, vorragender P. fehlt. F. P. sehr wenig beweglich, wenig „forceps“-artig, wenig vorragend, an ihrer Basis durch ein Querstück verbunden. An der Spitze des Kegels bemerkt man eine hautartige Hervorwölbung (Pr.?). Die ganze Kapsel kann hervorgestreckt und zurückgezogen werden. Die Muskeln, welche das Heraustreten unter der 9. V. S. bewerkstelligen, setzen sich ungefähr in der Mitte des hinteren Kegels an, die zurückziehenden dagegen an den vorderen, halbkugelförmigen Abschnitt.

Ich sah ein Exemplar dieser Art ohne P. K.

(Fortsetzung folgt).

Observations on an Australian Mud Dauber which uses in part its own Saliva in Nest Construction.

By A. A. Girault, Nelson (Cairns) N. Queensl.

Some of the mud daubers of Australia resemble those of North America in general habits but the following observations were made upon a species which builds large oven-shaped nests of clay attached to the rafters or other part of a building. Doubtless, they used to be attached to trees in the forest, before buildings of civilized man became numerous. It is still a common thing to see the nests of various species on the trees in the Australian forests but I have not observed this species in its original habitat. The shape of the individual cells composing the nest of this wasp lead me to think that, if occasion required, they were built singly and not in clusters, the whole afterward daubed over with mud until the oven-shape is attained; or at first, the mother wasp merely scattered her cells as convenient leaving them as originally built. This seems likely, though the only reason for thinking so is that the shape of the cells does not seem suitable for the cluster-nest; in other words, they are not well-adapted, for that kind of nest building. It is interesting to state in this connection, and perhaps pertinent, that Bates in his „The naturalist in the River Amazons“ figures the cells of a species *Trypoxylon*, three of them built side by side on a slender twig; these cells are identical in shape with those built by the species under consideration. Bates states that the same South American species when building on a verandah, makes rows of these cells. The species now under consideration is *Eumenes latreillei* Saussure as kindly identified for me by Mr. S. A. Rohwer of the United States National Museum. The observations were made in the second story of a cottage on the outskirts of the town of Nelson, North Queens-

land. The second story was surrounded by the verandah usually present on tropical residences.

I. The wasp was first observed in June 11 (1912), thus in the winter. It was working upon a nest on the floor of the north verandah, several inches from the wall. One cell had been built, stocked and closed; a second cell was just about half built and was finished by 11.50 a. m. It was exactly like a carafe or flat water-bottle, neck nearly sessile and central and with an opening through it with a diameter of not more than an eighth of an inch. At noon, the following day, the female was observed to return to this second cell carrying with her a long, slender, green noctuid caterpillar which she passed through the entrance by paying it out through her legs, using the mandibles for power. She left straightway. At 2 p. m., the second cell was plugged; it was open at 9 a. m. The mother wasp was not seen again that day; she did not pass the night at the nest. At ten o'clock, June 13, a third cell had been commenced, tilted against the bottom side of the first; the walls were being built up uniformly, in successive rings, gradually arching over and forming a roof; at 10. a. m. they had been raised about a tenth of an inch; at 10.33 $\frac{1}{2}$, the cell was roofed, leaving the entrance in the centre; eleven minutes later, the neck or mouth was completed; its axis was inclined to the east and a quarter way to the horizon. As soon as completed, the female left at once. While building this cell, she visited two different places, making a longer trip around the back of the house, presumably to a small field of maize where the soil was moist and a shorter one to a place beneath the verandah (nearly under the nest) where the soil was sandy and perfectly dry. On the longer trips, she probably obtained wet earth but on the shorter ones certainly only dry sand. Sometimes, she stopped at the sand and gathered it en route home from the longer trip. I saw her make two trips in succession to the sand, adding the burden of each to the cell and then leaving for the longer trip. The addition of each load of sand did not absorb all of the moisture of the cell's wall and thus was workable. The wasp returned to the third cell at 11.25 a. m. and added to it a green noctuid caterpillar about two thirds grown; I carefully extracted this after she left but it contained no egg. It was lying curved around the bottom of the cell (the floor of the verandah) and was alive, quite lively when disturbed but not able to crawl; it seemed in much the same condition as a parasitized larva. At 1.20 p. m., the cell contained another caterpillar; at 2.45 p. m. a second one was added, the female immediately flying off, returning at 2.47 and capping the entrance with mud; several trips were made for this purpose; it seems that the absence of the first caterpillar was not at all noticed. Upon my return at 5.30 p. m., the nest was unchanged as far as additions to it were concerned, the wasp apparently absent but it was noticed that the roof of the third cell had been broken, presumably by a bird or some rodent. On the following morning (June 14), the second cell had also been broken, one of its contained caterpillars exposed; it had already been attacked by ants; the third cell was now broken down entirely, its contents missing. This was, to all appearances, the work of mice, several of which had been seen in the building. A few pellets of excrement resembling that of mice were found scattered near the nest and the cells appear to have been gnawed rather than pecked at. The mother wasp first appeared at the nest at 10 a. m. but I did not see her behavior. However, she flew off and returned with earth, covering the irregular break in the second cell, continuing to daub the nest until 12.30 p. m., until the first and second cells had been covered by a coating of mud. The third cell was entirely neglected. The female then deserted the nest. On the morning of June 15, I again found that a hole had been gnawed through the top of the second cell; the female did not return to cover it. The hole was narrow as if made by long teeth.

II. A second female of this species was observed at 10 o'clock June 19, 1912 building a nest near the first one but against one of the uprights of the wall of the house, about three feet up from the floor of the verandah. Half of a second cell had been finished, above and against the first; these cells have their long axis at right angles to the axis of the joist; they were not rounded in outline like those of the first nest but cylindrical oval or oven-shaped with a central entrance, the whole not unlike in form those of the North American *Sceliphron cementarius* Drury. Thus, this Australian species seemingly adapts the form of its cells to the situation in which the nest is being built; at any rate,

the cells may vary considerably in shape. The second cell was nearly completed at 10.51 a. m. but it lacked the rim or neck of the entrance. This was completed at 11.14 a. m., and the wasp then flew off. This second cell was broader and shorter than the first, shaped more like a loaf of bread, somewhat longer than wide and with the ends of the longer axis more or less truncately rounded off. Thus, even the individual cells made by the same female may vary considerably. When leaving, after completion of the cell, the wasp flew off in a direction divergent from that of the regular flights during building.

She had not returned by noon but at 1.30 p. m. it was noticed that at least one caterpillar had been added to the cell; it remained open during the rest of the day and the following night. A second caterpillar was added at 11.30 a. m., June 20 but I did not see others added and the cell again remained open during the night (the day was windy and cloudy, rather cool). On June 21, the mother wasp was first noticed at 10 o'clock; she was on the nest and was frightened by my movements near the nest remaining "alert" and still for some time. After she left, I could not see that anything had been added to the second cell. At 4.20 p. m. the latter was found to have been closed and a third begun, above and against it. Only the two end sides were built up in the shape of crescents; the female had stopped work for the day. June 22 was rainy, windy and chilly and no work was done. June 23 at 4 o'clock, I found that the third cell had been completed, though the day was rainy throughout, except for short intervals near noon. The cell was empty. June 24 was clearer, fair and warm; the mother wasp was observed to put a caterpillar in cell 3 at about 10 a. m.; she paid it out through her fore legs, using the mandibles as formerly observed. Another caterpillar, which filled the cell, was added at four o'clock and soon afterward the cell was capped.

At 4.20 p. m., it was noticed that a fourth cell had been commenced above the third, the end walls raised first, at that time not very high. At 5.35, she was still at work on cell 4 which was nearing completion; at this time, she was visiting an entirely different spot for building material. Cell 4 was not quite completed today but at 8.30 the following morning (June 25), it was finished excepting the neck; later, it was found that the latter was not added, the round entrance hole merely being slightly rimmed, not a distinct flange as usual: this is another variation. By 10.15 a. m. June 25 a caterpillar had been added to cell 4.

A fifth cell was constructed between 2 and 5 p. m. June 25, with the usual neck but the latter not so large as usual. This cell remained empty and open during the night following but was filled the next day and closed about 6 p. m. On June 27 at 8.40 a. m., the female began a sixth cell above and against cell 5; all six cells are in a single row against the wooden joist, side to side. Cell 6 was completed by 10 a. m. (at least; not actual time). At 3.30 p. m. June 28, cell 6 was found to have been recently closed and a seventh cell partly constructed beside and against it. When completed, this cell had no rimming at all about the entrance. It was left open during the night though it contained at least one caterpillar; the wasp was not on or near the nest at 10 p. m. and evidently spends the night elsewhere. At 2 p. m. June 29, the seventh cell was found to have been closed (since 1 p. m.) and an eighth begun above it and against the joist, as with the others. This cell was completed by 3.30 p. m. or sooner and had no rimmed entrance. By 4.40 p. m. it was full but nevertheless was left open during the following night (the wasp being absent). During the following morning it was closed; unlike the *Sceliphron*, this wasp does not close its partly filled cells before leaving the nest for the night; the day of June 30 was occupied in building a ninth cell which was stocked and closed by 6 p. m. (at 4.30 p. m. it had only been partly stocked); this cell was against and above cell 8. July 1, the mother wasp continued building whenever the rain ceased, completing a tenth cell above and against cell nine; she commenced to work at about 8.30 a. m.; cell 10 was completed at about 3.30 p. m.; it had no rim about the entrance. It remained open (and empty) during the night and was filled during the morning of July 2 and closed at 10.45 a. m. After this, the female wasp daubed pellets of mud over the nest for a short while and then began an eleventh cell above the tenth and still in the same place; this cell was finished at about 1 p. m. and though partly filled during the afternoon it was left open the following night (with untoward consequences as we shall see). At 8.30 a. m. July 3, the open eleventh cell was found to have been invaded by ants (this doubtless explains why *Sceliphron cementarius* closes its partly filled cells at night,

reopening them the next morning) which were attacking the inclosed caterpillars; shortly, the wasp arrived at the nest (I did not see her behavior upon arrival), closing the entrance of the cell at once (hardly, I think saving its contents, because some of the ants were most probably shut in and would be quite capable of destroying what was left) and then daubing pellets of mud over the line of cells, continuing this up to noon (thus this disturbance by ants, at once stimulated the instinct of self preservation; the wasp discontinued her building operations at once and made efforts to insure the safety of the progeny already provided for) and through the afternoon up to 5.30 p. m., July 4, as early as 8.30 a. m., the mother wasp was at work, continuing to cover the „flat“ row of cells with earth until noon.

At this time, I distinctly saw her make two trips to a spot beneath the verandah and gather dry earth, applying it each time to a dry place on the nest; yet when these spots were examined after the female left, they were wet and pliable and therefore the female must use some sort of saliva. Consequently, I went below to the spot which she was visiting and saw her make six successive trips to it; after each trip, I examined the exact spot from which she had been gathering and at each place there was a small round concavity made by the mandibles perfectly wet. But, under each of these it was dry and afterward I dug up with my knife all the earth near the spot and under it without encountering moisture above the depth of two inches; the nature of the earth was sandy. The wasp was gathering sand from one little area which had become a grooved semicircle. Within an area of several square feet at this place were many of these shallow cavities, most of them quite irregularly situated but at this time this wasp was visiting one particular spot where her gathering operations had formed one of these cavities as noted, a shallow groove, crescentic in shape and resembling one which would be formed by drawing the tip of the middle finger gently over the sandy ground for a short distance and semicircularly. When the wasp was away at the nest, after her second trip during this observation, I obliterated the individual, small pits making up the grooved semicircle (and made by the mandibles at each gathering) by gently drawing the tip of a finger through them; when she returned her actions denoted that she sensed a difference — she hesitated and turned aside several times before finding the spot; this was repeated on her sixth return, immediately before which I had excavated the groove down to some distance with a knife. This did not disturb her much, however, as after a few seconds she gathered the pellet of sand from one edge of the little excavation. Hence, this species has developed a habit of using her own saliva for the purpose of wetting the pellets of earth used in building operations, an extremely useful adaptation in a country where (at least before the white man's settlement) much time may elapse at one particular spot before a suitable mudhole could be found or elsewhere it would be necessary to restrict reproduction to the vicinity of permanent watercourses.

This mother wasp continued to daub over her nest with earth pellets for a while in the afternoon but left later; she was still visiting the dry spot beneath the verandah (a soft muddy spot was not thirty feet away in the roadway). At 11 a. m., July 6 she returned and daubed the nest cluster for a short while, soon leaving. It was not seen again until 11.30 a. m., July 9, when the nest was daubed intermittently for an hour or two.

I was absent until July 31. I was informed that the nest remained unchanged until the day before my return when the nest had been broken off. On the morning of July 31 I found that the eight upper cells had fallen to the floor of the verandah in one piece; these cells were empty but all were lined with silk, showing that they had contained grown larvae; this was probably the work of some bird. I removed the remaining three cells (1, 2 and 3), all of which contained pupae, enclosed within stiff but very thin, white cocoons; the pupa of cell 1 was colored considerably, the others pale. The adult of cell 1 emerged on August 6 at noon; by this date, the two other pupae were more colored and fully so on August 12, emerging on August 14, 1912.

The following significant facts were observed.

(1). Variation in the situation, arrangement and form of the cells is usual and common.

(2). The mother wasp has not learned that a partly filled cell left open during the night is a source of danger; at any rate, that it would be more economical to close it, even if the egg is not placed in first.

(3). She has learned, however, economy in the use of building materials; thus by using her own saliva, she is able to utilize, for a time at least, dry earth and in an emergency is not dependent upon a water-supply. Also, though this same adaptation, a wider range is made possible.

(4). This wasp has adapted itself to human associations, where water is nearly always to be found.

(5). The life-cycle occupied fifty-two days (average of three cases).

(6). Her actions denoted, as far as could be judged, unconscious instinct rather than deliberate intelligence.

Kleinere Original-Beiträge,

Ueber das massenhafte Auftreten von *Coccinella quinquepunctata* L.

In Heft 10 des IX. Bandes der „Zeitschr. f. wiss. Insektenbiol.“, Jahrg. 1913, S. 311, befindet sich eine Notiz von Herrn Prof. Werner-Wien, betitelt: „Massenansammlung von *Coccinella*“.

Der Verfasser dieser Mitteilung beobachtete im August 1901 auf dem Gipfel des Bithynischen Olympos Tausende von Exemplaren von *Coccinella septempunctata* L. in einem lethargischen Zustande, welchen Zustand er auf die niedere Temperatur, die auf diesem Gipfel herrschte, bezog. — Gleichzeitig führt er noch eine in Kalifornien gemachte Beobachtung von einem Massenauftreten der amerikanischen *Coccinella convergens* F. an.

Eine ähnliche Beobachtung hatte ich Gelegenheit im Jahre 1912 zu machen. Im Herbst jenes Jahres erschienen ungeheure, man möchte fast sagen unglaubliche Mengen von *Coccinella quinquepunctata* L. an der ganzen Samländischen Küste.

Sie sassen auf Wegen und Stegen, im Walde und im Freien, überall, und bildeten für die Badegäste der zahlreichen Seebadeorte dortselbst, weil sie in die Wohnungen und Kleidungsstücke eindringen, geradezu eine Landplage. Zu Hunderttausenden wurden sie von den Winden ins Meer geweht und dann von den Wellen wieder ans Ufer geworfen, wo sie dann, halberstarrt, klumpenweise an Steinen, Holzstücken und Pflanzensängeln angeklammert sassen. In Mengen gingen dann diese Tiere zu Grunde, indem sie zu Hunderten überfahren und zertraten wurden. Das Auftreten besonderer Feinde dieser Käfer habe ich damals nicht feststellen können.



Aufgen. am 3. IX. 1912 bei Trockenhorn am Spiedingsee von meiner Tochter Erika v. Sancken.

Dieselbe Beobachtung machte ich dann auch noch an den Ufern des Spiedingsees, wo diese Coccinelliden zu derselben Zeit und in derselben Menge zu finden waren, und ebenso wie an der See, so auch an den Ufern dieses grossen Binnengewässers in der Uferzone jeden festen Gegenstand, dicht aneinander gedrängt, bedeckten: Siehe Bild. (Vergleiche auch: Hilbert, Eine naturwissenschaftliche Wanderung um den Spiedingsee. 37. Bericht d. Westpreuss. Bot.-Zool. Vereins, Danzig 1913, S. 68.)

Worauf diese plötzliche und unmässige Entwicklung dieser Käferart beruht, ist unklar: an einer besonders starken Entwicklung der Blattläuse, also an zu reichlicher Nahrung, lag es sicher nicht, da von einer solchen nichts zu bemerken war. Abnorme Witterungsverhältnisse bestanden gleichfalls nicht, abgesehen davon, dass der Sommer des Jahres 1912 regenreicher war als dieses durchschnittlich der Fall zu sein pflegt: übrigens ein Umstand, der für das Insektenleben durchaus nicht als fördernd betrachtet werden kann.

So entzieht sich dieses auffallende Phänomen demnach zur Zeit völlig unserer Beurteilung.

Dr. med. R. Hilbert (Sensburg a. d. Schloss).

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