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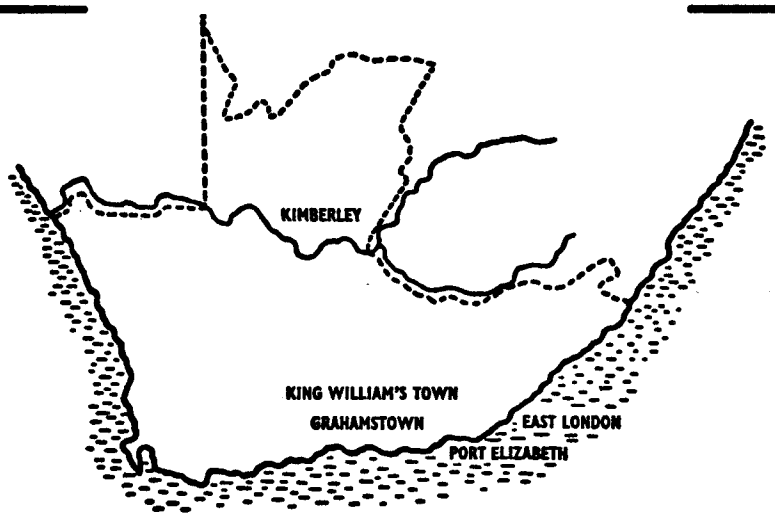


**VOLUME 13 • PART 4**

**11th JANUARY 1980**

PUBLISHED JOINTLY BY THE
CAPE PROVINCIAL MUSEUMS AT THE ALBANY MUSEUM, GRAHAMSTOWN
SOUTH AFRICA

# Ethological notes on Kohliella alaris Brauns (Hymenoptera: Sphecidae: Larrinae) in the Eastern Cape Province of South Africa

by

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## INTRODUCTION

The genus *Kohliella* Brauns, 1910 is endemic to southern Africa and includes two species poorly represented in collections.

*Kohliella alaris* Brauns, the type species, black and ranging in length from 6–11 mm, was described from Willowmore (Cape Province) (Brauns, 1910: 669) and was subsequently recorded from Hex River (Cape Province) and Bulawayo (Zimbabwe) (Arnold, 1924: 43) and from two localities on the Cape Peninsula (Beaumont, 1967: 510). In the Albany Museum collection it is represented by specimens collected by the authors at New Year's Dam, Alicedale and on Hilton, Grahamstown (both Cape Province). *K. stevensoni* Arnold, the second species, was described from Sawmills (Zimbabwe) (Arnold, 1924: 42).

It has been pointed out by Bohart and Menke (1976: 286) that, although *Kohliella* is similar to *Tachysphex* in general facies, only a few features such as the form of the collar, the male forefemoral notch, and the bare pygidial plate are common to both, and that *Kohliella* is probably best regarded as a specialized relic.

Nothing has hitherto been published regarding the biology of the genus.

The present paper is the sixth of a series of publications dealing with the ethology of certain solitary wasps occurring at Hilton, a farm situated 18 kilometres WNW. of Grahamstown (33° 19′S, 26° 32′E) in the Albany Division of the Eastern Cape Province of South Africa. An account of the climate and vegetation of Hilton has previously been given (Gess and Gess, 1974: 191–192).

## THE NESTING OF KOHLIELLA ALARIS BRAUNS

### *Description of the nesting sites*

At Hilton *Kohliella alaris* nests in sand on the floor of a sandpit and in close proximity to the sandpit in places where the vegetation has been removed leaving the sand bare or with very sparse plant cover (Figs 1 and 2). The sand, light coloured and fine grained, is derived from the weathering of Witteberg Quartzite and is of alluvial origin having been deposited upon its flood plain by a seasonal tributary of the New Year's River. *K. alaris* tends to nest in pseudo-colonies making use of only small areas within nesting sites which appear to offer suitable conditions for nesting throughout.

Fig. 1. Hilton, 12.i.1978. Portion of sand pit with figure marking a nesting site of *Kohliella alaris*.

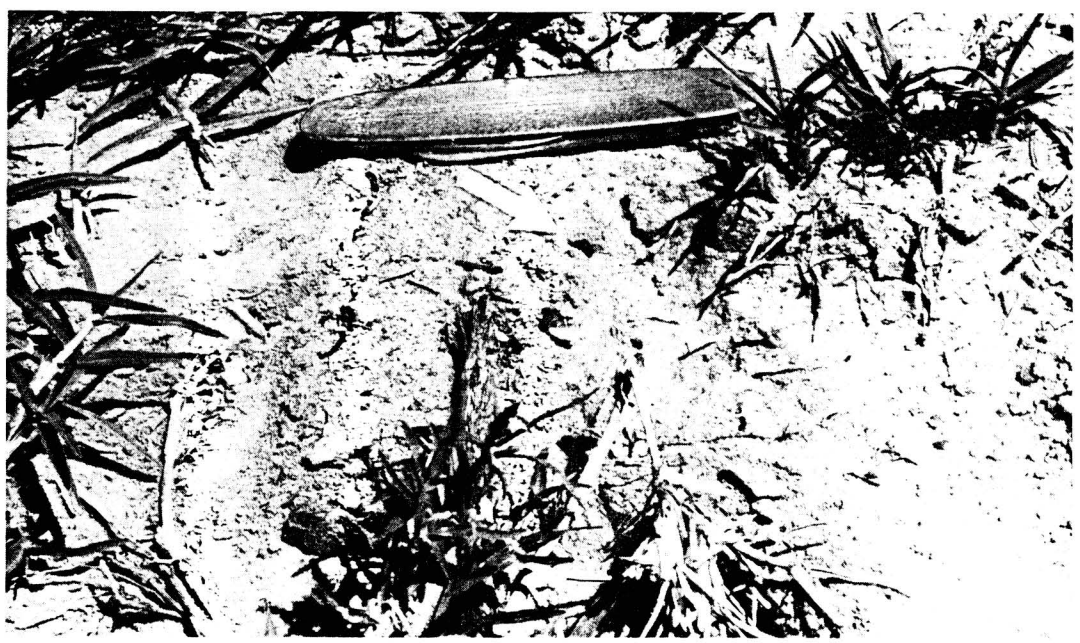

Fig. 2. Hilton, 12.i.1978. Entrance to a nest of *Kohliella alaris* in nesting site shown in Fig. 1.

*Flight period*

Males and females of *K. alaris* have been collected at Hilton from early December to early March and nesting takes place throughout this period. During the summer of 1977–78, which was a particularly successful season for this species, nesting was at its height in mid-January.

Whereas most of the sphecids nesting in the sandpit commence their daily nesting activities before the hottest time of day and continue them into the early afternoon or on the hottest days cease activity before noon, *K. alaris* never appears before noon and rather commences its activities after noon, when the heat of the day is past its peak, and on the hottest days may delay its nesting activities until as late as 4.15 p.m., with the peak of nesting activity half an hour later.

Males are present in the nesting area and have been seen to attempt to mate with females in close proximity to the nests.

*Plants visited by adult wasps*

There are no records of *K. alaris* visiting plants. However, trees and shrubs must be visited by the females when hunting for it is in such situations that the prey occurs. It is probable that the wasps visit a belt of shrubs and small trees which occurs along the banks of the seasonal tributary near the sandpit. Although *K. alaris* was not observed in this situation, both males and females were caught in a Malaise trap erected between shrubs on the edge of this belt.

*Identification of the prey*

Twenty-six prey were recovered from *K. alaris* or its nests and without exception were nymphs of the Tree Cricket *Oecanthus capensis* Saussure (Gryllidae: Oecanthinae). Adult *O. capensis* in the Albany Museum were collected at Brak Kloof, a farm adjoining Hilton, during the months February to April.

Details of the prey and of their captors are given in Tables 1 and 2. It will be seen that the prey is mutilated by the wasp in that the antennae are cut off short (Fig. 3). Mutilation must take place immediately after prey capture as prey being transported to the nest are already in the "dressed" condition.

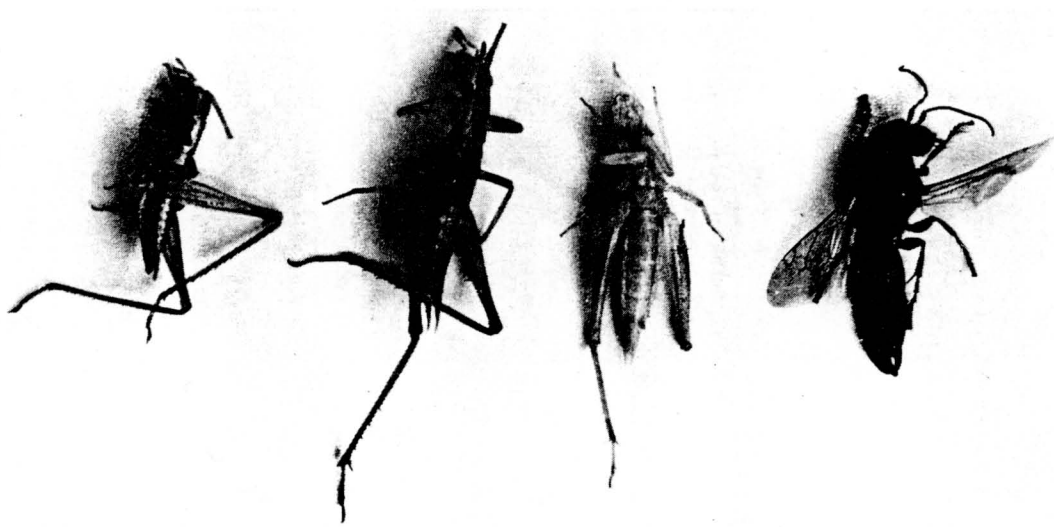

Fig. 3. Contents of the cell of nest 11 (see Table 1) consisting of three tree crickets, *Oecanthus capensis*, the third from the left bearing the egg of the nest builder shown on right. (x 2,8)

TABLE 1. Details pertaining to *Kohliella alaris* females, their prey and eggs associated in nests.

| Date | Nest no. | Cell no. | Cell contents: prey in order of introduction into cell (where known), prey bearing *K. alaris* egg. | Prey weight (mg) | Prey length (mm) | Mutilations to prey | Wasp weight (mg) | Wasp length (mm) |
|---|---|---|---|---|---|---|---|---|
| 13.i.78 | 1 | 1 | (1) male nymph (with egg) | 28 | 11,5 | Both antennae shortened<br>Left hind leg missing | — | — |
| | | | (2) female nymph | 31 | 13,0 | Both antennae shortened | | |
| 13.i.78 | 3 | 1 | (1) male nymph (with egg) | 36 | 12,0 | Both antennae shortened<br>Left hind leg missing | 22 | 10,0 |
| 13.i.78 | 4 | 1 | (1) female nymph | 26 | 11,0 | Both antennae shortened | — | — |
| 13.i.78 | 6 | 1 | (?) female nymph (with egg) | 31 | 13,5 | Both antennae shortened | 22 | 10,0 |
| | | | (?) male nymph | 14 | 9,2 | Both antennae shortened | | |
| | | 2 | (1) male nymph | 44 | 14,0 | Both antennae shortened | | |
| 17.i.78 | 7 | 1 | (?) male nymph | 5 | 6,2 | Both antennae shortened | — | — |
| | | | (?) male nymph | 4,5 | 6,0 | Both antennae shortened | | |
| | | | (?) male nymph | 7,0 | 8,0 | Both antennae shortened<br>Right hind leg missing | | |
| | | | (4) male nymph (with egg) | 37 | 14,0 | Both antennae shortened<br>Right hind leg missing | | |
| 17.i.78 | 8 | 1 | (1) male nymph | 31 | 12,5 | Both antennae shortened | 25 | 10,0 |
| 18.i.78 | 10 | 1 | (?) male nymph | 20 | 11,8 | Both antennae shortened | 24 | 10,0 |
| | | | (2) male nymph (with egg) | 29 | 11,3 | Both antennae shortened | | |
| | | | (?) female nymph | 50 | 15,8 | Both antennae shortened<br>Right hind leg missing | | |
| 9.ii.78 | 11 | 1 | (?) female nymph | 13 | 8,8 | Both antennae shortened | — | — |
| | | | (2) female nymph (with egg) | 29 | 11,3 | Both antennae shortened | | |
| | | | (?) male nymph | 29 | 12,0 | Both antennae shortened | | |
| 3.iii.78 | 14 | 1 | (1) female nymph (with egg) | 45 | 14,5 | Both antennae shortened | — | — |
| | | | (2) female nymph | 31 | 13,2 | Both antennae shortened | | |

TABLE 2. Details pertaining to *Kohliella alaris* females and their prey associated during prey transport.

| Date | Prey sex & developmental stage | Prey weight (mg) | Prey length (mm) | Mutilations to prey | Wasp weight (mg) | Wasp length (mm) |
|---|---|---|---|---|---|---|
| 16.ii.76 | female nymph | 43 | 12,5 | Both antennae shortened | 18 | 9,3 |
| 16.ii.76 | male nymph | 21 | 8,3 | Both antennae shortened | 24 | 9,5 |
| 9.xii.77 | male nymph | — | 11,0 | Both antennae shortened | — | — |
| 20.xii.77 | — nymph | — | 6,3 | Both antennae shortened | — | 10,0 |
| 17.i.78 | female nymph | 46 | 14,5 | Both antennae shortened | — | c.10 |
| 17.i.78 | male nymph | 26 | 11,0 | Both antennae shortened Right hind leg missing | 25 | 10,0 |

*Description of the nest* (Figs 4a and b, 5a and b)

The nest of *K. alaris* consists of a short trench, approximately 10 mm long, leading to a subcircular entrance hole, slightly wider than high, average width 4,3 mm (sample of 12), from which a shallow entrance passage of similar diameter extends from 20–35 mm (sample of 9) and reaches an average depth of 13 mm (sample of 7) below the surface of the ground. From this shallow burrow one to several secondary branches of a steeper gradient lead off, some of which end in a more or less horizontal single cell at an average depth of 35 mm (range 16–70 mm, sample of 15). Some passages appear to remain unused and are free from sand whereas the passages which end in a cell are filled with loose sand. A secondary passage may be excavated in the same direction as the entrance passage or it may make a sharply acute to obtuse angle with it. Similarly, a cell may have its long axis following the same direction as the secondary passage or it may be at an angle to it. Such secondary passages which terminate in a cell are 15–60 mm long (sample of 11) and 4–5 mm in diameter and the cells have an average length of 16 mm (sample of 8) and an average diameter of 6,6 mm (sample of 9), therefore being of a slightly larger bore than that of the secondary passages.

*Method of construction of the nest, provisioning and oviposition*

*K. alaris* is a sand raker. After the wasp has selected a nesting site, nest construction is immediately initiated by her digging and raking away the soil. When the sand which is excavated in the construction of the nest begins to accumulate forming a pile, the wasp spreads it from side to side using a light dancing motion. Any particles which are too big to be extracted from the excavation by raking are carried out by the wasp in her mandibles. At the start of nest excavation the wasp is easily distracted by passing insects such as ants but makes no attempt to chase them. However, as nest construction becomes more advanced she becomes more determined and aggressive making attempts to drive away passing insects.

Hunting takes place after a cell has been excavated and the nest temporarily sealed with sand. The wasp having located, captured, stung and mutilated her prey she flies with it to the nest holding it beneath her with its head facing the direction of travel. She alights close to the

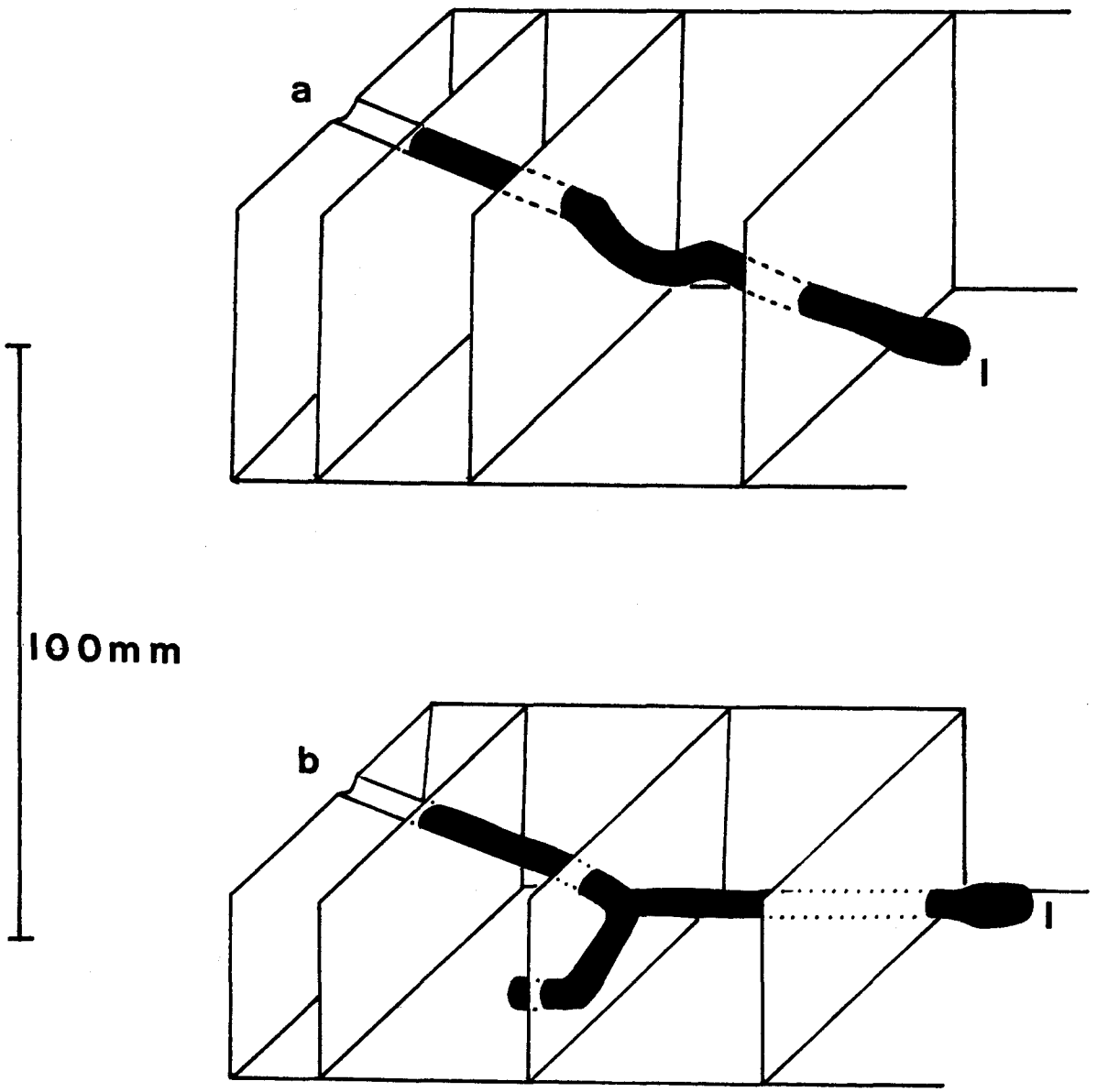


Fig. 4a and b. Plans of nests 8 and 3 of *Kohliella alaris*.

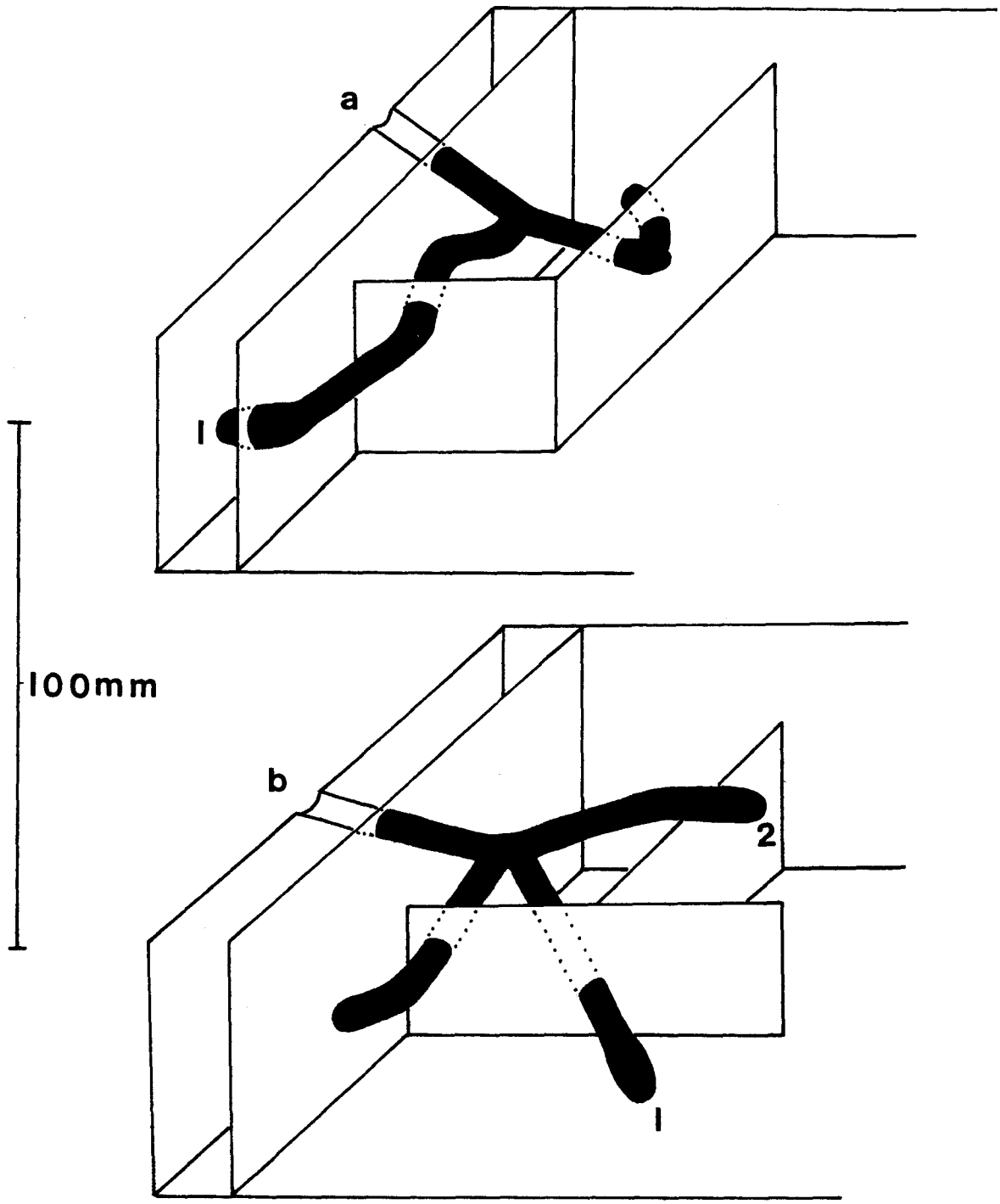


Fig. 5a and b. Plans of nests 1 and 7 of *Kohliella alaris*.

entrance to the nest, puts down the prey, rakes the sand out of the nest entrance, enters, turns around within, and draws the prey in head first.

Fourteen nests were excavated from which the contents of ten provisioned or partially provisioned cells were obtained (see Table 1) and were found to consist of twenty prey, seven of which bore wasp eggs. In a cell several prey are positioned venter up facing the inner end of the cell and parallel to each other but with every prey slightly in advance of that succeeding it. The prey are incompletely paralysed and exhibit occasional trembling movements of the palps and continuous pumping respiratory movements of the abdomen.

The egg of *K. alaris* is slightly curved, pearly white and 2,6 mm long (average of 5) and 0,5 mm wide at its mid length. It is attached by its anterior end to the underside of the prothorax of one of the prey, posterior to either the right or left prothoracic coxa, and extends transversely across the venter of the prey (Fig. 3). For six of the eggs it was possible to establish the order of introduction into the cell of the prey to which they were attached. Three eggs were on the first prey, two on the second prey and one was on the fourth prey. In the instance of the fourth prey being selected for oviposition it was the only one of any considerable size weighing 37 mg whereas the first three weighed only 5, 4,5 and 7,0 mg respectively. It is therefore likely that if the first prey to be captured are very small oviposition is postponed until one of a suitable size is obtained.

The secondary passage leading to a cell is usually filled with loose sand whereas the entrance passage is left clear. When leaving the nest the wasp closes the entrance. She stands inside the burrow and rakes sand in towards herself and through underneath to behind herself, gradually advancing out of the nest. When only a small depression is left she rakes sand over it from all directions until it is completely obscured. Three nests which had been seen to be closed in this way were excavated and were found to have as yet incompletely provisioned cells. It is therefore clear that the wasp closes her nest between visits.

*Parasites*

Five miltogrammine sarcophagids were reared from maggot infested prey recovered from a cell excavated on 18.i.1978. The flies emerged from their puparia on 6.ii.1978.

## DISCUSSION

*Kohliella* with *Parapiagetia, Holotachysphex* and *Prosopigastra* may be grouped around *Tachysphex*, one of the dominant sphecid genera and one of the most highly evolved members of the tribe Larrini (Bohart and Menke, 1976: 269). As these five genera together form a distinct evolutionary branch within the subtribe Tachytina and as nothing has hitherto been published concerning the biology of *Kohliella* it is of interest to compare the five genera with respect to various aspects of nesting ethology.

A considerable number of papers on the biology of *Tachysphex* species have appeared, important ones being listed by Bohart and Menke (1976: 270). A useful summary of the known biology of the Palaearctic species has been provided by Pulawski (1971: 16–20). In contrast little has been published on the biology of *Prosopigastra* and almost nothing on that of *Parapiagetia*. For both genera the known biology has been reviewed by Bohart and Menke (1976: 285 and 281 respectively) and for *Prosopigastra* additional data have been presented by Pulawski (1979) who has also summarized the life history of the genus. An account of the nesting of a species of *Holotachysphex, H. turneri* (Arnold) in trap-nests has been published by Gess (1978: 209–215). In addition, since the publication of this account, natural nests of *H. turneri* have been found by the authors at Hilton in old abandoned galleries of the carpenter bee, *Xylocopa caffrariae* Enderlein in the hollow internodes of dry culms of *Phragmites australis*, a reed fringing permanent and semi-permanent water bodies.

The nests of *Kohliella* like those of *Tachysphex* and *Prosopigastra* are situated in the ground, in friable soil; however, *Holotachysphex* by contrast nests up off the ground in hollow plant stems. The nests of *Parapiagetia* have not as yet been located but the presence in the female of fore-tarsal sand rakes and of a pygidial plate indicates that this genus like *Kohliella* is ground nesting.

*Kohliella* like almost all species of *Tachysphex* excavates its nest itself whereas *Prosopigastra, Holotachysphex* and the exceptional species of *Tachysphex* modify pre-existing cavities, frequently the galleries of other aculeate Hymenoptera.

The nests of *Kohliella* that were investigated were all still under construction; eight contained a single provisioned or partially provisioned cell and one contained two cells. It is therefore not known whether the number of cells constructed ever exceeds two. *Tachysphex* nests may be one- or two-celled or multicellular, those of *Prosopigastra* are multicellular and *Holotachysphex turneri* nests have been found with one, two and three cells. Thus it appears that all four genera show a tendency to construct more than one cell per nest.

*Kohliella* unlike *Prosopigastra* and *Holotachysphex* which leave the nest entrance open during provisioning maintains a temporary closure during this period. *Tachysphex* displays variability in its behaviour in this respect. As *Kohliella* maintains a temporary closure it may be assumed that like *Tachysphex, Prosopigastra* and *Holotachysphex* it constructs a final closure.

*Kohliella* like *Holotachysphex, Parapiagetia* and some species of *Tachysphex* preys upon Orthoptera. Other species of *Tachysphex,* however, prey upon Dictyoptera and *Prosopigastra* preys upon Hemiptera. In all genera nymphs are generally taken. The report that an unknown *Parapiagetia* species was seen transporting a caterpillar should, it is considered, be treated with great caution.

*Kohliella* like *Tachysphex* transports its prey held beneath its body and facing the direction of travel. *Kohliella, Tachysphex* and *Prosopigastra* are known to carry their prey in flight and judging from the small size of its prey and the situation of its nest *Holotachysphex* probably also transports its prey in flight. When the prey is large and heavy relative to the wasp, *Tachysphex* is known to transport it along the ground in short hopping flights.

*Kohliella* like some species of *Tachysphex* deposits the prey on the ground at the nest entrance, opens and enters the nest, turns around within it and then draws in the prey unlike *Prosopigastra* and some other species of *Tachysphex* which enter the nest directly.

*Kohliella* like *Holotachysphex* and *Prosopigastra* provisions each cell with several prey, however, *Tachysphex* when large prey are taken may provision with a single prey. In all four genera paralysis of the prey is incomplete. *Kohliella* like *Holotachysphex* and those *Tachysphex* species which provision their nests with Acrididae positions its egg attached immediately posterior to one of the prothoracic coxae and extending transversely across the venter of the prey.

From the above comparison of various aspects of the nesting ethology of the five genera it is evident that the latter form a fairly close-knit group. *Tachysphex*, the species-rich dominant genus around which the other genera are grouped shows a considerable ethological latitude or plasticity whereas the ethology of the other genera appears more circumscribed. However, this is likely to be merely an expression of the fact that the other genera have far fewer species and that data concerning these are limited. Among those ethological aspects considered *Kohliella* does not manifest any character which is unique to itself and which is not found also in the genus *Tachysphex* seen as a whole (though of course if compared with individual species of *Tachysphex* various differences do become apparent). On the other hand the ethology of *Kohliella* differs in several aspects from that of both *Holotachysphex* and *Prosopigastra*. (Not enough is known of the ethology of *Parapiagetia* to allow comparison.) Ethologically *Kohliella* therefore has the greatest affinity with *Tachysphex*, the affinity being greater than that shown by either *Holotachysphex* or *Prosopigastra* with that genus.

## SUMMARY

Some aspects of the ethology of *Kohliella alaris* Brauns (Hymenoptera: Sphecidae: Larrinae) in the Eastern Cape Province of South Africa are described. In the study which was based upon a series of nests excavated in sand attention is given to the description of the nesting sites, flight period, plants visited by adult wasps, identification of the prey, description of the nest and method of its construction, provisioning and oviposition. The nesting of *Kohliella* is compared with that of the genera *Parapiagetia, Holotachysphex, Prosopigastra* and *Tachysphex* and is found to be very similar to that of the last named.

## ACKNOWLEDGEMENTS

The authors wish to thank Mr T. C. White of the farm Hilton for his much appreciated kindness over the years in allowing them free access to his land. The senior author is grateful to the C.S.I.R. for a running expenses grant for field-work during the course of which the present observations were made.

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Manuscript accepted for publication 21 September 1979.