SYSTEMATICS BIONOMICS AND DISTRIBUTION

OF THE PLANT BUG

Nysius huttoni WHITE

(HETEROPTERA : LYGAEIDAE)

A Thesis Presented in Partial Fulfilment
of the Requirements for the Degree of
Master of Agricultural Science
in the University of New Zealand

by

Alan Charles Eyles

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INTRODUCTION

> "No locality seems too remote for the species of this genus. Whether it be the icy wastes of Greenland, the coral islands of the Pacific, or the upper slopes of the Himalayas, Nysius is certain to be represented. It occurs from Tierra del Fuego to Siberia, from Greenland to New Zealand."
>
> - W.E. China

Nysius huttoni White, endemic to New Zealand is a member of an almost cosmopolitan genus which shows remarkable adaptation throughout the world. As it is the only Nysius species so far recorded from this country, some attention to it is surely due, if for no other reason.

There are, however, other valid reasons which prompted this study, and these are as follows. Relatively little work has been carried out on N. huttoni, there being only one study (by Gurr, 1957) specifically on this insect; the immature stages have not been described; no illustrations of any of the instars either nymphal or imaginal have been published, except for one photomicrograph by Blair and Morrison (1949) of a balsam-mounted imago, but it is so distorted as to be unrecognisable; the systematics of the insect has not been fully studied, for Usinger (1943) states that two species may be represented; the number of broods per year is not known, but Myers (1926) states that there is probably more than one. An attempt has been made to elucidate the subject along these lines.

Further, the insect occurs in large numbers and is easily caught, which two factors contribute much to the suitability of the insect for study material. Thus N. huttoni presents ample scope for a general study on the bionomics of an animal.

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Thanks are also due to Mr. H. Drake for photographic work in the reproduction of the drawings, to Mr. J.E. van Paahuys for the translation of certain German literature, and to Mrs. A.W. Warren for typing this thesis.

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REVIEW OF LITERATURE

(a) Systematics

Nysius huttoni White was described in 1878 by Buchanan White from adult specimens collected by Hutton and Wakefield. Hutton (1897) gave a brief description, sufficient to identify imagines, in a list of Hemiptera then known in New Zealand. A key to the New Zealand Lygaeid genera and species, is included in his paper. Myers (1926), unable to identify four species of *Nysius* other than *N. huttoni*, sent specimens to Dr. Bergroth for description, but the outcome does not appear in the literature. In 1943, however, Usinger on examining eleven *N. huttoni* specimens, noted variability "in colour and even to some extent in structure that two species may be represented." The paper comprises a history of the tribe Orsillini in New Zealand, and descriptions of five new species including *Brachynysius convexus* Usinger, which genus he here also erects.

(b) Bionomics

Myers (1926) in a general study on the biology of New Zealand Heteroptera, gives, for *N. huttoni*, very brief notes on some host plants, and the final ecdysis. It was not until Gurr's paper in 1957 that the life history of the insect was published. He showed that:

(1) there are five nymphal instars, and gives the duration of each;

(2) unlike other species of *Nysius* which oviposit in grass glumes or composite flowers, *N. huttoni* oviposites in the soil. Total individual egg production by nine females is given

(3) newly emerged adults are pale buff in colour, but darken to full colour in twelve hours

(4) greatest activity coincides with the highest day temperature; the bugs conceal themselves under clods or debris on the ground as soon as the temperature begins to fall in the evening

(5) rain induces sluggishness

(6) adults overwinter at the bases of weeds and grasses and under vegetable debris.

(c) Distribution

Evidence that N. huttoni occurs throughout the North and South Islands is given by Myers (1926), Usinger (1943) and Gurr (1957). Alfken (1905) and Kirkaldy (1908) have both recorded it from the Chatham Islands whilst Woodward (1954) recorded it from the Three Kings Islands.

(d) Economic Importance

(i) Lucerne and Red Clover: Amongst harmful insects on lucerne Myers (1921) mentions "Nysius huttoni (very common)." The bug reached phenomenal numbers on lucerne (near Wellington) especially in dry patches where there were gaps in the crop. N. huttoni is also listed by Myers amongst harmful insects on red clover. "Perhaps the commonest insect in the field, both of lucerne and red clover, is the ... plant bug Nysius huttoni ... a close relative of the destructive chinch bug of North America and of the Rutherglen bug of New South Wales." Whilst in Blenheim, the crops were more advanced, but the bug was common throughout, and, although there was no apparent damage, Myers considered the continual sucking by the insects must be a factor of some importance.

(ii) Wheat: Certain lines of wheat from North Otago and South Canterbury produced "sticky dough" or "slimy gluten" when the flour was used for baking (Morrison 1939, Blair and Morrison 1949, Gurr 1957). They found Heteroptera present in large numbers in many wheat crops and in surrounding vegetation. Morrison (1939) caged samples of the most abundant species of plant bug, Stenotus binotatus Fabr., N. huttoni and Hudsona anceps (White) Evans, separately on developing wheat crops at Lincoln Agricultural College. Wheat not confined with insects was not damaged. Results from his experiments are:

(1) All three plant bugs caused bugged wheat and therefore sticky dough.

(2) Plant bugs causing the damage in New Zealand are different from those

species (mainly Eurygaster and Aelia species) causing similar damage in Europe and Asia. E. bipotatus is cosmopolitan, but E. hattorni and E. anceps are native to New Zealand.

(3) Because the harmful species in New Zealand are widely distributed, and not confined to Otago or Canterbury where the trouble is most prevalent, and because the proportion of crops attacked to the quantity grown, is small, it is suggested that wheat is not the normal or preferred food of the bugs.

(4) Damage is more prone in certain wheat areas than in others, which suggests that the prevalence of certain weeds, the climatic conditions prevailing, the time of ripening of wheat, or a combination of those factors, may be closely linked up with the trouble.

(5) Damaged grains show a white, oval or round patch with a central black spot, the rostral puncture.

Gurr (1957) states that damaged grains may be shrunken and cuboid in shape as a result of prolonged or multiple feeding of the bugs. He explains that wheat is attacked in the milk ripe stage, a proteolytic enzyme being injected to facilitate ingestion of the plant juices by suction. Abnormal behaviour of the gluten is caused by enzymatic residues in the grain. The following additional information on the effect of bug feeding on wheat in New Zealand was contributed by Gurr:

(1) "As little as one per cent of bugged wheat used in the production of flour has made it unsuitable for baking .... Bugged wheat may be used for flour without affecting its baking qualities if at blending it is mixed in quantities of less than one per cent with unaffected lines."

(2) Bug damage in New Zealand does not affect germination of wheat.

(3) The bugs live on weeds at the edges of crops, but as the weeds die at the height of summer, in the dry subhumid South Canterbury and North Otago regions, the bugs are forced onto the ripening wheat.

The writer noted the following difference between wheat bugs in New Zealand and bugs attacking cereals in other countries.

(a) Bug damage in New Zealand does not affect germination of wheat (Gurr 1957), whereas cereal grains damaged by bugs in other countries suffer reduced germination (Malenotti 1931, Tordesillas 1955, Lefage 1937).

(b) N. huttoni attacks only the grain of wheat when it is at the milk-ripe stage (Morrison 1939, Blair and Morrison 1949, Gurr 1957), whereas overseas bugs also feed on the growing cereal plants (Scott 1929, Wölfer 1932, Tischler 1939, Kretovich et al 1943).

(c) In New Zealand, the proportion of wheat crops attacked to the quantity grown, is small (Morrison 1939) due to restriction of bug feeding to the edge of the crop (Gurr 1957). In other countries, however, the bugs spread throughout the crop and cause severe damage, often to the extent that the crop is not worth harvesting (Scott 1929, Malenotti 1931, Manninger & Manninger 1953).

There is a similarity in that both the New Zealand and the overseas cereal bugs rely on other plants, mainly weeds and grasses, as overwintering quarters, and as a source of food until the appearance of, and subsequent movement onto, the cereal crop.

(iii) Crucifers: "Greatest economic loss is caused by its damage to cruciferous seedlings" - Gurr (1957). The reason is that the whole area of the seedling crop provides suitable bug habitat, so that damage is not confined to the edge of the crop. Large numbers feeding around the young stems, suck much sap from the plants which then wilt; blockage of conducting vessels as a result of feeding punctures prevents recovery by the plants.

SECTION A - SYSTEMATICS

"... it appears likely that the New Zealand Orsilline fauna will prove to be just as unique, though possibly somewhat smaller, than that of the Hawaiian Islands."

- E.L. Usinger

CHAPTER 1

THE PLACE OF N. huttoni WITHIN THE FAMILY LYGAEIDAE

N. huttoni belongs to the tribe Orsillini (Stål)*; one of three tribes which comprise the sub-family Lygaeinae. As well as the genus Nysius Dallas, at least twenty other genera have been assigned to the Orsillini. The major divisions of the family Lygaeidae represented in New Zealand are given below, and in particular, of the sub-family Lygaeinae.

Family LYGAEIDAE

Sub-family Lygaeinae
Sub-family Heterogastrinae+
Sub-family Cyminae
Sub-family Megalonotinae++

Sub-Family LYGAEINAE

Tribe Lygaeini
Tribe Orsillini
Tribe Metrargini (exclusively Hawaiian)

* The tribe Orsillini is a taxonomic category and therefore has a description, the genus Orsillus Dallas being the type genus.

+ Heterogastrinae Stål, 1872 takes priority over Chauliopinae Breddin, 1907 which is a junior synonym.

++ Megalonotinae Slater, 1957 replaces Rhyparochrominae Stål, 1862, the type genus Rhyparochromus Curtis, 1836 falling as a junior homonym of Rhyparochromus Hahn, 1826.

The New Zealand Orsillini, comprising eight species representing four genera, are as follows:

Nysius huttoni White
Brachynysius convexus Usinger
Hudsona anceps (White) Evans
Rhypodes clavicornis (Fabr.) Evans
Rhypodes sericatus Usinger
Rhypodes myersi Usinger
Rhypodes chinai Usinger
Rhypodes stewartensis Usinger

The genera Rhypodes Stål, Hudsona Evans, and Brachynysius Usinger, are endemic to New Zealand, but the genus Nysius is cosmopolitan. Usinger (1943) says:-

> "The New Zealand Orsillini are so peculiar that no relatives of the endemic genera are known from elsewhere. N. huttoni, however, is allied to the Hawaiian Nysius blackburni White and to Nysius backstroemi Bergroth from Juan Fernandez. The new genus Brachynysius is apparently a remarkable offshoot from typical Nysius."