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Notes on the Hypogaedic Ant, *Proceratium silaceum* Roger

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To complete the technical description of the species we give first a description of the male, which to date has remained undescribed.

Description of the Male

The following description deals largely with characters which differ from parallel characters in the male of *Proceratium croceum* Emery described by M. R. Smith (1930). The type male is from a nest of 5 males and 9 workers collected by C. A. Dennis on the south sand spit of Pelee Island, Ont., August 25, 1936 (Kennedy coll., No. 2361). The workers are of the lighter of the two forms of *silaceum* discussed elsewhere in this article. We have no males of the darker form. Neither have we been able to study males of *croceum*.

Length 3 mm. Length of face, excluding mandibles, into width, including compound eyes, 1.1-3 times ("slightly" broader than long in *croceum*).

Antenna, 12 segments, scape and first segment of funicle shiny; the other funicular segments dull. Scape equal in length to first 4 segments of funicle (equal to first 3 segments in Smith's fig. 3 of male *croceum*). Reticulation of face with 10-12 polygonal areas between compound eye and median ocellus (5 in Smith's fig. 3 of male *croceum*).

Mesonotum with very narrow median carina; scutellum with similar but a more distinct carina (in *croceum* not distinct enough on mesonotum for mention). Metanotum with median, posterior spine as in *croceum*. Epinotum with its posterior vertical face two times as long as dorsal surface (more nearly equal in *croceum*, Smith's fig. 2). Median furrow of epinotum wide and shallow, most distinct on upper half of vertical face (in *croceum* more distinct on the base).

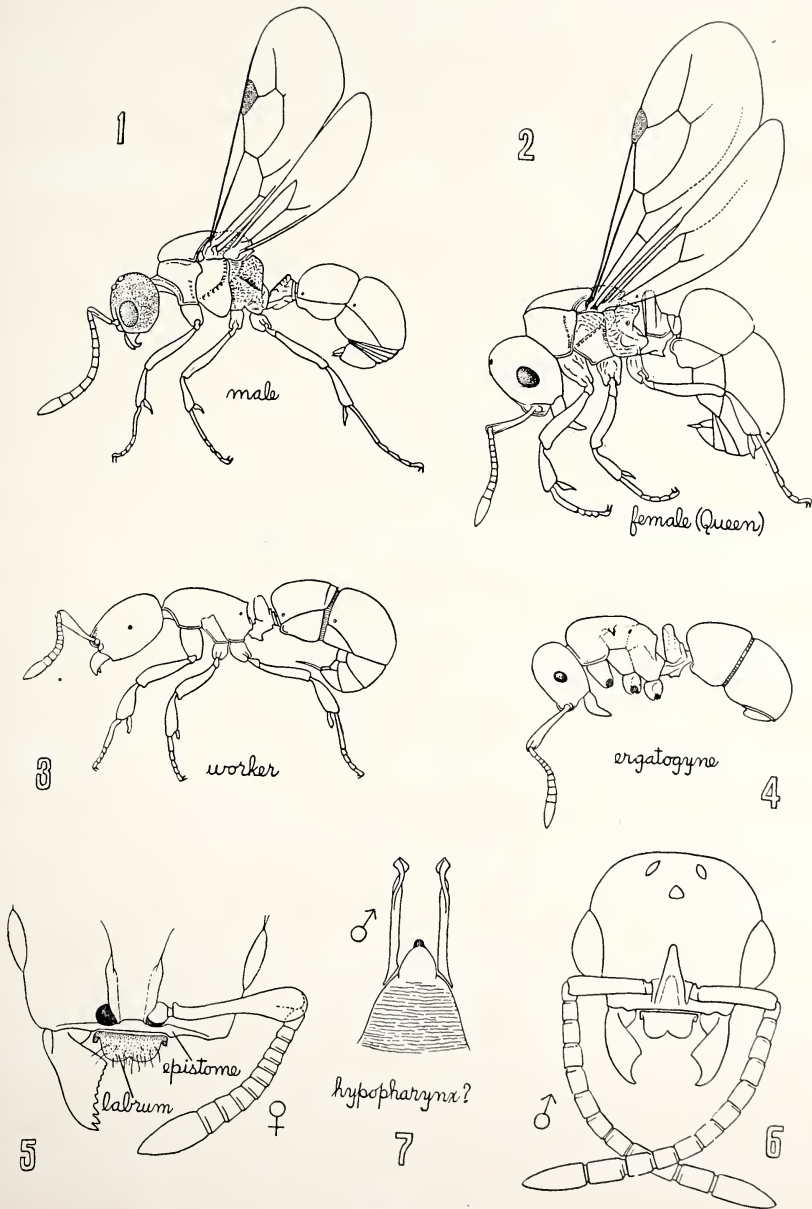
Color of head and body black; mandibles, antennae, and legs brown. Wings with colorless membrane and brown stigmas. (*Croceum* is ferruginous).

See Figures 1, 6, 8, 13, 15, and 21-26 which are drawn from regional material but from other nests than the male type nest.

Proceratium silaceum is a remnant from that time, barely a hundred years ago, when Ohio and Indiana were covered with an almost continuous forest. With the forest cover intact, drainage was much less rapid than now, so that much of the wooded area was more moist the year around. In those areas supporting white and burr oaks this species of ant was probably to be found in every oak log which, at a late stage of decay, had the proper moisture content.

Collection Records

Proceratium silaceum is sparsely listed in the literature because it is a rare ant which is never taken abundantly. Roger described it in 1863 (pp. 171-172), basing his description on one worker, which he lists as from North America. It has subsequently been collected along the eastern and southern parts of the United States.



Figs. 1-7.

The present paper concerns *P. silaceum* gathered from Ohio, Canada, and Tennessee. The collecting was done between 1930 and 1938, and during this time it was taken 16 times in Ohio, 9 times in neighboring parts of Canada, and 4 times in Tennessee. Most of the collections were made in the region of western Lake Erie over the islands and mainlands which surround Gibraltar island. This territory includes Ottawa County in Ohio and a part of Ontario, Canada. From Ontario the following collections are recorded: Middle Island (7-13-34 C. A. Dennis), Pelee Island (7-25-30 R. Wolf; 8-19-30, 8-23-30, 7-18-31, 8-18-31, 8-25-36 M. T.; 8-25-38 M. E. Amstutz), Point Pelee (8-5-31 C. H. K.). From Ottawa County, Ohio, are the following: South Bass Island (8-14-31 M. T.), Kelley's Island (8-18-35 C. A. Dennis), West Sister Island (7-18-36 C. H. K.), Catawba (7-10-31 S. R. Williams; 7-11-35 M. T.).

Other collections in Ohio show that the ant is rather widely distributed throughout the state. Records are as follows: in north central Ohio from Huron County (8-22-31 C. H. K.), in northeastern Ohio from Ashtabula County (8-29-38 A. E. Headley), in central Ohio from Franklin County (9-1-36 C. H. K.), Delaware County (6-5-38 C. H. K.), and Madison County (9-7-31, 9-25-31 C. H. K.), and in southern Ohio from Adams County (9-1-31 C. H. K.), Pike County (6-14-32 C. H. K.; 2 collections, no date, M. Schramm), and Meigs County (1 collection, no date M. Schramm).

The Tennessee records are from Blount County on the eastern edge of the state (9-15-31, 9-12-32, 9-17-32, 4-21-33 C. H. K.).

Since these scattered records extend over a period of intensive collecting by the authors and include the combined efforts of a number of other people, they tend to substantiate the evidence that *Proceratium silaceum* is truly a rare ant, not abundant in any habitat.

Ecological Distribution

The conditions under which the ants live are remarkably similar. Seemingly they possess very little toleration for variation in habitat. In every case they have been found in logs or stumps large enough to retain moisture, and in such a state of decay that the wood can be picked apart with the fingers or is already in fine, loose, soil-like granules. White oak logs seem to reach this state in the most perfect fashion, and most of the ants have been collected in this wood, but they have also been found in pine, elm, and burr oak logs in similar condition.

The logs must not only be well decayed but they must lie in a place where moisture is plentiful and constantly maintained. Other environmental factors in the surroundings may vary considerably. On Pelee Island and the neighboring mainland of Point Pelee, logs containing nests were found on sand of richly vegetated pine or oak dunes. Here the sand is subirrigated by the lake. Collections were also made from logs lying on loam in woods of various types of vegetation: elm-maple woods on Pelee Island, oak-maple woods on South Bass Island, hackberry woods on Middle Island, and oak-hickory woods at Willard (Huron Co., Ohio). These were usually deep, moist woods, in most cases near a river, lake, or bog. Thus the substratum may vary from sand to loam

and the type of vegetation may be quite diverse, but conditions must be such that large logs are kept thoroughly and constantly moist, and the logs must be in an advanced state of decay.

Nest Conditions

One of the aggravating things about collecting *Proceratium* is the fact that frequently a single individual is found, and then no amount of hunting will reveal the nest. In only 16 cases were nests actually found. One such, containing an unusually large colony of 60 workers, 73 males, 1 dealate female, and larvae and pupae, was collected on Pelee Island under rather typical conditions. The large white oak log, lying near the top of a small, completely vegetated white oak dune just back of the sand plain on the south spit of the island, was overgrown with wild grapes and poison ivy and was partially shaded by young trees. It was red and soft enough to be broken easily with the fingers in most places, although it retained its shape throughout. The ants were in an unusually soft part in the upper half of the log. They had small galleries following the annual rings of the wood. The workers were almost the color of the wood, and, since they moved slowly or remained curled up motionless, they were hard to see. The black, active males were quite conspicuous. In the same log were nests of *Ponera coarctata pennsylvanica* Buckley, *Myrmecina graminicola americana* Emery, *Strumigenys pergandei* Emery, *Aphaenogaster fulva aquia picea* Emery and *Camponotus herculeanus pennsylvanicus* De Geer.

Nests seem to be most frequently located in the soft wood which is just stiff enough to retain its shape but which is near an area of loose granular decay. Usually the nest is a small cavity 2.5 to 3 mm. long and .5 to 1 mm. wide with one or more slender galleries leading out from it and extending between the slightly harder circles of spring growth of the annual rings. Colonies are usually small; perhaps the one which contained 28 workers may be considered average.

Larvae and pupae were found from the beginning of the collecting season (July) until its end (September); so no data were gathered as to when they are first produced in the spring or whether they wintered over. Pupa cases are delicate enough that the pupae may be seen within them. They are white and only slightly elongated, not yellow and long as are those of the other two local *Ponerinae*, *Ponera coarctata pennsylvanica*, and *Stigmatomma pallipes*. They are about 1 mm. wide and 2.5 mm. long. Callows, newly emerged, are a very light straw color. Males and winged females probably emerge near the first of August (our earliest record for collecting them is 8-7-31). They are still in the nest in early September. Workers are entirely hypogaecic and have never been found in the light.

Associated Ants

Other ants, such as *Ponera coarctata pennsylvanica*, *Myrmecina graminicola americana*, *Stenamma brevicorne* Mayr, and *Strumigenys pergandei* or *pulchella* Emery, are frequently found associated with *Proceratium silaceum*. The colonies are never actually living together

but occur in different parts of the large moist logs which form the preferred niches of these species. However, the associated ants are not nearly so closely restricted in their nesting sites as is *P. silaceum*, since they are found in more varied habitats and are more abundant and widespread. Often ants of a wider range of habitat toleration are also found in the logs: *Camponotus herculeanus pennsylvanicus*, *Aphaenogaster fulva aquia picea*, and *Lasius umbratus mixtus aphidicola* Walsh. The logs are good niches for almost any kind of wood-inhabiting ant except such forms as *Crematogaster* and varieties of *Camponotus caryae* Nyl., which regularly nest in hard, dry wood.

Variations

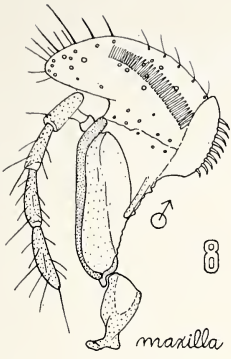
Three collections contained ants which were darker than the others. These were: (1) a large colony of 55 workers with one dealate female and one ergatogyne (Fig. 4), taken by C. H. K., No. 2618 (6-5-38) in Delaware County, Ohio, in a red, rotten white oak log lying in a shady second growth woods beside Big Walnut Creek; (2) a colony of 25 workers and one dealate female, taken at Catawba by M. T. (7-11-35) in a stump, with wood soft enough to come off in layers, lying under dense trees of an oak-walnut woods; (3) a single worker taken at Catawba by S. R. Williams (7-10-31) from unknown habitat. These answer Wheeler's description of *P. silaceum* subsp. *rugulosum* (from Wyandotte, Ind.) in that they are uniformly darker and more opaque than the other *P. silaceum* seen. However, they could not be distinguished by any uniform intensity of rugosity or any definite anatomical variation from the species. Whether they should be considered as being *silaceum* or Wheeler's Indiana subspecies cannot be decided until they are compared with type specimens.

Structure

The normal male, queen, and worker are shown in Figures 1-3. Proceratium belongs to the very primitive subfamily Ponerinae, many of which are distinguished by the groove between segments 1 and 2 of the gaster (abdominal segments III and IV). See Figures 1-4 and 16. The genus is further peculiar in the differentiation of the gaster into two regions. See Figures 16 and 17. Abdominal segments III and IV (Segs. 1 and 2 of gaster) are well developed and form most of the visible abdomen but tucked in the apex of abdominal segment IV is a post-abdomen of abdominal segments V to X which usually points cephalad but can be completely retracted into segment IV. This is similar to the anatomy of the higher flies (example, the house fly) but has evolved independently.

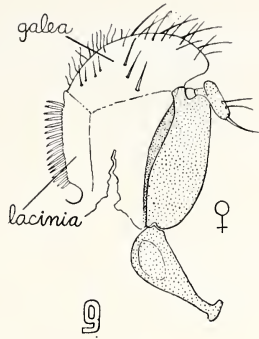
The eyes are large in the queen and male but are minute in the almost blind worker (Fig. 3). In the ergatogyne (Fig. 4) they are intermediate in size.

The ergatogyne is not found regularly in Proceratium nests but appears to be one of nature's genetic accidents. The latest evidence (Wheeler, 1937) is that the ergatogyne is a genetic mosaic of the worker and queen castes. We have found these in but one nest, Kennedy coll.,

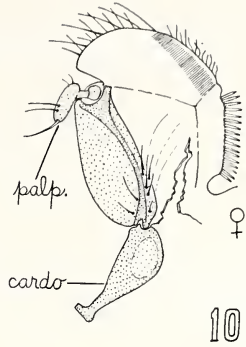


8

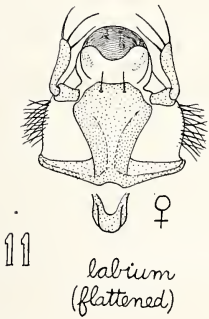
maxilla



9

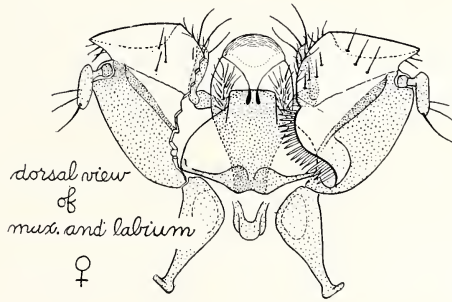


10



11

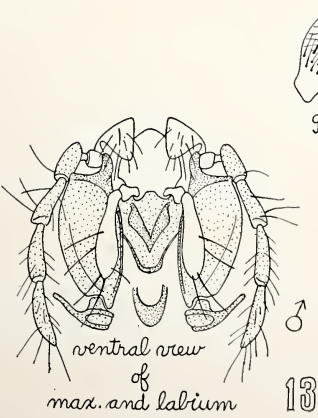
labium
(flattened)



dorsal view
of
max. and labium

♀

12



ventral view
of
max. and labium

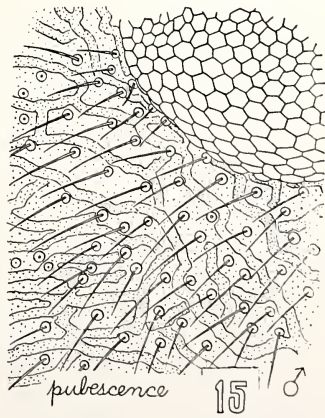
♂

13



glossa from
above, male

14



pubescence

♂

15

Figs. 8-15.

No. 2618 (Delaware County, June 5, 1938). This nest contained a normal dealate nest queen, the ergatogyne with undeveloped wing stubs, which is figured (Fig. 4), and two workers with eyes slightly larger than those of other workers but no wing development. In the same nest were 55 normal workers. This was a nest of the slightly larger, darker form which on comparison with types may prove to be *rugulosum* Wheeler (1915). The type material of *rugulosum* was collected by Dr. W. S. Blatchley at Wyandotte, Indiana.

The mouthparts are shown in detail because they are so minute in an ant 2-3 mm. long that they have been little studied and seldom figured for ants so small. Figures 5 and 6 show the labrum, which the ant keeps folded into the mouth. The mandibles of the male (Fig. 6) are without teeth as compared with those of the worker or of the queen (Fig. 5). What is probably a hypopharynx (Fig. 7) dissects out of the floor of the mouth of the male. It may occur in the female castes but was not found.

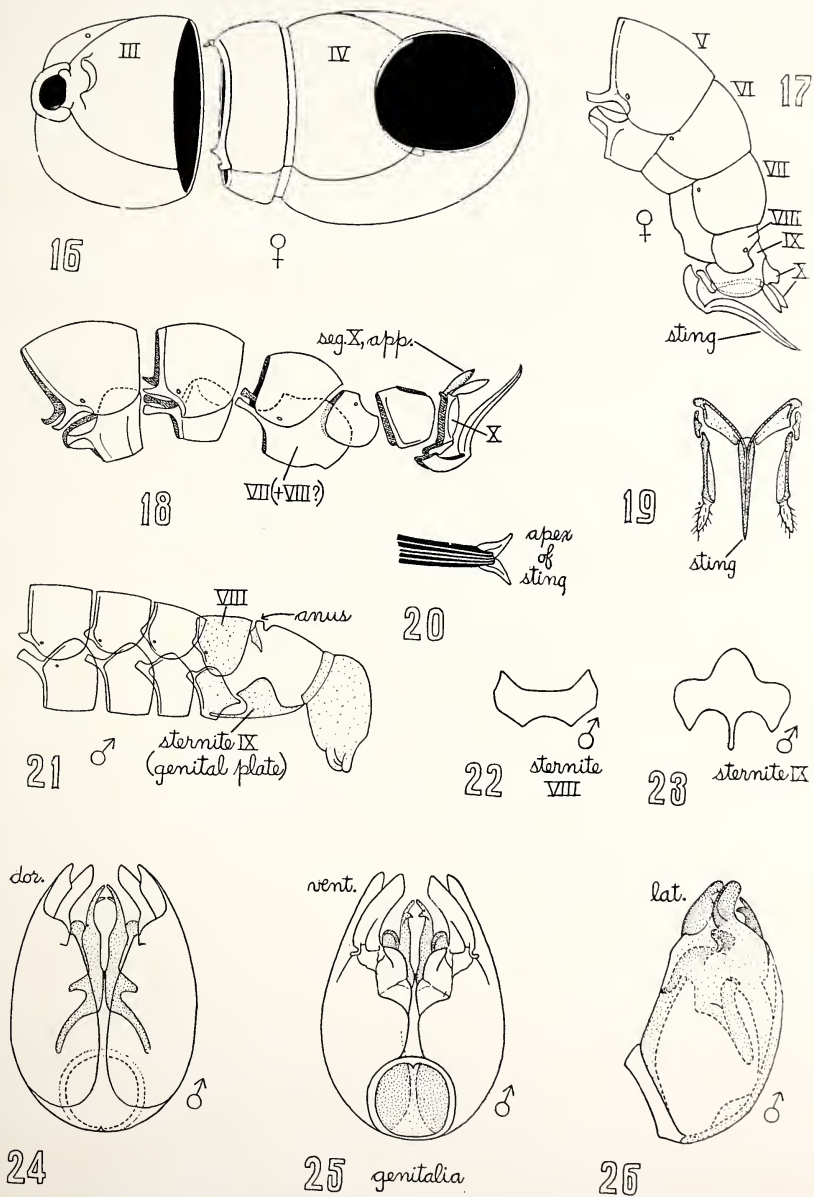
Figures 8, 9, and 10 are views of the maxilla, of male (Fig. 8), and queen (Figs. 9 and 10). The maxillary palp in the male is four-segmented, while in the queen and workers it has one segment. On the galea, revealed by transmitted light, is a comb-like series of sense organs. This is termed the "maxillary comb"; in the male it has 25 to 30 parts, while in the queen there are about 40. In larger ants these organs appear to be rigid hairs lying tight against the inner surface of the galea. Here they appeared to be more deeply embedded and less like free hairs. We have shown them, as seen by transmitted light, in Figures 8 and 10 and did not determine whether they were more closely associated with the internal or with the external surface of the galea. In Figure 9 the maxillary comb has been omitted to show better the hairs on the inner surface of the maxilla.

Figures 11, 12, 13, and 14 show the labium in the male and queen. In both the palpus is two-segmented. The inner surface is well supplied with long bristles (Figs. 11 and 14).

Figure 15 is a view at high magnification of the size of the pubescent hairs, showing their spacing as compared with the size of the ocellae of the compound eye. The area figured is between the eye and the base of the antenna of that side. We have been trying to develop some method of figuring the surface texture, pubescence, longer hairs, etc., of ants, as these items are used so extensively in describing species. The written terms are so susceptible of more than one interpretation. The checking by a figure of these parts against the size of the ocellae of the compound eye is one method of making a more accurate record of size and spacing of the pubescence.

The sting of the female (queen) is shown in Figures 17 to 20. The pair of cercus-like organs are considered appendages of segment X and are not cerci or appendages of segment XI. Before it has been lost by use, the apex of the sting bears a bifurcate membrane cap (Fig. 20).

Segments VII-X are highly modified in the female. Apparently the sternite is missing from segments VIII, IX and X. The sternite of segment VII is twice as long as those of segments V and VI, which suggests



Figs. 16-26.

that it may be double or a fusion of the sternites of segments VII and VIII. Notice the high position of the spiracle on segment VIII.

In the male (Figs. 21-26) the first highly modified segment is segment IX, where the tergite is reduced to a mere sliver in front of the anus, and the sternite is developed into a genital plate (Figs. 21 and 23). The latter is usually of a slightly different shape for each species of ant but to be studied has to be dissected out of the male. Figures 24-26 show three views of the male genitalia. The internal pair of slender forked parts (Figs. 24 and 25) are probably sagittae. The outermost pair of unstippled prongs are probably stipes.

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