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# A REARING TECHNIQUE FOR ONCOPERA BRACHYPHYLLA TURNER AND ONCOPERA MITOCERA (TURNER)

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SUMMARY

**The previous failure of laboratory rearing of the soil-inhabiting hepialids *Oncopera brachyphylla* Turner and *O. mitocera* (Turner) has been overcome. Key factors are temperature, humidity and food, and if these are satisfied the provision of a larval burrow habitation is not required. The major factor for larval survival is food, which at all times must include vegetable debris comparable to that occurring in natural habitats.**

## I. INTRODUCTION

The pasture webworms *Oncopera mitocera* (Turner) and *Oncopera brachyphylla* Turner as pests of pasture on the northern tablelands of Queensland have been under investigation for several years. During this period repeated attempts at rearing these two insect species have been made. However, their habit of living for almost a year in vertical burrows in the soil to a depth of 30 cm has been a feature not readily simulated under laboratory conditions. The disturbance caused in removing the larvae by digging them from the soil apparently produced serious micro-ecological changes unacceptable to the insects. Larvae hatched from eggs laid by collected field-mated females also failed to survive.

These experiences have been in keeping with those of other workers with species in this genus. Madge (1956) in South Australia with *O. fasciculata* (Walker) and Martyn (1960) in Tasmania with *O. intricata* Walker and *O. rufobrunnea* Tindale have been unsuccessful. Similarly, attempts at rearing the related hepialids in the genus *Oxycanus* in New Zealand have been unsuccessful (J. B. Waller 1968; personal communication).

Edwards (1964) in Great Britain has, however, reared the species *Hepialus humuli* (L.) in small cells drilled in blocks of plaster of Paris which stood in a tray of water and in vials containing a layer of moist plaster. Mortality under these conditions was very high and approached 100% by the time the pupal stage was complete. These methods did not prove successful at room temperature with the two *Oncopera* species studied in North Queensland.

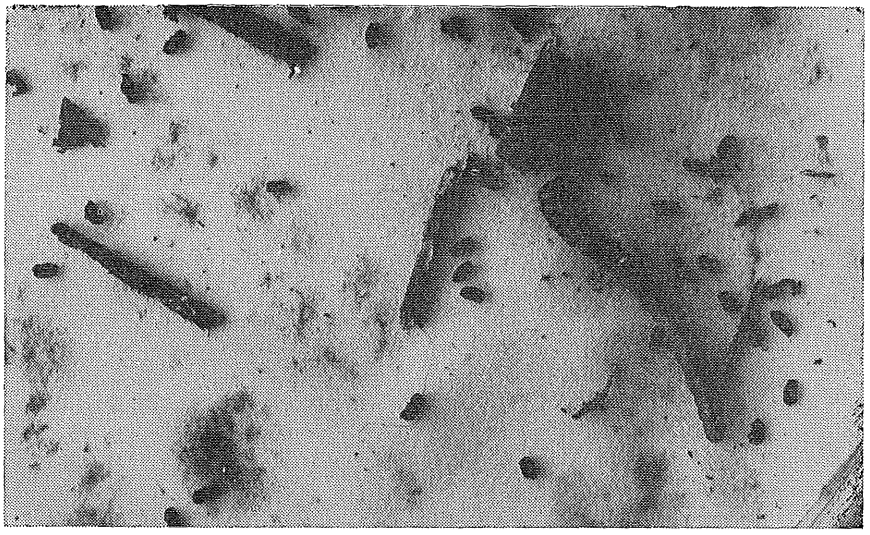

Fig. 1.—An *Oncopera mitocera* larva (centre) feeding on *Panicum maximum* leaf blade in a petri dish. The apparent unhygienic conditions of excreta and fungal development were not detrimental to larvae.

## II. DEVELOPMENT OF REARING METHODS

The investigations of *O. mitocera* and *O. brachyphylla* reached the stage where it was necessary to rear the immature stages in the laboratory in order to fill in missing links in the field biological studies. The missing information presented a major barrier to the ecological understanding of these insects so essential to advancement in solving the economic field problem.

Various techniques in handling the immature stages were attempted and the different factors considered as important to survival of the insects under laboratory conditions were soil type, moisture, food, temperature, darkness and the nature of the burrow. Repeated attempts at simulated burrow conditions with various modifications of each of the other factors and with different larval stages were all accompanied by disappointing results.

It was evident that moisture, temperature and food were the key factors. Temperature control equipment was first obtained in early 1969 and with the temperature factor under control the food and moisture requirements of the immature stages could be worked out by regular direct observations.

For this purpose larvae of both species were placed in petri dishes measuring 9.0 cm in diameter and 1.25 cm in depth. These were lined with two layers of Whatman No. 1 filter paper, which was kept moist at all times and frequently with free moisture between the layers. The dishes were placed in 10 chambers of a multiple-temperature incubator ranging from 10.7 to 27.0°C.

With regard to food, it was shown by the field studies in pasture areas that the material held in the food chamber associated with the larval burrow was partly of fresh grass leaf, but it included leaf which had become mouldy with fungal growth. Old leaf material, sometimes decayed, and even odd pieces of other

vegetable debris, were included. It was also evident with larvae inhabiting areas near rain-forest edges that the food chambers contained much forest floor debris. With larvae inhabiting areas within the rain-forest, forest floor debris must comprise the entire larval diet.

For these reasons, the food given the laboratory-held larvae included well-rotted debris from a grass lawn as well as pieces of fresh leaf blades of guinea grass (*Panicum maximum* Jacq.), one of the field host grasses.

It was soon evident that the period of holding larvae of both species alive in the laboratory was greater than any previous rearing attempt. Some well-grown field-collected larvae developed to the prepupal stage and it seemed that this method might permit satisfactory rearing through the complete larval period to the adult stage.

All larvae which died showed first a decline in feeding, then regurgitation, diarrhoea, loss of body-weight, reduction in size and mobility, and finally death. Pathological examinations of both dead and dying larvae were made but the evidence obtained suggested that the cause was non-microbial or possibly sub-microscopic (R. E. Teakle, 1969, personal communication).

## III. LARVAL REARING

Young larvae of *O. brachyphylla* from field-collected material and eggs obtained in the laboratory were contained individually in petri dishes and placed in each of the 10 incubator chambers. A number of these were successfully bred to the pupal stage. As larvae, they were examined on every second day. At each examination they were given ample food; at the same time water was added so that the filter papers appeared moist. Faecal pellets and soggy food waste were removed as necessary.

It was evident that food, and particularly decayed material, was a key factor for laboratory rearing, and provided this and moisture were adequate, other requirements in the field, such as a burrow for larval habitation, were not essential. Rearing therefore could be satisfactorily continued with larvae at large within the petri dishes.

Initially young larvae were fed only on lawn debris; later fresh grass leaf was added. Older larvae were given fresh leaf and rain-forest floor material which included dead tree leaves, some partly rotted, and well-rotted twigs.

## IV. RESULTS AND DISCUSSION

In the moist atmosphere within the petri dishes, eggs of both *O. brachyphylla* and *O. mitocera* have been hatched and larvae bred through to the prepupal stage. Larvae of *O. brachyphylla* collected in the field at about third instar have been reared to the pupal stage and during this rearing time had moulted nine times. Larvae of *O. mitocera* during the larval period have moulted up to 12 times. Nearly full-grown larvae in a 2-day period could consume more than 3 sq cm of dead leaf lamina and almost 10.0 sq cm of fresh grass leaf weighing 0.04 g and 0.05 g (dry matter) respectively.

Eggs of both species have hatched at temperatures from 13.7 to 27.5°C. Collapse of eggs sometimes occurred due to lack of moisture.

Greatest survival of *O. brachyphylla* larvae was at 18.9°C, but at this temperature survival of *O. mitocera* was nil. At 21.0°C, however, survival was 15% for *O. brachyphylla* and 50% for *O. mitocera.*

The rearing method evolved for these two species of *Oncopera* represents a great advancement towards detailed biological studies of species of soil-inhabiting hepialids previously considered impossible to handle under laboratory conditions. The convenience of the method allows for observations of larvae at any time without undue disturbance and for the regular handling of specimens for detailed measurement in the determination of larval growth and of the various instars.

Adequate moisture within the rearing container is an essential requirement; this was not satisfied by one lining of filter paper but the free moisture between two layers was sufficient for at least 2-day intervals. Possibly other containers with other linings could be used for these or other species of hepialids.

Newly hatched larvae were observed feeding on fungal mycelia in the rearing chamber. This fact and the survival of larvae on vegetable debris no doubt provide the key to the required diet. The food of larvae in rain-forest areas and of young larvae in pastures must consist mainly of debris rich in micro-organisms. The importance of micro-organisms in association with food has been demonstrated in many other insects.

Laboratory reared larvae also consume their own faecal pellets. This possibly could be a source of nutrients following further decay of the pellet material but which otherwise might be in an unavailable form.

Evidence to date suggests that *O. brachyphylla* and *O. mitocera* could have differences in optimum temperatures for larval development. This and other biological data can now be determined in detail by imposed variations in temperature, humidity and food.

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