

Notes on the Habits of the Cockroach-Hunting Wasps of the
Genus *Ampulex*, Sens. Lat., With Particular Reference to
Ampulex (Rhinopsis) caniculatus Say

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(Presented at the meeting of September 6, 1928)

Nearly 200 years ago Réamur, the celebrated French scientist, in his "Memoires pour servir a l'Histoire des Insectes," VI, pp. 280-284, 1742, described the "Guêpe Ichneumon," later known as *Ampulex compressa* (Fabricius) a splendid metallic blue wasp, attaining a length of nearly an inch, and that inhabits portions of Asia, Africa and some of the larger islands of the Indian ocean. It is the oldest known species of the family Ampulicidae. Réamur relates the observations of a certain M. Cossigni on the habits of this wasp, as noted in Mauritius (Île de France). The "Guêpe Ichneumon" boldly enters houses and searches among the folds of the window curtains and other places likely to conceal a "Kakkerlac" or cockroach*; when one of these blattids is found the wasp dashes at it and, seizing the anterior part in its mandibles incapacitates it by stinging it on the underside of the body. Subsequently the roach is pulled to a hole—in this case in a wall—and into which *Ampulex* endeavors to drag it; if failing this, because of the excessive bulk of the prey, the wasp reduces its dimensions by cutting off the wing covers and, if needs be, tears off a limb or two. Thus the roach is stored as provender for a future wasp generation.

From time to time, data on the habits of *Ampulex compressa* appear in literature. H. Lucas (Bull. Soc. Ent. France, 1879, p. CLIX) refers to the cocoon of *Ampulex*, presumably *compressa* from New Caledonia, as encased in the remains of "*Blatta americana*". Bingham, C. T., (Fauna of British India, Hymenoptera, I, pp. 253-254, 1897) says in part: "In Burma I have frequently seen these wasps come into the house and search for their prey under boxes and furniture." This insect is well known in India and Maxwell-Lefroy in his book entitled: "Indian Insect Life,"

* This wasp appears to restrict itself to the genus *Periplaneta*, which includes some of our largest and most objectionable of household cockroaches.

pp. 207-208, speaks of it as follows: "*Ampulex compressa* Fabr. is a very beautiful insect, common in the plains. In Pusa this insect is purely arboreal in its habitat. The chief haunts are the trunks of old Peepul (*Ficus religiosa*) and fig trees, which possess numerous holes and chinks. It is not an uncommon sight to see an Ampulex hurrying along the tree trunk searching hole after hole for cockroaches and occasionally flying to a distant branch only to return and continue the search in a few seconds. As far as observed this species confines itself exclusively to species of *Periplaneta* for its prey . . ."

Referring to the biology of other species of Ampulex, Sonnerat in his "Voyage a la Nouvelle Guinée," pp. 20-24, pl. 12, 1776, Paris, writes of the habits of an Ampulex, later named in his honor as *A. sonnerati* Kohl, in the suburbs of Manila, Luzon, Philippines. This brilliant insect which he refers to as "La Mouche Bleue" (the blue fly) is about 15 millimeters or 3/5 of an inch long and was observed attacking a "Kakkerlac" over an inch long, among the ruins of a church. The roach was stung to partial paralysis, dragged into a crevice, which was then stoppered up with dirt carried thereto in the wasp's mandibles.

On the testimony of Dr. D. Sharp (Cambridge Natural History of Insects, pt. 2, pp. 114-115, 1901) Perkins gives a brief sketch on the habits of *Ampulex siberica*, now referred to as *Ampulex compressiventris* Guer. In West Africa this species enters apartments in search of cockroaches which it overcomes and stores in some convenient place, such as a keyhole. The dead bodies of cockroaches have been found with the cocoon of the wasp protruding from them.

A very readable account of the habits of *Ampulex assimilis* Kohl is given by R. W. G. Hingston in "Nature at the Desert's Edge," pp. 29-54, 1925, London. This shining blue wasp which is about 3/4 of an inch long was observed searching the trunks of date palms about Bagdad, Turkey, for the wingless female of a particular species of roach known as *Shelfordella tartara* Sauss. and which it stores and parasitizes in some convenient hole in the palm trunks.

There are a number of species of these often strikingly metallic blue or green wasps scattered over the tropics of both hemispheres. Usually, however, they are considered rare insects and this seems

particularly true of those inhabiting temperate regions where likewise endemic Blattidae are not prominent. In the Gibraltar region in the south of Spain *Ampulex (Rhinopsis) ruficollis* Cameron, small, black and with a reddish thorax, is found, while sparse over Middle and Southern Europe we find *Ampulex (Rhinopsis) fasciatus* Jurine, 7-9 millimeters long and polished black. F. Picard (Bull. Soc. Ent. France, pp. 113-116, 2 figs., 1911) regards *Ampulex fasciatus* as the most graceful of the European sphegid wasps and gives some account of its habits. In examining some stems of brambles gathered near Montpellier, southern France, he found in one of these stems five cocoons in a large gallery, excavated probably by one of the solitary bees. The polished brown cocoon of *A. fasciatus* was drawn out nipple-like at either end and was enclosed in a very loose silken cocoon, the whole being enveloped by the hollowed out body of a cockroach, *Ectobia livida* (Fabr.) upon which the wasp grub had fed. Several of these cocoons produced adult wasps. Hence *A. fasciatus* uses the deserted tunnels of other insects, stores them with *Ectobia* roaches and stoppers up the cells with debris of sorts, as shown by J. Giraud (Verhandlungen der K. K. Zool-bot Gesellschaft in Wien, 1858) and which debris it carries in its mandibles. Later, Picard (Ann. des Epiphyties, pp. 1-144, 1919) found it utilizing the borings of insects in fig trees.

This rare European wasp is well figured by L. Berland in his excellent *Hymenoptères Vespiformes*, I (Faune de France 10), p. 3, fig. 101, 1925.

Aside from their proper nesting activities there are at least two of the smaller Indian *Ampulex* of duller coloration, *Ampulex (Rhinopsis) ruficornis* Cam. and *R. constanciae* Cam., that show an association with *Sima rufo-nigra* Jer., a slender, fiercely stinging arboreal ant of the Myrmicinae and which these wasps as well as a mimicking spider greatly resemble and with which they safely mingle. (See Rothney, G. A. J., Trans. Ent. Soc. London, p. 354, 1889, and p. 113, 1903.) The larger, shining blue *Ampulex compressa* on the other hand is on different terms with these ants for, to quote Rothney (l. c. p. 113, 1903): "I have found it occasionally in this situation busily engaged with the workers of *Sima rufo-nigra*, picking them up with its mandibles and tossing them off a tree, but with a sporting air rather than any serious or deadly pur-

pose, for the ants were never in the least injured." Previously the same observer noted this wasp carrying on with the ants on a wholesale scale. (*Ent. Mo. Mag.*, XIII, 87-88, 1876.)

AMPULEX IN THE UNITED STATES

Thomas Say (*Western Quarterly Reporter*, Cincinnati, II, p. 76, 1823) described *Rhinopsis caniculatus* (*Ampulex caniculata*) from Missouri. It seems pretty generally distributed in the United States east of the Mississippi and ranges into Canada. *Rhinopsis melanognathus* Rohwer (*Proc. U. S. National Museum*, 41, p. 464, 1912) described as a female, has proved upon subsequent examination at my request by government entomologists to be a male specimen and, as its description agrees sufficiently well with reared Missouri male *R. caniculatus*, I think it had best be regarded as a synonym of that species.

During the greater part of the summer of 1928, the writer was located at the United States Entomological Laboratory, at Webster Groves, Missouri, where he was rearing a certain egg parasite for the Experiment Station of the Hawaiian Sugar Planters' Association, Honolulu, Hawaii. Facilities for this work were kindly extended him by Mr. A. F. Satterthwait, government entomologist in charge of the laboratory, and in addition, his excellent library and experience were at his disposal, and for all of which the writer is extremely grateful.

The particular individual of *Rhinopsis caniculatus* (Say), whose activities of thirty-five days as a captive in a preserves jar furnished the chief materials for this paper, and that was the only specimen of this species captured at large by the writer, was thus discovered on the bright morning of June 12, at Webster Groves, an attractive tree-dotted suburb of St. Louis. While returning from a downtown breakfast, he observed a wasp half hopping and half flying, in rather swift progress, along a cement garden walk; it was immediately recognized as a rare and desirable insect that, however, soon took cognizance of his intentions and, ant-like, sought refuge in a narrow but extensive cavity alongside the cement. A brief, though none too hopeful watch over the spot where she had disappeared was rewarded by her reappearance; seemingly incapable of a decent take-off while on the level ground, a metal pill box was now readily clapped over her, a piece of paper slipped underneath

and the prize brought to the laboratory. A wide-mouthed jar was provided with some native cockroaches, dead leaves, pieces of bark and a cell or two fashioned of clay, to encourage nesting activities, and the wasp introduced. The arrangements, however, did not prove very satisfactory and, while *Rhinopsis* attacked more than one cockroach, none was stored nor parasitized. Furthermore, a larger wild roach of a species apparently not favored by the wasp and famished it seemed almost to a frenzy by long isolation in a bare test-tube, savagely pursued and sought to devour a smaller roach (*Parcoblatta virginica* [Brunner]) that had been somewhat

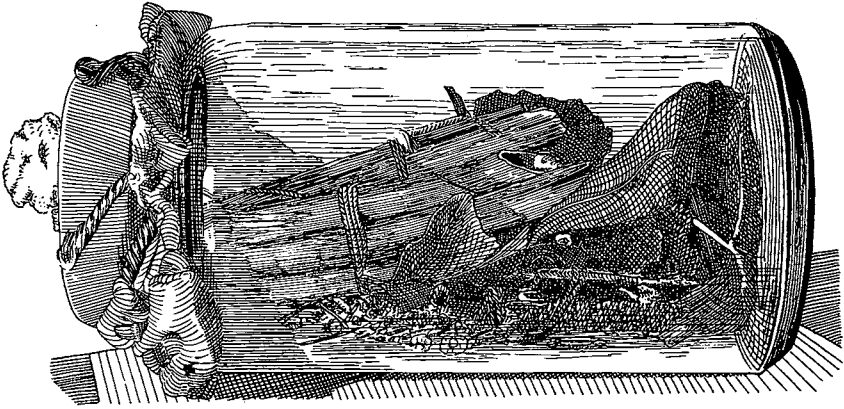


FIG. 1. In this one-quart jar *Rhinopsis caviculatus* lived for 35 days and during that time parasitized about 50 wood roaches. Drawn from a photograph by R. C. Lange.

incapacitated by the wasp's sting. Hence, a quart preserves jar was substituted for the smaller receptacle and supplied only with *Parcoblatta virginica* secured from beneath debris among the trees, and with dead leaves were placed short lengths of hollowed out twigs of elderberry (*Sambucus*) stoppered at one end, and finer materials such as leaf fragments and bits of pith and cork, and finally, two little slabs of bark so tied together as to leave but a narrow space intervening, completed the wasp's domicile and hunting grounds. Drops of honey served as food for Mrs. *Rhinopsis*, while bread, portions of vegetables, banana peeling, sweetened water, etc., were offered the roaches, although it did not prevent them from taking an occasional nip at one another. The jar, the mouth of which was covered with cheesecloth perforated in the center for a plug of

cotton, was placed on its side on the table in the laboratory and kept from rolling about (Fig. 1). Occasionally, however, when the weather seemed too warm it was left in the basement overnight and for a time there during some afternoons. It remained, until the death of the principal actress on July 18, a continuous source of interest for the observer but, one might conclude from the oft-repeated actions of the wasp within such narrow confines and unchanging scenes, a rather drab existence for the insect!

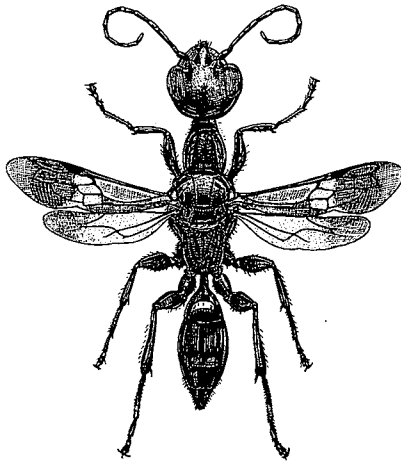


FIG. 2. *Rhinopsis caniculatus*, female, X 5

We find in *Rhinopsis caniculatus* (Fig. 2) a wasp of graceful proportions, the female, which is the larger, sometimes attaining a length of about 12 millimeters or nearly half an inch; the head and body are black, the abdomen being highly polished; the mouth parts, antennae and legs in part reddish brown, while the rather short wings are banded by a dusky shade with the effect of leaving a middle area in the forewings of a contrasting transparency. The large head is borne on an elongate neck-like prothorax typical of the Ampulicidae and is provided with long slender mandibles, curved, very pointed and with a sharp inner edge. Both the mandibles and the clypeus (Figs. 3 and 4) are best developed in the female, for she has much need of them in her work with the cockroaches that constitute her prey. She operates her needle-tipped jaws with great precision and combines their use with the toothed, beak-like clypeus and the labrum at its tip, and can secure thereby

a very firm grip on a cockroach. The abdomen is joined to the thorax by a slim pedicel and is quite flexible, being capable of much extension and bending, as takes place when the female with her long sting seeks a vulnerable spot in the body of her victim. The clypeus of the male (Fig. 5) has no lateral teeth and the mandibles have an inner notch-like tooth before their apex.

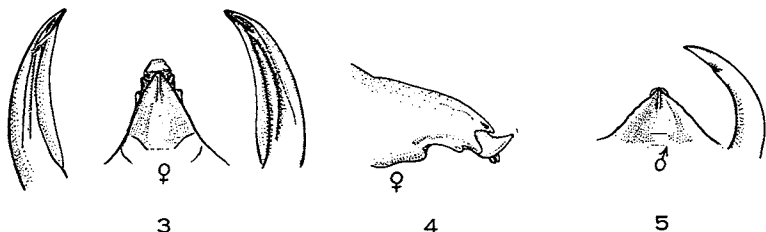


FIG. 3. *Rhinopsis caniculatus*, female; mandibles, clypeus and labrum as seen from above. Greatly enlarged.

FIG. 4. *Rhinopsis caniculatus*, female; clypeus and labrum as seen from the side. Greatly enlarged.

FIG. 5. *Rhinopsis caniculatus*, male; mandible, clypeus and labrum as seen from above. Greatly enlarged.

The European *Rhinopsis fasciatus* Jurine is of nearly the same size and appearance as our *Rhinopsis caniculatus* (Say) and seems to have very similar habits.

Parcoblatta virginica (Brunner), is one of our common wood roaches and the natural prey of *Rhinopsis caniculatus*. It has a wide range over the eastern half of the United States and is of about the same size as our smaller house roaches, but the sexes differ greatly in appearance and were in fact once regarded as separate species; the male is long-winged and uniform pale brownish yellow, while the female is darker brown and quite incapable of flight owing to her very short wings that overlie the base of the abdomen. The length of the body in the male is about 11.5 to 15.4 millimeters and that of the more stoutly made female 10.3 to 12.5 millimeters; hence averaging longer than *Rhinopsis* and far bulkier than that wasp. It was found rather abundantly in and about Webster Groves, occurring under piles of debris, boards, stones, bark, in rotten wood, and along with other wood roaches, at trees sugared for moths. It passes the winter as a young cockroach beneath logs or other debris and reaches full growth in spring.

Mrs. *Rhinopsis* soon became accustomed to her cramped quar-

ters and, being more given to proceeding afoot than to flying, gave you the impression of fair contentment; she did not dash about and seldom scaled the glass sides, as would many other wasps to the contrary, in a vain attempt to escape; rather she crept about in an exploring manner, she paused, cleaned her antennae, or other parts, fed at the drops of honey or at last became involved with a cockroach. Several attacks by *Rhinopsis* on her prey were carefully observed at close range and the first of these may be described as follows: Early in the afternoon of July 12, the huntress encountered a desirable cockroach—the disturbed blattid penetrated a short distance between the two pieces of bark; the wasp with its fore part well raised and showing no haste, approached her victim, striving always nearly to face it; thus the uneasy roach was forced to turn from side to side or to describe circle after circle; the wasp, cool, alert and apparently sure of her quarry, always coming up alongside so that almost their legs intermingled and the wasp, her face very close to that of the other, seemed anxious to pick a quarrel, the roach avoiding her by rather jerky turnings. Probably *Rhinopsis* was trying to secure a hold on the base of the antennae. This uncanny procedure lasted several minutes when finally, the roach becoming weary of revolving constantly, set forth in the open; hardly had she ventured out when quick as light and unerringly, the wasp seized her; there followed a violent though very brief struggle on the part of the roach, for a sting under the soft part of the thorax quieted her. *Rhinopsis* had seized the roach by the side of the thorax right behind the head, the toothed clypeus protruding over and clamping down upon the top of the thorax, the sharp jaws dug into the membrane under the edge of this plate, her two forelegs grasped the thorax, while the other four rested on the lower slab of bark; the long polished abdomen, parallel with underside of her own body, and slender and flexible, its glistening apex feeling about the soft underside, stung her victim between the pairs of legs and then in the throat, and again a little later on, rather forward under the thorax (Fig. 6).

One familiar with the method of attack on the leafhoppers by dryinid wasps is immediately struck by their similarity in this respect to the ampulicid, and indeed much resemblance in form exists between wasps of these two families; the Australian genus *Aphelotoma* being particularly suggestive of a dryinid. The

stealthy manner of *Rhinopsis* is in strong contrast to that of *Dolichurus*, her relative, and that madly pursues the racing blattid.

Several other encounters were witnessed and in all of these the wasp's crafty approach was followed by a swift leap upon her prey as soon as the latter got in motion. Here is another scene: In the middle of the morning, *Rhinopsis* discovered a cockroach in a narrow space between the glass and a leaf; when their investigat-

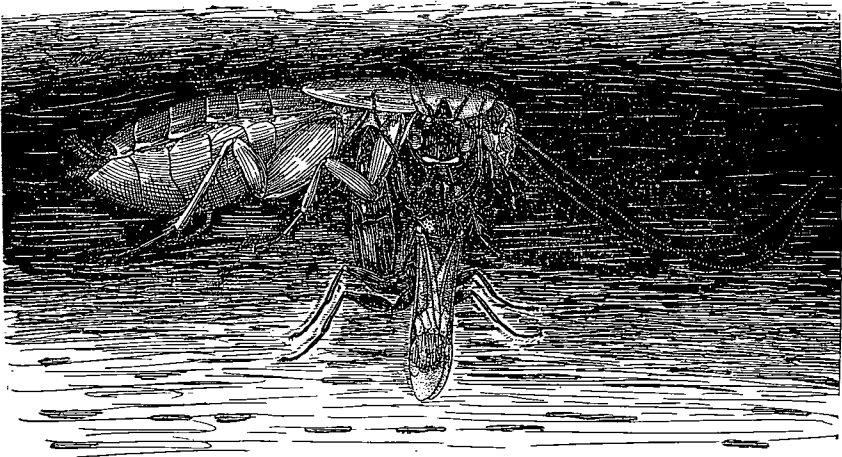


FIG. 6. *Rhinopsis caniculatus* attacking the wood cockroach, *Parcoblatta virginica*. In this grim act we see the cockroach along the edge of a shallow crevice, while the slim though powerful wasp has secured a firm hold along the thin edge of its thorax, by means of its toothed beak-like clypeus and its terminal labrum above and the needle-pointed jaws that sink into the softer tissues beneath; the wasp's telescopic abdomen is extended and the sting directed into the unprotected ventral portion between the two posterior pairs of legs, to administer the paralyzing thrust, X 5.

ing antennae touched, the wasp drew back her own and stood immovable; the blattid, however, soon becoming restless started to move off, but the wasp followed her and, executing an unerring leap of some millimeters, grasped her by one short wing pad so that in the ensuing struggle it was bent back upon the body; she finally quieted the blattid with her sting and pulled her up by the wing pad, the poor creature now hanging limp and in huddled fashion like some drunkard being led off by the shoulder. She stung it again and quite at length under the throat, leaving the sting imbedded there for a minute or more as one might use a

hypodermic needle. Then *Rhinopsis*, grasping her dazed victim by the base of one antenna drew this antenna through the tips of her jaws for perhaps a quarter of its length when, tightening her grip, as shown by her downbent head, exerted a pull so that the feeler was cut off at that point, and then the second antenna was similarly trimmed, the long severed portions being left where they fell. Immediately thereafter she drew the stumpy antennae of her victim through her jaws and paused at their tips so that it soon became evident that she was sucking the wounded stumps; both antennae were thus tapped more than once, and we are reminded here that many wasps suck at the wounds or mutilations they inflict upon their hosts. This procedure is invariable, although a delay may ensue before it is accomplished; the task demands some exertion on the part of the wasp, and her passively resisting victim, head pulled forward so that the neck membrane may show broadly, often winces as her sensitive and useful organs are thus severed.

Then, sometimes face to face with her victim, *Rhinopsis* may cleanse herself—an oft-repeated operation—she is very particular about her antennae, brushing them often simultaneously with downward sweeps of her forepaws, the palps and cheeks are also cleaned and the abdomen brushed with the hind legs. The forepaws are cleaned by passing them between her mandibles. At other times and less frequently, she sharpens her teeth by rapidly nipping at the edge of the bark slab, and calling to mind thereby, the business-like manner in which a cat sharpens her claws. Such operations, as well as resting, feeding and wandering about, are so interposed in her nesting activities that she may be a long time in putting away a cockroach. Probably, however, the maturation of the eggs within her body largely regulates the amount and speed of her work.

The roach victim, shorn of the greater length of her antennae, recovers considerably from her paralysis so that we can urge her to make a short run. Always on her feet, she clings to or rests quite naturally upon a leaf or other object, quietly awaiting the deadly plans of her mistress that, being in no particular haste may leave the paralytic in place for some time. But sooner or later *Rhinopsis* approaches her prize and, grasping the extreme base of one of the sensitive antennae in the tips of her mandibles pulls* or rather

* The roach resists more if the antenna is grasped far from its base.

leads it away to what is presumed to be a safe place until a proper nest hole is discovered. Many such holes are available in the bundle of hollowed-out elderberry twigs and these immediately attract her; she enters several and finally selects one. Now she returns to the roach which, having recovered yet more from the effect of the stings, may require another jab to render it more tractable; she examines it, returns to her chosen tube, then to her victim which she grasps by the base of one antenna and, walking backwards conveys it, after several stops to examine the tube, and perhaps with much difficulty with this heavy passively resisting burden, to the mouth of the tube which she now enters. She reappears directly, issues usually part way and again in the same manner grasps her prey

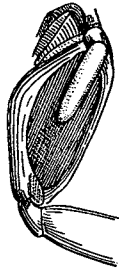


FIG. 7. *Rhinopsis caniculatus*. Egg glued on the base or coxal portion of one of the middle legs of the wood cockroach (*Parcoblatta virginica*). Greatly enlarged.

and backs inside with it. Here she remains for a short time—in nine observations, varying from approximately one and one-half to a little more than three minutes—during this period she has glued a polished, glassy white egg along the broad basal portion or coxa of one of the middle pairs of legs of the cockroach (Fig. 7). Now issuing head first from the tube, her first act is to clean herself, then, after a final peek at her victim she briskly sets to work filling up the tube, availing herself of the debris placed in the jar for that purpose. She seizes bits of pith, cork or fragments of dry leaves in her mandibles and runs into the tube with them; certain of the pieces are too large to be forced within and so after one or more trials they are discarded. Some of her actions in this regard almost suggest intelligence, others, however, appear to refute its existence in her. Sometimes she will fit a sliver of debris in a narrow space alongside a huge piece, or she may at last by procur-

ing a different grip, force in lengthwise a piece that she had been trying vainly to insert crosswise past an inadequate entrance. *Rhinopsis* exhibits great strength and speed in her work and frequently emits a squeaky buzz when striving to pack materials tightly in the tunnel, which finally is stuffed almost to overflowing.

On splitting open one of these stored elderberry twigs we will find the roach hemmed in by the debris packing but quite active, so that if freed it will run off a short distance and can only with

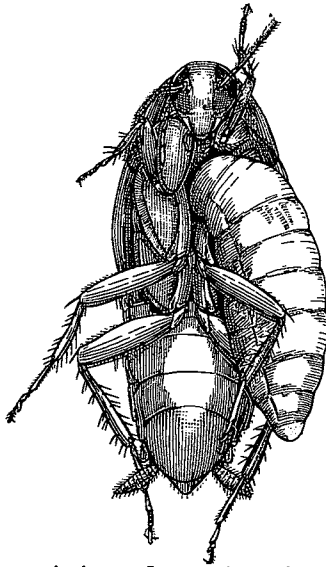


FIG. 8. *Rhinopsis caniculatus*. Larva about three-quarters grown, feeding with its head and thorax inserted into the body of the wood cockroach (*Parcoblatta virginica*), X 5.

considerable trouble be replaced in its cell. The delicate egg, glued in a position difficult of displacement, is practically straight, with its thicker, head end lying at the base of the roach's coxa; it was not measured but seemed less than 2 millimeters long. It hatches in between 2 or 3 days (in one case observed), the wasp grub occupying the position of the egg, and the nourishment that it sucks through the membrane of its host soon shows as a yellowish area along the middle line of the body. It increases rapidly in size, moults two or more times, and becomes more clearly segmented. Feeding at first externally on the cockroach it finally penetrates its tissues, inserting head and thorax within the body (Fig. 8).

Now we can perceive a regular streamlike motion of its darker gut, the current proceeding now forwards and now backwards. The grub's fore part may be seen within the roach, the head with active jaws perhaps within the base of one of the legs. Farther and farther it penetrates and now, fully half of the whitish body is within that of its prey of which the anterior portion has already been eaten out shell-like, and at last we see the grub after approximately five days of feeding, lying on its back in the midst of the hollowed

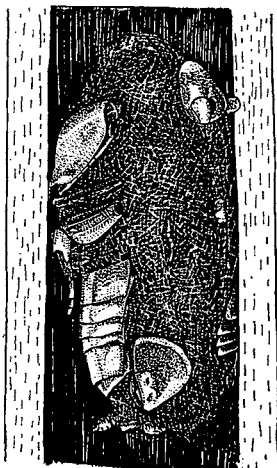


FIG. 9. *Rhinopsis caniculatus*. Loose outer or silk-spun portion of cocoon partly enveloped in the chitinized remains of its cockroach prey, in a hollow elderberry twig, X 5.

and often somewhat disordered remains among which it has already spun a few strands of silk as part of a superstructure for the cocoon of which there will be a loose, pale brown, cottony outer envelope clearly of silk (Fig. 9) and an inner, thin, smooth and brittle, parchment-like cask of rich, deep brown color and that is drawn out funnel-form at either extremity (Fig. 10). The tips of these funnels are open, but nearer their base are stoppered with a fine, straw-like material, and then by a more solid mass overlaid with a little silk. The broader end of this cask is the head end and is the one usually lying in the abdominal extremity of the cockroach skeleton.

Very likely *Rhinopsis*, after the manner of most solitary stinging wasps, passes the winter as a fullgrown resting larva within

the cocoon and at the approach of warm weather transforms into a pupa and ten days or a fortnight thereafter, emerges as a mature insect; in addition to this overwintering brood there is at least one and perhaps two summer broods. The wasp that for thirty-five days was confined in the quart jar, parasitized 50 or more *Parcoblatta* roaches and of which at least 43 produced wasps. On July 17 or thereabouts, a male issued from a cell stored June 14, the mother surviving this, her firstborn, but a day. Other emergences followed,



FIG. 10. *Rhinopsis caniculatus*. Inner papery cask of cocoon. The thicker end is the head end, X 5.

of which the last half dozen or so were males—quarrelsome fellows that fought with their strong mandibles. The stored elderberry twig sections were brought to Honolulu, arriving there on July 31, and wasps continued to issue until the last of August or first of September. During August, seven males and eight females were turned loose on the outskirts of Honolulu; we hardly expect them to become established as they are insects accustomed to a different climate and environment than ours, although they successfully attacked and parasitized *Loboptera sakalava* (Sauss.) a pale-margined, short-winged little cockroach that is almost everywhere abundant out-of-doors in Hawaii. One or two wasps were thus reared.

The operations of *Rhinopsis caniculatus* as described, were observed under rather artificial though very favorable conditions, since it is probably unusual that she could rear so large a family in her natural environment where enemies are present, the weather sometimes unfavorable, and the prey scattered and rather difficult

to capture. She is probably mainly arboreal or at least addicted to exploring old fallen timber in her search for the blattid.

While in captivity she stung and trimmed the antennae of many more cockroaches than she stored and parasitized, and she was not seen to attack the longwinged males. Occasionally at night time, the electric light would bring her out of her tube or other sleeping retreat and induce her to work as in the daylight.

From our scant knowledge of the habits of the family Ampulicidae it does not appear that *Ampulex assimilis*, *compressa* or *sonnerati* cut short the antennae of their victims; as far as known the egg is always glued along the lower or anterior face of one of the middle coxae. The cocoons sometimes vary in form even within the broad genus *Ampulex**; in the closely related black *Rhinopsis caniculatus* and *fasciatus* the casks are drawn out nipple-like at either extremity, while in the brilliantly metallic *Ampulex assimilis* and probably also in *compressa* they are rounded at the ends. In all of these species but little of the cockroach's skeleton is devoured and the cocoon is really encased in these remains—in contrast, the ampulicid *Dolichurus* consumes the greater part of this exoskeleton and, at least in the case of *D. stantoni* (Ashmead) spins a tough cocoon that is finished off at the head end by an open-work, globiform process.

In the sphecoid genera *Podium* and *Trigonopsis*, slender denizens of the American tropics and subtropics and of more or less mud-daubing habits, the cockroach prey, of which several individuals are usually placed within a single cell, is thus stored with the antennae quite uninjured, while the egg, as far as known, is affixed beneath one of the fore coxae.

*The genus *Rhinopsis* Westwood is separated from *Ampulex* Jurine by the possession in the former of only two cubital or submarginal cells in the forewings, whereas in *Ampulex* there are three cubital cells. However, Kohl (Ann. K. K. Naturhist. Hofmuseums, Bd. VIII, pt. 3, V. 4, 1893, p. 458) has pointed out that because of the occasional disappearance of the first transverse cubital vein in *Ampulex* even of the same species, there results in but two cubital cells and hence *Rhinopsis* is untenable as a genus.