THE "NETTLE GRUB" PEST OF TEA IN CEYLON.

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INTRODUCTION.

The intensive study of these pests began in March 1929, when Mr. Austin was deputed by the Department of Agriculture to study the bionomics, parasites and possible methods of control of Nettle Grub in Passara. Seven months later the investigation was closed down for want of suitable accommodation in the district.

In April 1930, at the request of the Uva Planters' Association, the Institute took over the work, and Mr. Austin was seconded by Government for service with the Institute for a period of one year, which was later extended to the end of September 1931.

This extended investigation was made possible by the kind co-operation of Messrs. George Steuart & Co., and Mr. G. Kent Deaker, who placed a small bungalow on Gonakelle Estate at the disposal of the Institute for the purpose.

The article gives a record of data gathered since April, 1930, with a brief summary of historical data from about 1872 up to the present time.

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The Species of Nettle Grubs affecting Tea.

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PART I.

1. HISTORICAL.

The earliest record of a Nettle Grub, as a pest of economic importance was made by Neitner [1] in 1872, when he referred to *Parasa lepida*, the blue-striped Nettle Grub, then known as *Limacodes graciosa*, as a pest of coffee.

By 1890 *Parasa lepida* had assumed the status of a pest of tea, and is the only Nettle Grub described by Green in his "Pests of the Tea Plant" published that year.

The next authentic record of a Nettle Grub causing damage to tea is the same author's [5] reference to *Natada nararia* Mo., the Fringed Nettle Grub, which was reported from Badulla in November 1897.

It is presumed that Nettle Grubs were not much in evidence between 1890 and 1897, because Trimen, Director of the Royal Botanic Gardens, Peradeniya, in his Administration Report for 1893, wrote: "with the exception of *Helopeltis* the tea plant is remarkably free from serious pests."

1899, however, saw the first real outbreak of Nettle Grubs on tea when *Thosea recta** caused a considerable amount of alarm by appearing in large numbers in Morawak Korale during the months of June and July. Ever since then, this particular species of Nettle Grub has been known as the "Morawak Korale Nettle Grub".

In 1900, in response to a request from the Chairman of the Planters' Association, Green [5] published a circular on caterpillar pests of tea, in which he included very useful notes on the four species of Nettle Grubs known up till then, viz., *Parasa lepida*, *Natada nararia*, *Thosea recta* and *Thosea cana*. Commenting on *Natada* he wrote: "The Uva tea districts seem to enjoy almost a monoply of this species as a tea pest. Though it is a widely distributed insect throughout the Island, and certainly occurs in all the tea districts, yet I have received no reports of damage to tea, or of its occurrence in unusual numbers in the Central Province".

The same year (1910) *Natada* was reported for the first time from Passara, (in July) where "over 100 acres of tea on one estate were completely defoliated, and hundreds of coolies were employed in collecting and destroying the insects"; *Thosea cana* appeared at Elpitiya, and *Spatulicraspeda castaneiceps*—then known as *Spatulifimbria*—was recorded as a pest of tea, for the first time, when it was reported from the Kelani Valley.

In 1901, the only species of Nettle Grub recorded was *Natada* in August, and again from the Badulla district.

In 1903, *Scopelodes venora* [6] the largest Nettle Grub on tea, and one which fortunately is rather rare, was recorded from Peradeniya in June, while a small outbreak of Spatulicraspeda [8] was reported from Neboda in February.

In 1905 *Natada* appeared in Dolosbage during the months of March and April, while *Narosa conspersa* [9] the "green gelatine grub" assumed the importance of a pest of tea for the first time, having made its appearance in Uda-Pussellawa in the month of December.

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* It was the late F. M. Mackwood who identified this Nettle Grub during the outbreak in 1899: E. E. Green, the Government Entomologist, was away on furlough at the time.

In 1906, *Thosea recta* was recorded from Yatiyantota and *Natada* from Elkaduwa, while *Thosea cervina* was reported from Bandarawela by R. G. Coombe, who wrote that the grubs were "in millions" and attacking his "best flushing tea".

In 1907, *Thosea recta* was reported from near Kandy and the following year from Uva.

Green's remarks made 23 years ago are quoted in full below because the comments offered then are equally applicable to the present situation in Uva which is according to some "twenty times worse".

"This pest has done considerable harm in the Uva District where it appears to have occurred (periodically) for many years. It often necessitates a premature and costly pruning of the affected fields. I think that if all these estates attacked by this pest would co-operate towards its extermination, the work would eventually be cheaper and more satisfactory. Individual and isolated efforts only result in driving the pest to neighbouring estates. The ground between the bushes should be swept and all the fallen leaves burnt in order to destroy the pupae which are like small tea seeds in shape and colour".[12]

In 1910 *Natada* was reported from Rattota in June, and the following year from Wattegama in March and April.

In 1912, Green wrote in his Administration Report that he had "received no notice of Nettle Grubs" during the year.

By 1913 *Natada* was again serious in Badulla and Demodera, where "80 acres were said to be affected, and all the leaves dropping off the bushes"; *Thosea recta* and *Parasa lepida* were reported as causing damage to tea in Ratnapura, where the former had consumed ten acres of the crop.

In 1914 Elkaduwa reported *Natada* in August, while *Thosea recta* and *Thosea cana* did damage to tea in Ratnapura in January and March. In July, Rutherford [13] published his notes on Nettle Grubs referring to the five common species known up till then.

In October 1915 outbreaks of *Natada* were recorded from Madulsima, Namunukula and Pelmadulla, and from Dehiowita the following May.

From 1918 to 1920 *Natada* was the only species reported and outbreaks were recorded from Madulkelle in January, and Badulla in May (1918); Watawala in February (1919); Madulsima and Badulla in August, Passara in September and Peradeniya in October (1920). Hutson [15] commented as follows: "outbreaks of Nettle Grubs have occurred in unusual numbers in a few localities".

In 1921 *Natada* was reported from Badulla in March and September, from Passara in May, June and October, and Madulkelle in December, while both *Natada* and *Thosea cervina* were responsible for a serve outbreak in Wattegama.

In 1922 *Natada* was again reported from Dolosbage in February and October, from Passara in September, and Badulla in October; while *Thosea cervina* was recorded for the second time in Uva when it appeared near Badulla.

By 1923 the pest was obviously becoming wide-spread, and in Passara the damage to tea was so extensive that the local Planters' Association made a request to Government for an investigation on Nettle Grubs, and A. M. Clarke of El Teb offered to place an acre of tea at the disposal of the Department of Agriculture.

In June, the Government Entomologist (Dr. Hutson) carried out experiments with lead chromate, as a spray, on El Teb.

Early in the year Dr. Hutson [17] published a very descriptive article on the Fringed Nettle Grub (*Natada nararia*).

In 1924 *Thosea recta* was again reported from Morawak Korale, when it appeared at Deniyaya in October. *Natada* broke out in Passara in June, Maturata in July, and the following year at Dolosbage in June, and Elpitiya in October.

In 1926 *Natada* was once again reported from Passara in May, while both *Natada* and *Spatulicraspeda* were recorded to have appeared simultaneously at Elpitiya also in May.

1926 saw the opening of the Tea Research Institute of Ceylon when the investigations on Nettle Grubs and other pests of tea, (excluding Termites and Green Bug) were handed over by the Department of Agriculture to the Entomologist of the Institute.

Light [18] in his first report for the year recorded an outbreak of *Thosea cana* in the low-country, which "was entirely wiped out by an Ichnemon parasite".

Towards the middle of the year Dr. W. H. Brittain, Provincial Entomologist, Nova Scotia, accompanied by Dr. Hutson of Peradeniya, carried out experiments with calcium cyanide in Passara against *Natada*.

In 1927 *Natada* appeared in Passara in July and December, while a "gelatine grub", presumably *Narosa conspersa*, was recorded from Kandapola in December.

In 1928 the following resolution, passed at a General Meeting of the Uva Planters' Association, speaks for itself: "This Association views with alarm the spread of Nettle Grub in Uva and asks the Department of Agriculture to investigate this pest thoroughly."

This appeal was supplemented a few months later when the Department was again requested "to investigate (a) Green Bug (b) Shot-Hole Borer (c) Nettle Grub". The situation was that the Entomologist of the Tea Research Institute was then too occupied with the Tortrix problem to devote time to Nettle Grub and other pests of tea.

Consequently, Dr. Hutson, the Government Entomologist, made a survey of the situation in Uva and in submitting his report made the following observation: "I would suggest that Nettle Grub is rapidly assuming the dominating position in Uva that Tortrix holds in Maskeliya or parts of Dimbula, and until some such concerted action is taken against Nettle Grub as has been started by Tortrix estates, I do not see any prospect of any marked improvement in the situation".

This statement created a stir in planting circles and on further representations being made by the Uva Planters' Association Government decided "to station a junior officer of the Department in the Nettle Grub area in Uva early in 1929 for a further investigation of the measures which may be adopted for the control of these pests".

In 1929 (March) the writer was transferred to Passara fom Peradeniya to investigate the pest on behalf of the Department of Agriculture. During this period a study was made of the various species of Nettle Grubs and their parasites, and a spraying experiment was carried out on Gonakelle. In September the investigation was closed down temporarily for want of accommodation in the district. (A report on the work accomplished during the six months was read by F. P. Jepson—Acting Entomologist—at a meeting of the Estate Products Committee in Peradeniya on September 10th).

By the end of 1930 the situation in Uva was no better, and it was then realised that the problem was more serious than was originally realised.

The Tea Research Institute then agreed to widen the scope of the investigation by increasing the staff and affording further facilities. This was accomplished in May 1931 with a certain amount of financial assistance from the Ceylon Estates' Proprietary Association, when two field assistants were engaged and a temporary laboratory and insectary fitted up in the Passara District.

Subsequently, in October 1931, the writer was transferred to the permanent staff of the Tea Research Institute and work on Nettle Grub further intensified.

2. GENERAL REMARKS ON CHARACTERISTICS AND BIONOMICS.

"Nettle Grubs", also known as "Slug caterpillars", belong to the family *Limacodidae*, the characteristics of which are chiefly noticeable in the general appearance of the grubs, and their gliding or slug-like habit of movement.

Moths are a dull-brown or yellowish colour, with the exception of Parasa which is apple-green. They are small to medium in size and nocturnal in their habits.

Eggs are flat, oval, scab-like objects, almost transparent and with a shinny surface. They are deposited singly or in masses on both the upper and lower surfaces of mature leaves.

Larvae or grubs, are rather short, stout and oval in shape. A good many of the species are covered or armed with branching spines, while a few like *Narosa Belippa* and *Spatulicraspeda* are naked. Their heads are retractile and feet, though present, are hardly noticeable. Colouration is variable, apple-green being prominent and common to most species.

Grubs tend to be gregarious on reaching pupation and cocoons are frequently found clustered together.

Cocoons are hemispherical or oval in shape. Those made by the spineless grubs are whitish or greyish in colour and are conspicuously placed on the foliage towards the upper part of the tea bush, while the cocoons of those with spines are dark-brown in colour, and invariably found beneath the bush, round the collar, in the forks of branches, under dead leaves and stones, and at times in the soil. Nettle Grubs are somewhat widely distributed, having been reported to occur in practically every tea district in the Island. A perusal, however, of the list of localities would indicate that the pest appears more frequently in those planting districts which receive the benefits of only one monsoon.

PART II.

NUMBER OF SPECIES AFFECTING TEA.

Nine species of Nettle Grubs are known to feed on tea. With the exception of one i.e., *Belippa laleana*, the remaining eight were all discovered by Green, and it is quite likely that he was responsible for the common names associated with them.

COMMON NAMES.

1. *Natada nararia* Mo. has been known as the "Fringed Nettle Grub" since 1900 when Green published his first notes on the Nettle Grubs known to attack tea. But in 1905, when referring to the same species, he mentioned the name "Small Nettle Grub". But

the former name has remained and is the most well known today. Since November, 1897, when *Natada nararia* was first reported from the Badulla district as damaging tea, it has remained the commonest Nettle Grub on this crop with the widest distribution, having been recorded from as many as twenty planting districts.

2. *Thosea cervina* Mo. was a recognized pest of tea in India before it was found in Ceylon and consequently its common names emanated from that country where it is still known as either the "Assam Nettle Grub" or the "Assam Tea Seed Moth". But on *T. cervina* assuming a status of economic importance in Ceylon in 1906, Green suggested that "to distinguish it from its allies the species might be called the 'saddle-backed Nettle Grub' , but this name does not appear to have been remembered again. Up to the present it remains the one Nettle Grub without a local common name.

3. *Thosea recta* Hmp. On account of the serious damage it caused to tea in the Morawak Korale District in the Southern Province, it has since 1899 been called the "Morawak Korale Nettle Grub."

4. *Thosea cana* Wlk. has been known as the "Green Nettle Grub" since 1900.

5. *Spatulicraspeda castaneiceps* Hmp. is occasionally referred to as the "Red-banded Nettle Grub".

6. *Parasa lepida* Cram. has all along been called the "Blue-striped Nettle Grub" owing to the characteristic blue bands on its back.

7. *Scopelodes venosa* Wk. owing to its size is still known as the "Large Nettle Grub".

8. *Narosa conspersa* Wlk. has of late been called a "Gelatine Grub". It might, however, be necessary to call it the "Green Gelatine Grub" in order to distinguish it from *Belippa laleana*, another gelatine grub, also found on tea.

9. *Belippa laleana* Mo. was the first to be called a "Gelatine Grub" when it was recorded by Speyer fourteen years ago. Recently it has been found in Madulsima, but not in such large numbers as Narosa. Compared with Narosa, *Belippa laleana* is of a bluish-green colour and its original common name "Gelatine Grub" should be allowed to remain.

Nettle Grubs have their equivalent in the vernaculars. The Sinhalese and Tamils call them "*Gini Panuwo*" and "*Eri Poochie*" respectively, "Gini" and "Eri" both mean fire or something which burns, while "panuwo" signifies caterpillars or grubs, and "poochie" is a common term applied to insects in general.

DISTRIBUTION.

The following is a list of localities from which the nine species of tea Nettle Grubs have been reported to occur:

Natada nararia Mo.

Aranayake
Badulla
Bandarawela
Dehiowita
Demodera
Dolosbage
Elkaduwa
Elpitiya
Galle
Haldummulla
Haputale
Kalutara District
Lunugala
Madulkelle
Madulsima
Matale
Maturata
Namunukula
Nawalapitiya
Passara
Pelmadulla
Peradeniya
Pussellawa
Rangalla
Rattota
Talawakelle
Watawala
Wattegama.

Thosea cervina Mo.

Badulla
Bandarawela
Demodera
Dolosbage
Galaha
Haldummulla
Haputale
Lunugala
Madulkelle
Madulsima
Namunukula
Passara
Pussellawa
Wattegama

Thosea recta

Badulla
Bandarawela
Demodera
Deniyaya
Haputale
Kandy
Lunugala
Madulsima
Morawak Korale
Passara
Pussellawa
Ratnapura
Talawakelle
Yatiyantota

Thosea cana Wlk.

Avisawella
Balangoda
Elpitiya
Ratnapura

Scopelodes venosa Wlk.

Demodera
Passara
Peradeniya

Narosa conspersa Wlk.

Badulla
Bandarawela
Haputale
Kandapola
Lunugala
Madulsima
Maskeliya
Passara
Talawakelle
Uda-Pussellawa

Spatulicraspeda castaneiceps Ham.

Badulla
Elpitiya
Kelani Valley
Lunugala
Neboda
Passara

Parasa lepida Cram.

Badulla
Madulsima.
Passara
Pussellawa
Ratnapura

Belippa laleana Mo.

Badulla
Madulsima.

SEASONAL HISTORY.

No definite conclusions can at present be drawn as to the seasonal history of the different species of Nettle Grubs. More accurate observations are necessary before it can be definitely stated that Nettle Grubs are a dry weather pest. This is, of course, a popular opinion held by several in Uva. In Passara the writer has seen equally severe outbreaks occur during both the rainiest and driest seasons of the year.

A chart prepared from a census of reported outbreaks between 1897 and 1930 indicates that Nettle Grubs were worst during the months of May, August and October.

MIGRATION AND DISPERSION.

No migration has actually been observed. But that migrations periodically take place at night is suggested by the various outbreaks which occur in different parts of an estate, and sometimes a considerable distance from any other infested area.

Several are inclined to believe that strong winds are responsible for the dispersal of moths. This is not the case. Moths and a good proportion of insects in general are apt to be very still or inactive on windy nights.

The writer, however, has on one occasion observed that strong blowing was responsible for the dispersal of *grubs*.

During an outbreak of *Natada* in Passara, in the month of June, grubs were as plentiful on dadaps as they were on tea. The superintendent of the estate attacked decided that the tea should be sprayed and the dadaps lopped and foliage burnt. That night the S.W. Monsoon blew over the downs of Uva, and by morning not a single Nettle Grub could be found on those dadaps which were to be lopped. Grubs were found in a field several hundred yards away which till the previous day had remained free of the pest.

Moths, in general, are mainly responsible for the dispersion of the pest.

What might be termed "artificial dispersion" was once observed by the writer while travelling at night by bus from Badulla to Passara. On the climb approaching Debedde, the bus was obliged to stop for a short while. Within a couple of minutes one female and two male *Natada* moths were attracted to the light inside the bus and remained resting on the hood till Passara was reached. The driver volunteered the information that on some nights these moths arrived in hundreds and were a nuisance.

Here is a possible explanation, and perhaps a contributory cause, of the wide distribution of Nettle Glubs in Uva and other districts during recent years.

The transport of tea seedlings from one district to another is perhaps another method of dispersion that requires further investigation. Nettle Grubs have been found to breed in tea nurseries and it is quite conceivable, if Nettle Grubs were originally limited to Uva, that their distribution to other tea districts was brought about by the transport of infested material.

The proposed legislation (if Nettle Grub is declared a pest) should prevent its further spread by declaring areas "infested" and prohibiting the "removal or reception" of plants from such areas.

Legislation should check the spread, at least of *Thosea cervina*, into the low-country, where this formidable Nettle Grub may adopt a taste for coconuts.

It was found on coconuts in the Andaman Islands in 1924 and recorded in the Peradeniya files.

LARVAL MIGRATION.

This is a characteristic feature which is not uncommon among certain kinds of caterpillars. These migrations invariably occur when the grubs or caterpillars are a little more than half grown. The stimulus, or motive, which prompts such a migration is, as in the case of moths and butterflies, either a lack of food, or some disturbance caused by weather conditions.

Larval migrations may occur from one part of the host plant to another, from the host to another plant in the same locality, or from its original habitat to that of another.

The writer has personally not seen a migration take place among Nettle Grubs, but would wish to comment on an observation recorded by Hutson [09] who wrote "during periods of heavy rains the Nettle Grubs mostly left the tea and assembled in thousands on the under side of the interplanted dadaps, presumably for the better protection afforded by the larger leaves. By keeping the dadaps denuded of their leaves during the wetter months, the Nettle Grubs were deprived of adequate shelter and returned to the tea whence they could be more easily collected."

It would be interesting to know whether similar observations have been made by others. Where shelter is concerned, the writer would submit that a tea bush offers more protection to a Nettle Grub than a large-leaved dadap, especially during the rains in Uva.

However, if such migrations are a feature of Nettle Grubs, the question of control appears to be a very simple matter.

It would be easier and more practicable to lop the dadap carrying Nettle Grubs than to prune infested tea. Pieces of jute hessian stitched together and stretched beneath the dadaps would prevent Nettle Grubs dropping down to the tea. If the dadaps were wanted and lopping considered undesirable at the time, the alternative would be to apply a tanglefoot round the trunks of the dadaps to prevent the grubs crawling down, and to spray or dust the foliage with some contact insecticide. A spray or a dust would be more effective on a Nettle Grub while it was on a dadap than if it were hidden within a tea bush.

FOOD PLANTS.

While tea is undoubtedly its favourite host plant, grubs have been recorded to feed on:—

Dadaps (*Erythrina lithosperma*)
Gliricidia maculata
Crotalaria spp.
Tephrosia candida
Blue Gum (*Eucalyptus globulus*)
Toona (*Cedrela toona*)
Ficus religiosa
Citrus spp
Roses
Honeysuckle and
Cannas in Passara

Hutson [24] has recorded the following as compiled from Peradeniya records:—

Bignonias spp.
Eucalyptus robusta
Psidium polycarpon
Castanospermum australe
Tecoma stans
Thunbergia laurifolia and
Rubus ellipticus.

NATURAL ENEMIES.

Nettle Grubs have quite a variety of natural enemies, which, at certain seasons of the year, contribute to the control of the pest considerably. These natural enemies, on the whole, attack the pest while it is in the larval or grub stage. No egg parasites have hitherto been found.

The following are some of the more potential parasites, which have been observed up to date:—

PARASITES.

Fornicia ceylonica Wilkn. is a small hymenopterous wasp belonging to the family Braconidae. It appears to be more a parasite of *Natada nararia* than any other Nettle Grub. It has, however, been bred from *Thosea cervina* and *Thosea recta*. Parasitised grubs turn a bright-yellow and are very conspicuous on the tea.

Rhogas sp., also a Braconid and like Fornicia, is a solitary larval parasite. It is of a brownish colour, and females possess a distinct ovipositor. It parasitises nearly all the species of Nettle Grubs and has been reared from *Thosea cervina*, *Thosea recta*, *Natada nararia*, *Narosa conspersa*, and *Parasa lepida*.

Apanteles sp. is a gregarious larval parasite, also a Braconid, and is known to attack *Thosea cervina*, *Thosea recta* and *Parasa lepida*. Adult parasites emerge from grubs almost full grown. Tachinids or fly parasites, yet unidentified, have occasionally emerged from the cocoons of *Thosea cervina*, *T. recta*, *Parasa lepida* and *Natada nararia*.

PREDATORS.

Canthecona robusta Dist, is a predaceous Pentatomid bug which is particularly fond of *Natada nararia*, but in the laboratory has been observed to feed on all species of Nettle Grubs offered. Both adults and nymphs are predatory in their habits.

Oecophylla smaragdina Fb. the large 'red ant' is said to be a formidable enemy of Nettle Grubs. But it has yet to be demonstrated that these insectivorous ants attack either the grubs of the emerging moths.

BIRDS.

The only bird known to feed on Nettle Grubs is the crow (*Corvus splendens*). Green records that on a visit to the Kelani Valley in 1900 he was informed that "during a bad attack of the pest (Nettle Grubs) the crows were said to have gorged themselves with the caterpillars until they could scarcely rise from the ground".

DISEASES.

"Wilt" disease is undoubtedly the most effective controlling factor, and is very often largely responsible for the so-called 'disappearance' of Nettle Grubs from infested areas.

Natada nararia appears to be the species of Nettle Grubs most susceptible to this disease. A point which requires further investigation is whether Wilt has been responsible for the partial elimination of *Natada* from those localities where, till recent years, it has

remained the dominant species of Nettle Grubs. Or, in the converse, whether *Thosea cervina*, owing to its apparent powers of resistance against Wilt, has succeeded in predominating over *Natada* in a few areas. Wilt attacks both the young as well as the older larval stages of Nettle Grubs; and "food shortage" and "overcrowding" are by no means the only causes conducive to an epidemic. Severe attacks of Wilt have been observed where grubs were few and far between and the food supply almost unlimited.

CATERPILLARS MISTAKEN FOR, OR ASSOCIATED WITH, NETTLE GRUBS

Heterusia cingala Mo. the 'Red Slug' is very frequently mistaken for a Nettle Grub. This caterpillar is reddish-brown in colour and though called a "slug" is not so sluggish in its movements as most Nettle Grubs. It is active when disturbed. Damage consists in the caterpillars defoliating mostly the very mature leaves at the bottom of the bush. Cocoons are formed within the folds of leaves. The moths are beautifully marked and are attracted to lights.

The following is a list of hairy caterpillars, found on tea and dadaps, and occasionally reported as "Nettle Grubs":—

Dasychira horsfieldi Saund. The Yellow Tussock.

Notolophus (Orgyia) posticus Wlk. The Small Tussock Moth.

Attacus atlas L. The Atlas Moth.

Taragama dorsalis Wlk. The Dadap Hairy Caterpillar.

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(To be continued.)