Some observations on swarming in nature and colony foundation under laboratory conditions in Odontotermes assmuthi (Holmgren) at Dera Dun

(*Isoptera*: *Termitidae*)

P. K. Sen-Sarma

Forest Entomology Branch,
Forest Research Institute, Dehra Dun (India)

(With 1 figure)

Contents

Introduction

Swarming behaviour and colony foundation have been studied in great detail in the primitive termite families, *Kalotermitidae* and *Rhinotermitidae* (Buchli, 1950; Herfs, 1951; Lüscher, 1951; Pickins, 1934; Roonwal & Sen-Sarma 1955; and Weesner, 1956). Williams (1959) has studied the swarming and colony foundation in two species of *Cubitermes* (*Termitinae*) in East Africa. Only casual observations have been made on the nuptial flight and foundation of new colonies in the higher fungus growing termites, while the biology of the new colony foundations by the Indian termites has not been studied at all. To fill up this lacuna observations were made on the swarming season and time, wing shedding by emerged alates, calling attitude, tandem behaviour, and foundation of a new colony in *Odontotermes assmuthi* (Holmgren): This species, it may be noted, is characterised by having a diffused subterranean nest.

Except for the study of the swarming behaviour which was made in the field, other observations were made in the laboratory under controlled temperature and humidity conditions.

Observations and discussion

a. Swarming

In Dehra Dun, swarming of alates of *Odontotermes assmuthi* (Holmg.) takes place in the fourth week of June and according to observations carried out for the last five years only a single swarm was observed in any year.

DOI: 10.21248/contrib.entomol.12.3-4.292-297

This is in contrast to the swarming habits of the primitive termites where two or more major swarmings per year have been recorded (HARRIS, 1958; HERFS, 1951; ROONWAL & SEN-SARMA, 1955). In *O. assmuthi* swarming followed immediately after a heavy shower of rain. Swarming in Dehra Dun invariably took place at about 4.30 p. m. while there was enough sun light, No flight was observed when the sky was cloudy. HARRIS (1958) observes that in *Odontotermes badius* in Africa, swarming of alates always takes place one hour after sun-set. Maintenance of a rigid time schedule for swarming, therefore, appears to be characteristic of various species of the genus *Odontotermes*.

For facilitating swarming, a large number of exit holes are formed all over the ground connecting the highly diffused subterranean nest of *O. assmuthi* with the exterior. Numerous soldiers and workers guard these exit holes, they scatter and try to retreat through the exit holes when disturbed. According to GRASSÉ (1942) presence of soldier and worker castes near exit holes acts as a stimulating agent inducing emergence of alates. Though each exit hole was large enough to permit 3—4 alates taking to flight simultaneously, alates of *O. assmuthi* generally emerged one by one. Swarming lasted for about 30—45 minutes, and during this period continous streams of alates were emerging from almost all the exit holes.

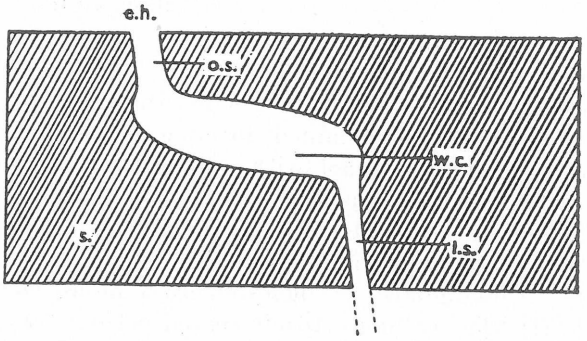

Fig. 1. Schematic diagram of an exit hole of *Odontotermes assmuthi* (HOLMG.) after it was opened up showing the outer shaft, waiting chamber, and inner shaft connecting the nest: *e. h.*, exit hole; *i s.*, inner shaft; *o. s.*, outer shaft; *s.*, soil; *w. c.*, waiting chamber

On opening up an exit hole, it was found that it leads through a vertical tubular channel, the outer shaft, into a rather wider horizontal chamber, the waiting chamber, and this in turn is connected by a tubular inner shaft with the nest (Fig. 1). Before swarming the waiting chamber was occupied by several alate forms.

The exact range of flight could not be determined. Some alates were found to settle down after a flight of only a few meters. A few, however, were drifted by air currents over much longer distances.

After swarming ceased, the workers dealed up the exit holes and no traces of them could be found subsequently. To determine the sex ratio, 100 specimens were collected at random as they emerged from the exit holes. In this collection two sexes were found to be more or less equal in proportion (♂ 48 : ♀ 52).

DOI: 10.21248/contrib.entomol.12.3-4.292-297

b. Shedding of wings

The process of shedding of the wings was studied in the laboratory. For this purpose, over a hundred alates, mostly with wings intact, were collected and kept over night in a large glass trough. It was observed next morning that the majority of alates had not shed their wings and that they collected together in one area. Wings, however, were shed almost immediately after alates were transferred singly to smaller glass troughs. The inhibitory factor against the shedding of wings in the large glass trough appears to be the crowding of a number of alates as they are found in a nest. In nature wings were shed soon after swarming.

Shedding of wings resulted from violent upward and downward bendings, followed by a lateral twist of the abdomen.

c. Calling attitude

Calling attitude was taken up by females only after the shedding of wings. In this attitude the abdomen of the female was raised up and moved fairly violently from side to side. In the calling attitude the female did not move about but remained stationary. The movements of the abdomen were continued till contact with a male took place. However, if the male was withdrawn after contact, or was lost in the subsequent tandem behaviour, the female again adopted the calling attitude. Attraction of the male towards the female in calling attitude, therefore, appears to be visual and not due to "scent signals" as suggested by some authors (Harris, 1958; Lüscher, 1951). The calling attitude ceased permanently only after the pair became lodged in the small nesting cell. It was often noticed that the female in calling attitude quickly jumped away when touched with blunt needles, etc.

d. Tandem behaviour

Tandem behaviour was studied in the laboratory. Males were found to be attracted towards females in calling attitude. With the approach of a male, the female in calling attitude stopped the abdominal movements and started moving forwards with the male following in tandem very closely. The following male was observed to be caressing with its antennae the tip of the female abdomen from time to time. Duration of tandem depended primarily on how soon a suitable nesting site was discovered by the leading female, and lasted from 5—20 minutes.

It was observed that females while in tandem preferred to move up and down over such objects as balls of earth, etc. as lay along their path instead of bypassing such obstacles. In this act the following male was often lost temporarily or permanently, but the female made no effort to search out the lost male, and instead again adopted the calling attitude.

Only female-male tandem was observed by me. Reversal of female-male tandem, as observed by Lüscher (1951) in *Kalotermes* and *Cryptotermes*, was not noticed in this species. No tandem comprising of only one sex was

DOI: 10.21248/contrib.entomol.12.3-4.292-297

observed in this species, though "a male tandem constant enough to be mistaken for a male-female one" was observed by WILLIAMS (1959) in *Cubitermes testaceus*. He, however, did not observe any female tandem. BUCHLI (1950) and WEESNER (1956) also report that in *Reticulitermes* tandem pairs comprising of two males or of two females are not very infrequent under laboratory conditions. WEESNER also claims to have observed in the field tandem pairs comprised of two males.

e. Colony foundation

For colony foundation in the laboratory, tandem pairs were released in medium sized rectangular glass jars loosely filled up with moist soil mixed with 10 gms. of semul (*Salmalia malabarica*) saw dust upto a height of 6 cm. These jars were kept in a chamber with 85% relative humidity and a controlled temperature of ca. 28° C

On this culture medium, the females in tandem moved about actively for the selection of a nesting site. The females exhibited a preference for corners and edges of the breeding jars where the soil matrix was not so closely packed; even artificial fissures, holes, etc., in the matrix readily adopted.

The females with the male following slowly entered the matrix initially, digging was done primarily by the female. The process of entrance was quicker if the passage was open, and the pair buried deep in the soil, ultimately preparing a small cell where it lived as "the male and the female". The tunnel connecting the cell with outside was sealed up subsequently. The pair did not take any food, and apparently lived on the food reserve in their bodies till the hatched workers grew up to feed them.

Unfortunately the process of copulation could not be observed, but as the eggs were laid after 6—9 days of swarming, copulation presumably took place soon after burrowing. It may also be mentioned that females without associated males did not lay any eggs in the laboratory. According to WEESNER (1956) primary pairs of *Reticulitermes hesperus* copulate between 13—36 hours after their introduction in culture containers.

Out of 50 pairs released in breeding jars, eggs were laid by only 10 pairs. Of these, six pairs laid the first batch of eggs on the 7th day after swarming, while in one pair eggs were laid on the 8th day. In the remaining 3 pairs first batch of eggs were laid on the 10th day after swarming. Approximate number of first batch eggs varied from 100—130.

Both the sexes took care of the eggs which were often licked and cleaned by them. That parental care was essential for hatching of the eggs was confirmed by the fact that in case of death of the parents after eggs laying, the eggs did not hatch out and were soon attacked by fungus growth.

The first batch of eggs hatched out after 40—42 days of egg laying. The young ones were looked after by the parents. The second batch of eggs was laid on the 4th day after hatching of first batch of eggs. This long interval

DOI: 10.21248/contrib.entomol.12.3-4.292-297

between laying of the first and second batches of eggs seemed to be advantageous for colony survival, as due parental care which is essential for hatching would not be possible if egg laying was a continous non-stop process. This observation differs from that of Harris (1958) who states that "among the Termitidae . . . the females may be slower in starting to lay eggs but it is then continuous and ever increasing in volume in spite of the fact that the parents have to feed the first lot of youngs until their penultimate moult is completed." In *O. assmuthi*, however, egg laying became a continuous non-stop process only after the laying of the second batch of eggs.

Acknowledgement

I am greatly indebted to Dr. Baini Prashad for his helpful criticism and valuable suggestions. My thanks are due to Dr. P. N. Chatterjee, Officer-in-Charge of the Forest Entomology Branch, Forest Research Institute, Dehra Dun, for encouragement and helpful suggestions during the course of this study.

Summary

In this paper the process of swarming in nature and colony foundation under laboratory conditions in *Odontotermes assmuthi* (Holmg.) has been described.

1. Swarming behaviour is described in detail on the basis of field observations. Flight of alates occurs in the fourth week of June and always at about 4.30 p.m. Swarming follows immediately after a heavy shower.

2. The process of wing shedding is described.

3. The calling attitude to attract males is taken up by females only after wing shedding. Female abdomen is raised up and moved violently until contact with a male takes place. Attraction of males towards the female in calling attitude appears to be visual and not a result of scent signals.

4. Observations on tandem behaviour have been recorded.

5. In colony foundation, nesting site is selected by females. Eggs are laid after some 6—9 days of swarming. Number of first batch of eggs varies from 100—130. Temporary cessation of egg laying takes place after the laying of first batch of eggs. The second batch of eggs are laid 3 days after the hatching of first batch of eggs, and egg laying thereafter becomes a continuous non-stop process. Incubation period is 40—42 days. In hatching parental care of eggs appears essential. Both sexes take care of the eggs and young. Parthenogenesis has not been observed.

Zusammenfassung

Das Schwärmen in der Natur und die Nestgründung unter Laboratoriumsbedingungen bei *Odontotermes assmuthi* (Holmg.) werden beschrieben und nähere Beobachtungen über Schwarmzeit, Abwerfen der Flügel, Anlockung der Männchen, Paarungsverhalten, Eiablage und Fürsorge der Elterntiere für ihre Nachkommen mitgeteilt.

Резюме

Описываются полет в естественных условиях и создание колоний в лабораторных условиях у *Odontotermes assmuthi* (Holmg.), кроме того сообщаются наблюдения о времени полета, о сбрасывании крыльев, о приманке самцов, о поведении при спаривании, о яйцекладке и об ухаживании родительских животных за своим потомством.

DOI: 10.21248/contrib.entomol.12.3-4.292-297

References

BUCHLI, H., Recerches sur la fondation et le devéloppement des nouvelles colonies chez le termite lucifuge (*Reticulitermes lucifugus* ROSSI). Physiol. comp. Oecol., **2**, 145—160, 1950.

GRASSÉ, P.-P., L' essaimage des Termites. Essai d'analyse causale d'un complexe instinctif. Bull. biol. France Belgique, **76**, 347—382, 1942.

HARRIS, W. V., Colony formation in the Isoptera. Proc. Xth int. Congr. Ent., **2**, 435 to 439, 1958.

HERFS, A., Der Schwarmflug von *Reticulitermes lucifugus*. Ztschr. angew. Ent., **33**, 69—77, 1951.

LÜSCHER, M., Beobachtungen über Koloniegründung bei verschiedenen afrikanischen Termitenarten. Acta Tropica, **8**, 36—43, 1951.

PICKENS, A. L., The biology and economic significance of the western subterranean termite, *Reticulitermes hesperus*. In KOFOID & al., Termites and termite control, University of California Press, 2nd ed., 157—183, 1934.

ROONWAL, M. L., & SEN-SARMA, P. K., Biology and ecology of oriental termites (*Isoptera*). No. 3. Some observations on *Neotermes gardneri* (SNYDER). Journ. Bombay nat. Hist. Soc., **53**, 234—239, 1955.

WEESNER, F. M., The biology of colony foundation in *Reticulitermes hesperus* BANKS. Univ. California Publ. Zoology, **61**, 253—314, 1956.

WILLIAMS, R. M. C., Flight and colony foundation in two *Cubitermes* species (*Isoptera: Termitidae*). Insect Sociaux, **6**, 203—218, 1959.

Die Entdeckung von Haemodipsus lyriocephalus Denny an Lepus europaeus Pallas in Deutschland

(*Anoplura*)

V. P. NEGROBOW
Staatliche Universität Woronesh, USSR

In der deutschen Literatur wird der Standpunkt vertreten, daß die Hasenlaus *Haemodipsus lyriocephalus* DENNY außerordentlich selten sei. 1938 schreibt JANCKE, daß trotz spezieller Nachforschungen *Haemodipsus lyriocephalus* in Deutschland in den letzten 50 Jahren am Hasen nicht gefunden wurde. Später bemerkt auch MOHR (1954) in ihrem Überblick über die Ektoparasiten der Nagetiere Deutschlands, daß selbst sorgfältige Nachforschungen nach dieser Läuseart in Deutschland in den letzten 60 Jahren nicht von Erfolg gekrönt waren.

In den Jahren 1959—1961 wurden von uns im Rahmen der Erforschung der Ektoparasiten der Säugetiere in der Deutschen Demokratischen Republik neben anderen Tieren auch 64 Hasen (*Lepus europaeus* PALL.) untersucht. Die Hasen wurden nach dem Abschuß sofort in Säcke aus weißem Gewebe gesteckt. Im Laboratorium wurde den Tieren der Balg abgezogen und im Verlauf der folgenden Tage (meistens 4—6 Tage) auf Ektoparasiten untersucht. Ähnliche Vorsichtsmaßregeln in Verbindung mit einer sorgfältigen Durchsicht der Wolle am Balg in großen Emailleschüsseln bewahrten uns vor möglichen Verlusten an Ektoparasiten während der Unter-

DOI: 10.21248/contrib.entomol.12.3-4.292-297