ENTOMOLOGICAL RESEARCH ON
THE CAUSE OF MORTALITIES OF
EUCALYPTUS SALIGNA SMITH
(SYDNEY BLUE GUM)

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SYNOPSIS

Investigations into the cause of death of *E. saligna* (Sydney blue gum) in coastal and highland areas of New South Wales were made, and these included an examination of the influences exerted on this species by several insect species, particularly the beetle *Xyleborus truncatus* Erichson (Coleoptera: Scolytidae) which was found to be associated with brown staining in the wood, and the psyllid *Glycaspis baileyi* Moore (Homoptera: Psyllidae) which occurred in large numbers on the foliage.

The biology, distribution and hosts of these insects, and factors which apparently were contributing to attack by them, were studied.

Assessments of the loss in quantity of commercial timber represented by tree-mortalities were made.

INTRODUCTION

Areas were observed where *E. saligna* was debilitated and dying during the period 1949 to 1958, on Enfield State Forest (Glen Innes District), Doyle's River State Forest (Wauchope District), Cloud's Creek State Forest (Coff's Harbour District), Bulga State Forest (Taree District), Ourimbah State Forest (Newcastle District), and on approximately 150 separate localities in the Gosford-Wyong area (see map) where these investigations were conducted.

Large numbers of *Glycaspis* spp. (Psyllidae) were in these areas, on *Eucalyptus saligna*, *E. propinqua*, *E. paniculata*, *E. triantha*, *E. deanei* and *E. umbra*. *Manorina melanophrys* Latham (bellbird) occurred in variable numbers in all of these areas.

Species of the Psyllidae feed on the sap of many species of plants, construct lerps or coverings on the surfaces of leaves and twigs, feed openly among the tender growth of new shoots, or produce galls of the leaf tissues. They are known by the common names of "jumping plant-lice", or "lerp" insects. The aboriginal word "lerp" refers to the coverings composed of solidified body excretions which the nymphs build over and around themselves.

In the genus *Glycaspis* some species construct round conical lerps, others construct flat lerps, rectangular lerps, or produce foliage galls. They are apparently specific to the genus *Eucalyptus*. Their lerps are sweet to the taste.

Of the 39 species collected and named, those of one sub-genus occur only on hosts contained in the *Eucalyptus* group Renantherae-Renantherae Normales (Blakely 1955), while those of the other sub-genus do not occur on hosts within that group.

* This research note is a summary of work previously reported in detail (Campbell & Moore 1956, Moore 1959, 1961a, 1961b).
Most of the species of *Glycaspis* exhibit host-specificity, so that where *E. saligna*, *E. deanei*, *E. paniculata*, *E. trianinha* and *E. propinqua* occur as a mixed stand, the *Glycaspis* sp. breeding on one of these hosts does not breed on any of the other host-species. This was verified from examinations of separate populations 300 miles apart.

**Damage**

During the early stages of an incipient large population, damage is not readily discernible from the ground and the initial attack may be indicated by the presence of bell-birds which feed on the psyllids and lerps.

The foliage of *E. saligna*, *E. deanei*, *E. propinqua* and *E. paniculata* which is heavily attacked by *Glycaspis* spp. gradually becomes reddish-purple and the colour deepens during the months of colder weather, eventually becoming red-brown. During the spring and autumn, the severely damaged leaves fall, and epicormics may appear on the branches and trunks. The vitality of trees which have been almost defoliated many times over a number of years, is thus affected, so that attack on these trees by a number of other insect species may occur.

(A) *Glycaspis baileyi*

**Biology**

The small yellow eggs, which are approximately 0.4 mm. long and 0.2 mm. wide, occur on either surface of a leaf and are laid either singly, in circles or segments, or in groups of from 2 to 10.

No parasitism, predation or disease of eggs has been observed.

Nymphs pass through five instars, the skin of the fifth instar nymph being shed on the leaf surface after the nymph moves from under the lerp.
Six or seven generations of *G. baileyi* may occur during the one year. The winter generation occupies from 80 to 93 days, embryonic development requiring approximately 40 days prior to emergence of the nymph. The summer generation occupies from 20 to 35 days, and there is a considerable overlap of generations throughout the year.

The round, conical (lerps Fig. 1) vary in size up to 5 mm. in diameter and are usually of a glistening white colour. Lerps are at times removed from the leaves by various factors, and reconstructed lerps are then circular and dome shaped. Large quantities of liquid honey-dew are sometimes produced by nymphs, and a sooty-mould fungus growing in this medium may cover the surfaces of leaves. Numerous fine filaments are sometimes present on the outer surfaces of lerps.

During the nymphal stages, *G. baileyi* is attacked by a complex of parasites, hyperparasites and predators. Several species of small wasps of the Chalcidoidea function as parasites and hyperparasites, while predators include larvae of syrphid flies, green or brown lacewings, larvae of coccinellid beetles, spiders and bell-birds.

**Damage**

(B) *Xyleborus truncatus*

Many trees severely affected by the psyllids are attacked by *X. truncatus* (Fig. 2), and in these, variable degrees of dark brown staining of the timber occurs contiguous to the hole made by the beetle. This staining extends in a strip of variable width, from the entrance hole and along the sapwood for variable distances toward both the bases and the crowns of the trees. In many instances it penetrates the truewood.

![Fig. 2](image-url)
Early stages of attack are denoted by a dark brown stain approximately one quarter of an inch in width on the surface of the sapwood, extending about six inches above and below the hole. In the later stages, this stain has spread along the sapwood and truewood, principally below the holes, becoming paler brown in colour as it extends down the trunk, and the bark covering the stained area eventually becomes cracked and dead. In trees assumed to be almost dead, the stain, covered by the dead and dying bark, sometimes extends to ground-level. The earlier stage shows little or no cracked bark, but this condition always begins contiguous to, and beneath, the scolytid hole, spreading downwards extensively, and upward for a few inches.

*X. truncatus* attack, in all the areas examined and where damage by the psyllids was severe, was usually indicated by the presence of one or more dead lower branches, the tree showing reduced crown foliage and often some epicormics on the trunks and branches. Initial attack occurred in the dying lower branches, and only in the trunk when a tree was considerably debilitated.

The association of *X. truncatus* attack with brown staining and probably the eventual death of a tree was consistently established in 76 trees examined. Attack by *X. truncatus* and consequent deaths of trees sometimes occurred where the psyllids had played no part in their debilitation.

*X. truncatus* occurs throughout Australia, and recorded hosts are *Angophora floribunda, Eucalyptus triantha, E. maculata, E. saligna, E. camaldulensis, E. citriodora, E. propinqua, E. piperita* and *E. maideni*. It is thus assumed that most *Eucalyptus* spp., and a number of other tree-species, are attacked.

**Biology**

*X. truncatus* was found only in standing trees. The colony-chambers, which are variable in size, are usually more or less triangular in shape, with the rounded apex uppermost, and may be 20 mm. in height with a basal length of 15 mm., and 2 mm. wide. They occur in the truewood as deep as two inches within the branches or the trunk, with an entrance hole connecting with the basal area of the chamber where the larvae develop gregariously. An exit hole is later constructed from the side of the colony chamber opposite to that of the entrance hole. As many as 13 larvae have been found in the one chamber. The walls of the chamber, or the holes, are stained brown to black in colour, and the larvae feed on fungi which have developed within them. Such an association with fungi is typical of many species of the Scolytidae.

A single colony chamber may be utilised for the rearing of more than one generation of beetles, and an adult beetle sometimes attends the colony, removing the larval excreta from the colony chamber and the entrance tunnel.

Oviposition may occur from October to May, and larvae of most instars, pupae and adults, have been found in the one colony. The life cycle occupies approximately 3 months in the warmer weather, and six months or more in the overwintering generation. Emergences may occur from September to May.
Larvae are white, and about 3·5 mm. in length during the last instar; the abdomen is prominently deflexed from about the fourth abdominal segment, so that the distal segments form an angle of approximately 90 degrees with the proximal segments. The head capsule is pale cream, with the mouthparts tan-colour to dark brown. Larvae are without thoracic or abdominal legs.

Adults are 2 mm. to 3 mm. in length, and are dark brown to almost black; the posterior portion of the elytra is truncate, and circular when viewed posteriorly.

Assessments

The amount of commercial timber represented by the *E. saligna* killed on two areas of 2·4 acres and 1·05 acres respectively, was determined by 100 per cent. assessments. A total of 161 trees was measured, the proportion of dead trees being 57 per cent. and representing 25,565 super feet hoppus of a total of 41,102 s.f.h. Volume tables for *E. grandis* were used for these assessments.

CONCLUSION

The complex of factors apparently contributing to debilitation and death of *E. saligna* during these investigations is summarised.

(a) The association of plagues of psyllids, with *X. truncatus*, in discrete areas of dead and dying *E. saligna*, occurred on slopes of all aspects and with variable amounts of timber—or undergrowth—cover, from sea level to about 3,000 feet, and in either very sheltered or relatively exposed situations. Such conditions did not occur along ridges, but were confined to the slopes and gullies, even though some of the host-species extended to the ridges.

(b) *E. saligna* of diverse ages and heights was affected, and after an initial period of psyllid dispersal, attack by them usually became static in a given area. As several discrete large populations of various *Glycaspis* spp. occurred at the one time in a number of limited areas, it appeared that some local influence, common to all of these psyllid species, acted as the predominating factor affecting their population numbers.

(c) As psyllid adults feeding alongside the main veins on leaves appeared to oviposit the greatest number of eggs, there may be a feeding-site favourability associated with a stronger sap flow, for adults to oviposit the maximum number of eggs. A reduced flow of sap during drier years may thus influence the occurrence of large populations.

(d) Parasites are able to operate at a high level of efficiency only during periods of relatively dry weather conditions, and moist conditions favour survival and increase of *G. baileyi* populations.

(e) Subsequent to the year 1941, a cycle of 15 years of comparatively high rainfall occurred in all of the areas studied, so that the earliest reports of large populations of *Glycaspis* spp. during 1944, coincided with the early stage of the higher rainfall cycle.

(f) The fungus *Armillaria mellea* (Vahl.) Quel. also contributed to mortalities of *E. saligna*. 
Influences such as soil drainage were investigated, and it was determined that the trees in the areas examined were situated on shallow top-soils (11 to 18 inches) over deep, heavy clay bands.

From evidence gained during these investigations, it is considered that poor site quality, usually associated with such conditions which have accentuated the effects of poor drainage during a number of years with above average rainfall is a factor of considerable importance. Because of these localised conditions the trees in such situations, and often showing prolonged attack by *G. baileyi*, became debilitated and predisposed to attack by *X. truncatus*.

Temperatures of 97°F associated with low relative humidity over five days in the field, have almost eliminated large populations of *Glycaspis* spp. for several months during summer and autumn. Laboratory experiments using high temperature and low humidity on *G. baileyi* supported the field observations. It is thus anticipated that the more intense and extensive the periods of comparatively dry weather, with low relative humidity, the more effectively will *G. baileyi* and closely allied psyllid species be controlled by this weather pattern.

Species of the Scolytidae are known to be vectors of Dutch Elm disease with consequent deaths of trees in forests of Europe and America. Possible effects from a toxic pathogen or substance associated with *X. truncatus* and the deaths of *E. saligna* is at present being investigated. Certain weather conditions, or physiological conditions of trees, may be essential for optimum effect of the mortality factor which, although not necessarily associated with psyllid attack, may be accentuated by it.

**REFERENCES**


**EXPLANATION OF PLATE**

Fig. 1. Lerps of *Glycaspis baileyi* on *E. saligna*.

Fig. 2. Adult of *Xyleborus truncatus*.

Photos by P. HADLINGTON.
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Research Note No. 10  
A. G. FLOYD, 1962  
Investigations into the Natural Regeneration of Blackbutt—E. pilularis.

Sydney: V. C. N. Blight, Government Printer—1962
Distribution of *Glycaspis* spp. (*Psyllidae*)
In association with Bellbirds
Gosford—Wyong Area
New South Wales

Scale: 1 Mile to 1 Inch