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Proceedings of the American Academy of Arts and Sciences.

VOL. 56. No. 8.—JUNE, 1921.

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Received February 16, 1921.

Presented February 9, 1921.

ALTHOUGH the progress of myrmecology during the past twenty years has been so rapid that more seems to have been written on the subject during that period than throughout the nineteenth century, there are several problems that yield to solution very slowly and reluctantly. One of these is the ethology of the nomadic legionary, or army ants of the subfamily Dorylinæ, which possess worker, male and female forms so peculiarly specialized and diverse that they can be correlated with certainty only when captured in the same colony. The workers are rarely encountered, except when foraging and at seasons of the year when the brood is not well developed, the males are seldom seen, except at lights, and the huge wingless females are among the rarest of insects. Notwithstanding all these obstacles, considerable information has been gradually accumulated concerning the Ethiopian and Indian species of the genera *Dorylus* and *Ænictus* by Emery, Forel, Santschi, Brauns, Vosseler and others. Less progress has been made in the study of our American species, which belong to the genera *Eciton* and *Cheliomyrmex*.

Emery divides the former genus, which comprises more than a hundred described species, and ranges from Argentina to North Carolina, Missouri and Colorado, into three subgenera: *Eciton* sens. str., *Labidus* and *Acamatus*. The genus *Cheliomyrmex* contains only a few rare species, and ranges only from Brazil and British Guiana to tropical Mexico. While the females of certain species of *Labidus* and *Acamatus* are known, those of *Eciton* s. str., have been sought in vain for over half a century. During the summer of 1920, while I was working at the Tropical Laboratory of the New York Zoölogical Society at Kartabo, British Guiana, I was able to secure the female of *E. burchelli*, its males and those of *E. (A.) pilosum* Smith, and to make observations on the habits of these and several other species. As my first myrmecological paper, on some Texan *Ecitons*, was published just twenty years ago, and as I have not since had occasion to con-

¹ Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 183.

tribute much to our knowledge of the group, it seems advisable to begin with a brief resumé of what has been accomplished in correlating the various phases of *Eciton*, both in South and North America.

The following table gives a conspectus of the number of described species of the genus and the various subgenera and the number of known phases. It will be seen that of the 104 species described up to date, 38 are known only from worker specimens, 52 only from males and that we know both the worker and male of 8 and all three phases of only 6 species.

Subgenera	Total Number of Species	♀ Alone Known	♂ Alone Known	♀ and ♂ Alone Known	♀ ♀ and ♂ Known
<i>Eciton</i> sens. str.	12	5	3	3	1
<i>Labidus</i>	17	5	10	—	2
<i>Acamatus</i>	75	28	39	5	3
Total	104	38	52	8	6

The first female *Eciton* to be discovered was that of *E. (L.) coccum* Latr., and was described by Ernest André in 1885 from Mexico under the name of *Pseudodichthadia incerta*. The insect measured 25 mm. (gaster alone 20 mm.). Although *coccum* is a common species from Argentina to Texas a second female has not since been captured. Nine years later the Rev. Jerome Schmitt, O. S. B., took a female of *E. (A.) opacithorax* Emery at Belmont, North Carolina, and permitted me to publish a figure and description of it (1901). In 1900 and 1901 and during more recent years I have taken several females of this species and of *E. (A.) schmitti* Emery in the Southwestern States. Forel, while on a visit to North Carolina in 1899 captured the female of *E. (A.) carolinense* Emery, and Mr. W. T. Davis captured both the female and male of this species from a colony at Clayton, Georgia, in June 1909. I give below descriptions and figures of these specimens, which he generously presented to me. In 1918 Luederwaldt described and figured the female of *E. (L.) praedator* F. Smith from São Paulo, Brazil. It measured 33 mm. (head, thorax and petiole 7 mm., gaster 26 mm.). The female of *E. burchelli*, captured during the past summer, completes the list of known female Ecitons.

Although a number of male Ecitons were long ago described as species of *Labidus* by Jurine (1807), Lepeletier (1838), Shuckard (1840), Westwood (1842), Haldeman (1852), F. Smith (1859) and Cresson (1872), the first to find a male in the nest with the workers was Wilhelm Müller (1886). He identified the species which he studied at Blumenau, in the Province of Santa Catharina, Brazil, as *E. hamatum* Fabr., but it proved to be *burchelli* Westwood. Mayr in the same year described both the male and worker of *E. (A.) hetschkoi*, taken by Hetschko from a nest in the Province of Paraná, Brazil, and Emery, in 1896, described the males of *E. hamatum* and *quadriglume*. The former he seems to have determined by a process of exclusion, the latter was taken from the nest by Schmalz's sons in the Province of Santa Catharina. In 1900 Emery was able to recognize the males of *E. (A.) legionis* and *E. (L.) coccum*. In the same year and in 1901 I described the males of our North American *E. (A.) schmitti* Emery and *opacithorax* Emery. Forel described the male of *E. (L.) prae-dator* Smith in 1906, and in 1912 I took the male of *E. vagans* Olivier near San José, Costa Rica, accompanying a file of workers. Recently Gallardo (1915) has found that the workers of the Argentinian *E. (A.) spegazzinii* Emery are conspecific with the male previously described as *spinolæ* by Westwood, and Bruch (1916) has proved that the worker *E. (A.) nitens* Mayr is conspecific with the same author's male described as *strobili* on a preceding page of his paper published in 1868. The male of *E. (A.) pilosum* Smith, described below, which proves to be the same as *mexicanum* Smith, and the male of *E. (A.) carolinense* also described in this paper, complete the list of Ecitons in which the males have been definitively correlated with conspecific workers. Forel (1897) believes that his *E. (A.) antillarum* from Grenada may be the worker of *klugi* Shuckard from that island and St. Vincent, and it is very probable, as I have stated in a former paper (1908, p. 410) that *E. (L.) crassicornis* Smith is the worker of *esenbecki*, previously described by Westwood from a male specimen. I shall also give reasons for regarding *Labidus morosus* Smith as the male of *Cheliomyrmex nortoni* Mayr.

Eciton burchelli Westwood.

(Figs. 1-4, 5c, 6a-d.)

Among the various Ecitons which I observed at Kartabo, this was the most abundant and the most aggressive, and therefore the dominant species throughout the jungle. Scarcely a day passed that I

did not witness a foray of one of its enormous armies, which often came close to the laboratory and on one occasion actually entered the kitchen and would have overrun the building, had not the cook placed live coals in the path of the oncoming hosts. During the summer of 1919 an army actually took possession of the laboratory and bivouacked for several days in a corner of the storeroom. It is to this species that Beebe's two fascinating articles (1917, 1919) in the *Atlantic Monthly* refer. The forays seem to be most frequent during the rainy season. At any rate, during the latter part of August 1920, when the rains were becoming somewhat less frequent and copious, fewer armies were encountered in the jungle.

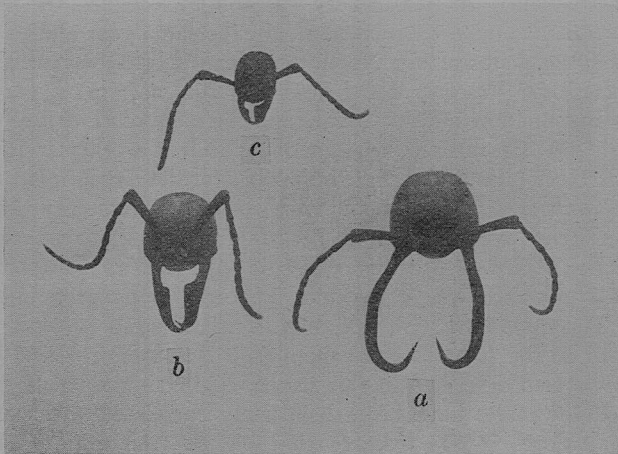


FIGURE 1. *Eciton burchelli* Westw. Heads of soldier (a), large worker (b) and small worker (c).

So many accurate and detailed accounts of the behavior of *burchelli* have been published by such accomplished observers as Bates (1863), Sumichrast (1868), Belt (1874) and Wilhelm Müller (1886) that I find little of interest to add. Three occurrences, however, mentioned by some of these authors are so striking and so regularly connected with the forays as to deserve long and careful study by some future student at the Tropical Laboratory. These are, first, the behavior of the chirping flock of ant-thrushes which accompany the fan-shaped van of the army and feed on the numerous insects and spiders, driven into the open by the feverishly ferreting workers; second, the swarms

of small flies of the Conopid genus *Stylogaster* and of the family Tachinidæ, which hover over the van, and third, the plundering of the larvæ and pupæ from the nests of the most diverse ants. The army that attempted to enter the kitchen had plundered all the nests of *Pheidole fallax* and of an allied species in the sandy yard of the laboratory and had temporarily stored the larvæ, pupæ and young callows in piles like handfuls of rice around the bases of the tall Javanese bamboo clumps. This army also attacked a flourishing colony of yellow wasps (*Polybia* sp.) in the wall of the kitchen, expelled the workers and carried off the brood.

The swarms of small flies above mentioned were regularly seen hovering from one to two feet above the advancing columns of ants. Bates (1863), who seems to have been the first to observe this singular phenomenon, says: "The armies of all *Ecitons* are accompanied by small swarms of a kind of two-winged fly, the females of which have a very long ovipositor, and which belongs to the genus *Stylogaster* (family Conopsidæ). These swarms hover with rapidly vibrating wings, at a height of a foot or less from the soil, and occasionally one of the flies darts with great quickness towards the ground. I found they were not occupied in transfixing ants, although they have a long needle-shaped proboscis, which suggests that conclusion, but most probably in depositing their eggs in the soft bodies of insects, which the ants were driving away from their hiding-places. These eggs would hatch after the ants had placed their booty in their hive as food for their young. If this supposition be correct, the *Stylogaster* would offer a case of parasitism of quite a novel kind." Townsend also gives an account of *Stylogaster*, which he observed in 1897 in the State of Vera Cruz: "Fifty-one specimens of this interesting genus were taken hovering over the front ranks of a moving army of ants, in a cafetal at Paso de Telayo, during the last hour or two of daylight on March 29. In company with them were numerous specimens of *Hyalomyia* and some other small tachinids. The ants have been determined by Mr. Theo. Pergande as *Eciton foreli* Mayr [= *burchelli* Westw.]... The column of ants was about 15 feet wide and 25 feet long, and moved slowly but surely through the cafetal, swarming rapidly over the thick covering of dead leaves, branches and other obstructions that strewed the ground under the coffee-trees. The specimens of *Stylogaster* hovered continually over the ants, now and again darting at them, without doubt for the purpose of ovipositing in their bodies. During the whole three months of my collecting in this locality, I saw not a single specimen of *Stylogaster* at any other

time, but on this occasion, during the short time that I had before dark overtook me, I succeeded in capturing fifty-five specimens, by sweeping closely with the net over the front ranks of the ants." Although I saw these flies on several occasions, accompanying the advancing armies of *burchelli* and darting at the ants or even at vacant parts of the ground, I could see nothing that convinced me that they were ovipositing. On one occasion I came upon a swarm of both sexes of *Stylogaster* hovering over a spot where there were no Ecitons, although a few workers of *Gigantiops destructor* and *Ectatomma ruidum* were running about in the vicinity. This observation and the fact that some species of *Stylogaster* occur in North America north of the range of *Eciton*, make it seem doubtful whether these flies are as intimately attached to the ants as some authors have supposed. They are, perhaps, attracted by the rank odor of the Ecitons.

On several occasions I followed prey-laden files of *burchelli* workers to their temporary nests under great logs, but was so severely stung and bitten when I attempted to make closer observations that I had to desist. On the morning of July 19 my son Ralph discovered a colony in a more favorable situation for study only a few hundred yards from the laboratory. The ants had selected a dead tree trunk about a yard in diameter, hollow but still standing. At its base there was a long narrow hole, nearly two feet high covered, except for a small opening near the ground, with a huge, inert mass of workers, dark brown and punctuated here and there with the ivory-white heads of the soldiers. Into the small opening below the cluster a dense file of workers was pouring, laden with prey of all kinds, including many larvæ of alien ants. After Mr. Tee Van had photographed the pendent cluster, I stirred it up with a stick, in the hope of finding the queen, but was attacked so viciously that I had to leave the premises. Returning the following day I found that the ants had all withdrawn into the roomy cavity of the tree trunk, leaving the long opening fully exposed to view. Through it the colony could be dimly seen in great masses draped on the walls of the cavity. Early in the morning of July 21st Mr. Alfred Emerson and I decided to smoke the ants out and, if possible, to secure their queen. We ringed the legs of two chairs with carbolated vaseline, planted them in front of the opening, crouched on their seats and with long tweezers placed in the bottom of the cavity a lot of moist bamboo leaves and paper. A match was applied and soon a dense smudge filled the cavity and even issued from cracks in the old wood at a height of nearly twenty feet from the ground. The ants remained quiet for some time, but when the smoke

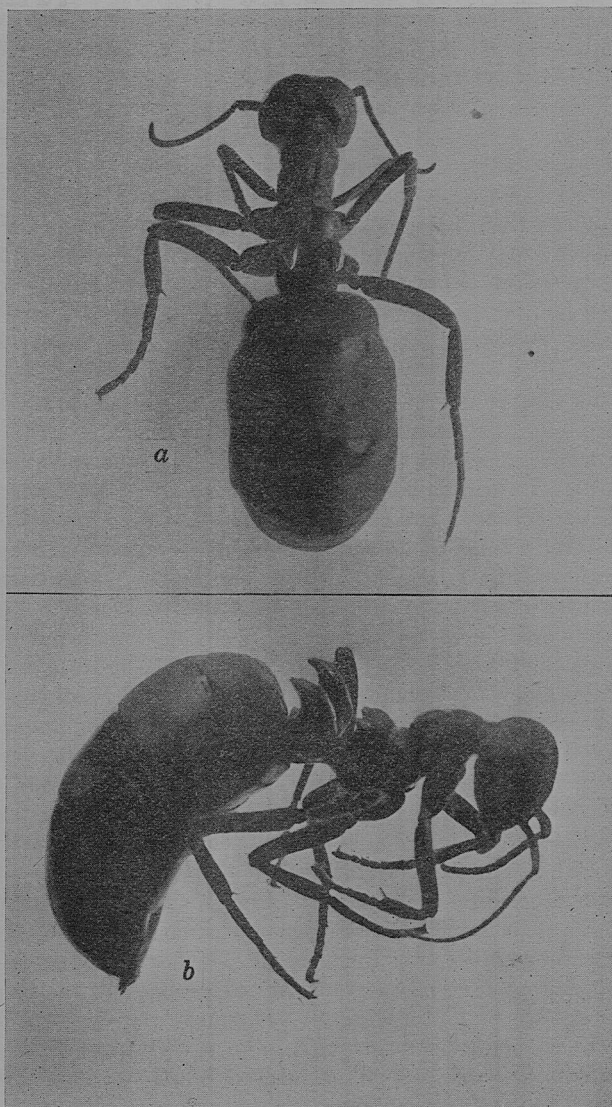


FIGURE 2. *Eciton burchelli* Westw. Female; (a) dorsal, (b) lateral view.

grew denser decided to move, and columns of workers and soldiers began to emerge from the top of the long orifice, crawled out over the bark and descended to the ground. In these columns balls of ants appeared from time to time, each more or less completely enveloping an elongate object, which proved to be a large cocoon, 20 mm. long, of a rich brown color and tough consistency. I supposed at first that these cocoons belonged to some large *Camponotus* or *Pachycondyla* whose nest had been plundered on one of the preceding days, but on opening one of them I was delighted to find that it contained a nearly mature male *Eciton* pupa (Fig. 3b and c)! In all more than a hundred of these cocoons were brought out and each was moved along with the greatest solicitude by an ant cluster as big as a hen's egg. There were also a few young or half grown *burchelli* larvæ, but no worker pupæ.

We now discovered that a large column of the ants was leaving the cavity by a small opening, which we had overlooked, on the opposite side of the trunk, and was descending to the ground and assembling in masses on the dead leaves. After we had moved our chairs to this new scene of activity, Mr. Emerson observed a large halting mass of workers in the column and on thrusting his tweezers into it drew forth a young queen (Fig. 2), which was being very slowly piloted along by a dense cloud of attendants. We had spent the whole morning crouching on our chairs in an uncomfortable position, though out of reach of the ants, and being elated by the capture of the queen returned to the laboratory for lunch. At three o'clock we found masses of ants still resting on the dead leaves a few yards from the tree. A second queen, precisely like the first, was discovered in one of these masses. I infer that this was the only remaining female in the colony, for after her removal a perceptible apathy or dejection seemed to fall on the whole body of ants. They became much less active and aggressive and with some hesitation formed a single dense and rather slowly moving column that made off through the jungle, attended by a small swarm of hovering *Stylogasters*, which had somehow made their appearance during the lunch hour. We searched the departing army for ecitophiles and succeeded in capturing several specimens of three species of Staphylinids (*Mimeciton*). They very closely resembled the smallest workers both in color and behavior, but were more difficult to catch and all seemed to belong to portions of the colony that had formed the immediate *entourage* of the queens. At any rate, none was taken from the masses of ants enveloping the male cocoons, although I had thrown all of these masses together with

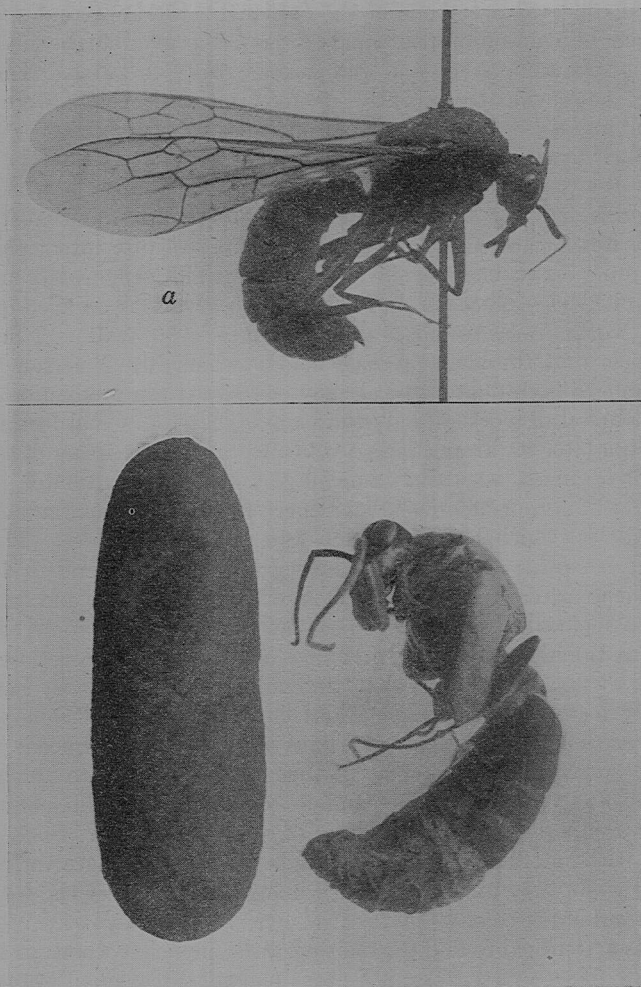


FIGURE 3. *Eciton burchelli* Westw. (a) Male; lower figures, mature pupa (b) and cocoon (c).

the cocoons into jars of formalin and was therefore able to go through the material at my leisure in the laboratory.

I had collected every one of the cocoons in the hope that some of them might contain pupal females, but all proved to be males in precisely the same stage and very nearly ready to hatch. The two females had evidently recently emerged for their colors were very brilliant and the delicate golden pile on their bodies was intact. Moreover, their ovaries were undeveloped as shown by the relatively small size of the gaster. That this part of the body must later become greatly distended, with the maturation of the ovaries, and must have its sclerites separated by the extension of the white intersegmental membranes, may be inferred from Luederwaldt's figures of an old queen of *E. (L.) praedator* and from my observations on aged queens of the North American species of *Acamatus* (1900, 1901). I believe, therefore, that the large *burchelli* colony which Mr. Emerson and I were able to investigate, had already completed the production of its annual brood of workers and soldiers and that the sexual forms constituted a later or, at any rate, a retarded brood, consisting of a large number of males, all in the same stage and destined to hatch before the end of July, or before the incidence of the dry season, and a very few females, which had hatched before any of the males. The old female, or mother of the colony, had probably died recently. Hence it would seem that this *burchelli* colony was proterogynic, and destined later to separate into two colonies, each with its own young queen, for it is practically certain that new *Eciton* colonies must be thus formed by fission of an old colony and not, as in most ants, by isolated, recently fecundated females. The fecundation of the *Eciton* queens is still an unsolved problem. Perhaps the two *burchelli* queens would have been fecundated by some of their brothers about to hatch, i. e. adelphogamically, though we cannot exclude the possibility of fecundation by males from other colonies of the same species. Such males might be temporarily adopted or might hastily fecundate the young queens while they are being moved along during one of the frequent migrations of the colony.

I was astonished to find the male *burchelli* pupæ in cocoons as all the pupæ I had seen in the Texan *Ecitons* (subgen. *Acamatus*) were nude. But these were all worker pupæ. On reading Beebe's account (1919) of the *burchelli* colony that had bivouacked in the store-room of the Kartabo laboratory, I learned that he had given an interesting account of the method of spinning the cocoon by a lot of larvæ which had been assembled by the workers on the surface of an old board. He says:

"On the flat board were several thousand ants and a dozen or more groups of full-grown larvæ. Workers of all sizes were searching everywhere for some covering for the tender immature creatures. They had chewed up all available loose splinters of wood, and near the rotten, termite-eaten ends, the sound of dozens of jaws gnawing all at once was plainly audible. This unaccustomed, unmilitary labor produced a quantity of fine sawdust which was sprinkled over the larvæ. I had made a partition of a bit of a British officer's tent which I had used in India and China, made of several layers of colored canvas and

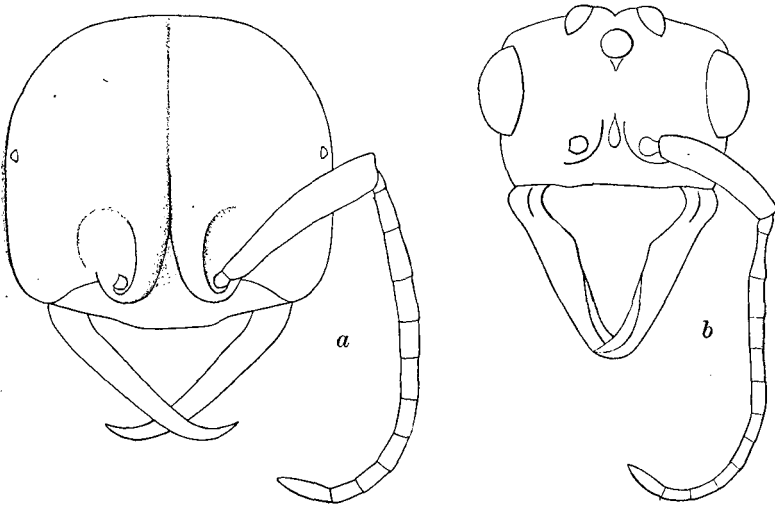


FIGURE 4. *Eciton burchelli* Westw. (a) Head of female, dorsal view; (b) head of male.

cloth. The ants found a loose end of this, teased it out, and unraveled it, so that all the larvæ near by were blanketed with a gray particolored covering of fuzz.

"All this strange work was hurried and carried on under great excitement. The scores of big soldiers on guard appeared rather ill at ease, as if they had wandered by mistake into the wrong department. They sauntered about, bumped into larvæ, turned and fled. A constant stream of workers from the nest brought hundreds more larvæ, and no sooner had they been planted and débris of sorts sifted over them, than they began spinning. A few had already swathed themselves in

cocoons — exceedingly thin coverings of pinkish silk. As this took place out of the nest, in the jungle, they must be covered with wood and leaves. The vital necessity of this was not apparent, for none of this débris was incorporated into the silk of the cocoons, which were clean and homogeneous. Yet the hundreds of ants gnawed and tore and labored to gather this little dust, as if their very lives depended upon it. . . . When first brought from the nest, the larvæ lay quite straight and still, but almost at once they bent far over in the spinning position. Then some officious worker would come along, and the unfortunate larva would be snatched up, carried off, and jammed down in some neighboring empty space, like a bolt of cloth rearranged upon a shelf. Then another ant would approach, antenna the larva, disapprove, and again shift its position. It was a real survival of the lucky, as to who should avoid being exhausted by kindness and over-solicitude. . . . There was no order of packing. The larvæ were fitted together anyway, and meagerly covered with dust of wood and shreds of cloth. One big tissue of wood nearly an inch square was too great a temptation to be left alone, and during the course of my observation it covered in turn almost every group of larvæ in sight, ending by being accidentally shunted over the edge and killing a worker near the kitchen middens. There was only a single layer of larvæ; in no case were they piled up, and when the platform became crowded, a new column was formed and hundreds taken outside. To the casual eye there was no difference between these legionaries and a column bringing in booty of insects, eggs and pupæ; yet here all was solicitude, never a bite too severe, or a blunder of undue force." These observations show that in thus covering their larvæ with foreign particles just before pupation, *Eciton burchelli* behaves exactly like many other ants, a fact which Beebe did not know, for legless larvæ, like those of ants, cannot, of course, spin their cocoons without a temporary covering of earth or débris to which they can attach their silk. Unfortunately he fails to tell us anything about the castes to which the cocoon-spinning larvæ belonged, and we are left to infer that they were probably, in great part at least, workers and soldiers.

When I looked up the earlier literature on *Eciton* on my return to Boston I found that Wilhelm Müller (1886) had found pupæ of *burchelli* enclosed in cocoons. March 1st, 1885, he found a little to one side of an *Eciton* file a dealated male *Labidus burchelli* which was being partly dragged and partly pushed along by a couple of workers. As the insect, when placed among a lot of workers and soldiers, remained unharmed, he naturally inferred that it belonged to the

species, which he incorrectly called *E. hamatum*. March 14th he captured and anaesthetized a large mass of workers and brood taken from the colony while it was bivouacking in a hollow tree, and found

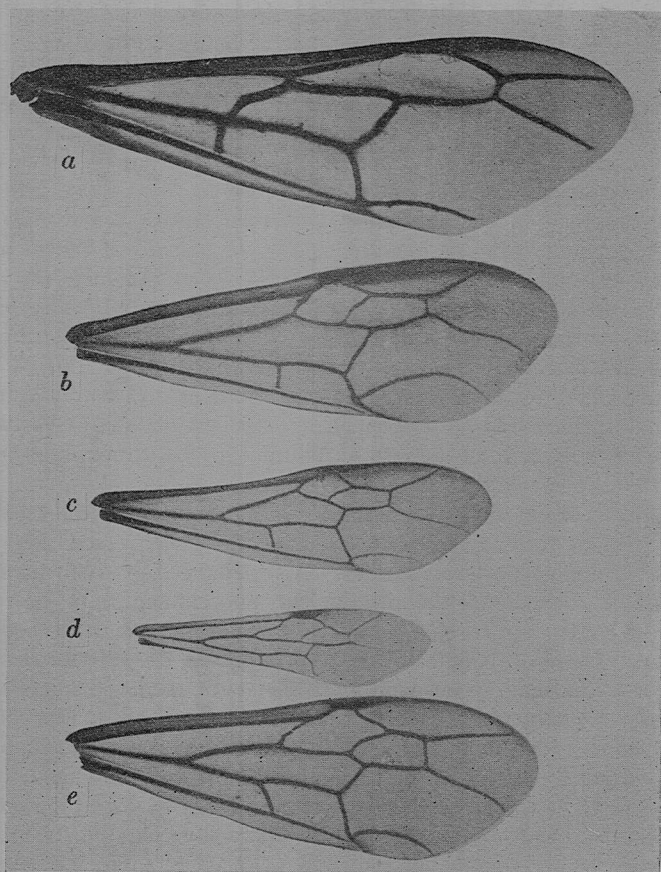


FIGURE 5. Fore wings of (a) *Dorylus* (*Typhlopone*) *fulvus* Westw. subsp. *badius* Gerst.; (b) *Cheliomyrmex megalonyx* n. sp.; (c) *Eciton burchelli* Westw.; (d) *Eciton* (*Acamatus*) *schmitti* Emery; (e) *Eciton* (*Labidus*) *coecum* Latr.

in the lot a single large male cocoon and numerous cocoons containing soldier pupæ. The latter were easily identified by their long, hook-shaped mandibles. His account of the worker larvæ is not very clear,

but I infer that they also regularly spin cocoons. He states, however, that one of the smallest workers was seen to pupate without a covering. Some confusion was introduced into the account by Müller's finding among the *Eciton* brood a number of small cocoons which Forel interpreted as containing pupæ of "substitution males," but which Emery (1900) later interpreted as kidnapped Ponerinæ. From what is now known of ant-larvæ it can be positively asserted that Müller's description and Fig. 2 refer to larvæ of the Ponerine genus *Pachycondyla* and very probably to one of the common species, *harpax* Fabr. or *striata* F. Smith. While it thus appears that the larvæ of at least one species of *Eciton* sens. str. spin cocoons, the habit is probably not widespread in the subfamily Dorylinæ. Both the worker and soldier pupæ of various Congolese species of *Dorylus* of the subgenus *Anomma* in my collection are all nude, Forel (1912) figures the pupæ of *A. nigricans* as nude and, according to Emery (1901) neither the worker nor the male pupa of *Dorylus* (s. str.) *affinis* Shuckard is enclosed in a cocoon.

I insert here technical descriptions of the female *E. burchelli* and of the male, which was not described in sufficient detail by Westwood.

Female (Fig. 2, 4a). Length 21-23 mm.; head, thorax and petiole 9-10 mm., gaster 12-13 mm.

Head as broad as long, distinctly broader in front than behind, with straight sides, feebly impressed in the ocular regions and with convex, rounded posterior border. A pronounced groove runs down the middle, deepest on the anterior half and expanding in the region of the frontal area, feebler behind and obsolescent near the occipital border. There are small obtuse projections at the inferior occipital corners of the head, corresponding to the acute, recurved spines in the soldier. Eyes at the middle of the sides of the head, in the form of small, convex, ocellus-like structures, of the same size as in the soldier. Ocelli absent. Mandibles long, slender, falcate and toothless, straight except at their tips. Clypeus short and broad, slightly impressed in the middle, its anterior border feebly and evenly arcuate in the middle and very feebly sinuate on the sides. Antennal foveæ not carinate externally as in the worker, the frontal carinæ farther apart, each forming a thick welt, which suddenly narrows anteriorly to curve around the front of the antennal insertion. Antennæ long; scapes robust, about half as long as the head and clypeus together; funiculi slender, their first joint as long as broad, the remaining joints growing gradually shorter and narrower to the penultimate; joints 2-4 twice as long as broad, terminal joint shorter than the two preceding taken

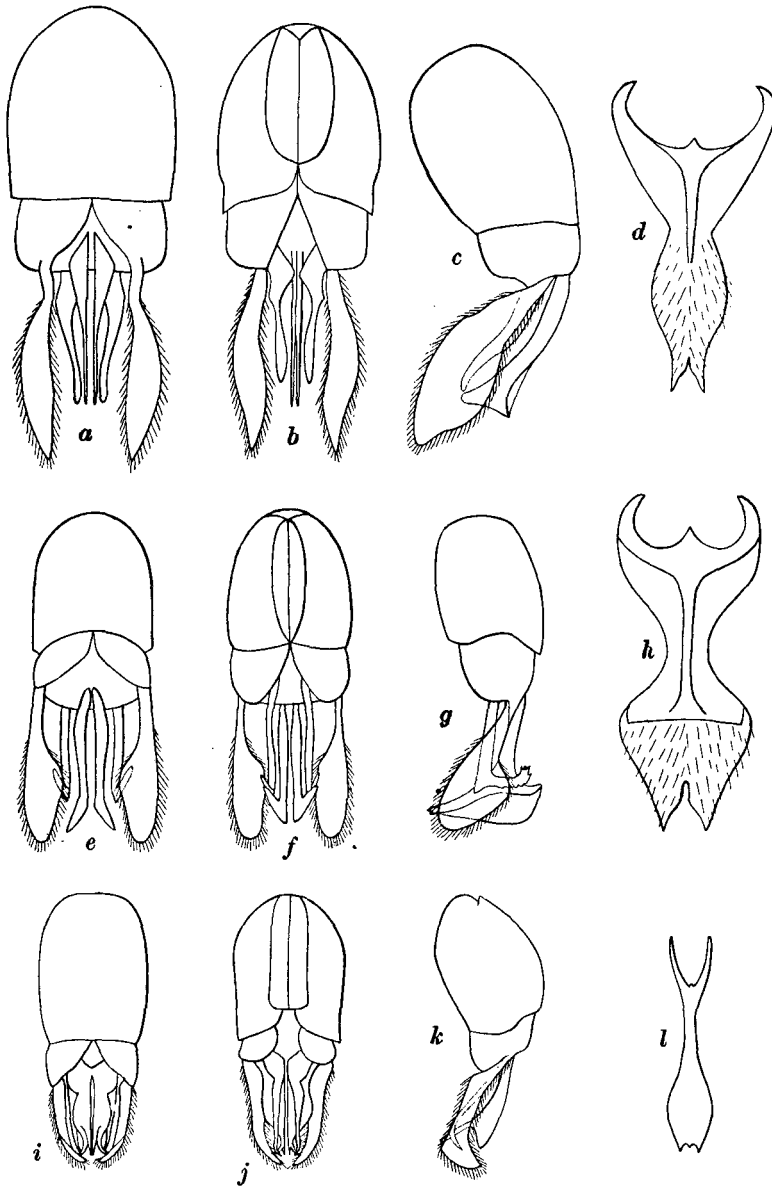


FIGURE 6. Male genitalia of *Eciton burchelli* Westw., (a) dorsal, (b) ventral, (c) lateral view; (d) subgenital plate of same; (e), (f), (g), and (h) corresponding parts of male *E. (Labidus) coecum* Latr.; (i), (j), (k), (l) corresponding parts of male *E. (Acamatus) schmitti* Emery.

together. Thorax small and short, only a little longer than the head with the mandibles and much narrower; seen from above as broad through the pronotum as through the epinotum, but distinctly narrowed at the mesonotum. Pronotum as broad as long, feebly convex and rounded above, somewhat flattened on the sides, but expanded ventrally. Promesonotal suture obsolete, but represented by a pronounced, lunate groove. Mesonotal stigmata elevated as strong, rounded tubercles. Mesonotum a little longer than broad, its dorsal surface in the form of two longitudinal welts, separated by a groove which does not extend to the lunate promesonotal groove. In profile the dorsal outline of the mesonotum is slightly convex in front, then straight and sloping backward, and finally abruptly vertical to the low metanotum, which is distinct and transverse, short and bounded by distinct, straight mesometanotal and metaëpinotal sutures. Metanotal stigmata small, tubercular. Epinotum broader than long, from above transversely oblong, its base in profile convex and rounded, rising high above the metanotum, its declivity concave. Seen from above the base is divided by a deep longitudinal furrow into two parts, each of which is very convex and terminates behind in a strong, blunt projection. Sides of epinotum somewhat flattened, with very large, slit-shaped stigmata. Petiole very large, much higher than long, broader than the epinotum and nearly twice as broad as long, repeating the shape of the epinotum in a more exaggerated form. It bears above two large, erect horns, which curve upward and backward and are as high as the pronotum and terminate in blunt points. Between these horns the dorsal surface of the petiole is deeply and broadly concave. Ventral surface of petiole smooth and nearly straight in profile, without a tooth or projection. Gaster very large, in life fully 6-7 mm. broad, very convex above and concave beneath, in profile elongate elliptical, the first segment somewhat truncated anteriorly and with a pair of feeble impressions to receive the tips of the petiolar horns. Stigmata on the various segments very large, slit-shaped. Hypopygium terminating in two broad triangular points separated by an angular excision; pygidium convex, its posterior border evenly and broadly rounded, entire. Sting short and robust, but exerted. Legs long and stout; claws well-developed, dentate.

Surface nearly opaque and very finely, densely and evenly punctate, or granular, except the mesopleuræ, sides and declivity of epinotum, the whole of the petiole, coxæ, venter and anterior portions of the gastric segments, which are shining and very finely and superficially shagreened. Head and dorsal portion of thorax covered with sparser,

coarser piligerous punctures. These punctures are more scattered on the legs, mandibles and antennal scapes, but otherwise their sculpture is like that of the head.

Hairs bright golden yellow, in some lights almost ruby red, short, erect or reclinate, very short and most abundant on the head, longer and of uneven length and thickness on the thoracic dorsum, sparse and reclinate on the petiole and gaster. The longer hairs on the scapes and legs are also more reclinate and somewhat flexuous. Venter and sides of petiole, the meso- and metapleuræ and the external surfaces of the coxæ almost hairless. On the clypeus and gula the hairs are long and many of them flexuous. Pubescence absent, except on the antennal funiculi.

Rich reddish brown; mesopleuræ, declivity of epinotum, coxæ and femora, except at their articulations, castaneous brown; epinotum, except its dorsal surface, petiole and gaster black; apical halves of petiolar horns on their dorsal surface bright orange yellow as are also the posterior borders of the ventral gastric segments and a broad apical band, almost interrupted in the middle, on each of the dorsal segments.

Male (Fig. 3a, Fig. 4b, Fig. 5c, Fig. 6a-d). Length nearly 20 mm.

Head large, rather flat in front, through the eyes somewhat less than twice as broad as long. Eyes small, only a little more than three times as long as the cheeks and not very convex. Ocelli small, the distance from each lateral ocellus to the eye being fully twice the greatest diameter of the former. Frontal carinæ very short, not prolonged backward and curved outward behind. Frontal area distinct, impressed, elongate. Antennal scapes about as long as the sides of the head, slightly curved, moderately stout; funiculi long; first joint longer than broad, joints 2-4 twice as long as broad, remaining joints shorter, except the last, which is slender and pointed. Clypeus rather flat, its anterior border very broadly, feebly and arcuately concave. Mandibles long, narrow, straight, and flattened, very abruptly bent downward at the extreme base, their tips curved, blunt; their blades broadest at the basal third where the inner border has a broad, very blunt tooth. Mesonotum not broader than the head including the eyes, not very convex in front and not concealing the pronotum when the insect is viewed from above, somewhat longer than broad, somewhat narrowed in front, with a median longitudinal groove on its anterior half. Sides of pronotum concave. Epinotum in profile with very short base and long, sloping, concave declivity, the lateral corners between the two surfaces forming blunt protuberances. Epi-

notal stigmata large and slit-shaped as in the female. Petiole broadly and deeply concave above, its sides and posterior corners produced backward as a pair of large flattened, bluntly pointed projections. Gaster rather short, rather strongly curved, very convex above, concave below. Subgenital plate lanceolate, with a sharp median longitudinal carina and terminating in two slightly diverging, acuminate points. Stipites subtrapezoidal, with bluntly angular tips; sagittæ slender, of even diameter except at the tip which is abruptly expanded and truncated, longer than the volsellæ which are slender, tapering, with simple, blunt tips. Legs rather long and slender; claws toothed. Wings only moderately long (13 mm.).

Opaque; very densely and finely punctate, the head, thorax and petiole also with larger, coarser, rather evenly distributed, piligerous punctures. Such punctures are also present, but much sparser, on the mandibles, legs and sides of gaster.

Hairs fulvous, long, suberect, moderately abundant, absent on the sides of the thorax and mid-dorsal portions of the more posterior gastric segments, very long and conspicuous on the clypeus, gula, mandibles, front, scutellum, epinotum, petiole, base, sides and tip of the gaster, more reclinate and of uneven length on the pro- and mesonotum. There are also a few long hairs on the antennal scapes and tips of the basal funicular joints on the extensor surface. Pubescence fulvous, short, dense, appressed, confined to the antennal funiculi and to the dorsal surface of the gaster, which has a velvety appearance.

Dark brown or blackish; petiole, tibiæ, articulations of thorax and legs and tips of mandibles somewhat paler and more reddish; gaster, tarsi and tips of petiolar projections much paler, brownish red. Wings slightly yellowish, with dark brown veins.

Described from two females taken at Kartabo, British Guiana, July 21st, 1920, two males taken at light in the same locality July 20; two males taken by Mr. Wm. Beebe, also at Kartabo June 20, 1919, three males from Pará, Brazil (C. F. Baker), and numerous mature pupal males taken from the colony containing the two females.

The female *burchelli* exhibits a very peculiar development of the thorax compared with the known females of *Acamatus*, which are all much simpler in structure, as may be seen by comparing Figure 2 with the figure of the *carolinense* female (Fig. 8). Judging from the descriptions and figures of André and Luederwaldt, the known *Labidus* females are intermediate between those of the two other subgenera, as would be expected from a study of the workers and males. Undoubtedly the old *burchelli* queen, with fully expanded gaster, must be a

much larger insect than those described above, as large as or even larger than the *E. (L.) praedator* queen, which, according to Luederwaldt, measures 33 mm. The great development of the thoracic and abdominal spiracles in the females and males of the Dorylinae seems to me to be an adaptation to the peculiar conditions in which the sexual phases of these insects live, for when the colony is resting these phases are enveloped in such a dense mass of ill-smelling workers that some provision would seem to be necessary to increase the supply of oxygen. Emery calls attention to the fact that all the known female specimens of *Dorylus* have their appendages more or less mutilated and surmises that this may result from their being dragged along during the migrations by the workers over the rough ground and pebbles. All the *Eciton* females I have seen, however, had perfect legs and antennæ. The longer and more powerful legs and proportionally smaller gaster in these insects, as compared with the *Dorylus* queens, suggest that the former are not so much dragged as piloted or urged along by the workers when the colony is migrating. On the other hand, the male *Ecitons* found in columns of workers are often more or less mutilated, i. e. deâlated. I have observed this in *E. (A.) pilosum* (*vide infra*) and Wilh. Müller noticed it in *E. burchelli*. This deâlation is due not to a tearing of the wing membranes but to their tendency to weaken and break off at the base, precisely as in the recently fecundated female ants of other subfamilies. Even cabinet specimens of *Eciton* males are sometimes liable to lose their wings at the slightest touch. This, too, is probably an adaptation, enabling the workers readily to deprive their own or adopted males of their wings, thus preventing them from escaping from the colony and facilitating the fecundation of the young queens.

***Eciton hamatum* Fabricius.**

At Kartabo this species, though common, is less abundant than *burchelli*. Its columns are also clearly less populous and aggressive, though the soldiers and larger workers can sting and bite severely. Mann noticed in Brazil that *hamatum* "is a timid species in comparison with some of the others, such as *E. vagans*." Both *burchelli* and *hamatum* have white-headed soldiers, with very similar long, hook-shaped mandibles (Fig. 1a), but the head in the latter is smooth and shining, instead of opaque, as in the former species.

Eciton (Labidus) coecum Latreille.

(Fig. 5e, Fig. 6e-h).

This widely distributed, hypogaecic species, so common in southern and central Texas and in many parts of Central and South America, seems to be rare at Kartabo, where I found it only once, foraging under some large logs in a damp spot near the laboratory. I saw it also in the Botanical Garden at Georgetown. Although several varieties of the male have been recognized (*biloba* Emery of Ecuador, *jurinei* Shuckard of Brazil, *sevillei* Westwood of Central and South America, *kulowi* Forel of Mexico and *hostilis* Santschi of French Guiana), only one variety, *schlysi* Forel, has been recognized among worker specimens. The validity of this form seems to me to be doubtful, as it was based on rather small workers. All the soldiers and workers in my collection, representing numerous localities from Texas to Paraguay show very little variation, with the exception of a single soldier taken by Mann at Pará. This evidently represents a distinct variety which may be called **opacifrons** var. nov. It differs from the soldier of the typical form in having the head broader in front and less excised in the middle of the posterior border, the tips of the mandibles are coarser and much more decidedly incurved, with scarcely a trace of the subapical tooth. The front, vertex and gula are opaque and densely shagreened, instead of very shining as in the typical form and the whole pronotum is opaque and sharply shagreened, instead of being more or less smooth and shining on the sides. The hairs on the body are shorter, more abundant, and of more even length, especially on the dorsal surface of the head and thorax and on the legs. The surface of the mandibles is very strongly, arcuately rugose. The legs, coxæ, petiole, postpetiole and gaster are distinctly yellowish, the remainder of the body as dark red as in the typical *coecum*. Of course, this form may be the unknown soldier of one of the varieties described from male specimens.

Eciton (Labidus) praedator F. Smith.

Like *coecum*, this species has a very wide range, from Argentina to tropical Mexico, but it is not known from the Sonoran Region or from our Southern States. In habits it is somewhat intermediate between the species of *Eciton* s. str. and *E. coecum*, making its forays above ground when it is not convenient to keep under the dead leaves. It

also constructs galleries or cause-ways of particles of soil. When foraging or migrating its columns are conspicuously broader and denser than those of other army ants. Bates (1863) and Mann (1916) have described its habits in Brazil. The latter, who observed it along the Upper Madeira, says: "Houses along the railroad were frequently raided at night by *E. praedator*, which is well-known to the Brazilians and called by them "cazadoro" (hunter). I had the opportunity of observing one hut while the ants were in possession. The ground was covered with the ants, which swarmed also in the cracks and on the few pieces of furniture, while the owner of the place, a Barbados negress, not accustomed to such intrusions, stood for safety in a puddle of soapy water with which she had attempted to drive the ants away, and begged me to tell her what to do to get rid of them."

E. praedator is not common at Kartabo, and the few foraging colonies I encountered were much smaller than those described by Bates and Mann. Moreover, they belonged to an undescribed variety which I shall call **guianense** var. nov. The soldier of this form is smaller than the type and measures only 7.5–8.5 mm.; head 3–3.5 mm. (typical form 8.5–11.5 mm.). The upper surface of the head is decidedly more opaque, very finely, densely and evenly punctate or reticulate, with the larger, sparser, piligerous punctures more indistinct. The body is paler, being dull ferruginous, with pale brown legs and blackish gaster. The worker, however, is darker and colored more like the typical form, but the head is somewhat less shining above. Though considerably darker, *guianense* approaches the subspecies *emiliae* Mann in color, but is much closer to the type. In the soldier *emiliae* the head is more finely and more indistinctly sculptured and somewhat glossy and the gaster and sides of the thorax are less shining. The var. *ferruginea* Norton from Mexico is probably closely allied to *guianense* but was inadequately described. Santschi has based a subsp. *auripubens* on male specimens from French Guiana and this may prove to be covarietal with my soldiers and workers from Kartabo. In my collection there are a few soldiers and workers taken by Forel at Esperanza, Colombia, which also belong to the var. *guianense*. intermediat?

Eciton (Acamatus) angustinode Emery subsp.
emersoni subsp. nov.

This small form, which I dedicate to Mr. Alfred Emerson, was seen only on two occasions at Kartabo, once rapidly running over the logs of an old stelling and once migrating with larvæ across the sandy soil

of the laboratory yard. On both occasions the workers formed a straggling file and were extremely timid, turning back on their trail at the slightest disturbance. The typical form occurs in Southern Brazil and Paraguay; the Kartabo form has the postpetiole as broad as the petiole (narrower in the type), and only $1\frac{1}{3}$ times as long as broad ($1\frac{1}{2}$ times in the type), the sides of the petiole are longitudinally rugulose, the dorsal surface of its node shining, with a few coarse punctures. The antennæ, head, thorax and petiole are deep red, the remainder of the body and appendages yellow, the mandibles infuscated. I have compared the specimens with a small cotype of the typical *angustinode* from Rio Grande do Sul in my collection.

Eciton (Acamatus) pilosum F. Smith var. **beebei** var. nov.

(Fig. 7b).

Only two foraging colonies of this ant were seen in the jungle about Kartabo. July 20, Mr. Beebe found one of them near the *burchelli* nest above described, running in a long file from which he took two partially dealated males that were being conducted along by the workers. On going to the spot somewhat later I captured two more males, also partially dealated. The ants had their nest in a huge log where it could not be reached. On July 21, another foray of the same colony was observed but no males were seen. The workers were ascending and descending a large liana and carrying to their nest dozens of cocoons of some small *Camponotus* which apparently nested in the epiphytes on one of the trees, at a considerable distance from the ground. Thus laden with its prey the column resembled a party of *Polyergus* returning from a slave-raid on *Formica fusca*. The second colony, observed July 28, was foraging on the ground in a long column.

On examining the worker and male specimens taken July 20, I find that the former represent a variety of *pilosum* very close to var. *angustius* Forel, originally described from specimens taken by K. Fiebrig at San Bernardino, Paraguay. Comparison with a dozen cotypes of this variety in my collection shows that the Kartabo form, which I call *beebei*, differs only in the following particulars: The color of the body is even darker, being almost jet black and much darker than the typical *pilosum*; the mandibles, cheeks and the antennal funiculi are light brown throughout, whereas in *angustius* the upper surface of the funiculi is black, the mandibles and cheeks are fuscous

or piceous and the legs are somewhat paler than in *beebei*. In both varieties the polymorphism of the worker is less pronounced than in the typical *pilosum*.

Turning to the male we find that it is merely a variety of *Eciton mexicanum* Smith, a form easily recognized by the peculiar shape of its mandibles (Fig. 7a). Smith described the worker as *Eciton pilosum* from Brazil in 1858, and the male as *Labidus mexicanus* from Orizaba, Mexico in 1859. Of the male Forel has described a var. *aztecum* from Guatemala and a subsp. *rosenbergi* from Northwestern Ecuador.

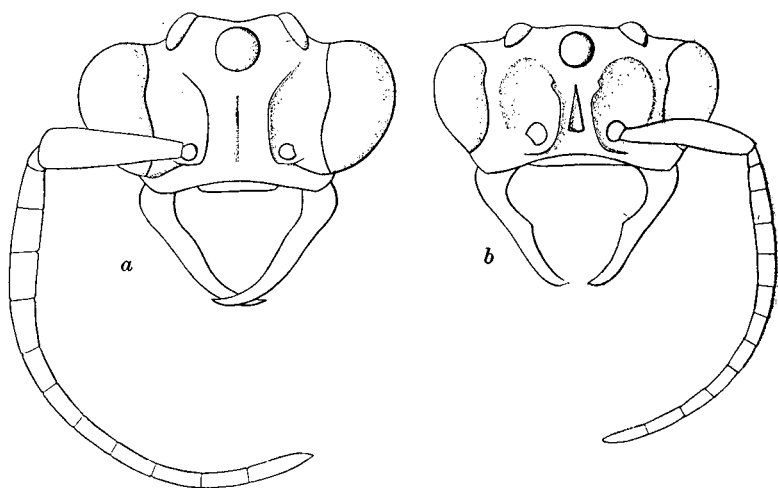


FIGURE 7. (a) Head of male *E. (A.) pilosum* F. Sm. (in sp.); (b) head of male *Eciton (Acamatus) pilosum* F. Sm. var. *beebei* var. nov.

That the typical *mexicanum* is the male of the typical *pilosum* (worker) is evident from the fact that both of these forms, and only these, occur in Texas. The male of the var. *beebei* measures 10.5–11 mm. and is therefore decidedly smaller than the male of the typical form of the species, which measures nearly 13 mm., and exhibits also the following differences: Ocelli smaller, head seen from above proportionally longer; frontal carinae distinctly more acute, with their posterior ends more sharply dentate. Antennae shorter. Thorax proportionally longer and more slender, with less elevated scutellum. Color more yellowish, with the posterior part of the head jet black; subgenital plate, posterior border of each gastric segment and the funi-

cular articulations fuscous. In some specimens the last gastric segment is infuscated and the mesonotum has a fuscous streak on each parapsidal furrow and a broader, paler brown, anteromedian streak. The pilosity, especially on the thorax, is shorter than in the typical *pilosum*. Wings less yellowish, slightly infuscated, with brown, instead of resin yellow veins.

I regard as typical *pilosum* males several specimens in my collection from Frontera, Tabasco, Mexico; Nogales, Arizona (Osler), Texas (Belfrage), Wharton, Texas (Cornell Univ.) and Austin, Texas (Wheeler). Forel's var. *aztecum* is extremely close to some of these. His subsp. *rosenbergi* is scarcely smaller (13 mm.), the head behind the eyes is described as feebly convex, instead of concave, the mesonotum as not so far advanced anteriorly over the pronotum, the tibiae as less enlarged apically, the color as darker and the wings as tinged with blackish brown. I am inclined to believe that this is not a form of *pilosum*, but a distinct species, as Forel himself surmised.

***Eciton (Acamatus) carolinense* Emery.**

Female (Fig. 8a and b). Length nearly 14 mm.; gaster 8.6 mm.

Head from the front as long as broad, scarcely broader anteriorly than behind, its sides rather rounded, its posterior border slightly emarginate, with a median longitudinal groove, deep and very distinct on the anterior half of the head, very faint on the posterior half. At the sudden transition between the two halves of the groove the surface is distinctly impressed. Seen from behind the head is subpentagonal, narrowed above, with concave occipital border and bluntly angular inferior occipital corners. Ocelli lacking; eyes reduced to minute white dots, just in front of the posterior third of the head. Mandibles narrow, edentate, straight, their pointed tips not incurved. Clypeus broad, somewhat impressed in the middle, the anterior border nearly straight, very feebly arcuate. Frontal carinae short, welt-like, not encircling the antennal foveae in front. Antennal scapes robust, about half as long as the head, excluding the clypeus; funiculi nearly three times as long as the scapes and more slender; first joint small, as broad as long; joints 2-8 a little longer than broad; remaining joints longer; last joint nearly as long as the two preceding taken together. Thorax long, narrow through the pronotum, broader through the mesonotum and broadest through the epinotum, which does not, however, equal the width of the head. In profile the thorax

is fully three times as long as high, its dorsal outline straight, its dorsal surface flattened. Promesonotal, mesometanotal and meta-epinotal sutures indicated by impressed lines. Pronotum as long as broad, its anterior border marginate at the neck; mesonotum slightly longer than broad, its anterior border strongly arcuate, its posterior border less so; metanotum in the form of a very short, transverse, arcuate band; epinotum broader than long, with rounded rectangular posterior corners, its surface broadly impressed in the middle and with a distinct, median, longitudinal groove on its anterior half; the base in profile longer than the straight declivity with which it forms an obtuse angle. Petiole as high as the epinotum, but much narrower, from above transversely oblong, with rounded sides, about $1\frac{1}{4}$ times as broad as long, broadly impressed in the middle; the ventral portion protruding downward and forward as a thick convexity. Gaster long and rather slender, though more than twice as broad as the petiole, its anterior segment rectangular from above; pygidium large, convex, bluntly pointed and entire behind; hypopygium angularly excised in the middle and terminating in two membranous, rather blunt points. Sting small, partly exerted. Legs rather short; claws simple. Stigmata of the thorax, petiole, post-petiole and gaster large.

Head, thorax and petiole nearly opaque, very finely shagreened, densely and rather coarsely punctate; gaster shining, with much smaller, shallower and more scattered punctures, except on the first segment (postpetiole), which approaches the petiole in sculpture.

Hairs yellowish, short, erect, abundant on the head, thorax, petiole and appendages, much shorter and sparser on the gaster; mandibles, clypeus, gula and scapes also with numerous long, flexuous hairs of uneven length.

Rich ferruginous red; antennæ and legs slightly paler and more yellowish; pygidium brown.

Male (Fig. 8c). Length 9.3 mm.

Closely resembling the male of *opacithorax* Emery but slightly smaller and distinctly more slender. Eyes and ocelli even smaller. Mandibles much narrower and less expanded in the middle. Antennæ more slender. Thorax shorter; petiole shorter in proportion to its width. Terminal points of subgenital plate longer and less curved. Sculpture, pilosity and color much as in *opacithorax*, except that the thorax is not shining but opaque and more densely and more coarsely punctate. The scapes and mandibles are black, not red as in *opacithorax*.

Described from single specimens taken by Mr. W. T. Davis at Clayton, Georgia (2000-3700 ft.) during June, 1909.

The female can be readily distinguished from that of *opacithorax* by the following characters: The eyes are even smaller, the anterior clypeal border is much less arcuate, the epinotum is broader and more angular behind, its declivity shorter compared with the base and the angle between the two surfaces more pronounced. The pet-

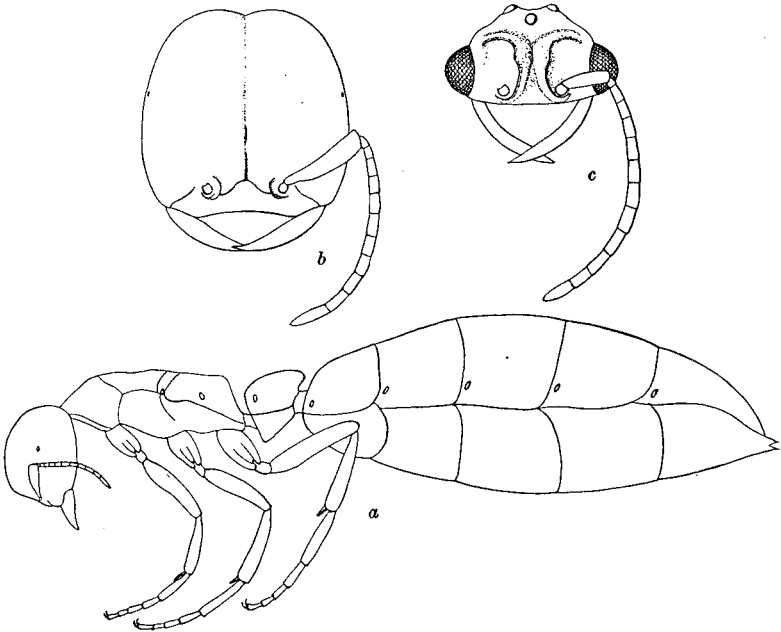


FIGURE 8. (a) Female of *Eciton* (*Acamatus*) *carolinense* Emery, lateral view; (b) head of same more enlarged, dorsal view; (c) head of male.

iole is larger, with more pronounced anterior angles and broader and deeper dorsal concavity. The surface of the head, thorax and petiole and especially of the head, is much more opaque and more coarsely punctate and beset with longer and more abundant hairs.

Cheliomyrmex Mayr.

(Fig. 5b, Figs. 9 and 10.)

Mayr established the genus *Cheliomyrmex* in 1870 on worker specimens of a species which he called *nortoni*, because he had received them from Edward Norton. They were evidently collected by Sumichrast

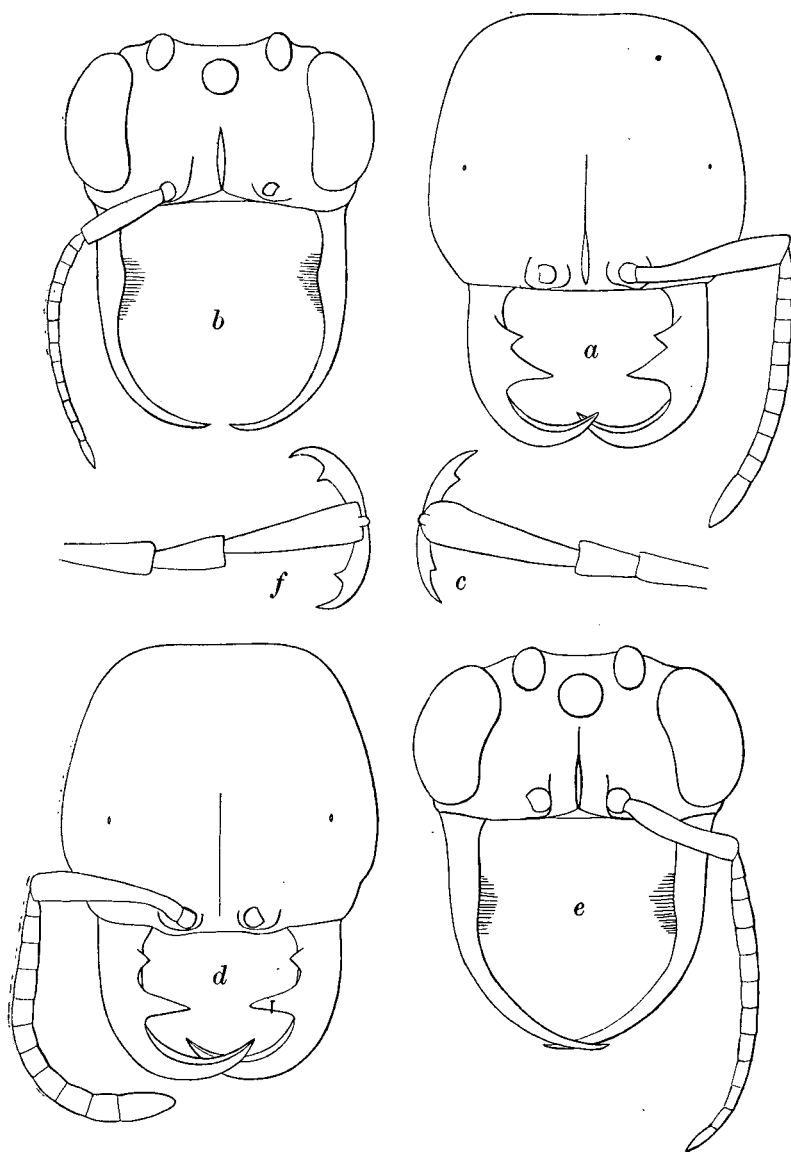


FIGURE 9. *a*, Head of soldier *Cheliomyrmex morosus* F. Sm.; *b*, head of male; *c*, terminal tarsal joints of worker; *d*, head of soldier *C. megalonyx* sp. nov.; *e*, head of male; *f*, terminal tarsal joints of worker.

near Mount Orizaba, in the state of Vera Cruz, Mexico. Mayr was struck by the peculiarities of the insect, in which he detected resemblances to the African *Dorylus* (*Typhlopone* and *Anomma*) on the one hand and to the Ponerinæ on the other. Since its description, *C. nortoni* has been recorded only from Mexico and British Honduras. Very recently Mann has taken a few specimens of it in Spanish Honduras, but it seems to be rare and sporadic, and no observations have been published on its habits. In 1894, Emery described an opaque form from Peru as the subsp. *andicola*, but Forel, after examining numerous specimens from the highlands of Colombia, raised it to specific rank.

In his comparative studies of the Dorylinæ Emery made the interesting suggestion that the male of *C. nortoni* might be the form previously described from Mexico as *Labidus morosus* by F. Smith (1859) and provisionally cited in the Genera Insectorum as *Eciton* (*Labidus*?) *morosum*. Forel described from Honduras and Mexico a variety of this male as *payarum*, which seems to differ from the type only in a few insignificant characters, and Emery has also described a male specimen as subsp. *ursinum* from Brazil. It will be seen that *nortoni* and *morosus* have precisely the same distribution. This is also evident from the specimens in my collection, which comprise worker topotypes taken by F. Silvestri at Orizaba, and males taken by Fred. Knab in the same locality, also workers taken at Manatee, British Honduras by J. D. Johnson and a male taken in the same country by Prof. C. H. Fernald. These and more cogent considerations to be cited below so thoroughly convince me that Mayr's *nortoni* is merely the worker of Smith's *morosus* that I propose to change the name of the species to *Cheliomyrmex morosus* (F. Smith). In British Guiana I found the workers of a *Cheliomyrmex* which I at first took to be *morosus* and also secured the males, which I am sure had escaped from its colonies, but on closer examination I am inclined to regard this form as a distinct species and describe it below as *C. megalonyx* sp. nov. Since the range of the genus has thus been extended to British Guiana, it is probable that Emery's *ursinum* really represents a fourth species, peculiar to Brazil.

Emery has made the further interesting suggestion that *Cheliomyrmex* is an archaic genus, and this is borne out by a study both of the worker and the male, for the characters of both show a mixture of the characters of *Dorylus* and of *Eciton*, together with certain peculiarities observable in no other ants of the subfamily. Thus in the worker, the structure of the thorax and pedicel, the feeble carina-

tion of the cheeks and the distinctly advanced clypeus in the smaller workers remind one of *Dorylus*, and the simple pygidium, the toothed claws and the antennæ are Ecitine, whereas the structure of the mandibles of the soldier and the scale-like transverse petiolar node are peculiar to the genus. In the male the venation (Fig. 5*b*) and toothed claws conform to the *Eciton* type and the flattened femora, especially the hind pair, and the shape of the antennal funiculi are as strongly reminiscent of *Dorylus*, while the structure of the mandibles, though sickle-shaped and toothless, and more like those of certain Ecitons, are nevertheless very singular. The genitalia (Fig. 10) conform in the main to the *Eciton* type (Fig. 6) in having the stipites articulated and not fused with the basal annulus, but their shape is more like those of certain *Dorylus*. The structure of the subgenital plate (Fig. 10*d*), however, with its four terminal teeth is peculiar. Emery (1910, p. 16 nota) believes that *Cheliomyrmex* is "very close to *Eciton*, subgen. *Labidus* and especially to *E. coecum*," and therefore includes it in the tribe Ecitini. I am unable to follow him in this procedure since I believe that the resemblance to *coecum* is superficial and illusory and due to similarity of habits (convergence) and that the genus *Cheliomyrmex* should constitute an independent tribe, the Cheliomyrmicini. It is, in fact, the most archaic and generalized of all the tribes of the Doryline subfamily, just as the Leptanillii constitute the most specialized, or degenerate tribe. Undoubtedly *Cheliomyrmex* is a very ancient group, very near the ancestral stem from which both the Dorylini and the Ecitini sprang and diverged, possibly during the late Cretaceous. The discovery of the female will probably yield additional arguments in favor of this contention.

C. megalonyx was first found at Kartabo July 20, on the edge of the jungle and just back of the laboratory, where it was foraging in columns under prostrate logs. At first sight this species may be mistaken for *E. coecum*, but the columns are denser and more populous and the soldiers and workers exhibit much less variation in stature. *Cheliomyrmex* seems also to be even more photophobic than *coecum*, disappearing at once into the soil when the light is let into its galleries. It stings much more painfully and will attack fiercely when intercepted in its movements. On several successive days I saw detachments of the same army under logs in the same locality. There were no larvæ nor pupæ and very probably what I saw were merely hunting columns of a huge colony which I failed to locate till a month later. August 21, on visiting the taxidermist's hut, behind the laboratory and less than a hundred yards from the spot in which I first found the

species, I came upon a great army moving its larvæ. Sam, the negro laboratory attendant, informed me that this army had been living for many days under a pile of large logs about forty feet from the hut. He had disturbed the pile on the preceding day and the *Cheliomyrmex* had begun to move. They were running along in dense, orderly columns under leaves, sticks or boards, wherever such cover was available, but where they had to cross open spaces, they had built covered galleries about four-fifths of an inch wide, of small particles of earth. The column kept in the shade and crossed the earthen floor of the shed diagonally, disappearing in the dense grass and weeds behind it. There were also numerous openings in the soil, usually circular and about the size of a cent-piece, and from these files of ants, after having proceeded long distances beneath the surface, were emerging to join the columns in the surface galleries. These holes and all the openings in the galleries presented an extraordinary appearance for both the circumferences of the former and the edges of the latter, wherever their ceiling had caved in — and this had occurred in places for distances varying from a few inches to a foot — had a regular guard of soldiers, standing close together, side by side, on extended legs, with their heads directed upward, their mandibles wide open and their antennæ waving about in the air. Each round hole presented a beautiful rosette of these guards and each open surface gallery two parallel rows, between which the workers were hurrying along in a dense procession, the smallest carrying the larvæ tucked under their bodies. Sam was offered a substantial reward for the queen, but although he devoted most of the day to watching the ants, the only unusual object he found in their moving columns was a fine red myrmecophilous Staphylinid allied to *Xenocephalus*. The extraordinary behavior of the soldiers of this army is of considerable interest as indicating certain ethological affinities of *Cheliomyrmex* with the African species of *Dorylus* of the subgenus *Anomma*, for very similar behavior has been repeatedly observed in these ants by Savage, Vosseler, Lang and others, but, to my knowledge, has never been seen in any species of *Eciton*. The *Cheliomyrmex* larva closely resembles other Doryline larvæ which I have examined (*Eciton* s. str., *Acamatus* and *Anomma*) but has no rudiments of antennæ. In this respect it also agrees with *Anomma* and differs from the *Ecitini*.

On many nights, from July 26 to August 31, a few male Dorylines were observed — usually from one to five or six — flying to the lights in the laboratory. I collected all of these specimens, 41 in number, and on examining them found them to comprise two males of *E.*

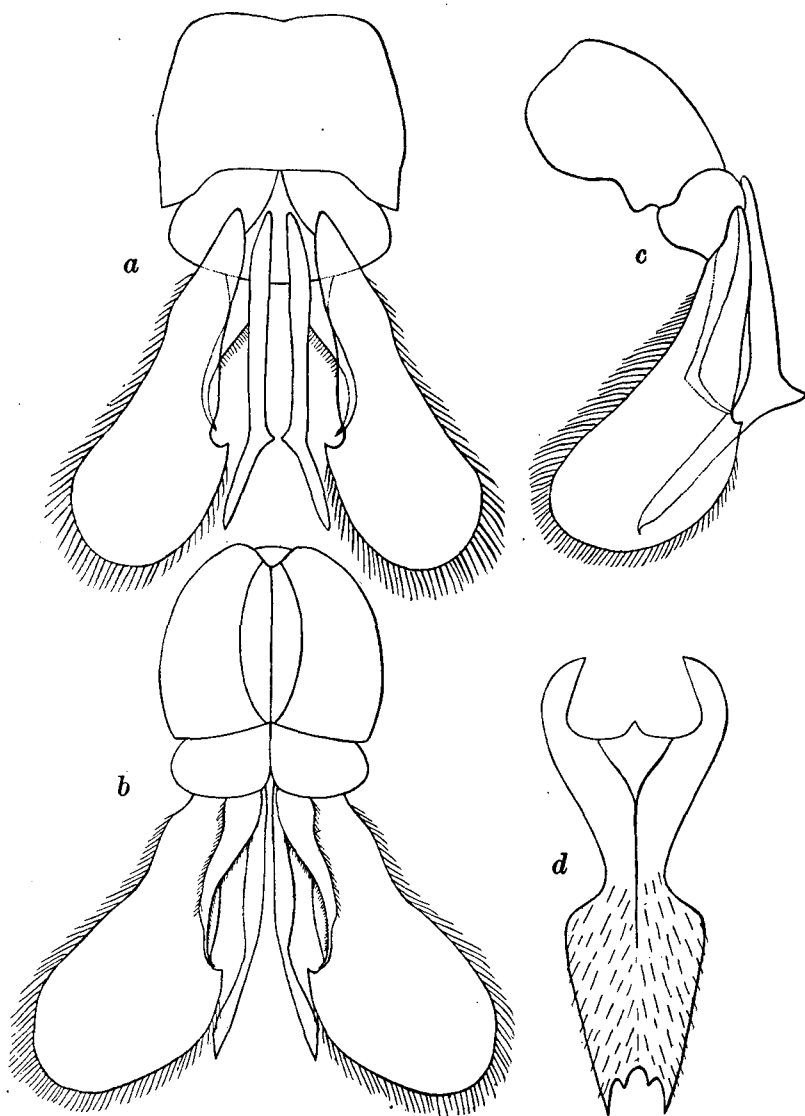


FIGURE 10. Male genitalia of *Cheliomyrmex megalonyx* sp. nov.: a, dorsal, b, ventral, c, lateral view; d, subgenital plate.

burchelli and 39 of a form very close to *E. morosus* but of a paler, more reddish brown color and with somewhat longer mandibles. No other Dorylines appeared at the lights during my stay at Kartabo. I conclude that these 39 males had escaped from the *Cheliomyrmex* colony just back of the laboratory for the following reasons: First, their flight coincided with the sojourn of the large *Cheliomyrmex* colony behind the laboratory. Second, the laboratory is on a point of land at the confluence of two great rivers, the Mazaruni and Cuyuni, which cannot be crossed by such feeble flyers as these male Dorylines. Furthermore, the building is screened on the sides from the rivers by huge clumps of bamboo. Hence the males must have come from the immediate vicinity behind the laboratory. Third, my days of intensive search for ants about the laboratory convinced me that the only Doryline with dentate claws and unknown male in the immediate vicinity was the *Cheliomyrmex*, the males of the other species encountered (*E. burchelli*, *hamatum* and *coccum*) being known. Fourth, both the males taken at lights and the soldiers and workers of the *Cheliomyrmex* from the colony behind the laboratory differ specifically, or at least subspecifically from *morosus*. I therefore regard all of these phases as belonging to the same species, which may be distinguished from the Mexican and Honduran form as follows:

***Cheliomyrmex megalonyx* sp. nov.**

Soldier (Fig. 9d, f). Very similar to *morosus* (Fig. 9a, c) but differing as follows: Color of body more deeply ferruginous red; head and mandibles proportionally somewhat longer, the latter narrower in the region of the median tooth, which is longer and narrower at its base. The basal tooth is more acute and separated by a distinct diastema from the median tooth, not arising from its base as in *morosus*. Antennæ somewhat longer, the median joints especially. Occipital border of the head, seen from above more deeply excised and sharply marginate, the margination continuing down the inferior occipital angle on each side as a sharp ridge on to the gular surface. In *morosus* these lateral ridges are absent and the median margination of the occipital border is feeble. Epinotum less swollen and convex, somewhat lower and more sloping than in *morosus*, its base and declivity more distinct, subequal and nearly straight in profile. Petiole slightly more compressed anteroposteriorly, the anterior and posterior surfaces of the node more flattened, the sides and dorsal surface

less rounded; postpetiole distinctly shorter, more than twice as broad as long. Claws, especially on the hind legs, conspicuously larger and coarser than in *morosus*.

Mandibles more distinctly striolate, their punctures much smaller, less foveolate and less numerous. Surface of head, thorax, and petiole with small, sparse, piligerous punctures instead of the large, shallow, more or less oblique piligerous foveolæ of variable size of *morosus*, so that the surface is smoother and more even. Gaster somewhat more shining, with finer, scattered piligerous punctures. Pilosity very similar in the two species.

Worker. Very much like the corresponding phase of *morosus*, but with the occipital margination and ridges as in the soldier. Sculpture also like that of the soldier and differing in the same way from that of the *morosus* worker. In the large worker the basal tooth of the mandibles seems to be more frequently developed in the Guiana form.

Male (Fig. 5b, 9e, 10). Length about 19–20 mm.

Eyes and ocelli somewhat larger and more convex than in *morosus* (Fig. 9b), the inner orbits of the former more strongly sinuous; antennæ and mandibles longer. Petiole with more distinct posterior corners, its sides more depressed and with sharper borders, its mid-dorsal surface much less concave. Genitalia large, retracted; stipites large, expanded, subelliptical, articulated with the basal annulus as in *Eciton*, volsellæ slender, apically geniculate and tapering; sagittæ longer and stouter, geniculate at the middle and there furnished with an acute dorsal process. Subgenital plate large, trowel-shaped, terminating in two large, acute lateral and two small acute median teeth.

Color much paler than *morosus*, being rich, reddish brown, usually with a narrow transverse band near the posterior border of each gastric segment, the base of the last segment, the posterior part of the head, two broad parapsidal streaks and an even broader anteromedian streak on the mesonotum, dark brown. These darker markings seem to vary considerably in different individuals. Wings much paler than in *morosus*, resin yellow, darker at the anterior border of the radial cell; veins also resin yellow. Pilosity on the mesonotum and dorsal surface of the gaster distinctly shorter than in *morosus*.

Described from numerous specimens taken at Kartabo Point, British Guiana.

In conclusion I list the four species of *Cheliomyrmex* and their synonymy as I understand it at the present time.

Cheliomyrmex morosus (F. Smith).

Labidus morosus F. Smith, Cat. Hym. Brit. Mus. 7, 1859, p. 6, ♂.

Eciton morosus Mayr, Wien. Ent. Zeitg. 5, 1885, p. 33, ♂.

Eciton morosum Dalla Torre, Cat. Hymen. 7, 1893, p. 4, ♂; Forel, Biol. Centr. Amer. Hym. 3, 1899, p. 27, ♂; Forel, Ann. Soc. Ent. Belg. 56, 1912, p. 43, ♂.

Eciton (*Labidus*?) *morosum* Emery, Gen. Insect. Dorylinæ 1910, p. 23, ♂.

Cheliomyrmex nortoni Mayr, Verh. zool. bot. Gesel. Wien. 20, 1870, p. 968, ♀; Ern. André, Rev. d'Ent. 6, 1887, p. 294, ♀; Dalla Torre, Cat. Hym. 7, 1893, p. 7, ♀; Forel, Biol. Centr. Amer. Hym. 3, 1899, p. 30, ♀; Ashmead, Proc. Ent. Soc. Wash. 8, 1906, p. 27, ♀; Wheeler, Bull. Amer. Mus. Nat. Hist. 23, 1907, p. 271, Pl. 11, figs. 4-9, ♀; Wheeler, Ants, etc. 1910, p. 255, Fig. 148, ♀; Wheeler, Boll. Lab. Zool. Gen. Agrar. Portici 3, 1909, p. 231, ♀; Emery, Gen. Insect. Dorylinæ, 1910, p. 17, ♀.

Cheliomyrmex morosus Wheeler. *Ante*, p. 318, ♀ ♂.

Type locality: Mexico.

Mexico: Orizaba, Vera Cruz, ♀ (Sumichrast); Atoyac, Vera Cruz, ♂ (Schumann); Orizaba, ♀ (F. Silvestri); Cordoba, Vera Cruz, ♂ (Fred. Knab); Santa Rosa ♂ (Wm. Schaus).

British Honduras: ♂ (C. H. Fernald); Manatee, ♀ (J. D. Johnson).

Honduras: La Ceiba, ♀ (W. M. Mann).

C. morosus var. **payarum** (Forel).

Eciton morosum var. *payarum* Forel, Biol. Centr. Amer. Hym. 3, 1899, p. 27, ♂; Forel, Mitteil. Naturh. Mus. Hamburg 18, 1901, p. 49, ♂.

Eciton (*Labidus*?) *morosum* var. *payarum* Emery, Gen. Insect. Dorylinæ, 1910, p. 23, ♂.

Type locality: Honduras (Staudinger).

Mexico.

Cheliomyrmex ursinus Emery.

Eciton morosum subsp. *ursinum* Emery, Bull. Soc. Ent. Ital. 33, 1901, p. 52, ♂.

Eciton (*Labidus*?) *morosum* subsp. *ursina* Emery, Gen. Insect. Dorylinæ, 1910, p. 23, ♂.

Cheliomyrmex ursinus Wheeler, *ante* p. 318, ♂.

Type locality: Brazil (André).

***Cheliomyrmex andicola* Emery.**

Cheliomyrmex nortoni subsp. *andicola* Emery, Bull. Soc. Ent. Ital. 26, 1894, p. 185, ♀; Emery, Gen. Insect. Dorylinæ, 1910, p. 17, ♀.

Cheliomyrmex andicola Forel, Mem. Soc. Neuchat. Sc. Nat. 5, 1912, p. 10, ♀; Wheeler, *ante* p. 318, ♀.

Type-locality: Panamarca, Peru.

Colombia: Cafetal Camelia, near Angelopolis, 1819 m.; Aguacatal, Dep. Tolima, 1515 m.; Facatativa, Dep. Cundinamarca, 2588 m. (O. Fuhrmann).

***Cheliomyrmex megalonyx* Wheeler.**

Ante p. 322, ♀ ♂.

Type-locality: Kartabo Point, British Guiana (Wheeler).

Postscript.

After the manuscript of this paper was completed Mr. Frederick M. Gaige wrote me that he had taken a female of *Eciton vagans* Olivier in the Arroyo de Arena, at an altitude of 400 ft., in the Santa Marta Mts. of Colombia, on August 25, 1920. Dr. Carlos Bruch also sends me word by Prof. J. C. Bradley that he has recently captured a female of *Eciton* (*Acamatus*) *strobili* Mayr in the Argentine. Thus the number of species of which all three phases are known is increased to eight.

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