ENTOMOLOGICAL NOTES

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PESTS OF GARDEN PLANTS

1. THE ROOT-EATING ANT (DORYLUS ORIENTALIS WESTW.)

This ant belongs to a group which includes the notorious "driver ants" of Tropical Africa and America. These "driver ants" are essentially carnivorous and entomophagous, that is, in addition to being able to devour any of the larger animals which they come across in a confined or helpless condition, they also feed on any other insects which they find in the soil or elsewhere on their foraging expeditions. One of the Eastern species (*Dorylus orientalis*), which, according to Bingham [1] occurs "throughout India, Burma and Ceylon, extending to the Malay Peninsula, Borneo, Sumatra and Java", has been known for some time to have entirely different feeding habits from those of its relatives in other parts of the tropics. This species was reported some 35 years ago to be damaging potato tubers in India, but at first these ants were thought to be incapable of the injury in view of the predaceous habits of their relatives elsewhere. Then they were definitely found riddling sugarcane plants in India and their herbivorous habits were confirmed in Ceylon by Green [3] who made the following observation: "The workers of this species (determined for me by Colonel Bingham) live entirely underground and I can assert from repeated personal observation that they are most confirmed vegetarians. I found it quite impossible to grow potatoes at Pundaluoya solely on account of this insect, and they were most aggravating in their systematic attack upon the tubers of dahlias and the roots of the common sunflower (*Helianthus* sp.). In the case of the tubers they form galleries through and through the substance and in the case of roots they eat off the tender bark below the collar". Green completely satisfied himself that the *Dorylus* was really feeding upon the vegetable tissues and was not merely hunting for other insects. It may be mentioned that another species,

Dorylus labiatus, in India [1] is known to be partly carnivorous, attacking other ants, and partly herbivorous, feeding on potato tubers. Up to the present time, *orientalis* has not been observed locally to have carnivorous habits.

In Ceylon since 1900 this ant has been reported occasionally in some up-country and mid-country districts, but within recent years its observed and reported appearances have been much more frequent and widespread. This species has also been gradually extending its range of food plants and is now known to feed on the underground portions of a great variety of ornamental and vegetable plants, including zinnia, balsam, groundnut, potato, sweet potato, beet, carrot, radish, cabbage, knol-khol, artichoke, bean, etc. These ants have also been found attacking the roots and collars of young trees, such as potato tree (*Solanum macranthum*), *Citrus* spp., flamboyante (*Poinciana regia*), *Eucalyptus* sp., etc. In the case of plants with bulbous or tuberous roots the fleshy portions are completely riddled, while in other plants the tender portions of the roots and collar are devoured.

The Eastern species of *Dorylus* according to Bingham [1] are noteworthy for the great difference in appearance between the workers and the males and between the males and females, or queens. The *workers*, which are responsible for the damage to plants, are about one-fifth of an inch long, chestnut brown to reddish brown, with rather large rectangular heads bearing a deep furrow down the middle. The central portion of the body, mainly the thorax, is flattened and not markedly constricted as in many other ants, that is, there is no distinct "waist", while the abdomen, or hinder portion of the body, is somewhat flattened above. There are two castes of workers, one as described above, and the other much smaller and paler in colour. Both castes of workers are wingless and have no eyes, hence the local name "blind ants".

The males are nearly an inch long, winged, yellowish-brown, with well-developed simple and compound eyes, and somewhat resemble wasps; they sometimes fly to bungalow lights at night. The *female* of *orientalis* has apparently not been found in Ceylon, but that of a related species of *Dorylus* in Burma [1] is said to be more than an inch long, reddish-brown, without wings or eyes, and with a "large abdomen a little resembling that of a queen termite".

The *Dorylus* worker ants live entirely underground and, so far as is known at present, their main nests are probably situated fairly deep down. It is thought that from the main nests foraging parties go out in all directions underground to feed on the roots of the plants. It is possible, however, that in some cases small colonies may be established temporarily at the bases of certain plants. As indicated above, the workers are not known to appear above ground and their presence is usually not detected until the attacked plants begin to wilt. When disturbed they rapidly retreat into the soil again.

It may be mentioned that owners of gardens in the drier districts have reported that these ants are more troublesome in the dry weather, that is, during May to September. A possible explanation of this dry weather prevalence of the pest may be that the ants come to the well-watered gardens from drier areas in search of moisture and the more succulent food so conveniently provided for them.

CONTROL MEASURES

When once this ant has become established in a garden it is not at all easy to get rid of. There is usually no chance of being able to exterminate the main nests, since these are probably situated deep underground and possibly at some distance from the points of attack. But it is possible, however, gradually to kill off many of the ants actually in the garden beds by the use of petrol and to make life so uncomfortable for the survivors that the plants are left alone in the early stages of growth.

Preventive measures.—In areas where the ants are known to be troublesome, the beds should be thoroughly treated with petrol before replanting. This fumigant can be poured in small quantities along shallow furrows made at intervals along the beds or into a number of small holes made in the soil at frequent intervals. The furrows or the holes as the case may be, should be covered over with soil immediately after treatment. Or the top few inches of soil can be removed from a portion of a bed, the exposed surface sprinkled with petrol and the soil replaced immediately; the remaining portions of the bed can then be similarly treated. One to two pints should be sufficient to treat every thirty square feet of surface, depending on the thoroughness of the treatment.

After manuring and before replanting, the beds can be treated with sawdust or wood ashes steeped overnight in a solution of any good carbolic disinfectant at the rate of two teaspoonsful to every bottle of water. This deterrent mixture can be sprinkled over the beds worked thoroughly into the top soil and left for a day or two before replanting.

Remedial measures.—If the pest appears for the first time in beds of growing plants and its presence is detected only after the young plants have begun to wilt and die off, then usually the general fumigation recommended above cannot be applied owing to the risk of injuring the surviving plants. All badly attacked and dying plants should be carefully removed one at a time and the holes immediately treated with petrol before the ants have had time to disperse, one or two small table-spoonsful being poured into each hole which is then forthwith plugged with damp earth. If the plants are well spaced, the furrow method of applying the petrol between the rows can be tried, or individual plants can be treated by applying the petrol in shallow circular furrows in a radius of about 6 to 9 inches from the plant. A few plants in different beds should be treated first as an experiment and if the ants are killed without injury to the plants then the remainder of the plants can be treated gradually. The impregnated sawdust of wood ashes can be applied around such plants a day or two after the petrol treatment to serve as a deterrent. If the attack is not discovered until most of the plants in a bed are dying, then the only remedy is to take out all the plants and give the bed the full treatment recommended under preventive measures before replanting.

If these *Dorylus* ants have become thoroughly established in a garden, a vigorous campaign should be launched at the beginning of each planting season or at any other time that they become troublesome. It may be a long and rather tedious struggle, but owners of gardens have found that, by adopting the above measures thoroughly and systematically whenever the ants appear, they can manage to grow vegetables and ornamental plants successfully without serious injury by this pest.

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2. COCKCHAFER BEETLES

Everyone is familiar with the moderate-sized, rather stout, brownish beetles which come buzzing and blundering into bungalow lights at night after the first good rains in April and May. The earlier arrivals begin to emerge from the soil about the end of March and during April, and their numbers rapidly increase throughout May and June, during the south-west monsoon rains, gradually becoming fewer in July to a few belated stragglers in August. Every now and then in certain districts there comes a "cockchafer year", during which grass lawns are killed out in patches by the root-feeding grubs and ornamental shrubs and flowering plants are tattered and torn by vast swarms of beetles which carry on their destructive work mostly at night. The beetles are known by different names in other countries, such as "May beetles" or "June beetles" in America, and "hard backs" in the West Indies. The grubs are usually known as "white grubs" in most parts of the world.

Our Ceylon cockchafers are of many different kinds and sizes, but the more important species belong to two sub-families of the very large family of beetles known as the *Scarabaeidae*. The true cockchafers are grouped under the sub-family *Melolonthinae* and include mostly dull-coloured beetles of varying shades of brown. They are active mainly at night, coming out at dusk and retiring at dawn to hide in the ground or in other sheltered places; these insects are usually attracted to lights. In the beetle stage they usually feed on the leaves of a great variety of plants and sometimes attack flowers as well, while the grubs consume grass roots or eat away the underground portions of various cultivated plants.

The members of another closely related sub-family, the *Rutelinae* include many brightly-coloured species and are sometimes also called cockchafers. Many of these are night-feeders, but some, especially the more conspicuously coloured ones, are also active during the daytime and rarely come to lights at night. Some species of this group show a distinct preference for flowers rather than leaves, while others are general feeders. Speaking generally, it may be said that the Melolonthine beetles are rather less injurious than the Ruteline beetles, since the former are not such voracious feeders as the latter nor do they attack flowers so readily. On the other hand the Melolonthine grubs are as a rule far more serious pests than the Ruteline grubs, since the

former are essentially root-feeders, while many species of the latter probably feed mainly, if not entirely, on decaying vegetable matter in the soil.

Below will be found some observations on a few of the more important species of Ceylon cockchafers grouped under the two sub-families. The notes on local distribution and feeding habits are taken mainly from our records extending over a number of years and give some indication of the type of injury caused by some of our local species and their grubs. The brief descriptions of their external appearance and approximate size are taken from pinned specimens or fresh material, whenever possible, and in the case of the *Rutelinae* are supplemented by numerous references to Arrow [1]. In the measurements of sizes, 25 millimetres (mm.) = 1 inch. It should be mentioned here that, so far as is known at present the great majority of our Ceylon cockchafers are found mainly in the southern and wetter half of the Island; therefore the term "widely distributed" means distributed throughout this range, and "low-country" means the wetter low-country districts.

MELOLONTHINAE

Lepidiota pinguis.—Length, 35-40 mm.; breadth, 17-22 mm. The largest of our local cockchafers. Greyish to greyish brown. Widely distributed. Grubs attack roots of cinnamon, young rubber and tea. Beetles feed on leaves of dadap, acacia, etc.

Holotrichia serrata.—Length, 23-26 mm.; breadth, 12-14 mm. Deep chocolate brown. Mainly low-country. Grubs a pest of grass lawns and roots of various plants. Beetles eat leaves of canna, etc.

Microtrichia spp.—Length, 11-13 mm.; breadth, 6-7 mm. Dark brown. Mainly low-country. Nothing known about the the grubs. Beetles feed on canna flowers, leaves of albizzia, young rubber and various garden plants.

Autoserica mollis.—Length, 8·5-9·5 mm.; breadth, 5-6 mm. Stout, golden brown. Mid to low-country. Nothing known about grubs. Beetles feed on rose flowers and on albizzia and young rubber leaves.

Apogonia rauca.—Length, 9-11 mm.; breadth, 6-6·5 mm. Dark brown to blackish. Nothing known about grubs. Beetles attack cacao leaves.

RUTELINAE

Popillia discalis.—Length, 9-11 mm.; breadth, 5-7 mm. Oval, shiny, varying from deep metallic green, blue, coppery to almost black; elytra, or wing covers, varying from deep metallic green to pale brown; white spots around the sides and end of body. Mainly up-country, but occasionally found at lower elevations. Grubs may feed on roots of grasses, etc., or on decaying vegetable matter. Beetles common on grass lawns and on garden plants, feeding on leaves and flowers.

Mimela mundissima.—Length, 13-16 mm.; breadth, 8-9 mm. Broadly oval, shiny, deep grass green, with a narrow yellow band around the edges of wing covers, etc. Widely distributed, but mainly up-country. Grubs attack tea roots. Beetles feed on leaves of acacia, eucalyptus, etc., and on flowers of garden plants.

Anomala tenella.—Length, 4·5-6 mm.; breadth, 2·5-3·5 mm. Orange yellow, suffused above with a golden green or coppery lustre. Widely distributed. Nothing known about grubs. Beetles feed on young leaves of tea, dadap, rose, etc.

Anomala superflua.—Length, 19-22·5 mm.; breadth, 10-11·5 mm. Yellowish brown with a black head and a fine black line around the edges of the wing covers. Widely distributed. Grubs feed on tea roots. Nothing known about feeding habits of the beetles.

Anomala dussumieri.—Length, 24-26 mm.; breadth, 13-15 mm. Oval, shiny, bright emerald green. Mainly low and mid-country. Grubs attack roots of cinchona. Beetles feed on cinchona leaves.

HABITS AND LIFE-HISTORY

The complete life-cycle of any species of cockchafer has not been worked out in Ceylon, but from partial observations made on the development of several different species and from what is known of related species in India, [3], and in the Dutch East Indies [2], the habits and life-cycle of a typical cockchafer are somewhat as follows:

The *eggs* of the various species are laid singly, sometimes in the top two or three inches of soil, but sometimes deeper. They are small rather long oval and whitish when freshly laid, but gradually increase in size and become almost spherical before hatching. They vary in size according to the species. After

about ten days to about a month, according to the species, the eggs hatch into small whitish grubs with pale-brownish heads, curved bodies and three pairs of well-developed legs.

The *grubs* burrow down into the soil where they remain for several months feeding on roots of grasses and other plants. Some species breed in patna soils and attack the roots of estate crops planted in patna clearings. As indicated above, the root-feeders are mainly Melolonthine grubs. Other species of grubs, belonging mostly to the *Rutelinae*, feed on decaying matter in the soil. These various grubs usually become full-grown in about 6 to 9 months and then change into the pupa or resting stage inside earthen cells. Some species may remain dormant in the grub stage for several weeks or even months before actually becoming pupae.

The *pupal* stage is usually comparatively short, lasting only from about ten days to about one month, according to the species. Sometimes the beetles remain in their earthen cells until the rains have softened the ground sufficiently to allow them to emerge and begin breeding all over again. It is probable that most of our local species take just under one year to develop from egg to beetle, at any rate in low to mid-country districts, although it is possible that at higher elevations the life-cycle may occupy rather more than a year.

CONTROL MEASURES

These pests can be controlled to some extent in both the beetle stage and as grubs.

Beetles.—Since some species are attracted to lights, it is sometimes possible to catch numbers of them by rigging a simple light-trap made by placing a windproof lantern on a brick in the middle of a pan or basin of water with a film of kerosene on the water. Light-traps are usually more successful on dark, damp still nights and need only be put out for a couple of hours after dusk. On wet nights the lamps can be protected by a rough shelter. Tests on suitable nights during April to June will indicate whether light-traps are going to be successful for the particular locality. Some species can be collected from the plants or from grass lawns in the late afternoon and early morning and dropped into tins half-full of water covered with a film of kerosene. Other species can be found on garden plants during

the day and similarly disposed of. As many beetles as possible should be trapped or collected during April to June before they lay their eggs.

Grubs.—These are difficult to kill in the soil, especially under grass. If certain garden beds are known to be infested year after year, the opportunity should be taken of removing as many grubs as possible whenever the beds are dug up before replanting. The petrol fumigation recommended against *Dorylus* ants is sometimes useful in killing off white grubs, although rather stronger doses are needed. Powdered naphthalene (moth balls) worked into the soil around, but not too near, the plants will act as a deterrent, or the impregnated sawdust or woodashes suggested for *Dorylus* can be used as an alternative method of keeping away the grubs.

When grass lawns are attacked in patches, sometimes watering the patches with a solution of nitrate of soda before rain should bring many of the grubs to the surface. This fertiliser can also be sprinkled over the grass before rain with similar results. It is sometimes advisable to take up badly infested patches and remove the grubs or drench the soil with petrol poured into numerous holes. If the latter method is tried, then the area should not be returfed until the next day.

Cockchafer beetles and grubs are often liable to be troublesome in gardens adjoining patna areas, since the beetles breed freely in such places and invade the gardens annually from April to June. Problems such as these involve a thorough and systematic campaign almost every year in each individual garden, since there is no practicable method of controlling these pests in patna soils nor of preventing the beetles invading cultivated areas.

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