THE "NETTLE GRUB" PEST OF TEA IN CEYLON.

(Continued.)

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CONTROL.

ARTIFICIAL MEASURES.

MECHANICAL CONTROL.

Hand-picking, or the collection and destruction of both grubs and cocoons is the commonest, cheapest, and most effective measure of control. It has been recommended in the past, and will continue to be advocated as long as labour is reasonably cheap. But, like all other measures of control, it has its limitations. The collection of *grubs* is practical and effective when the pest is described as a "medium attack" or anything less in severity. When grubs are present in thousands, as they invariably are during severe outbreaks, then collecting is a practical impossibility. During such an attack collecting podians would have to devote about an hour to a bush if they were to pick out every single grub. On the other hand, if they were allowed to pick every leaf carrying grubs, the defoliation caused by this measure would be as bad or worse than if the pest was allowed to remain uncontrolled. Collection of grubs is, therefore, recommended when an outbreak is considered slight or medium.

Dr. Hutson [11], the Government Entomologist at Peradeniya, has recently advocated that "collections should be carried on continuously throughout the year when, say, 10 coolies are each getting only 25 to 50 specimens daily from several acres." This recommendation was made by Dr. Hutson because it was his considered opinion that nettle grubs never completely disappeared once they established themselves in a particular area. There is a certain amount of evidence in support of Dr. Hutson's contention in that on two groups of estates the pest has been observed right through the year. The few grubs collected off and on would never have been detected had not podians been out regularly examining all areas liable to attack. A measure adopted recently is the training of estate podians to become familiar with the appearance of all nettle grubs and their different stages. The chief duty of these podians, 6 to 10 in number and in the charge of a reliable kangany, is to be out collecting every day, and practically "comb out" the whole estate at least twice a month. Each podian is equipped with a tin for the collection of grubs and cocoons. When collecting grubs it is expedient to have the tins

smeared with crude oil in order to prevent the caterpillars crawling and dropping out. The day's collection should be shown to the superintendent. Under existing conditions pluckers are invariably the first to detect and report the presence of the pest and by this time the attack is sometimes considerably advanced.

The collecting of *Cocoons* is considered an easier and more practicable measure of control than the collecting of grubs. In fact Green [3] once suggested that the best course to adopt was to wait till the grubs entered the cocoon stage and then commence collecting. Estates which have adopted this method of control report the collecting of bushels or sacks of cocoons per day. What this means can be realised when it is remembered that a sack weighing 25 lbs. would contain about 160,000 cocoons. During the severe outbreaks in Passara in 1928, Hutson [8] records "From a 40-acre field which was heavily infested by *Natada* over a period of nine months it was estimated that a total of at least 75 million cocoons was collected and destroyed during this period. These figures were calculated from careful records of the weight of cocoons collected, allowing an average of 400 to the ounce. In other words nearly 5¼ tons of cocoons were collected from the 40 acres during nine months."

The practice of taking the day's collection, in sacks or empty kerosene tins, to the factory or some other part of the estate is deprecated owing to the risk of emerging moths settling down in new fields. All cocoons gathered should be destroyed, once every two hours, by dropping them into a fire, close to the area from which they are collected. Some estates carry a portable incinerator for this purpose.

Nettle grub is now a declared pest* and it is a legal obligation on the part of all superintendents of estates in Uva to report its presence when found and to *collect cocoons*.

PRUNING.

In cases of severe infestation, and if the tea is due for pruning, it is recommended that the affected field be pruned at once and all prunings be buried (if the grubs are very young) or burnt (if the grubs are half-grown or a bit older). Hutson [6] has advised that "pruners should start around the edges of the field and gradually work in towards the centre"; and Green [2] advocated that "a belt of quicklime round the pruned area will help to keep the caterpillars from straying to the surrounding field".

CHEMICAL CONTROL.

Green [1], Rutherford [4], and Hutson [6] have all at one time or another recommended that spraying should be resorted to when the collection of grubs was found impracticable and pruning too drastic

* Proclamation in *The Government Gazette* of 29th January, 1932.

a measure of control. Green and Rutherford both suggested a lead arsenate spray. The former, however, qualified the recommendation by advising its application against the pest in "young tea which was not in plucking" or "immediately after a round of plucking" and that "bushes should be allowed to run from 10 to 12 days before next plucking". Rutherford [4] was more cautious and suggested that if "two or three pluckings were discarded thereafter there would be no danger of arsenate of lead getting into made tea".

In 1919 Jardine [5] recommended the spraying of lead chromate for the control of Tea Tortrix, and as this non-arsenical insecticide was found to have no harmful effect on either the flush or made tea, it was recommended for the control of all caterpillar pests of tea, which, of course, included nettle grubs. Subsequent experiments in Peradeniya showed that this insecticide had *no* toxic effect on nettle grubs and its recommendation was dropped.

In 1928 Light [7] carried out a series of laboratory tests with Paris Green, lead arsenate, and sodium silicofluoride, with the aim of determining their relative toxicity against *Natada nararia*. He found Paris Green more toxic than the other two insecticides tested and therefore recommended its use against nettle grubs in nurseries and young tea in clearings. All the insecticides hitherto experimented with or recommended were stomach poisons.

In 1929 the writer commenced a series of trials with contact insecticides, the purpose of which was to find some cheap, quick-acting spray which could be applied while the pest was on tea in full plucking. The result [9] of these preliminary experiments was the discovery of soap and water as a spray for nettle grubs.

Field experiments during the last two years have demonstrated that the dilution of a pound of soap in 30 to 40 gallons water, if applied well, would give a kill of 70 to 80 per cent. Laundry soaps like "Sunlight" or "Umbrella" brand are preferable to the soft soaps in that the former are cheaper, more easily procurable, and less liable to taint tea owing to local soft soaps containing either fish oil or some carbolic compound.

Lead arsenate, though less toxic than Paris Green, is a more popular stomach poison for general application against all leaf-eating insects. Its chief advantages are that it is a good indicator when sprayed on foliage and it does not scorch; when diluted with water it does not settle as quickly as Paris Green. Further, under estate conditions, it is an easier spray to prepare. In the preparation of Paris Green, as a spray, it is very essential to add a second ingredient, i.e., quicklime, to neutralize any soluble arsenic and thereby prevent scorching. Arsenate of lead has only to be mixed with the right

quantity of water and it is ready for immediate application. McDougall's Super Arsenate of Lead* was experimented with and found very effective (1 lb. in 30 gallons water) against young *Natada* on tea in a new clearing.

If Paris Green is preferred by estates, which may have the insecticide in stock, the following formula, as recommended by the Department of Agriculture, is suggested:—

Paris Green $\frac{1}{2}$ oz., or 3 large level teaspoonfuls.

Quicklime 2 oz. or a handful.

Water 4 gallons or a kerosene tin full.

The spraying of lead arsenate or Paris Green is recommended for the control of nettle grubs in tea nurseries, young tea in new clearings, and on tea-seed bearers. But *not* on tea in full plucking.

APPLICATION.

For the application of sprays, either contact or stomach poisons, compressed air sprayers are recommended. These machines consist of a brass cylinder with a liquid and working capacity of $2\frac{1}{2}$ to 3 gallons. The advantage of this type of sprayer is that when the container, which is first filled with liquid and given sufficient pressure to spray the liquid contents, is strapped on the back of the labourer, both his hands are free. He is therefore able to control the spraying hose with one hand and turn over the branches of the bush with the other—a very necessary action when spraying against nettle grubs.

It is estimated that a dozen compressed air sprayers are required to spray an acre of tea in a day. The cost of application, which includes cost of soap and labour, has on the average worked out at Rs. 15 per acre.

For the spraying of a new clearing (young tea) with arsenate of lead, it has been ascertained that an acre can be sprayed in three days with one machine, and the probable cost should be in the proximity of Rs. 8, i.e., cost of insecticide Rs. 5, labour Rs. 3.

DUSTING.

Dusting, or the application of an insecticide in powder form, so that it may replace spraying, is an urgent necessity on estates where water is a limiting factor.

All "dusts" experimented with so far have proved unsatisfactory. If sufficiently toxic to nettle grubs they have been found too costly for general use under estate conditions. Another drawback has been the difficulty of making the dusts adhere to the undersides of the leaves.

* Stocked by Messrs. Cargills Ltd. Price Rs. 2-00 per lb.

[For a list of all insecticides—sprays and dusts—which have been tested during the last two years, the reader is referred to the Annual Report of the Entomologist for 1930 and 1931, published in Bulletins Nos. 5 and 8, respectively, of the Tea Research Institute.]

BIOLOGICAL CONTROL.

In considering the biological control of a pest, which has been defined by Dr. Myers as† "the utilisation of one kind of organism for the limitation or destruction of another", the problem to be decided is whether an indigenous parasite should be encouraged or an exotic species introduced to bring about the required control.

In the present investigation it was decided to make a systematic survey of all local parasites of nettle grubs first. This was very essential. Without a knowledge of the parasites already in existence in the Island, it would have been extremely difficult to determine which parasite should be introduced at a later date. There was the likelihood of introducing a species of parasite which was already present. And further there was the possibility of discovering a potential parasite suitable for local distribution.

Of several Hymenopterous parasites discovered, the Braconid, *Rhogas* sp., gave considerable promise. It was observed to parasitise the larval stage of four species of nettle grubs irrespective of their age and size. Its complete life-cycle (when bred in the laboratory) lasted a fortnight and it was therefore capable of producing at least two generations during the larval periods of its hosts. Its efficiency ended here. Attempts to find an alternate host on which it could be easily propagated have not met with success so far.

Consequently, as suggested by the Entomologist [10] of the Tea Research Institute in his Report for 1930 and again in his address* to the Uva Planters' Association in February this year, it will be necessary to make a search for parasites from outside the Island, and Malaya, the Dutch East Indies, and the Celebes are all likely places which will have to be explored.

† *The Tropical Agriculturist*, July, 1929, p. 43. . . .

* Published in *Times of Ceylon*, February, 24th, 1932.

The following is a list of indigenous parasites bred from nettle grubs:—

HYMENOPTERA

	Parasite	Host
Braconidae	*Apanteles* sp.	*Thosea cervina*
		T. recta
	Apanteles parasae Rohw.	*Parasa lepida*
	Fornicia ceylonica Wilkinson.	*Natada nararia*,
		Thosea cervina,
		T. recta
	Rhogas sp.	*Natada nararia*,
		Thosea cervina,
		T. recta, *Narosa conspersa*
		Parasa lepida
Ichneumonidae	*Goryphus variibalteatus* Cam	*Natada nararia*
	Hemiteles sp.	*Natada nararia*
Eulophidae.	*Euplectrus* sp.	*Natada nararia*
	Tetrastichus sp.	*Natada nararia*
	Trichospilus pupivora Ferrière	*Thosea cervina*
Eurytomidae	*Eurytoma parasae* Gahan	*Parasa lepida*

DIPTERA.

Tachinidae	*Eurigaster setosa* Dol.	*Parasa lepida*, *Thosea cervina*

SUMMARY OF CONTROL MEASURES.

1. Collect grubs when outbreak is "slight" or "medium" in severity. Collecting tins should be smeared with crude oil.
2. Collect cocoons and destroy same periodically during the day in the field from which they are collected.
3. If attack is severe and field is due for pruning, then prune attacked area. Prunings might be buried if grubs are very young. If grubs are half-grown then all prunings should be burnt immediately to prevent grubs making cocoons.
4. If field cannot be pruned then spray with a dilution of laundry soap and water (rate one pound soap in 30 to 40 gallons water.) A dozen compressed air sprayers should spray an acre in a day at a cost of Rs. 15.
5. When pest is found on (a) tea-seed bearers, (b) young tea in clearings, (c) tea nurseries—spray with either lead arsenate (1 lb. in 30 gallons water) or Paris Green (1 lb. in 60 gallons water).
6. Train a small gang of podians, 6 to 10 in number, to examine regularly throughout the year all fields and especially those which have had nettle grubs previously.

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