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## Nest Construction of a Malayan *Vespa tropica* (Vespidae, Hymenoptera, Insecta)

With 3 textfigures

### Introduction

VECHT (1957) refers to 7 species of *Vespa* being present in Peninsular Malaysia. They are *Vespa affinis* (LINNAEUS, 1764), *V. tropica* (LINNAEUS, 1758), *V. velutina* LEPELETIER, 1836 (PAGDEN, 1958 referred this species as *V. mongolica divergens*), *V. analis* FABRICIUS, 1775, *V. mandarinia* SMITH, 1852, *V. mocsaryana* BUYSSON, 1905 and *V. multimaculata* PEREZ, 1910. While their taxonomy has been well described by VECHT (1947), PAGDEN (1952) mentions a simple means of differentiating between the two common species — *V. affinis* and *V. tropica*. The nesting habits of these two species have briefly been recorded by BEQUAERT (1936), PAGDEN (1952) and VECHT (1957). SIEW and SUDDERUDDIN (1982) gave a pictorial description of a nest colony of *V. affinis* in Malaysia.

This report described the nest building behaviour of *V. tropica leefmansii* in a house in Tanjung Karang, Selangor. The only previous record of *V. tropica* in Malaysia are those of PAGDEN (1952) which contains no details of nest building. The present findings will provide preliminary information on the nesting behaviour and may clarify taxonomic position of *V. tropica* in Malaysia.

### Description of nest-building

A wasp, later identified as *V. tropica leefmansii* VAN DER VECHT 1957, began to build a nest on 21st February, 1985 on the inside of the wooden ventilator in a rural Malay house. The wasp took three days to complete the petiole or pedicel of the nest with wood pulp (made of chewed wood mixed with the wasp's saliva). After this, the wasp began to make the hexagonal cells of the comb, whilst at the same time building up the outer cover or envelope over the comb.

Seven cells had been built by the end of the first week and by that time an egg had been laid in each cell. It could not be observed exactly when and how the eggs were laid. The eggs were off white in colour and were stuck to the inside of the cells. On the eighth day, the first wasp was joined by another wasp and both wrapped their

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bodies around the petiole of the nest. They were seen wrapping or lying over the comb (fig. 1) constantly at night time and with some breaks during the day. Whether this was related to the rise and fall of the ambient temperature of the room was not experimentally investigated. But the wasps were more often seen taking breaks in wrapping over the comb at mid day time when the temperature rose high.



Fig. 1: *V. tropica* nest: One wasp making the nest, the other wrapping herself over the comb.

Over the next three days, two more cells were added and the envelope was extended. By day 11, a third wasp joined and they exhibited division of labour. One brought wood pulp, one lied over the comb and the other probed inside the cells to feed the hatched larvae (fig. 2). As the wasps were not individually marked, it was not possible to observe whether each wasp had a fixed task, or the tasks were shared by rotation. More cells were added in the next three days and by the end of the second week, the number of cells was seventeen. At this stage, the envelope had been extended

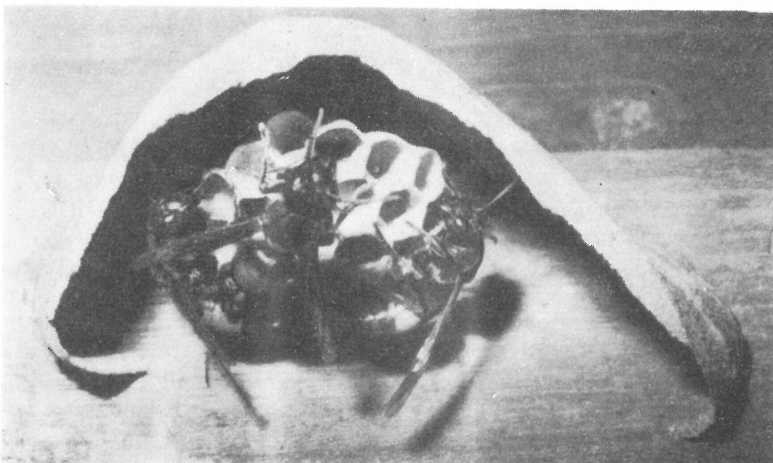


Fig. 2: *V. tropica* nest: The three foundress queens who shared the tasks of nest construction.

downwards and narrowed to a small mouth at the centre and this prevented further observations of the events inside the nest.

Two observations suggested that trophallaxis occurred between adults and larvae. First, nursing adults were seen probing inside the cells and caring for the larvae once detected, and second, salivary droplets fell down from the mouth of the responding larvae of the nest. The base below the nest was found wet due to the dropping of the excess of salivary droplets from the larvae.

A brief chronology of the nest building activity is given below:

Date	Events
21-2-85	Beginning of the nest construction
24-2-85	Petiole completed
25-2-85	3 cells built; start & construction of the outer covering/envelope
27-2-85	7 cells built; eggs laid inside the cells
28-2-85	Extension of sides of the covering; second wasp joins and together lied on the covering during the night
29-2-85	9 cells built; a third wasp joined—one constructing nest, one feeding the larvae and one lying over the comb
1-3-85 to 3-3-85	13 cells built, activities of the three wasps as before
5-3-85	No. of cells now 17; the nest covering is further extended narrowed towards centre
6-3-85 to 10-3-85	all activities as before; nest covering further extended to form a narrow mouth; internal activities are no longer visible

The completed nest (fig. 3) was a multicoloured scallop-shaped body. About five weeks after the beginning of the nest construction, the nest was found broken at several points perhaps by the emerging adults who were seen sitting on the nest.

The breakages in the nest were quickly repaired. The nest may have been used by several generations but this was not recorded. The nest was still in use when the authors left the house after six months.

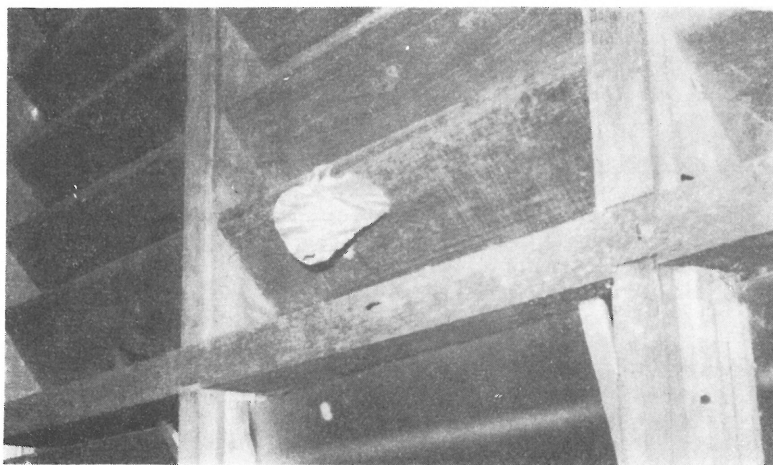


Fig. 3: Complete nest of *V. tropica*. Note the multicoloured striations.

### Discussion

The subfamily Vespinae was known to be haplometric and monogynous (WILSON, 1971; SPRADBERY, 1973) until recently when polygamy was observed in *V. affinis* in Malaysia (Dr. S. G. KHOO in SIEW & SUDDERUDDIN, 1982) and in Sumatra of Indonesia (MATSURA, 1983). Ours is the first record of pleometrotic founding and polygamy in a colony of *V. tropica leefmansii*. An interesting finding was that the nest was initiated by a single foundress and joiners came after a week and later. The possible phenomenon of division of labour is another feature. As mentioned earlier, the three queens shared the tasks of the nest activities but by not being able to mark them, it was not possible to ascertain if the tasks were fixed or rotational. MATSURA (1983) observed pleometrotic founding in nests of *V. affinis* but he failed to confirm a division of labour in the colonies. He, however, noted that the spermathecae of all the foundress queens were full of sperms but the egg laying was monopolised by only one or two.

With regard to *Vespa*'s behaviour of lying over the petiole or the comb, there are three possible explanations: i) regulation of temperature in the nest, ii) nest guarding, and iii) resting (the wasps took rest in between their works). A raised temperature (28° to 32 °C) is considered helpful for the growth of the immatures of Vespinae wasps in colder climates (EDWARDS, 1980). MAKINO and YAMANE (1979) observed that the queen of *V. similis* in Japan raised the temperature of the cell walls from 18° to 22 °C by curling her body around the petiole. The temperature at the site of the present study varied from 27° to 33 °C at day time and from 20° to 27 °C at night. No predator was seen except on one occasion when a nest attending wasp was seen flying over a lizard near the nest. The way the wasps lied, by curling and placing the whole body closely over the comb (fig. 1) did not seem to be mere resting. Thus, if the nest-guarding and resting are excluded, the wasp's lying over the comb in the present study could be for the regulation of temperature in the nest. The continuous lying over at night when the temperature goes down adds further to this inference. The degrees of the temperatures may vary from one climatic condition to the another.

With regards to trophallaxis, its exact function in *V. tropica* has not been determined. It has been demonstrated by ISHAY and IKAN (1968) that adults of *V. orientalis* do not produce proteinase enzymes, but that adults obtain these from larval forms. The enzymes are essential for adults whose insect food must be digested to supply the nitrogenous raw materials for metabolism and egg production.

The heterogenous colouration of the nest could be attributed to a similar explanation given for *V. annalis* (EDWARDS, 1980). This was due to the work being carried out by more than one wasp, the wood pulp being obtained from different sources; light strips were from very rotten wood.

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### Summary

For the first time, the stepwise construction of the nest of a *Vespa tropica leefmansii* VAN DER VECHT, was observed. It was built on the ventilator inside a rural house in Selangor, Malaysia. The nest consisted of a single-tier small comb covered by an outer envelope either completely covered or with a narrow opening near the centre. The nest was initiated by a single foundress

queen which was joined by two more queens at a later time. The queens shared the works of nest-building, larval caring, maintenance of temperature in the nest and nest-guarding activities. Trophallaxis occurred in between adults and larvae. The nest was used by several generations.

### Резюме

Впервые наблюдались этапы постройки гнезда *Vespa tropica leefmansii* VAN DER VECHT внутри сельского дома в Селангоре, Малайзия. Гнездо состоялось из однослойных маленьких сотов, которые полностью были покрыты внешней оболочкой или имели отверстие близи центра. Постройка гнезда была начата одной пчелой-основательницей, которой позже присоединились две другие матки. Все матки выполнили различные функции как например постройку гнезда, заботу о потомстве, регулирование температурного режима и охрану гнезда. Наблюдался обмен пищей между взрослыми особями и личинками. Гнездо было использовано несколькими поколениями.

### Zusammenfassung

Erstmalig wurde der stufenweise Bau eines Nestes von *Vespa tropica leefmansii* VAN DER VECHT beobachtet. Es wurde auf dem Ventilator innerhalb eines Landhauses in Selangor, Malaysia, erbaut. Das Nest bestand aus einer kleinen einschichtigen Wabe mit einer äußeren Umhüllung, die sie entweder völlig bedeckte oder eine enge Öffnung nahe der Mitte freiließ. Das Nest wurde von einer einzelnen Königin begonnen, der sich später zwei weitere Königinnen beigesellten. Die Königinnen teilten sich in die Arbeiten des Nestbaus, der Larvenpflege, der Temperaturerhaltung und der Nestbewachung. Es trat Trophallaxe zwischen Adulten und Larven auf. Das Nest wurde von mehreren Generationen benutzt.

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