KARL V. KROMBEIN

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## ABSTRACT

Krombein, Karl V. Life History Notes on Some Egyptian Solitary Wasps and Bees and Their Associates (Hymenoptera: Aculeata). *Smithsonian Contributions to Zoology*, 19:1–18. 1969.—Biological notes are presented on seven Egyptian wasps: *Chrysura pustulosa* (Abeille), *Chrysis episcopalis* Spinola, *Eumenes mediterraneus* Kriechbaumer, *Rhynchium oculatum* (Fabricius), *Telostegus melanurus* (Klug), *Trypoxylon aegyptium* Kohl, and *Philanthus triangulum abdelcader* (Lepeletier); seven Egyptian bees: *Hylaeus adspersa* (Alfken), *Heriades moricei* Friese, *Osmia latreillei* (Spinola), *O. aurantiaca* Stanek, *Megachile variscopa* Pérez, *M. minutissima* Radoszkowski, and *M. flavipes* (Spinola); and on the sarcophagid fly *Miltogrammidium chivae* Rohdendorf, parasitic on an unknown species of *Megachile* bee.


During the period 1 March–29 May 1965, I participated in the "Insect Survey of Egypt," a Public Law 480 project of five years' duration carried on cooperatively by entomologists from the Entomology Research Division, United States Department of Agriculture, Washington, D.C., and from the Department of Plant Protection, Ministry of Agriculture, Dokki, Egypt, U.A.R. This project had as its main purposes the collection of Egyptian insects, their identification subsequently by taxonomists specializing on the Egyptian fauna, and the deposition of sets of identified material in the collections of the United States National Museum and the Egyptian Ministry of Agriculture.

Necessarily, most of my time in the field was devoted to the collection of wasps, bees, and other insects, an activity largely incompatible with prolonged observation of the activities of nesting wasps and bees. I obtained a few scattered notes, however, mostly on the prey of ground-nesting wasps, which are reported below.

Also, in several localities I set out wooden trap nests in which several species of solitary wasps and bees nested. These traps are attractive to some species which nest ordinarily in abandoned borings of other insects in wood or in naturally occurring cavities. Such traps have been every effective in North America as a device to investigate the nest architecture and prey or pollen preferences of wood- and twig-nesting wasps and bees, respectively, and to obtain information on the life history of these insects and their associated symbionts, parasites, and predators. The traps were not so successful in Egypt because the majority of solitary wasps and bees are ground-nesters. Eight species which nested in the traps are treated in systematic order in the following account.


*Karl V. Krombein, Chairman, Department of Entomology, Smithsonian Institution, Washington, D.C. 20560.*


The traps were fabricated from straight-grained sticks of white pine measuring approximately 165×20×20 mm. A boring about 150 mm long was drilled in each trap; borings of three diameters, 4.8, 6.4, and 12.7 mm, were made in these longer traps. I also used some shorter traps containing a boring 3.2 mm in diameter and about 65–70 mm long. Bundles of traps were made up containing two each of the 4.8- and 6.4-mm borings and one each of the 3.2- and 12.7-mm borings. These bundles were set out in what I hoped were attractive situations in the localities which follow.

Ismailia: Stations were in a garden, on wooden posts and beams containing abandoned borings of other insects; the garden was at the edge of town, was enclosed by walls, and was devoted to growing ornamental flowers. The traps were set out on 3 April; they were inspected and completed nests picked up on 23 April, 23 May, 13 June, and 29 July.

Giza (Figures 1–4): Traps were set in two areas— in a garden on the grounds of an orphanage located just north of the Pyramids and on the grounds of the experimental orchard of the Faculty of Agriculture, Cairo University. Stations at the orphanage were on wooden trellises, on trunks of Casuarina trees adjacent to a citrus planting, and on branches of citrus trees. At the University the settings were made on wooden trellises, on a Bougainvillea hedge, and on trunks of old trees— all settings were negative at this site. At the orphanage the traps were set out on 13 March; they were inspected on 25 March, 28 April, 12 and 27 May, 14 June, and 16 July. The traps at the Faculty of Agriculture were set out 27 March; they were checked on 28 April and 12 May.

FIGURES 1–6.—Trap-nest settings at Giza orphanage, 13 March 1965: 1, Station 8 on post supporting grape trellis, nesting site of *Heriades moricei* Friese; 2, Station 12 on wooden shed, nesting site of *Megachile minutissima* Radoszkowski; 3, Station 13 on *Casuarina* trunk, nesting site of *Heriades* and *Rhynchium oculatum* (Fabricius); 4, Station 14 in citrus tree, nesting site of *Trypoxylon aegyptium* Kohl. Similar stations at Apiculture Section, Dokki, March 14, 1965; 5, Station 17 on roof of Apiculture Section laboratory, nesting site of *Osmia aurantiaca* Stanek and *Chalicodoma flavipes* (Spinola); 6, Station 19 in densely shaded summerhouse, nesting site of *Megachile variscopa* Pérez.

Dokki (Figures 5–6): The study area was on the grounds of the Apicultural Section of the Ministry of Agriculture in a suburb of Cairo; stations were on the edge of the flat roof of the one-story apicultural laboratory, on a vine-covered wooden summerhouse, and on a wooden trellis. The traps were set out on 14 March; they were inspected on 25 March, 28 April, 12 and 27 May, 14 June, and 15 July.

Kom Oshim: Traps were set in a desert scrub area at the northeast edge of the Fayoum about a kilometer west of the desert road; the dominant shrub was tamarisk; stations above ground were all on tamarisk branches; some bundles were set upright in the ground with the boring entrances flush with the ground level. This was an unprotected area, and all traps were picked up in a few weeks by inquisitive people. The traps were set out on 5 April; they were checked on 18 April and again on 24 April, at which time all were missing.

The nests which I obtained from 23 April to 23 May were opened within two or three days, the architectural details were recorded on standardized data sheets, and developmental details were noted at periodic intervals of several days. For an explanation of the study techniques and terms used in describing the nest architecture, the reader is referred to my recently published study on trap-nesting wasps and bees occurring in the United States (Krombein, 1967, pp. 8–22).

The nests obtained prior to my departure from Egypt were maintained in my hotel room at temperatures ranging from 70°–90° F. At the end of May I sealed the boring entrances with aluminum foil and masking tape and sent them to the United States by sea mail, where they arrived about mid-August. After my departure from Egypt, my colleague, A. B. Gurney, kindly checked the traps twice during June and July and sent the completed nests to me by airmail, after sealing them as described above. Most of the nests were then held in my office in Washington, D.C., at a relatively constant temperature of about 70° F. until emergence occurred. A few nests containing diapausing larvae were set outside in cooler temperatures from mid-October to mid-November in an attempt to break the diapause.

ACKNOWLEDGMENTS.—I am indebted to Dr. Mohammed Mahmoud Ibrahim, director of the Department of Plant Protection and sponsoring scientist for the Public Law 480 project, for his interest in facilitating these field studies. Dr. Moustafa Hafez of the same department made arrangements for a number of the field trips. Dr. A. K. Wafa, chairman of the Department of Entomology in the Cairo University Faculty of Agriculture was kind enough to arrange for setting out trap nests on the experimental grounds of that Faculty. Mr. M. Abdel Khalek Moustafa of the Ministry was a cheerful companion on many field trips and facilitated my contacts with his non-English speaking countrymen. Dr. M. A. Hafeez of the Ministry generously processed the photographs I made of the trap-nesting stations and of the nests themselves. Mr. A. Alfieri, Sécrétaire Général of the Société Entomologique d'Egypte, drew on his extensive knowledge of Egypt in suggesting several localities for study and also made available his personal synoptic collection which helped identify some of the collected material. Finally, Mr. James K. Hutchins, agricultural attaché in the American Embassy, Cairo, was extremely helpful in arranging contacts within the Embassy and in the Ministry and contributed in general to the successful completion of the project.

I am further indebted to the following specialists for identification of material reared or obtained from these nests: H. E. Evans, Museum of Comparative Zoology, Cambridge, Massachusetts (Pompilidae); W. J. Gertsch, American Museum of Natural History, New York City (Araneae); P. D. Hurd, Jr., University of California at Berkeley (*Megachile*); J. J. Pasteels, Université Libre de Bruxelles, Belgium (*Chalicodoma flavipes*); Salah Rashad, Faculty of Agriculture, Cairo University, Giza (pollens); B. B. Rohdendorf, Palaeontological Institute, Moscow (*Miltogrammidium*); E. Stanek, Uhersky Brod, Czechoslovakia (*Osmia*); J. van der Vecht, Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands (Eumenidae); D. M. Weisman, United States Department of Agriculture (lepidopterous larvae); S. Zimmermann, Vienna, Austria (Chrysididae). The other identifications are my own.

## Family CHRYSIDIDAE

### *Chrysura pustulosa* (Abeille)

FIGURES 15, 19

See notes under *Osmia* (*Chalcosmia*) *latreillei* (Spinola), its putative host.

### *Chrysis* (*Chrysis*) *episcopalis* Spinola

Circumstantial evidence suggests that this cuckoo wasp has as one of its hosts the wall bee *Chalicodoma* (*Chalicodoma*) *siculum* (Rossi) (Megachilidae). The most productive collecting spot near Ismailia was a small, sparsely vegetated, sandy area near the base of the Suez Defense Monument about eight kilometers south of the town. There, on 23 April, I collected males and females of *C. episcopalis* that were flying around and alighting upon concrete blocks which bore mud nests of the *Chalicodoma*.

## Family EUMENIDAE

### *Eumenes mediterraneus* Kriechbaumer

On 23 March I found a small mud nest (No. 32365 A) of this wasp about a meter above the ground on a twig of a tamarisk shrub in a desert scrub area at Kom Oshim. The nest was flattened spheroidal in shape, about 4 mm wide, 5 mm long, and 3.3 mm high. It did not have a pronounced jug-shaped neck as in the nests of some other *Eumenes* species.

Presumably the nest was completed several days before my discovery. A male wasp emerged about 17 April or a day or two earlier while I was absent on a field trip. I found it dead but still limp in the rearing tin on 19 April.

Deleurance (1946, pp. 90–96), under the name *Eumenes pomiformis* var. *mediterranea*, published some biological notes on this species made at Nice, France, and summarized previous observations on the nesting habits of the species. He noted that this *Eumenes* built its nest on herbaceous stems or slender branches, beneath leaves, on walls, and in burrows of *Anthophora* bees. Construction of the delicate mud nest required 1½–2 hours. In one case the wasp built the nest and laid an egg in it on 7 July, the egg hatched on the 9th, the wasp placed paralyzed green caterpillars in the nest on the 9th, 10th, and 11th, and sealed the nest on the last date. The wasp larva completed feeding on the stored caterpillars on the 13th. The mother wasp commenced a second nest on the 12th. This instance of progressive provisioning, unusual for an eumenid wasp, was repeated later by another specimen of *mediterraneus*, so it appears to be a fixed habit of this species.

Consolidated prey records attributed to *mediterraneus* are as follows:

OECOPHORIDAE: *Agonopteryx heracliana* (Linnaeus) [recorded as *Depressaria applana* Fabricius].

YPONOMEUTIDAE: *Plutella xylostella* (Linnaeus) [recorded as *cruciferarum* Zeller].

PHALONIIDAE: *Eupoecilia angustana* (Hübner) [recorded as *Cochylis cruentana* Froelich], *C. hybridella* (Hübner).

PYRALIDAE: *Evergestis extimalis* (Scopoli) [recorded in *Pionea*], *Pyrausta sanguinalis* (Linnaeus), *Homoesoma nimbellum* (Duponchel).

PTEROPHORIDAE: *Platyptilia acanthodactyla* (Hübner) [recorded in *Amblyptilia*], *Oxyptilus tristis* Zeller, *Pterophorus monodactylus* (Linnaeus), *Mimeseoptilus seronitus* Zeller.

GEOMETRIDAE: *Lobophora halterata* (Hufnagel), *Cidaria juniprata* (Linnaeus) [recorded in *Thera*], *C. bifasciata* ab. *unifasciata* (Haworth), *Eupithecia oxycedrata* Rambur, *E. linariata* (Fabricius), *Gymnoscelis pumilata* (Hübner) [recorded in *Eupithecia*], *Lythria purpurata* (Linnaeus), *Ligydia adustata* (Denis & Schiffermüller).

NOCTUIDAE: *Heliothis armigera* (Hübner), *H. dipsacea* (Linnaeus).

Deleurance cites Chrétien as finding 3–38 caterpillars per cell and Fabre 14–16. The wasp larva spins a cocoon and voids its accumulated fecal wastes in about six days. During the summer pupation occurs about a week later. The entire life cycle in summer, egg to adult, requires 30–40 days.

Parasites of *mediterraneus* were listed as follows:

CHRYSIDIDAE: *Holopyga rosea* (Rossi) and *H. purpurascens* (Dahlbom) [both of these listed in *Hedychrum*], *Chrysis cyanopyga* Dahlbom, *C. ignita* (Linnaeus).

EULOPHIDAE: *Melittobia acasta* (Walker) [recorded as *audouini*].

ENCYRTIDAE: *Paralitomastix varicornis* (Nees) [recorded in *Encyrtus*].

ICHNEUMONIDAE: *Mesostenus* species, *Bathyplectes exiguus* (Gravenhorst) [recorded as *Canidia pusilla* Holmgren, a synonym], *Mesoleius abbreviatus* Brischke [recorded as *Mesolephus* (!)].

BOMBYLIIDAE: *Toxophora maculata* (Rossi).

It should be noted that some of these parasite records are unquestionably erroneous, being based presumably either on misidentifications, on specimens reared from prey of the wasp, or on other insects occurring by chance in the wasp nests. Thus, *Mesostenus* and *Paralitomastix* parasitize lepidopterous larvae; this species of *Bathyplectes* has as its host species of the weevil genus *Hypera;* and the species of *Mesoleius* parasitize sawfly larvae.

### *Rhynchium oculatum* (Fabricius)

FIGURES 7–9

This large eumenid wasp occupied six 12.7-mm borings, one each from four different settings (nest Nos.

328, 329, 330, 333) on wooden posts in a garden in Ismailia and one each from settings on a wooden trellis (No. 313) and on a Casuarina trunk (No. 316) in a garden area in Giza. In addition the same wasp probably used two 6.4-mm borings (Nos. 226, 227) from the Casuarina trunk station in Giza; occupants of these nests died as small larvae.

The Ismailia nests were stored and completed during the period 23 May to 13 June. The nests from the Casuarina trunk setting in Giza were stored and completed during the period 25 March–28 April. The nest from the trellis in Giza was stored and completed between 28 April and 12 May.

NEST ARCHITECTURE.—In one each of the 6.4- and 12.7-mm borings at Giza, the mother wasp placed a little mud in the inner end of the boring before bringing in prey. In the other nests the wasps placed the paralyzed caterpillars at the inner end without first coating it with mud.

The six 12.7-mm nests each contained 1–4 provisioned cells (mean 2.5); in length these cells ranged from 18–43 mm (mean 27). Three cells from which females were reared were 24–37 mm long (mean 29), and five male cells were 23–29 mm (mean 26); progeny was not reared from the other seven cells. Each of the 6.4-mm nests had a single provisioned cell 35 and 39 mm long respectively.

Empty intercalary cells were lacking in both 6.4-mm nests and in three 12.7-mm nests; they were present in two of the 12.7-mm nests from Ismailia and in one of the 12.7-mm nests from Giza. In the latter nest there were intercalary cells 13 and 22 mm long between stored cells 2 and 3 and between stored cell 3 and the vestibular cell. In a 4-celled nest from Ismailia there was one intercalary cell 9 mm long between stored cells 2 and 3; the other 2-celled nest (No. 333) had two intercalary cells 22 and 14 mm long between stored cells 1 and 2.

All nests had an empty vestibular cell except one nest from Giza. In the two 6.4-mm nests these cells were 110 mm long; one was divided into two sections by a transverse mud partition. Five vestibular cells in 12.7-mm borings were 13–80 mm long (mean 49); one was divided into two sections by a transverse mud partition. The one nest from Giza which lacked the vestibular cell may have been abnormal; it had only a single stored cell 30 mm long which was sealed by a much thicker partition (4–9 mm) than normal.

The partitions closing the cells and the plug at the nest entrance were made from mud except in the one abnormal (?) nest from Giza which was sealed by a plug made from agglutinated sand. The partitions in 6.4-mm nests were 1.5–3 mm, and the closing plugs were 4–5 mm thick. The partitions closing stored cells in 12.7-mm nests were quite thin in the middle, about 1 mm, but 3–8 mm thick at the edges. The partitions closing empty intercalary cells were slightly thicker than those closing stored cells. The closing plugs in 12.7-mm nests were 2–13 mm thick (mean 7).

PREY.—*Rhynchium oculatum* stored a large number of rather small caterpillars per cell or a smaller number of larger caterpillars. When I opened nest 313 from Giza, I found a prepupa of *oculatum* and 103 specimens of a species of Gelechiidae which had not been eaten by the wasp larva. Ninety-nine of the specimens of prey were larvae and four were partially transformed to the pupal stage; the larvae were shriveled and about 5 mm long. Nest 328 from Ismailia contained two dead adult *oculatum*, and I recovered the head capsule of a small specimen of Pyraloidea from one of the cells.

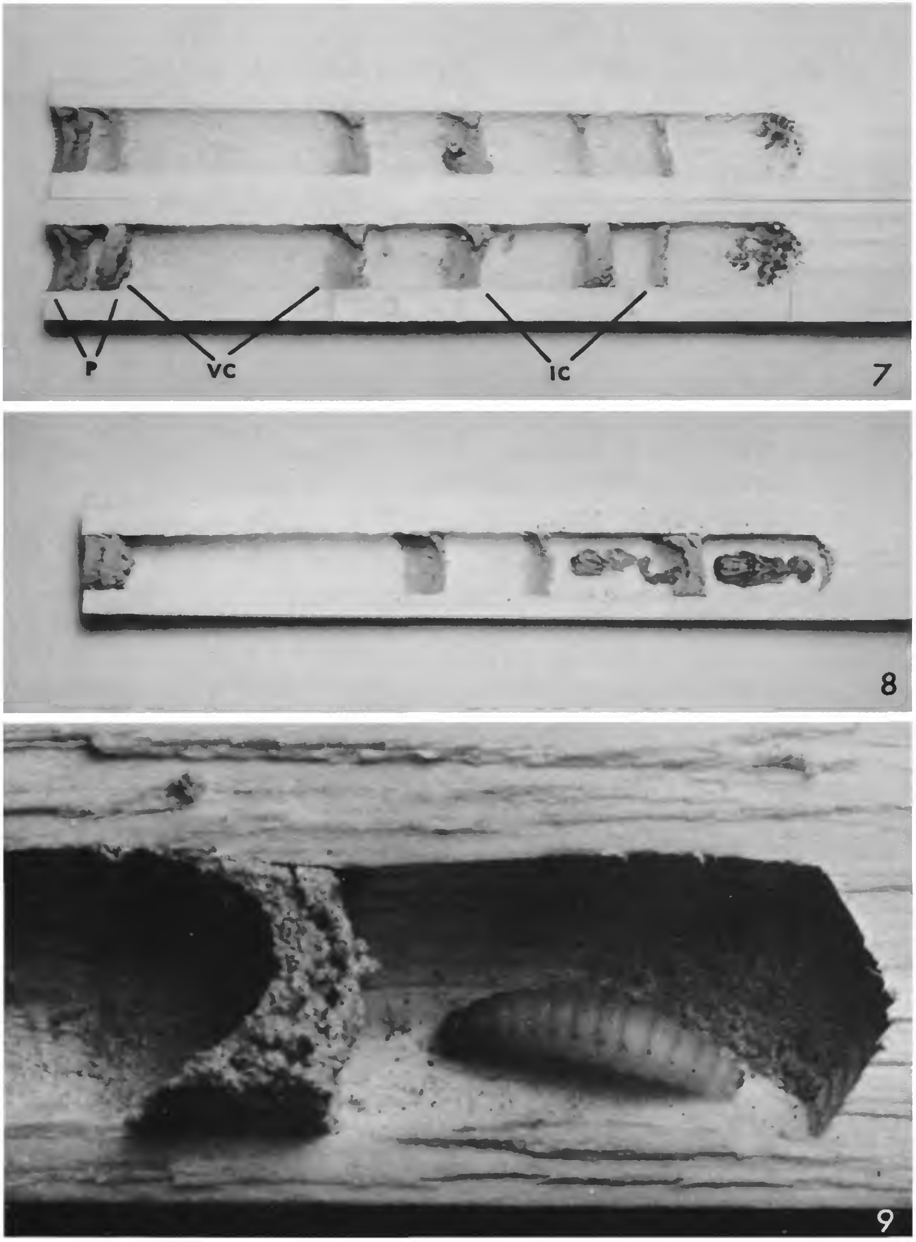
Nests 329, 330, and 333 from Ismailia were stored with caterpillars of a species of Amphipyrinae (Noctuidae). Fourteen larvae from 333 were 10–15 mm long. Fourteen larvae or fragments thereof were recovered from nest 330, and six from nest 329.

Development of the wasps in all nests of *oculatum* had progressed so far by the time I opened the nests that it was not possible to ascertain the original number of caterpillars provided in each cell.

LIFE HISTORY.—The empty egg shell in one nest was 3 mm long; it was attached by a delicate filament at a point 3 mm from the inner end and on the upper side of the boring.

The small wasp larvae in the 6.4-mm nests and in one of the 12.7-mm nests from Giza were dead when I opened these three nests on 28 April, probably because of the high temperatures during that period. This suggests that *oculatum* normally nests in situations offering greater protection from ambient temperatures than afforded by the relatively thin-walled wooden traps.

The other 1-celled nest (No. 313) from Giza contained a creamy, leathery skinned prepupa 14 mm long on 12 May; this nest was provisioned some time after 28 April, probably early in May. There was a pale, pink-eyed pupa in this cell on 17 May, so pupation must have occurred about the 15th. Adult eclosion had not occurred by 26 May, and the nearly fully col-




FIGURES 7–9.—Nests of *Rhynchium oculatum* (Fabricius) in 12.7-mm borings: 7, nest 333, Ismailia, 19 August 1965 (note two empty intercalary cells [ic] between stored cells 1 and 2, empty vestibular cell [vc] and thick closing plug [p]; 8, nest 328, Ismailia, 19 August 1965 (note two dead pupae in cells 1[♀] and 2[♂], absence of empty intercalary cells between the stored cells, and division of empty vestibular cell into two sections by a cross partition); 9, nest 313, Giza, 12 May 1965, resting male larva in cell 1 (note mud at inner [right] end of cell and thick lenticular mud partition sealing the cell).

ored pupa was dead the next time I examined the nest on 16 August.

The four nests from Ismailia were stored during the period 23 May to 13 June. I opened two of them on 29 July and found that the adult occupants had died in the cells before that date. Dead adults were found in their cells in the other two nests when I opened them on 19 August. Three of the Ismailia nests contained both sexes; females were in the innermost, and males in the outermost cells.

The cocoon of this wasp is evanescent or entirely lacking. In the Ismailia nests the larvae in one nest just varnished over the inner wall of the mud partition capping the cells; in two nests the larvae silked over these closing partitions and about 2–3 mm of the cell walls adjacent to the partitions.

Lichtenstein (1869) published the first biological note on this species in southern France. He stated that it nested in rose canes in cavities as short as two to three inches in length. Each cell was provisioned with 8–12 caterpillars of the noctuid moth *Plusia gamma* (Linnaeus). A female wasp might provision 15–20 cells during her lifetime, storing 150–200 caterpillars in these cells. There was only one generation a year, the immature wasp remaining as a resting larva in the cell during the winter and pupating in April.

Grandi (1961, pp. 47–52, figs. 28–32) summarized his earlier observations on this wasp in Italy. At Pontecorvo he found four nests in dry canes of *Arundo donax,* arranged vertically to form a wall of a shed for drying tobacco leaves. At the bottom of each nest the wasp coated the whole diaphragm of the internode with a thin layer of mud or made a mud plug 4–5 mm thick if the diaphragm was perforated or broken. A nest in a cane with a calibre of 7 mm had a single stored cell 25 mm long; three nests in canes having a calibre 10–11 mm had 11 stored cells 14–30 mm long (mean 22). Two of the latter nests were 143 and 161 mm long, had five and four stored cells respectively, and vestibular cells of 13 and 26 mm length respectively. One of these nests had a closing plug of mud 14 mm thick. The cells were stored with light green caterpillars of a pyralid moth 25–27 mm long. The wasp egg was 4.3 mm long and was suspended from the cell wall by a filament 2 mm long. Grandi reared the hypermetamorphic rhipiphorid beetle *Macrosiagon ferrugineum flabellatum* (Fabricius) from resting larvae of the wasp. Later, at Bologna, he found *oculatum* preying on larvae of the pyralid moth *Lypotigris ruralis* (Scopoli).



## Family POMPILIDAE

### *Telostegus melanurus* (Klug)

I captured a female spider wasp (No. 51765 B) 10 mm long at 1420 hours on 17 May at Dahshur. She was running rapidly forward over the sand, with her wings flicking, and carrying beneath her a paralyzed green oxyopid spider, *Peucetia viridis* Blackwall, 9 mm long.

## Family SPHECIDAE

### *Trypoxylon aegyptium* Kohl

This slender black sphecid wasp nested in two of the 3.2-mm borings. One (No. 27) was in a bundle of traps suspended from a branch of an orange tree in Giza. The other (No. 53) was from a setting on a wooden post in a garden at Ismailia. Both borings were empty when I inspected them on 27 and 23 May respectively; the nests were completed between those dates and 13–14 June when they were picked up by A. B. Gurney.

NEST ARCHITECTURE.—Both females stored spiders at the inner end of the boring without first coating the inner end with mud.

The nest from Giza had a stored cell 12 mm long at the inner end, an empty intercalary cell 4 mm long, a second stored cell 12 mm long, and another empty intercalary cell 5 mm long. The remaining 38 mm of the boring contained a series of four vestibular cells 8, 7, 6, and 17 mm long. The cell partitions were ½–¾ mm thick, and the closing plug at the nest entrance was 2 mm thick; both were made of mud.

The Ismailia nest had a stored cell 19 mm long at the inner end, an empty intercalary cell 5 mm long divided into two sections by a thin mud partition, and a second stored cell 20 mm long. There was an empty vestibular cell 9 mm long beyond the second stored cell. The cell partitions and closing plug were made of mud; the partitions were ½–1 mm and the closing plug 2 mm thick.

PREY.—A desiccated spider in the nest from Ismailia was identified by W. J. Gertsch as a female theridiid belonging to the genus *Theridion*. *Trypoxylon carinatum* Say from North America, which belongs to the same species group as *aegyptium,* preys on *Theridion lyricum* Walckenaer (Krombein, 1967, p. 228). It is quite likely that both wasps prey on a variety of snare-building spiders belonging to several families.

LIFE HISTORY.—I opened the Giza nest on 19 July and found a dead broken male inside the boring. The other occupant had escaped from the nest before it was sealed for shipment on 14 June. Data from this nest indicate a maximum developmental period, egg to adult, of about 2½ weeks. The North American *carinatum,* another member of the Scutatum Group to which *aegyptium* also belongs, requires four weeks from egg to adult.

The Ismailia nest was opened on 19 August. I found a dead female and a dead male in the boring, but I was unable to ascertain from which cell either had come. The cocoons in this nest were 8–9 mm long, fusiform in shape, and were spun from opaque, delicate white silk.

### *Philanthus triangulum abdelcader* Lepeletier

This ground-nesting sphecid wasp preys on honeybees. At Dahshur on 17 May at 1400 hours I captured a female (No. 51765 A) 15 mm long, resting on a grass stem. She was clutching a paralyzed worker honeybee 11 mm long.

In his original description of this taxon, Lepeletier (1845, p. 34) said that his son had observed it provisioning its nest in Algeria with honeybees.

## Family COLLETIDAE

### *Hylaeus (Spatulariella) adspersa* (Alfken)

I obtained one nest (No. 57) of this small colletid bee in a 3.2-mm boring from a setting on a wooden post in a garden at Ismailia. The nest was stored and completed during the period 23 May to 13 June.

I got two additional nests (Nos. 29, 30) of a species of *Hylaeus* in 3.2-mm borings from a setting on the trunk of a Casuarina tree in a garden at Giza. Apparently these nests were completed early in the period 14 June–16 July, because the occupants transformed to adults and left the nest by the later date. The architecture definitely proves these to have been *Hylaeus* nests, but nests of species of this genus are not specifically diagnostic.

NEST ARCHITECTURE.—The cell walls and partitions were made of an extremely thin, very delicate, transparent film formed from the dried salivary secretions of the mother bee. The Ismailia nest had eight stored cells, 4, 7, 7, 5, 6, 7, 6, and 4 mm long, respectively, beginning with the innermost. There was also an empty vestibular cell 8 mm long sealed by a very thin partition of the salivary secretion.

LIFE HISTORY.—No details are available on the early stages. When I opened the Ismailia nest on 19 August, it contained eight dead, dry bees, four females, and four males. The sequence of sexes in the cells could not be determined, because the adults moved around after eclosion.

If the Giza nests are also those of *adspersa,* the life cycle, egg to adult, must be of rather short duration. In North America *modestus* Say has only a single generation annually (Krombein, 1967, pp. 262–264); however, I reported a larval feeding period of two weeks and a period of 12–13 days from pupation to adult emergence.

## Family MEGACHILIDAE

### *Heriades moricei* Friese

I obtained four nests of *moricei:* one (No. 136) in a 4.8-mm boring from a setting on a vine-covered summer house in Dokki, one (No. 114) in a 4.8-mm boring from a setting on a wooden trellis in a garden at Giza, and two (Nos. 25, 125) in 3.2- and 4.8-mm borings from a setting on a Casuarina trunk in a garden at Giza.

NEST ARCHITECTURE.—The single nest in a 3.2-mm boring had an empty space 13 mm long at the inner end, capped by a resin partition 1 mm thick. Then there were four male cells 8, 8, 7, and 14 mm long; the latter cell was abnormally long because it was capped by a closing plug, 7 mm thick, of resin with tiny intermixed pebbles. The cell partitions capping the first three cells were of resin and about ½ mm thick. There was no empty vestibular cell.

The three nests in 4.8-mm borings each had an empty space 80–85 mm long at the inner end, capped by a partition, ¾-1 mm thick, of resin or of resin and tiny intermixed pebbles. There were 14 stored female cells in these nests, containing 2, 5, and 7 cells respectively, 5–7 mm long (mean 5.6). Each nest had an empty vestibular cell 5–10 mm long (mean 8); two of the cells were divided into two sections by transverse partitions of resin. The cell partitions and closing plugs were made from resin or from resin with tiny intermixed pebbles. The partitions were ½–1 mm, and the closing plugs 1–2 mm thick. The outer 21–42 mm of each boring was empty.

LIFE HISTORY.—The 3.2-mm nest was stored during the period 12–27 May; there were four dead, dry males in the boring when I opened it on 17 August. The 4.8-mm nests were completed during the period 27 May–14 June; four and seven females respectively emerged from two nests when I opened them on 19 August, and a female in the third nest eclosed from the pupal exuvia on 20 August and left the nest on the 28th. Data from the last nest suggest that the life cycle, egg to emerged female, is about 11–12 weeks in duration.

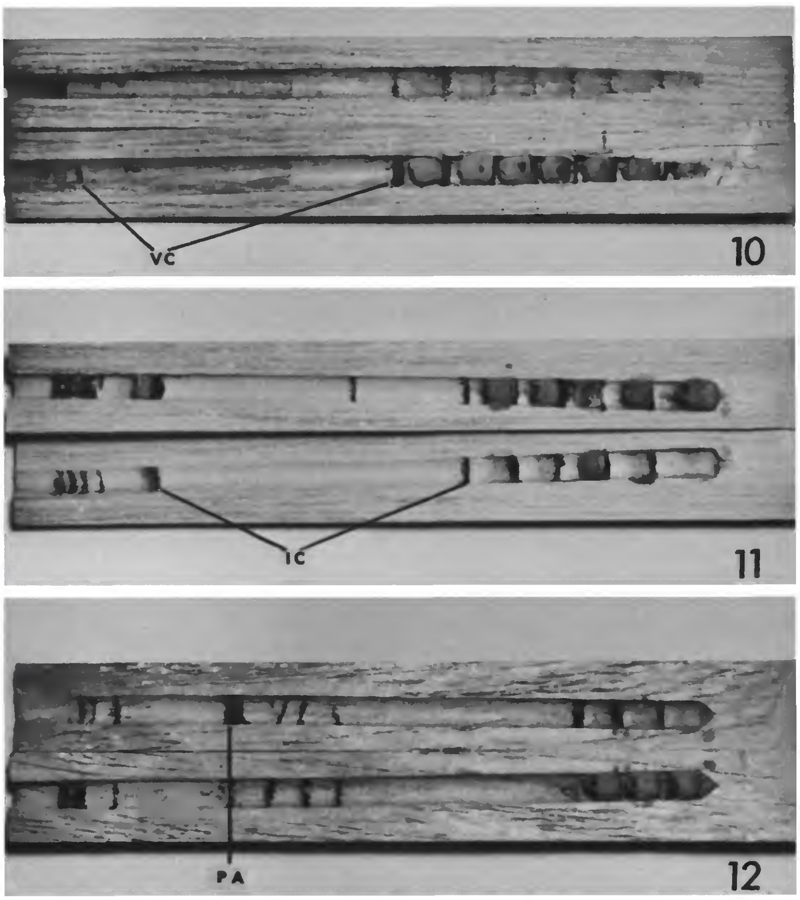
One cell in a 4.8-mm boring, in which a larva failed to develop, contained a pollen-nectar mass 3.5 mm long.

Five female cocoons were 4–5 mm long. They consisted of a single layer of delicate, soft, white, opaque to semitransparent silk. They were cylindrical in shape and lacked a nipple at the anterior end.

### *Osmia* (*Chalcosmia*) *latreillei* (Spinola)

FIGURES 10–19

On 9 March, while on a collecting trip along the Suez Canal, I noted several females of *latreillei* nesting within abandoned borings of other insects inside wooden posts in a garden devoted to commercial flower




FIGURES 10–12.—Nests of *Osmia latreillei* (Spinola) in 6.4-mm borings, Ismailia, 26 April 1965: 10, nest 252 (note long undivided vestibular cell [vc]); 11, nest 253 (note long empty intercalary cell [ic] between stored cells 5 and 6 and lack of empty vestibular cell); 12, nest 382 (note division of empty vestibular cell into two sections by a thick partition [pa] of leaf pulp).

growing at Ismailia. I captured two of the females for identification. On 3 April I revisited this site, found *latreillei* still nesting in the posts, and set out a number of empty borings. On 23 April I checked these borings and found that *latreillei* females had completed nests in one 4.8-mm (No. 151) and in four 6.4-mm borings (Nos. 252, 253, 264, 382) and were storing cells in two 4.8-mm (Nos. 152, 158) and two 6.4-mm borings (Nos. 265, 381).

NEST ARCHITECTURE.—The single completed nest in a 4.8-mm boring contained five stored cells, an intercalary cell 30 mm long between cells 3 and 4, and lacked a vestibular cell. There was one completed cell and one partially stored cell in each of the other 4.8-mm borings; the mother bees had left empty spaces of 5 and 30 mm at the inner end of these borings. The seven completed cells were 7–14 mm long (mean 12); males were reared from three cells 12–14 mm long, and presumably would have developed in the other four cells. The closing plug in the completed nest was 0.5 mm thick, and the partitions capping the cells were 0.14–0.4 mm thick. Both the closing plugs and partitions were made of masticated leaf pulp which dried to form a tough, stiff septum.

There were no empty spaces at the inner end in the 6.4-mm borings. There were 3–7 stored cells (mean 5.5) in the four completed nests. One 6-celled nest (No. 253) had an intercalary cell 65 mm long between cells 5 and 6. One nest (No. 253) lacked a vestibular cell, and the other three had vestibular cells 75–107

FIGURES 13–16.—Larval development, *Osmia latreillei* (Spinola), Ismailia: 13, young larva, cell 1, nest 152 in 4.8-mm boring, 30 April 1965 (note that larva has not yet begun to defecate); 14, somewhat older larva, cells 4 and 5, nest 151 in 4.8-mm boring, 30 April 1965 (note a few small rodlike feces [f] on split edge of trap); 15, same data as Figure 14, but 8 May 1965 (note that larva in 5 has consumed almost all of pollen-nectar mass; also note small attached larva of *Chrysura pustulosa* (Abeille) [c]); 16, still older larvae, cells 3 and 4, nest 252 in 6.4-mm boring, 9 May 1965 (note that larvae have begun to spin outermost layer of silk for cocoon).

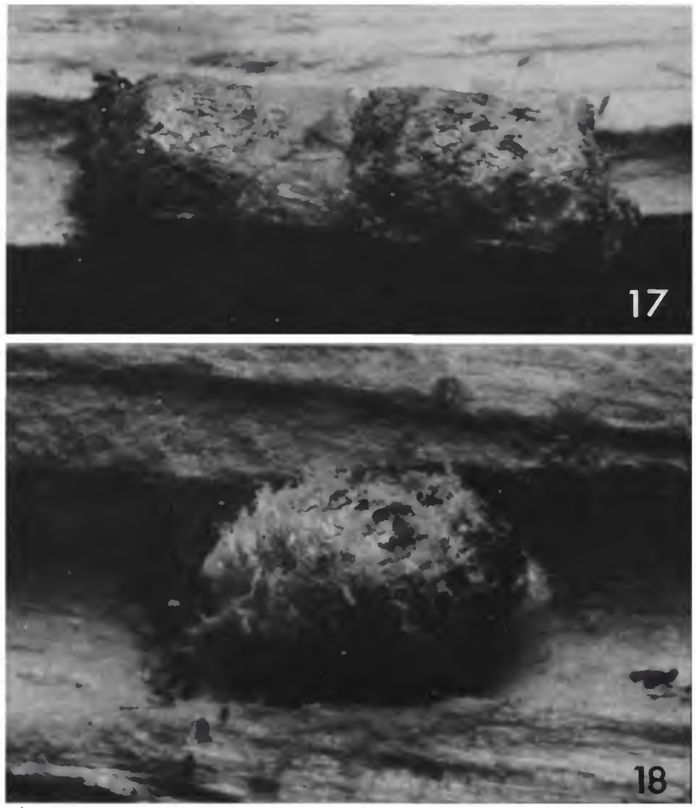
mm long (mean 91); two of the cells were divided into two sections by transverse partitions of leaf pulp. There was only one completed cell in the two partially stored 6.4-mm borings. One cell from which a female was reared was 14 mm long. The other 22 cells were 8–13 mm long (mean 9); males were reared from 16 of them, having the same range and mean in length. The closing plugs were 4–7 mm thick (mean 5), and cell partitions were 0.14–0.4 mm thick. Usually the partitions and closing plugs were made of masticated leaf pulp, but one plug had a layer of mud sandwiched between two layers of leaf pulp, and another plug had some thin interspersed layers of wood-pulp fragments from the sides of the boring, and the outer end was plastered with a thin layer of mud.

LARVAL FOOD.—The pollen-nectar masses were rather dry and contained a lesser proportion of nectar than in nests of some other *Osmia*. The pollen-nectar masses in male cells in 4.8-mm borings were 4–10 mm long (mean 6.6), and 3.5–7 mm long (mean 5.4) in male cells in 6.4-mm borings.

In six nests the bees stored pollen of Compositae, probably *Dahlia*. Pollen of a species of Rosaceae was stored in another nest. In the remaining two nests the bees stored pollen from still a third family of plants.

LIFE HISTORY.—Larvae had hatched in all of the completed cells when I opened the nests on 26 April, three days after gathering the nests. Egg hatch probably occurred only a day or two earlier in several of the cells in incompleted nests. The larval feeding period apparently lasted 20–25 days; larvae in these nests completed feeding 11–20 May. Newly hatched larvae fed for about 3–4 days before beginning to void fecal pellets; 10 days later the larvae began to spin these fecal pellets into a silken net against the anterior end and walls of the cell; feeding was completed in another 5–10 days.

Spinning of the cocoon required more than a day. The single female cocoon is 9 mm long; 18 male cocoons are 7–9 mm long (mean 8). The cocoon is ovoid in shape and slightly narrower than the diameter of the boring. It is composed of several layers of silk, the outermost being a loose network of fine white fibers attaching the inner cocoon to the cell wall. Beneath this is a thin layer of unvarnished white silk which can be readily peeled from the innermost layer of tough, brown varnished silk. At the anterior end there is a small cap composed of several layers of dense white silk which covers the nipple of the cocoon. The nipple is a rounded protuberance about 0.6 mm thick and 1.2 mm wide; it is composed of about four layers of coarse, reddish silk fibers.




FIGURES 17–18.—Cocoons, *Osmia latreillei* (Spinola), Ismailia, in 6.4-mm boring, nest 382, 15 May 1965: 17, cells 2 and 3 (note incorporation of fecal pellets on outermost layer of cocoon); 18, cell 1 (outermost layer of cocoon removed from anterior end to show the white cap covering the nipple).

After spinning the cocoon the larvae began a prolonged period of diapause which lasted variable lengths of time. In 6-celled nest 253 the male in cell 3 pupated before 16 August and eclosed as an adult the first week in September; I removed it from the cocoon in mid-October. (Males in cells 1, 4, 5, and 6 of this nest pupated in June the following year.) In nest 264 three males pupated about 1 September and eclosed as adults about 1 October; I removed them from the cocoons in mid-October.

No pupation occurred in the other nests by mid-October, so I put all of them outdoors in Arlington, Virginia, for a month to expose them to cooler but not freezing temperatures in an attempt to break the larval diapause. I brought them into my office in mid-November where they were kept at a temperature of 70° F. The prepupae continued to wriggle about actively when I examined the nests periodically, but pupation did not begin until mid-May 1966; pupation continued at intervals until 29 June. Newly eclosed pupae were entirely pale; the eyes turned pink four days later, dark brown after another three days, and black a day later; the rest of the body darkened gradually during the next 18 days. Periods of 25–31 days (mean 27) elapsed between pupation and eclosion of the adult. These adults remained in their cocoons for as long as two months before I removed and killed them.

The North American *Osmia* are vernal species which do not have a prolonged larval diapause. In *pumila* Cresson, for example, pupation occurs about 16–21 days after the larvae complete feeding, and the adults eclose in a month or less (Krombein, 1967, pp. 312–318). The adults remain in their cocoons for the remainder of the summer, autumn, and winter; they emerge from the nests early in the spring. It will be of interest to ascertain the developmental cycle of *latreillei* under normal conditions in Egypt. The data from these traps are possibly not typical because they were subjected to other than normal temperatures after 29 May 1965. Also, the sex ratio (1 ♀ : 19 ♂) is undoubtedly abnormal; many more females would probably have been obtained had the traps been set out when nesting began.

PARASITES.—The cuckoo wasp *Chrysura pustulosa* (Abeille) is probably a social parasite of *latreillei*. I captured a female of *pustulosa* on 9 March alighting on the same wooden post in which *latreillei* was nesting. I found a small, recently hatched chrysidid larva in one cell in each of three nests (Nos. 151, 252, 253) when I opened the *latreillei* nests on 26 April. These were bristly, fish-tailed larvae very similar in appearance to those of the North American *Chrysura kyrae* Krombein, which parasitizes *Osmia lignaria* Say (Krombein, 1967, pp. 444–445, figs. 87, 88, 128–130).

*Chrysura* larvae hatch several days later than the host bee larva, attach by their mandibles to the host bee, and suck a small amount of blood. They do not increase much in size, nor do they molt until the host larva has completed feeding and spun its cocoon. Then the *Chrysura* larva molts to the second instar and feeds on the resting larva of the host. It spins its own cocoon inside that of the host, then pupates and transforms to an adult that same summer. It emerges from the cocoon the following spring concurrently with the host bees.

A chrysidid larva 1.6 mm long was just emerging from the egg shell in cell 3, nest 252, at 1300 hours on 26 April, several days after the host bee larva hatched. The chrysidid egg had been deposited on the bottom side of the pollen-nectar mass. By 1400 the chrysidid larva had attached by its mandibles to the host bee larva several segments behind the head. It was still attached four days later. Subsequently, a male bee developed in this cell. I presume that the chrysidid larva may have become detached at the time the host larva spun its cocoon and was devoured by it.


FIGURE 19.—*Osmia latreillei* (Spinola) larva removed from the cocoon it was spinning, cell 3, nest 253, 9 May 1965, to show the small attached larva of *Chrysura pustulosa* (Abeille) [c].

The small chrysidid larva in cell 3, nest 253, was loose on the floor of the cell on 26 April. It finally attached to the bee larva on 29 or 30 April, and I noted it on the bee larva as late as 9 May. A male bee eventually developed in this cell, however, and I suppose it may have killed the parasite at the time of cocooning.

There was a newly hatched chrysidid larva just emerging from the egg in cell 5, nest 151, on 26 April. This cuckoo wasp egg was laid on the upper side of the pollen-nectar mass. The parasite larva attached to the bee larva on 29 or 30 April. The bee larva had almost completed feeding on 11 May, and the chrysidid larva was still attached securely and had not increased much in size. When I next examined this cell on 16 August, I found a pale, dark-eyed chrysidid pupa in the cocoon. It was accidentally injured the next time I examined it and died subsequently. Development had proceeded far enough so that the pupa could be definitely identified as that of a species of *Chrysura*.

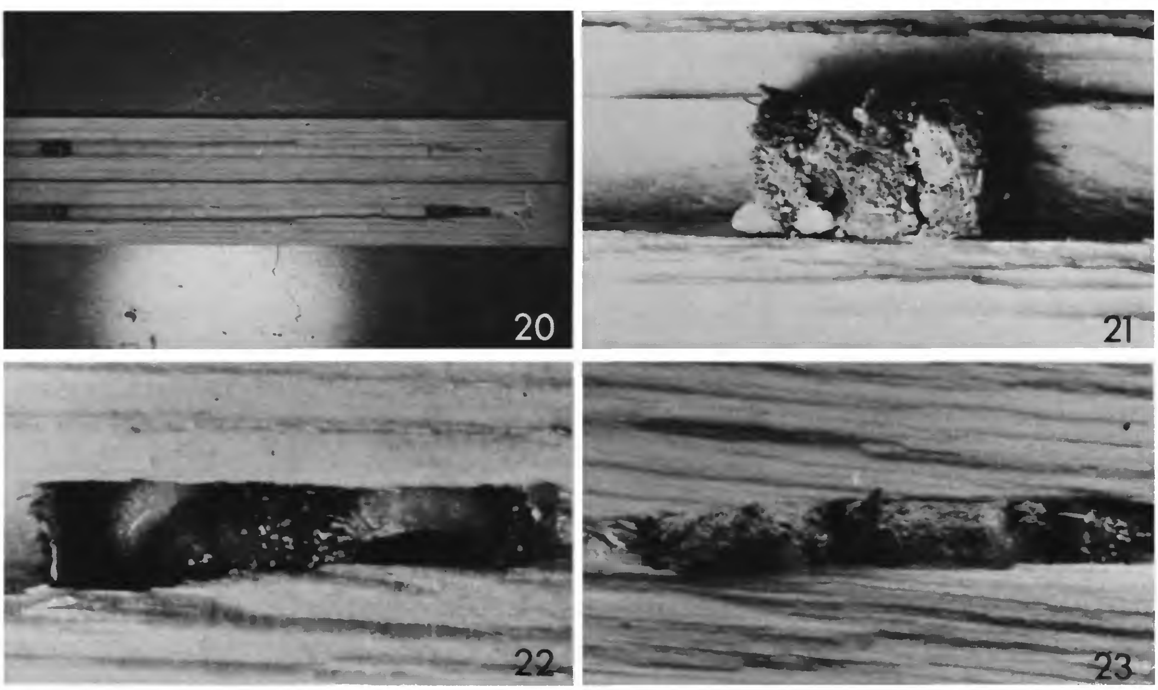
*Chrysura pustulosa* has been reared from several other species of megachilid bees. Trautmann (1927, p. 111) reared it at Nuremberg from *Osmia adunca* (Panzer) and *O. aenea* (Linnaeus), and mentions that Frey-Gessner had bred it also from *adunca* and from *O. caementaria* Gerstaecker. Stoeckhert (1933, pp. 200, 204) reported *Osmia adunca, O. caementaria,* and *O. aenea* as hosts in southwestern Germany. Linsenmaier (1959, p. 80) stated that Bytinski-Salz had reared *pustulosa* from nests of the mud-daubing megachilid bee, *Chalicodoma muraria* (Retzius) in Palestine. Mocsáry (1912) notes that it was reared from *Osmia solskyi* Morawitz by Chobaut and from *O. melanogaster aterrima* Morawitz by Ferton as well as from two other hosts mentioned above.

## *Osmia aurantiaca* Stanek

FIGURES 20–23

I obtained three nests of this species from Dokki—two in 3.2-mm borings (Nos. 33, 34) from a setting on the edge of the flat roof of the one-storied Apicul-

FIGURES 20–23.—*Osmia aurantiaca* Stanek, Dokki: 20, nest 130 in 4.8-mm boring; 21, closing plug, nest 130, consisting of alternating layers of leaf pulp and mud; 22, young larvae, cells 1 and 2, nest 130, 28 April 1965; 23, cocoons in cells 3 and 4, nest 34 in 3.2-mm boring, 30 April 1965.



tural Laboratory and one in a 4.8-mm boring (No. 130) from a different setting on the same roof. All nests were begun and completed during the period 25 March–28 April.

NEST ARCHITECTURE.—Only one of the 3.2-mm nests was completed. It contained five stored cells, respectively 5, 9, 9, 9, and 32 mm long. Males were reared from the first four cells; each of these cells was sealed by a thin, tough septum of leaf pulp 0.1 mm thick. The fifth cell contained a pollen-nectar mass 4 mm long but no egg; it was sealed by a closing plug 5 mm thick at the nest entrance.

The second 3.2-mm boring contained one completed male cell 10 mm long at the inner end, sealed by a partition of leaf pulp 0.14 mm thick.

The completed nest in a 4.8-mm boring contained two cells 9 mm long at the inner end of the boring; a male was reared from cell 2. These stored cells were capped by thin partitions of leaf pulp 0.1 mm thick. There was an empty vestibular cell 115 mm long, capped by a closing plug 8 mm thick, consisting of thin alternating layers of leaf pulp and mud.

A fourth nest (No. 133) in a 4.8-mm boring was possibly also made by this species of *Osmia*. It came from the same setting as the nests in the 3.2-mm borings and was stored during the same period. It contained a single cell 7 mm long at the inner end, capped by a partition of leaf pulp 0.14 mm thick. There was an empty vestibular cell 133 mm long, capped by a plug 4 mm thick, composed of alternating layers of leaf pulp and tiny pebbles.

LARVAL FOOD.—The pollen-nectar masses in nests 130 and 133 were quite moist. One of them in a 3.2-mm nest (No. 34) was 4 mm long.

The pollen stored in nest 33 was of a species of Leguminosae. In nests 34 and 130 the pollen masses were composed mainly of Leguminosae with about 15 percent admixture of Rosaceae.

LIFE HISTORY.—Occupants of nests 33 and 34 were already in cocoons when I opened the nests for study on 28 April. Nest 130 had a nearly full grown larva in cell 1, and a smaller larva already passing feces in cell 2. The larva in cell 1 completed feeding on 1 May, and that in cell 2 on 9 May, indicating that provisioning of this 2-celled nest possibly required a week.

Three male cocoons in 3.2-mm nests were 6-8 mm long. A male cocoon in a 4.8-mm nest was 9 mm long. The silken cocoons consisted of an outer sheath incorporating the fecal pellets and a cylindrical inner cocoon with rounded ends that was medium brown in color, varnished, and somewhat brittle. There was no nipple at the anterior end.

There was an extended period of larval diapause lasting 4–5 months. The five reared males pupated between 14 August and 7 September. Adults eclosed between 7 September and 11 October. The actual elapsed time between pupation and adult eclosion was noted for only one individual—about 25 days. I removed the adults from their cocoons in mid-October, probably about six months before they would have emerged naturally from the nests in Egypt.

### *Megachile* (*Eutricharaea*) species [1]

On 5 April at 1300 hours at Kom Oshim I captured a female (No. 4565 A) 10 mm long of this leafcutter bee as she was capping her nest in the ground with leaf cuttings. She had placed about six irregularly rectangular leaf cuttings just below the ground level to seal her nest. The burrow in which the nest was constructed was most likely the handiwork of some other insect or animal; it was almost perpendicular, 13.5 cm deep and about 8 mm in diameter. Below the surface seal was an empty vestibular cell 6 mm long. Beneath this cell was a roll of seven stored cells made from leaf cuttings. The roll of cells was 6 cm long and about 6 mm in diameter, and I was able to lift it out of the burrow without disarranging the cells. I opened the two cells at the upper end of the roll and found an egg in the ultimate and a small, recently hatched bee larva in the penultimate.

PARASITES.—On 7 April I found four small dipterous larvae loose in the rearing tin and a fifth larva just emerging from between the leaf cuttings in cell 4. These larvae transformed into light tan puparia. Subsequently, I found an additional ten puparia in the tin or in the leaf rolls. Later examination of the remains of the bee nest showed that the dipterous larvae had fed principally on the stored pollen and nectar. The bee larvae must have died soon after the nest was infested because none had begun to excrete fecal pellets.

Emergence of adult flies began on 1 May; by 4 May five females and one male had emerged from the puparia. When I returned from a field trip of four days on 8 May, I found that an additional four females and

[1] Neither Dr. Hurd nor Professor Pasteels was able to provide a specific name for this bee that belongs to one of the most taxonomically difficult subgenera of *Megachile*.

one male had emerged and died. Four more flies died in their puparia without being able to emerge. The fly was identified as a sarcophagid, *Miltogrammidium chivae* (Rohdendorf), a species known hitherto only from Middle Asia (teste Rohdendorf, in litt.).

### *Megachile* (*Eutricharaea*) *variscopa* Pérez

FIGURE 24

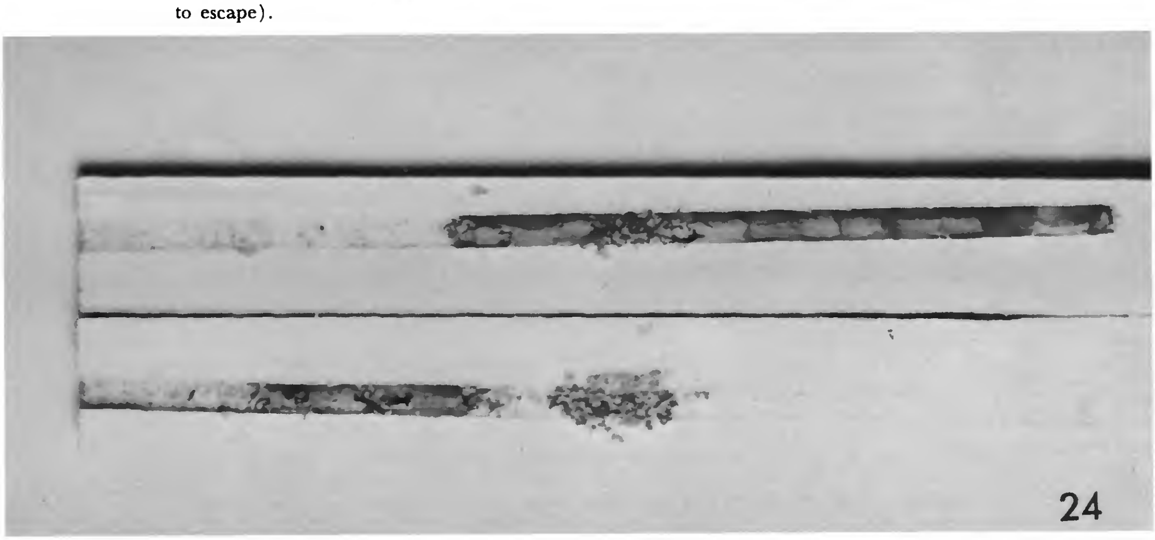
I obtained six nests of this leaf cutter bee. At Dokki one was stored during the period 15 June–15 July in a 6.4-mm boring (No. 238) from a station on a vine-covered wooden summer house. The other five nests were in 4.8-mm borings and were from four different settings on wooden posts and beams in the enclosed garden at Ismailia: Two (Nos. 162, 163) were from a single station and were stored during the period 23 April–23 May; one (No. 369) was begun and completed during the period 24 May–14 June; and the last two (Nos. 157, 161) were from two stations and were provisioned during the period 15 June–29 July.

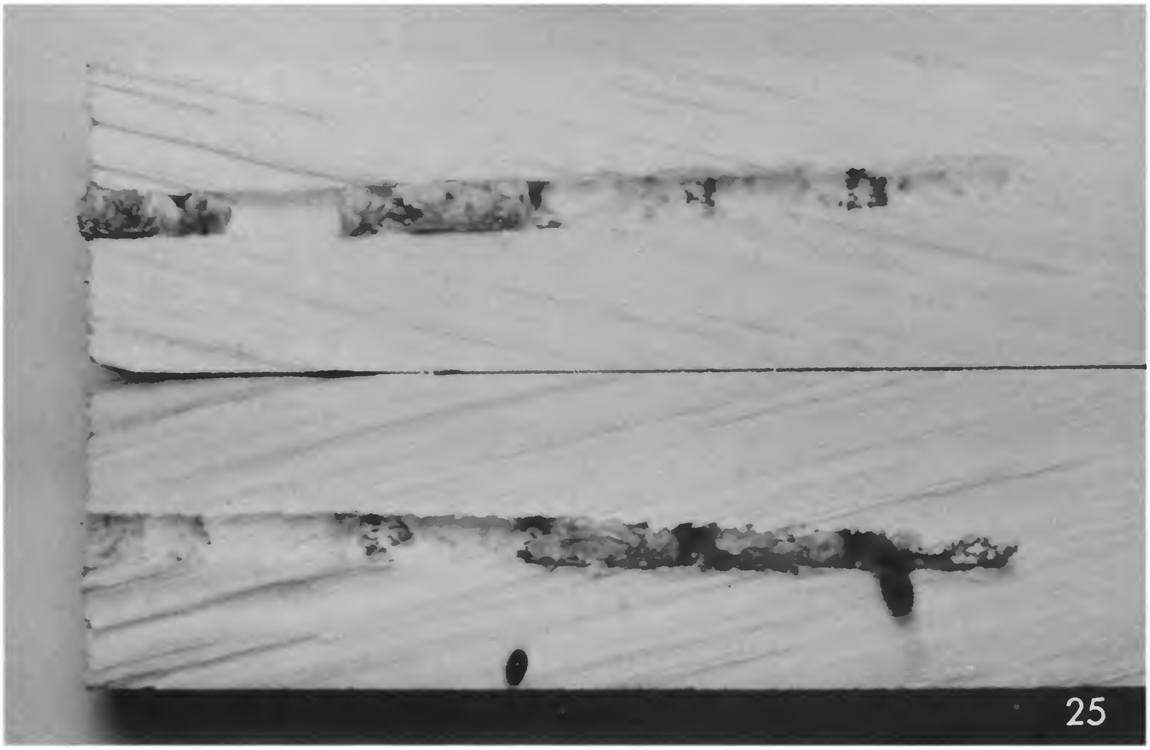
NEST ARCHITECTURE.—The stored cells were constructed in the usual manner for *Megachile*. The inner end of each cell and the cell walls were made from 5–6 approximately rectangular leaf cuttings about 5×8 mm, bent inward at the inner end to form a cup-shaped cell. After storing the proper amount of pollen and nectar and laying an egg, the bee sealed this cell with several circular leaf cuttings; then she proceeded to make another cell in the same manner. Most of the leaf cuttings were green, but in several of the Ismailia nests many of the leaf cuttings were made from purple Bougainvillea blooms. Nest 162 had the innermost cell of green leaf cuttings and then 16 cells made from purple cuttings; the closing plug was made from green leaf cuttings.

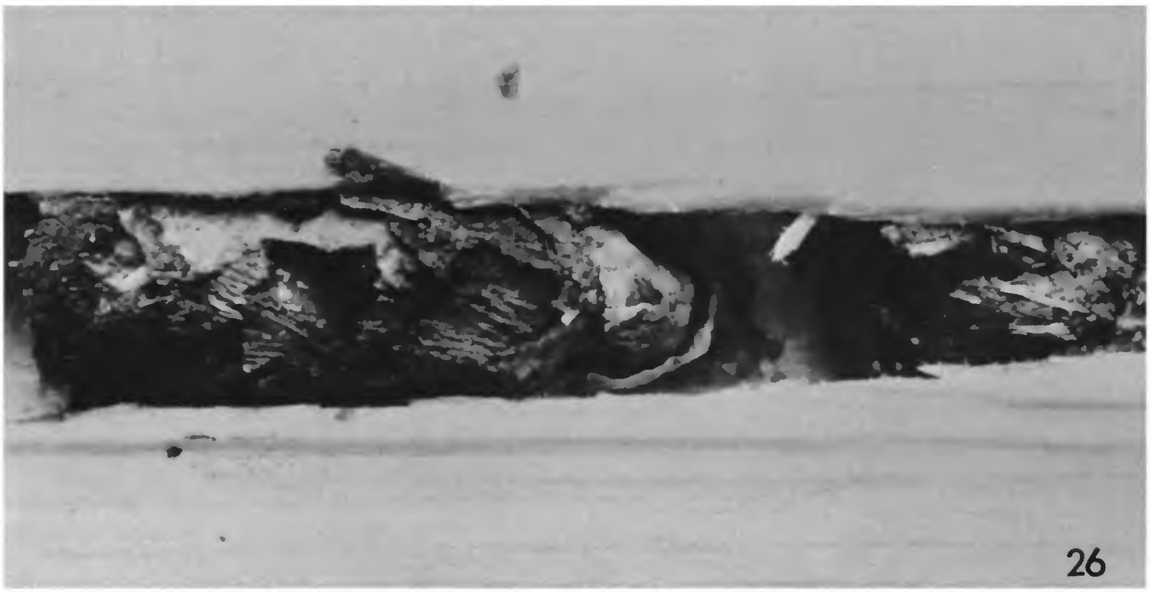
Nests 157, 161, 162, 163, and 369 contained respectively 4, 6, 17, 4, and 10 stored cells 6–10 mm long (mean 8). Nests 157 and 163 were only partially stored, so we can assume that a nest in a cavity 150 mm long contains an average of 11 stored cells. I was unable to determine the number of stored cells in nest 238, but I reared five females and five males from it.

The method of nest closure could not be ascertained because emergence took place while the nests were in transit to the United States. The adult bees were trapped inside by the metal seals taped over the entrance, but they disarranged the closing plugs in their attempts to emerge. One completed nest (No. 162) from Ismailia had 17 stored cells in the inner 125 mm and a closing plug composed of 25 mm of loosely packed circular leaf cuttings.

FIGURE 24.—*Megachile variscopa* Pérez, nest 162 in 4.8-mm boring, Ismailia, 16 August 1965 (note that emerging bees destroyed some of walls of leaf cuttings in their attempts to escape).






FIGURES 25–26.—*Megachile minutissima* Radoszkowski: 25, nest 18 in 3.2-mm boring, Giza, 18 August 1965 (occupants in cocoons, and note absence of leaf cuttings in cell walls); 26, cell 1, nest 135 in 4.8-mm boring, Dokki, 9 May 1965 (note leaf cuttings surrounding the cocoon).

LIFE HISTORY.—No notes were made on the developmental cycle in these six nests. Adults emerged while the nests were in transit to the United States, and I found them dead and dry in the borings in mid-August.

The progeny from the nests consisted of the following:

No. 157 – 2 ♂ – bees did not develop in two other cells.
No. 161 – 2 ♀, 2 ♂ – bees did not develop in two other cells.
No. 162 – 4 ♀, 8 ♂ – bees did not develop in five other cells.
No. 163 – 1 ♂ – bees did not develop in three other cells.
No. 238 – 5 ♀, 5 ♂ – total number of cells unknown.
No. 369 – 8 ♀, 2 ♂ – ten cells in nest.

Apparently females and males are produced in about equal numbers. The sequence of sexes in an individual nest could not be determined, but it is presumed that females are in the inner and males in the outer cells, as has been reported for nests of other species of *Megachile* subgenus *Eutricharaea*.

### *Megachile* (*Eutricharaea*) *minutissima* Radoszkowski

FIGURES 25–26

I reared this tiny bee from a 3.2-mm nest (No. 18) from a wooden trellis in the garden at Giza. The nest was begun and completed during the period 27 May–14 June. It is quite likely that the same species, perhaps even the same female, constructed another nest (No. 17) in a 3.2-mm boring at the same station and during the same period; the eggs or young larvae died in this nest. A third nest (No. 135) was made during the period 25 March–28 April in a 4.8-mm boring set on a wooden trellis in full sun at the Apicultural Laboratory in Dokki. On 28 April I found a male of *minutissima* resting in each of two 3.2-mm borings at a single station on a wooden shed in the garden at Giza.

NEST ARCHITECTURE.—The small diameter of the 3.2-mm borings apparently prevented the mother from constructing the usual nest of leaf rolls in nests 17 and 18. Nest 18 had a few leaf cuttings at the inner end and then four stored cells, 10–11 mm long, whose walls contained at the most one layer of rectangular leaf cuttings; occasionally there was no leaf cutting at all between the pollen-nectar mass and the wall of the boring. The cells were separated by several circular leaf cuttings arranged transversely. There was an empty vestibular cell 16 mm long, sealed by a plug 8 mm thick, of closely packed, transverse, round to irregular leaf cuttings.

Nest 17 had a couple of leaf cuttings at the inner end of the boring, an empty space of 4 mm, and then a few more leaf cuttings forming the base of cell 1. This cell was 12 mm long and contained a pollen-nectar mass 6 mm long; it was sealed by a few leaf cuttings. Beyond cell 1 was an empty space 11 mm long and a few circular leaf cuttings, then a second cell 11 mm long, containing a pollen-nectar mass 5 mm long. There was an empty vestibular cell 15 mm long, sealed by a plug 9 mm thick of small, irregularly rounded leaf cuttings. There were no leaf cuttings lining the cell walls.

In the 4.8-mm nest (No. 135) from Dokki there was a leaf pulp partition 5 mm from the inner end of the boring, then a moist pollen mass with no bee egg. It is assumed that this cell may have been stored by a female of *Osmia*, inasmuch as *Megachile minutissima* did not use leaf pulp in its other nests. Beyond this pollen mass was an empty space 5 mm long, then a *Megachile* cell 10 mm long, formed from leaf cuttings. The *Megachile* constructed a second cell of leaf cuttings 55 mm from the first one, but she stored no pollen in it. The boring entrance was sealed by a closing plug 3 mm thick, formed from several more or less circular leaf cuttings.

The general impression of nest architecture gained from these three nests is that *minutissima* does not construct a linear series of juxtaposed cells as do most other leaf cutter bees, of which *variscopa* (Figure 24) is a typical example.

LIFE HISTORY.—The earliest nest (No. 135), completed during the period 25 March–28 April, was presumed to have been stored about mid-April. In the single completed cell there was a mixture of pollen and nectar having a rather liquid consistency. The larva completed feeding on 12 May, spun a cocoon, and entered a period of rather extended larval diapause. It pupated 17–24 August, the adult eclosed on 1 September and I removed the female bee from the cocoon on 3 September. The cocoon was 8 mm long.

In nest No. 18 the larva in cell 1 was dead on 19 August when I first examined the nest, and the occupants of cells 2–4 were in cocoons in extended larval diapause. In mid-October I set this nest outside for a month in cooler weather in an attempt to break this diapause. Pupation occurred in cell 4 between 28 December 1965 and 3 January 1966; the male in this cell was dead and dry on 18 February. On the latter date the males in cells 2 and 3 were ready to eclose as adults, and eclosion took place during the following two days; they left their cocoons during the last few days of February.

### *Chalicodoma* (*Pseudomegachile*) *flavipes* (Spinola)

I found a female of this leafcutter bee on the morning of 12 May in a 6.4-mm boring (No. 235), set on the edge of a flat roof of the one-story Apicultural Laboratory in Dokki. The bee had not begun any nesting activities in the inner end. It is not known whether she had selected this boring as a potential nesting site or had just entered it for shelter overnight, but previously published data, as summarized below, suggest that she intended to nest therein.

Gutbier (1915, pp. 32, 52) stated that in Russia, *flavipes* nested in all kinds of cavities in which it constructed mud cells in a series of one to three ranks. The entrance to the nesting cavity was closed by a tampon of mud.

Alfken (1934, p. 147) noted that in Egypt, *flavipes* nested in mud walls, especially of native huts and therefore the assumption might be that it is not a leafcutter.

Mavromoustakis (1939, p. 159) found two elongate mud cells of this species on clothing within a room of his house in Cyprus.

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