THE BIOLOGY AND ECOLOGY OF THE DAMPWOOD TERMITE,
POROTERMES ADAMSONI (FROGGATT)
(ISOPTERA : TERMOPSIDAE) IN SOUTH AUSTRALIA.

by

PHILLIP OBED YOBE NKUNIKA

B.Sc. (University of Zambia), M.Sc.,
D.I.C (University of London), M.A.I.Biol.

Department of Entomology,
Waite Agricultural Research Institute,
University of Adelaide.

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University of Adelaide.

SUMMARY

The dampwood termite, *Porotermes adamsoni* (Froggatt) is a native Australian insect. It is well known as a pest of eucalypt forest trees in the Australian Capital Territory, Victoria, New South Wales, and Tasmania where it is said to be restricted to these native eucalypt trees. The available literature on the taxonomy, biology, distribution, ecology and pest status is reviewed. In South Australia, however, it is not considered to be an important pest of native forests, although it is widely spread in cut pine (e.g. logs and stumps) in pine plantations. Fire-damaged eucalypts, and their stumps and logs were found to be important sources of infestation of dead radiata pine (*Pinus radiata* D. Don).

Studies on the biology, ecology and distribution of *P. adamsoni* were carried out at Second Valley Forest Reserve in South Australia from 1982 to 1986 with particular emphasis on colony initiation, growth, behaviour, dispersal and establishment on dead pine wood in pine plantations. At Second Valley Forest Reserve, considerable areas of native eucalypt forests have been cleared and replanted with trees of exotic radiata pine, occupying ca. 93% of the total plantation area. Some of these plantations have been thinned leaving behind pine stumps and logs. These transient habitats were attacked by *P. adamsoni*, which was able to survive and reproduce in this new resource. The study was in three stages; stage one involved field observations and experiments, stage two involved simulated field experiments and stage three involved laboratory experiments.
Despite intensive and extensive field sampling, very few *P. adamsoni* colonies were headed by primary reproductives and these were always relatively small colonies, with an average size of 150 termites (range 6 to 945); colonies with more than 945 termites were invariably headed by neotenics, most of them being apterous and the others brachypterous. Few colonies were headed by a mixture of primaries and neotenics.

Simulated and laboratory results showed that the mortality rate in colonies started by primaries in this species is very high (90 to 99%). In some cases, 100% mortality was recorded. In the few successful young colonies initiated by primary reproductive pairs, initial rates of growth were very low. For example, primary pairs held in the laboratory at 22 ± 2°C produced on average 93 offspring (range 73 to 115) in one and a half years. In contrast, neotenic pairs plus workers (by which they are normally accompanied in the field) produced an average of 402 offspring (range 332 to 478), far more than primaries. Experimentally, this comparison between unaccompanied primaries and accompanied neotenics may seem to be weighted in favour of the neotenics, but these are the normal circumstances in nature. The primaries subsist on their stored fat reserves and the neotenics are fed by other members of the colony.

The terminology used in this thesis is based on morphology and function and is in some respects different from that originally used by Miller (1969) for the lower termites. It is suggested that the terms 'dispersal' and 'spread' as defined and discussed by Laughlin (1982) are appropriate for this species.
The fluctuations in numbers of different castes and stages in field colonies of *P. adamsoni* were studied during different months and correlated with meteorological data. Alate production began in January and continued to early March. Swarming appeared to be triggered by the internal economy and physiological interactions within the colony but was also dependent on external environmental conditions. The sex ratio of dispersing alates caught at light traps was biased in favour of males.

*P. adamsoni* has the ability to spread, i.e. individuals may leave one piece of wood and move to another either when the two are in contact or via subterranean galleries when they are not. This ability together with the production of neotenic reproductives allows the termite to establish new colonies by 'budding'.

A synthesis of the results obtained in this study shows that *P. adamsoni* uses two strategies in the process of colonisation. (1) Alates act primarily as colony initiators, although colony growth started by primaries is very slow taking from three to four years until appreciable numbers of workers are produced; colony growth may then start to accelerate. The primaries are short lived and their reproductive function is typically taken over by neotenics which are more fecund, develop swollen abdomens and are long lived. (2) The other strategy is that of spread by colony budding, which, unlike the flight of alates, is not seasonal. It can take place at any time when the colony is expanding or when the original food becomes unsuitable i.e when the wood becomes very decayed. *P. adamsoni* is unusual among termites in that colony budding appears to be the main means by which this insect propagates itself.
Contrary to current belief, the insects are not restricted to the trees in which the primary colony is founded, at least in South Australia, but instead foragers (workers and nymphs) find new food sources via subterranean galleries (e.g. dead pine wood), leading to spread by colonies budding. This study has shown that by means of budding and also by seasonal production of alates that can initiate colonies in dead pine wood, the insect is able to move from eucalypt to pine over a relatively short period. In consequence there is a need to reassess the pest status of P. adamsoni in South Australia.

The study concludes by developing a model of the life history of the termite and discussing it in the context of the insect's ability to establish itself in a marginal environment. The work is also discussed in relation to current theories on insect life history strategies in general and on population growth in social insects in particular. Many of the major summaries and conclusions of the thesis are covered in Chapter nine.
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