

ON THE PEST-STATUS OF CERTAIN COFFEE-FEEDING
INSECTS, WITH RECORDS OF SOME INSECTS NEWLY
RECORDED FROM COFFEE IN KENYA.

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The insect pests of a crop are often classified as major pests, minor pests, and insects which occasionally or accidentally feed on the plant. This is a convenient classification, and although there are no sharp distinctions between the three classes, it may very generally be understood that a major pest is one which causes an obvious and decided financial loss to the planter, and against which in consequence it is usually necessary or advisable to spend money on control measures; a minor pest is one which does some damage but does not cause such a severe loss that it can be obviously and definitely assessed monetarily, hence in most cases control measures would be uneconomic, and are seldom employed; and the insects which occasionally or accidentally feed on the plant do no appreciable damage and are of theoretical interest only, though it will be shown later that they are not unimportant.

The coffee feeding insects in Kenya may be classified, in respect of their economic status, in the three groups described, but they are so numerous and the damage they cause is so varied, that it is possible to describe the status of each in more detail, and it is believed that the classification which results is of practical value, as will be shown in the following discussion. The insects recorded as feeding on coffee in Kenya number nearly one hundred, and they vary from insects which yearly take a heavy toll of the industry, to insects completely unimportant which may have been noticed on one occasion only, to feed on the plant.

It is proposed here to discuss certain coffee-feeding insects, to examine in some little detail their pest-status, and show from these examples how a more detailed classification than that given above may be of practical value.

The highest pest status any insect can have, is of course to be a permanent major pest, and in the case of coffee in this country, the insect which most nearly approaches this is *Pseudococcus lilacinus*, Ckll., the Mealybug. In certain coffee-growing districts where this bug is attended by the ant *Pheidole punctulata*, Mayr., although the intensity of the infestation does wax and wane at different times, it now appears necessary to maintain bands effective against the ants during the whole year, otherwise attacks of the most extreme severity may develop at certain times, such as directly after a flowering, too rapidly to be controlled by banding. It has been shown possible in such a district to save a crop from Mealybug by banding, but only

with constant and most careful attention to bands, and at considerable expense. Where expensive control measures have thus to be employed constantly, the insect may be considered a permanent major pest.

In certain other areas where *Pseudococcus lilacinus* is attended by *Pheidole punctulata*, it appears sufficient to band for several months, beginning before the flowering and ceasing after the fruit has grown almost to its full size. Here it may be considered a frequent major pest, and provision may be made for the application of control measures in anticipation of its outbreak which usually begins with fair regularity. These differences in the pest status of the bug attended by the same species of ant must apparently be set down to some climatic or other natural difference in the two districts. The importance however of recognising such a difference (or in other words, of determining the exact pest-status of the bug) is obvious. In the first district the realisation that, though the attack may wane temporarily, it is unsafe to cease the work of keeping the bands effective, may enable the planter to save the crop; while in the other district the realisation that banding is unnecessary at certain times of the year, may save the cost of the measure. It should be mentioned that there have been very occasional attacks of great severity without any ant attendance. The cause of such attacks is unknown and there is at present no means of guarding against them.

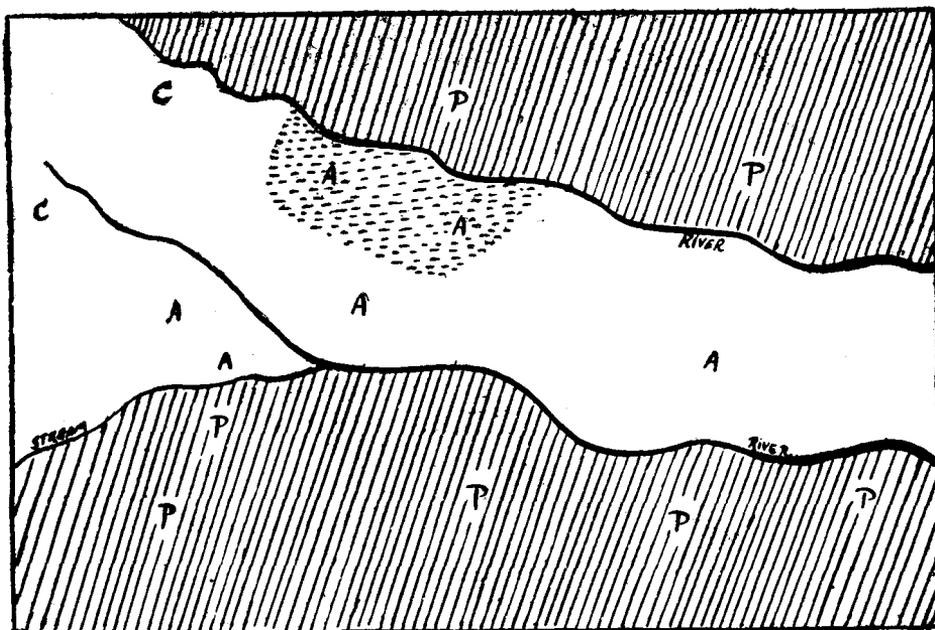
Apart from the differences due to locality described above, the pest-status of *Pseudococcus lilacinus* depends chiefly on the species of ant attending it, and this is shown very beautifully in a portion of one of the districts in the Mealybug area. Between two rivers in this district *Pheidole punctulata* is not present, the Mealybug being attended here by *Acantholepis capensis*, Mayr., subspecies *incisa*, Forel, in one part, and somewhat casually attended by *Crematogaster* sp. and some other unimportant ants in another part. Outside this portion of the district, delimited by the two rivers, *Pheidole punctulata* is present. The association of this ant and the Mealybug is a highly developed mutualism, both insects derive considerable benefit from the association and they both increase markedly in numbers when they are together. In this district where *Pheidole punctulata* is present the Mealybug is a frequent major pest and some attacks of the most extreme severity have occurred.

The association of *Acantholepis capensis* subspecies *incisa* and *Pseudococcus lilacinus*, while definite, is not so highly developed; it enables the Mealybug to remain as a permanent minor pest, with occasional outbreaks of severity. In most of that portion of the district where the Mealybug is attended by this ant, it is a minor pest, but on two farms there have been attacks of moderate severity necessitating banding for their control. Where *Crematogaster* sp. is the ant present with the Mealybug, no bad attacks have occurred.

This ant only occasionally busies itself with the bug and no noticeable benefit is thus derived by either insect. On these farms the Mealybug is a permanent minor pest, no control measures have ever been necessary, and the bug, while always present somewhere, is usually difficult to find.

These peculiar differences in the incidence of a bug, due to association with different ant species may be pictured as in the diagram.

1" = 1mile.



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| P | <i>Pheidole punctulata</i> , Mayr. |  | Mealy bug (<i>Pseudococcus lilacinum</i> , Ckll.)
Frequent Major Pest. |
| A. | <i>Acantholepis capensis</i> , Mayr., subsp.
<i>incisa</i> , Forel. |  | Occasional Major Pest, at other
times minor pest. |
| C. | <i>Crematogaster</i> sp. |  | Permanent minor pest. |

No definite reason for the absence of *P. punctulata* in this portion of the country between the two rivers can be given. The conditions of climate, soil and aspect in the small areas uninfested seems to be iden-

tical with those to the north and south. The streams are bridged in several places and *P. punctulata* is present between the two rivers both east and west of the area shown in the diagram. There are reasons for believing however that *P. punctulata* may not formerly have been present throughout all the region now occupied by it, and that it has lately penetrated new areas; if this be the case its absence in small parts of these areas is entirely fortuitous, and it appears almost certain that these areas will eventually become infested.

Another example of a frequent pest is *Antestia lineaticollis*, Stål. This Pentatomid increases over large areas at irregular intervals and not infrequently becomes a major pest, necessitating the active application of control measures. A small percentage of the adult and nymphal stages is usually parasitised, and in addition the eggs are generally heavily parasitised. The waxing and waning of infestations are partly caused by parasite conditions but no direct correlation of percentage of parasitism and severity of attack is possible. Planters know this bug to be a frequent serious pest and so need no warning that an increase in its numbers is a danger. No means of preventing the bugs from becoming serious, except by the timely application of control measures, is known.

A number of coffee insects are occasional major pests, and the ranks of these are recruited from three chief types. Insects that apart from the occasional severe outbreaks are always present in small or moderate numbers on the coffee as minor pests; insects that may not always be found but are frequently present as minor pests; and insects which only occasionally occur on coffee as minor pests. An examination of examples of each of these types of occasional major pests will show that the differences between them are valid, and of use in determining the likelihood of the pests becoming serious.

The Lepidoptera which bore into coffee berries may be considered, for practical purposes, as one pest. The species of most importance is the Pyralid, *Thliptoceras octoguttalis*, Feld., the next in importance is the Lycaenid butterfly, *Deudoryx lorisona*, Hew. *Eucosma nereidopa*, Meyr., is sometimes not uncommon, and several new species are recorded in this paper. On every plantation at all times, berries bored by one or more of these insects may be found, and the group may be considered as a permanent minor pest, except for certain times when the infestation is severe enough to do considerable damage. The writer has seen one attack, chiefly by *Thliptoceras* and *Deudoryx*, where counts showed that over a number of acres, 25 per cent. of the crop had been destroyed. The larvae of these insects are heavily attacked by internal parasites, therefore when an attack appears to be increasing greatly it may be useful to handpick the bored berries and keep them, in order to destroy the moths and butterflies and release the parasites obtained. The value

of such action is not proved and it is desirable that it should be tried on a large scale.

The case of *Lygus simonyi*, Reut., the chief Capsid bug causing flower abortion in Kenya, may prove also to be a case of a permanent minor pest which becomes of major importance at certain times. Although it is too early to be certain what pest-status it will eventually have, there seems considerable reason for believing that it has been present on coffee for some years. Many experienced planters recognise the typical damage by *Lygus simonyi* to be similar to a less common affection of coffee buds, known in the past. It appears almost certain that the extremely severe damage done by the bug in 1930 and 1931 was due chiefly to a disordered state of the coffee tree, caused probably, in the main, by abnormal rains, which upset the usual condition of one large general March flowering. It appears that for maximum damage of this type both the bug and abnormal flowering conditions are necessary. The conditions are the cause while the bug is the agent. If the bug again becomes of little importance owing to another change in climatic conditions, the fact that it has previously been of major importance, while it cannot help in preventing another attack which may be stimulated by peculiar climatic conditions, can at least enable preparations for the application of control measures to be made when such conditions are likely to recur, and so make it possible to save a crop which would otherwise be lost.

Among the insects which, though not always present, are often minor, and sometimes major pests may be mentioned the Cutworms, again grouping together all the species of the Noctuid larvae that feed on coffee. Cutworms are chiefly a pest of young coffee, which sometimes remains free from attack, but of which a number of plants are frequently destroyed, generally a small percentage of the total. At other times, however, they cause severe loss, which may necessitate the almost complete replanting of the areas attacked. Again the conditions governing these severe attacks are not completely known, but doubtless the condition of the weed flora of the plantation and surrounding lands is an important factor. In several cases land which was to be planted was thick in weeds, including grass for some time before planting; the weeds were cut and the coffee planted immediately, and a severe attack of cutworm developed. The cutworms present as general feeders on the weeds and grass, turned to coffee when these were cut. Some time before planting therefore it may be advisable to clean-weed the land, and even possibly at the same time to spread a poison bait. When the infestation is particularly heavy, complete reliance cannot be placed on the tin collars often used to protect the young plants.

Again there are insects which, while not invariably or even usually present, are occasionally minor pests and which sometimes

become major pests. Among these may be mentioned the leaf-eating caterpillars of *Parasa virida*, Walk., and *Odites artigena*, Meyr., and the scale insect *Asterolecanium coffeae*, Newst. The larvae of both species of moth sometimes occur in small numbers and usually do little damage. With both species however attacks which have resulted in the defoliation of a number of acres have occurred. Although they are an occasional minor pest, the fact that they have been known to increase severely, indicates to the planter that any unusual increase, particularly when this begins in a small area as is often the case, should immediately be suppressed by a lead-arsenate spraying. With *Parasa* planters have on occasions been forced to spray, because the extremely painful stinging of the slug-like larvae has made coffee picking by natives impossible.

Asterolecanium is the scale insect which probably more severely affects the coffee tree than any other, eventually causing its death if the attack is severe. It is present in most districts, and is occasionally seen as a minor pest, but major attacks of it occur in some areas. The presence, however, of a serious attack by this insect may be taken almost definitely as an indication of something wrong with the conditions in which the coffee is growing. The insect, as far as the writer knows, has never become of major importance on healthy vigorous coffee, growing on soil in "good-heart." When either the soil is inherently unsuited to coffee growing, or when it has become depleted of plant nutrients, *Asterolecanium* appears to have most chance to increase, and it is nearly always in such conditions that bad attacks occur. Therefore the planter who knows his coffee is vigorous and adequately manured, at least up to the present, has had no need to fear the presence of an odd scale, here and there. On the other hand a heavy attack of *Asterolecanium* may perhaps be considered less a source of worry in itself, than an indication that efforts should be made to improve the soil in which the coffee is being grown.

Other insects are permanent minor pests, these are insects that can nearly always be found feeding on coffee but which do not become of major importance. Examples are the Green Scale *Lecanium africanum*, Newst., and the leaf-miner moth *Leucoptera coffeella*, Staint. In undisturbed conditions the writer is aware of no major attack by either of these insects in this country, but this does not preclude the possibility that it might occur with either, if the condition at any time became peculiarly favourable to it. The green scale is very heavily attacked by predators and internal parasites, and in this country the biological complex which maintains it at a low level of importance, seems to be a fairly stable one. It appears unlikely, though not impossible, that conditions will so change as to enable the insect to become of great importance.

Leucoptera coffeella is always present on coffee in this country, but in undisturbed conditions no really serious attack has occurred.

The writer however has seen three attacks of considerable severity, leading in one at least of the cases to almost complete defoliation of eight to ten acres of coffee, which occurred after repeated sprayings of poison bait to control *Antestia*. There seems little reason to doubt that the attacks in these cases were due to a decrease in the hymenopterous parasites, which regularly attack this moth, owing to their poisoning by the bait. In each case on adjoining plantations where poison had not been applied, the moth was present in no greater numbers than usual. The writer is not concerned here to argue for against the bait as a control for *Antestia*. Its probable effect on *L. coffeella* in these cases, however, is of considerable interest in the present discussion.

The Aphid *Toxoptera aurantii*, Boyer, can be cited as an example of a frequent minor pest. It is very often present on coffee, and it is always heavily attacked by predators and internal parasites. The writer has neither seen nor heard of any severe attack.

A number of other insects are less frequently seen on coffee and may be considered as occasional minor pests. Examples are the Coccid *Pulvinaria psidii*, Maskl., and the Pentatomid *Sphaerocoris ocellatus*, Klug. The scale insect is found somewhat rarely in numbers on the coffee, to which it seems fairly well adapted, but its occurrence is unusual and no really serious attack has been recorded. The Pentatomid sometimes occurs on coffee in large numbers, and may on these occasions be considered a minor pest. It has native food plants which are usually favoured in preference to coffee.

Another group, not definitely differentiated from the last, is that of insects which occasionally feed on coffee but which are hardly sufficiently serious ever to be classified as minor pests. Among these we have the frequent coffee feeders, that is insects which are probably beginning to become used to a coffee diet, of which we might quote as an example the Flatid *Cryptoflata unipunctata*, Ol.; and the accidental coffee feeders, such as *Heliothis obsoleta*, Fabr., and the Locust *Locusta migratoria ph. migratorioides*, Rech. and Frm. The Flatid is fairly often found feeding on coffee but nearly always in very small numbers. The larvae of *H. obsoleta* were recorded by Anderson to bore into the green cherries on one occasion. This is unusual or accidental, coffee not being a favoured food. The locusts again are accidental coffee feeders. *L.m. migratorioides* did some little damage in 1931 by ringbarking young twigs, and the writer on one occasion observed them eating the flowers. The petals were chiefly devoured, but in many cases the young fruit was also partly nibbled and noticeable damage was done. Heavy swarms of locusts settling for the night have also been known to break coffee trees by their weight.

From two of these last groups, the occasional minor pests, and the frequent occasional feeders, the ranks of both the major and minor pests of a crop which is not indigenous to a country, are

ultimately largely recruited. When the crop is closely planted over large portions of virgin country, indigenous insects often adapt themselves to the crop of which they previously had no experience. The occasional feeders are therefore possibly even more potentially dangerous than insects that have come into a permanently minor position of seriousness.

With the majority of minor pests and occasional feeders little can be done, or needs to be done, in the way of control. Their tax on the industry is not great and their control would entail considerable expense and be uneconomic. But as has been stressed above, the possibility of any of them becoming serious should be carefully considered, taking into account past records of serious attacks, and attempting to explain the outbreaks, in order to be able to make efforts to prevent them recurring. It is in this connection chiefly that a pest-status classification in some detail has been attempted here, and the conclusions reached above may be tabulated. It is realised that the ten groups given do not exhaust the possibilities of differences in behaviour of insect species on a plant, and also that it is not possible to place one insect definitely and permanently in one or other of the categories; but the classification is a compromise between the division solely into major and minor pests which gives little information, and a division so finely made that each insect would need a separate group for itself, which would be of little value owing to its extreme complexity.

A. Permanent.	<i>Pseudococcus lilacinus</i> , Mealybug, attended by <i>Pheidole punctulata</i> , in some areas.
B. Frequent.	
I. Major pests.	{ Mealybug attended by <i>P. punctulata</i> in some areas. { Antestia.
	{ i. permanent minor. { Mealybug attended by <i>A. capensis</i> subsp. { Berry Borers. { ? <i>Lygus simonyi</i> .
	ii. frequent minor. Outworms.
C. Occasional.	{ iii. occasional minor. { Parasa. { Odites. { Asterolecanium.
A. Permanent.	{ Mealybug attended by <i>Crematogaster</i> sp. { <i>Lecanium africanum</i> . { <i>Leucoptera coffeella</i> .
II. Minor pests.	<i>Toxoptera aurantii</i> .
	{ <i>Pulvinaria psidii</i> . { <i>Sphaerocoris ocellatus</i> .
	<i>Cryptoflata unipunctata</i> .
III. Occasional feeders.	{ <i>Heliothis obsoleta</i> . { <i>Locusta migratoria ph. migratorioides</i> .

The following annotated list gives some new records of coffee-feeding insects in Kenya.

LEPIDOPTERA.

Plemyristis oenochares, Meyr. (Lyonetiidae).

Encolpotis xanthoria, Meyr. (Glechiidae).

Pyroderces coriacella, Snell. (Cosmopterygidae).

These moths have been bred on several occasions, in some numbers, from collections of bored coffee berries in Kiambu. Details of their life-histories have not yet been ascertained.

Tortrix dinota, Meyr. (Tortricidae).

The larva of this moth feeds on coffee leaves, shoots and berries. The larva often webs together two leaves and feeds between them on the leaves and shoot; this damage is perhaps more common than damage to berries. The moth is not uncommon in Kiambu, but damage has not yet been serious.

Blastobasis industria, Meyr. (Blastobasidae).

This moth has been bred from *buni* coffee in the plantation, in Kiambu. It is not known whether it ever attacks growing berries.

Porthesia aethiopica, Snell. (Limantriidae).

The larvae of this moth are not infrequently found feeding on coffee leaves in Kiambu. It is generally distributed but has not yet been seen to do appreciable damage.

Epigynopteryx ansorgei, Warr. (Geometridae).

This moth is not uncommon on certain plantations in Kiambu. The long green "looper" caterpillars feed usually on the protected leaves inside the tree, out of which they often eat round holes, somewhat resembling the damage of the coffee bag-worm. On occasions there may be an average of about 50 larvae per tree over large areas, and in these conditions the moth is a minor pest. There is a possibility that this moth may become of importance at some future time.

Cleora tulbaghata, Feld. (Geometridae).

This moth has been bred from larvae feeding on coffee leaves in Kiambu. At present its occurrence on coffee is rare.

DIPTERA.

Anthomyia griseobasis, Mall. (Anthomyiidae).

This fly has been bred from larvae apparently feeding on the pulp of ripe coffee "cherries." Fruit fly larvae are of little importance; they sometimes make the skin stick to the berries during the pulping. It is not known how common this Anthomyiid is in coffee cherries, but there are probably a number of flies of which the larvae occasionally feed on the pulp of cherries.

RHYNCHOTA.

Lygaeus electus, Dist. (Lygaeidae).

This large red bug has been observed feeding on coffee shoots in Thika and Kiambu. It is likely that it feeds also on the berries but this has not yet been observed. It has not been seen present in large numbers on coffee.

Lygaeus bettoni, Dist. (Lygaeidae).

This yellow and black bug, smaller than the last named, is very common on coffee at Nyeri, and is often present in large numbers. It feeds on the plant but at present little is known about it.

Cryptolata unipunctata, Ol. (Flatidae).

This bug feeds, in the nymphal and adult stages on coffee. The nymph hops strongly and the adult flies readily. Tender upright shoots, either the terminal shoots of the tree or "water-shoots" are usually favoured, and occasionally the bugs may be seen feeding on such shoots on a large number of trees. Up to the present they have not been of economic importance.

REFERENCES.

Details of all the Coffee pests mentioned may be seen in the Annual Reports of the Department of Agriculture, Kenya, from 1908.