THE LONG-HORNED TREE-HOPPER OF COCO-NUTS SEXAVA SPP.

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This pest is commonly known as the "Coco-nut grasshopper", but the term "grasshopper" so applied is decidedly a misnomer, and leads to confusion with the "grasshopper" of plague fame, that is common in so many parts of the world, and which belongs to a totally different family of insects and varies both in structure and habits. The plague grasshopper belongs to the *Acrididae,* which have short antennae (feelers) and are ground feeders, whereas the Sexava belongs to the *Tettigoniidae,* which have very long antennae and are essentially arboreal in their habits; there are many other differences, but these will suffice for the occasion.

Two species of Sexava have been identified from this Territory by the Imperial Institute of Entomology, from specimens submitted—

(*a*) *Sexava nubila, St.*—from Madang, New Britain, New Hanover, Sepik and New Ireland.

(*b*) *Sexava novae-guinea, Brancs.*—from Manus and New Hanover.

All stages of this pest feed on the foliage of the coco-nut palm, and where present in plague form they will practically completely defoliate the palms, resulting in such a setback as to stop production for eighteen months to two years.

Sexava is distributed generally throughout the Territory of New Guinea, with the exception of the Kieta district (the northern portion of the Solomon Islands Group), and some of the outlying islands which, as far as is known, are free from this pest. The most heavily infested district generally is the Manus area, although there are parts of New Ireland, New Hanover, and New Britain that are at times very severely attacked.

There are curious anomalies in the dispersion of Sexava for which no reason can be assigned, as for example the Seeadlerhafen Group in the Manus district, comprising the islands of Koruniat, N'Drillo and Hawai; these lie between Mokareng Plantation and Pitelu Island, which are both Sexava infested, whereas these islands are free, although Koruniat is only separated from Mokareng by a narrow strip of water, as also is N'Drillo from Koruniat. There are numerous other instances of a similar nature.

The only other record of Sexava spp. as a pest of coco-nuts is from the Moluccas group of islands and that portion of the main island of New Guinea in the Dutch Territory; in some parts of this area the pest is as serious as in the worst areas in this Territory, but in others it has never been known to cause serious damage. *Sexava nubila, S. coriacea* and *S. karyni* are recorded from the Dutch Territory.

Research investigations into the Sexava problem were started in detail in the latter half of 1929, with observations on the life-history, habits, &c., of the pest, both in the laboratory and the field; data in relation to the dispersion and relative severity in the various localities of the Territory were also collected.

In 1932 the Sexava Research Station was instituted with the appointment of an Assistant Entomologist, the first appointee being Mr. N. E. H. Caldwell, B.Sc. The station was first posted to the Manus district at Sissi Plantation, then at Pak Plantation and later with Mokareng Plantation as head-quarters, operating

from the last-mentioned centre from Loniu village through Papitalai, Lombrum, Salami, Mokareng Plantation to Pitelu Island. In May, 1934, the Research Station was moved to New Hanover, in the Kavieng district. Mr. Caldwell left in May, 1933, to take up a position in Queensland, and the position was filled in September, 1933, by Mr. B. A. O'Connor, B.Sc., the investigations in the intervening period being re-organized and carried on by the Entomologist, under whose direction and supervision the work of the station is carried out.

LIFE HISTORY AND HABITS.

The Egg.

In general, the majority of the eggs are deposited in the soil, but in New Hanover they appear to be fairly evenly distributed in the soil, the epipthytic growths on the palm trunks and the crown of the palm.

In laboratory experiments it has been found that where gravid females are placed on soils of the following physical conditions, namely (1) loose moist sandy loam, (2) slightly compacted moist sandy loam, (3) well compacted moist sandy loam, (4) moist heavy soil, (5) dry soil, the greatest number of eggs are laid in the loose moist sandy loam. This has been borne out by field observations. In the collection of eggs in the plantation, a greater number of eggs are collected in bare sandy patches than in any area of similar size elsewhere in the plantation, although they will be found anywhere in the infested area.

Rotting logs and the bases of rotten fronds are also common sites for oviposition.

Oviposition always occurs at night in the plantation, but in the laboratory, where the females have been confined in small wire-gauze cages, eggs have been laid in Rabaul between 8 a.m. and 3 p.m.

Eggs are always laid singly, although three or four may often be found close together as if deposited in succession by the one female, the ovipositor having been withdrawn after deposition of each egg.

The egg when newly deposited is light brown in colour and measures about 9 mm. long, being flattened laterally; when fully developed, it measures about 11 mm. long and is considerably swollen. When deposited in wet ground the colour is much darker, the "shell" being somewhat discoloured.

In the field they are generally about half an inch below the surface of the soil, with the micropilar end upwards, but the orientation in the soil does not appear to very materially affect the emergence of the nymphs, as shown by laboratory tests in which the eggs were buried in loose moist soil at all angles and up to half an inch in depth; emergence is affected if the soil becomes compacted and possibly with greater depths of covering soil than that given above.

From laboratory observations on female Sexava collected at night ascending the palms, it seems probable that all the mature eggs in the ovaries are not necessarily laid at the one time. Females so collected and caged soon after collection have deposited eggs the same night. It is, of course, possible that they had been disturbed before completing oviposition, but it has occurred on so many occasions that it can hardly be accidental on every occasion. This is also borne out by other observations, referred to below.

A single female has laid as many as 16 eggs in one night, but generally the number is much less. The average total tumber of eggs laid by a single female in her lifetime is 20-30, but as many as 41 have been recorded. From counts made in Rabaul from two or more females collected in the field and caged together, an average of 39 has been found, the average of individual lots rising as high as 49 per female.

By dissection, as many as 30 apparently mature eggs have been counted from a single ovary, with in addition more than 20 in various stages of development.

The period from deposition of eggs to emergence of nymphs varied from 42 days to more than 100 days, although the majority matured in under 60 days. On New Hanover the egg stage has occupied from 56-85 days, average 61·8 days.

The average fertility of eggs collected in the field was 87 per cent., although as high as 91.7 per cent. has occurred. The average hatching from these eggs was 82 per cent., although in some lots it was as high as 91.7 per cent.

The eggs can withstand very adverse conditions and still yield a percentage of nymphs, although such may be low. Eggs exposed in dry soil for 119 days and then transferred to moist soil for one week, yielded a few nymphs within ten days.

A high moisture content of the soil, provided no water is lying on the surface, does not appear seriously to affect the maturation of the eggs.

Oviposition continues through the life of the female, but is greater in the early than the later stages of life.

From tests carried out in the laboratory, it has been found that eggs laid on the same night usually hatch about the same time, but laid on even successive nights by the same female, they show a greater variation in time in reaching maturity.

In order to test the statement that birds spread Sexava through scattering eggs after devouring gravid females, apparently mature eggs were dissected from the ovaries and incubated in the usual manner; in not even a single case did they yield nymphs.

The Nymphs.

On emerging from the egg, the nymph is covered in a fine membrane, which is shed as soon as it reaches the surface of the soil; this is known as *vermiform larva.*

Emergence in the field occurs apparently in the early evening and the nymphs ascend the palms within a maximum of 24 hours. Sometimes, however, nymphs have emerged in the laboratory up to 11 a.m.

When newly emerged, the nymph is a dark green in colour, but as development advances this becomes much lighter, and in the second and subsequent stages it is a light green, although brown variants are not uncommon.

The nymph resembles the adult in general form, but has no wings and is not sexually mature. It develops by a series of moults, of which there are apparently six in the male and seven in the female, the former taking 20-22 weeks and the latter 21-26 weeks to reach the adult stage.

The first stage nymph is very much more active than the later ones, and is much more easily disturbed.

The first instar measures 9-11 mm. in length, and about 2 mm. in width across the thorax, while the antennae measure about 36 mm. in length. The sixth male instar measures 38-46 mm. long and the seventh female instar 43-53 mm. in length. On New Hanover the measurements are respectively, first instar average 15 mm., sixth male average 49.1 mm., seventh female average 54 mm.

Feeding time begins soon after emergence of the first instar, such beginning at the tips of the leaflets of the more mature fronds, and gradually spreads upwards through the fronds in succession. The new fronds are very seldom touched until the other foliage has been largely devoured. The reason for this appears to be the furry nature of the young leaflets, which apparently cloggs the mandibles, especially of the younger stages. Prior to moulting the nymphs practically cease feeding for a short period.

The food consumption of the early instars has not been worked out in actual figures, but is relatively light; it gradually increases through the various stages until with the last stage nymphs it is about 3.3 square inches per individual per 24 hours, about the same as that of the adults. Without food the nymphs in all stages will live for about one week.

The nymphs as well as the adults have a very definite water requirement per day, which is normally filled by rain or heavy dews on the foliage. In the insectaries this is maintained by spraying the fronds with water once or twice each day.

The complete life cycle, i.e., from deposition of the egg to the emergence of the adult, occupies about 4-5 months, or even more. To give one specific case, observed in the insectaries in Rabaul, the egg period was 65-66 days, while the nymphal stages occupied 78-82 days, a total of 143-148 days.

On New Hanover, Sexava males have taken an average of 88.5 days from emergence to maturity and the females over 100 days.

The Adults.

It is only in this stage that the "hoppers" develop wings, and are sexually mature.

The adults are generally green in colour, although brown variants often occur; in New Hanover, however, all the adults are brown.

The following summary gives the relative sizes of the two sexes, the figures being an average of a considerable number of measurements:—

	Male.	Female.
Body	48-57 mm. (1.9-2.3 in.)	.. 57-63 mm. .. (2.3-2.5 in.)
Head to tip of folded wings ..	78-83 mm. (3.1-3.3 in.)	.. 86-92 mm. .. (3.4-3.7 in.)
Ovipositor	—	.. 31-33 mm.
Antennae	209 mm. (2.3 in.)	.. —

On New Hanover the average body length of males is 66.3 mm. and females 72.7 mm.

In cages in the laboratory the adult life is from 4-12 weeks, the males having lived for as long as 71 days, and the females for as long as 90 days, 4-6 weeks being common.

Many counts have been made of the proportion of males to females from adults collected in the field and bred in the laboratory, as a result of which it appears to be about 55 per cent. females and 45 per cent. males.

The powers of flight are very poor, the wings more generally serving as a means of "volplaning" to the ground; instances have been noted where adults, disturbed from the crowns of palms, have sustained a flight of up to 50 feet on to another palm without losing elevation, but this appears to be a maximum. Their power of holding on to the foliage is undoubtedly great, although adults and nymphs, especially the latter, are often dislodged by high winds.

They normally shelter during the day on the undersurface of the leaflets towards the base, such being the largest part and thus affording more shelter. Their general colouration conforms very closely to that of the foliage on which they are resting.

Feeding is usually confined to the night, but on dull days a small amount may be consumed during the day. The food consumption of the adults is about 3-4 square inches per individual per 24 hours.

Copulation apparently takes place at night on the palms. Although the act has not been actually observed caged specimens have been seen under obvious sexual excitement in the early evening, but the use of light apparently inhibited the act.

Stridulation is a function of the males only, and may be heard at any time of the day or night; it does not appear to be necessarily associated with sexual excitation.

Observations at night in the field have shown that in the Manus and New Britain areas numbers of adults come down from the palms at about dark and ascend the palms from about 7 p.m.; at these times females are much more numerous than males. This movement of the adults is very greatly influenced by climatological factors; on moonlight or dark dry nights relatively few adults leave the crown of the palms, but on dark nights after rain, especially in the afternoon, the numbers descending are very considerable.

Other food plants of both adults and nymphs are principally the leaves of banana, Heliconia, wild sugar cane, sago and Areca palms. In some parts Heliconia is reported to be preferred to coco-nuts.

Dispersion.

The pest is so widely distributed throughout the Territory that the question of dispersion rather applies to localized areas, except in the case of the Kieta district.

Both the transportation of soil and apiphytic growths and orchids from an area infested with Sexava may lead to the carrying of eggs from one place to another, especially the epiphytes and orchids.

Coco-nut fronds have been found on canoes amongst the islands of the Siassi group carrying both nymphal and adult Sexava. Baskets of coco-nut leaf made in kanaka villages have also been found to be sheltering Sexava. Both of these sources may lead to localized dispersion of the pest.

In any one area such as a plantation, the dispersion from one part to another is undoubtedly gradual. This pest does *not* swarm, and therefore there is no mass migration. It has been observed that adult Sexava "volplaning"

down to the ground at night or late afternoon, land many feet from the palm which they had left; any wind at the time will extend this distance. Where this procedure continues over a period, eggs will be laid many rows away from the original, and the centres of infestation be gradually spread farther afield.

Where fronds of adjacent palms overlap, a certain amount of migration will take place by these natural bridges.

Infestation is practically always worst on the loose sandy soils, although it has also occurred in more or less plague form in areas where the soil is of a more clayey nature.

Control.

Although mechanical measures, if carried out sufficiently in the early stages of an outbreak, will give a good measure of control of the pest, where the value of the product (copra) is so low, the cost has necessarily to be considered.

Biological Control.

The alternative of biological control, therefore, offers a field worthy of thorough exploration, even although if successful, its result must necessarily be slow in coming to fruition.

The search for local parasites (i.e. those already in any district of the Territory) has received very careful attention, and some very interesting results have been obtained.

Moreover, in February, 1933, the Entomologist was commissioned to visit Amboina, an island of the Moluccas Group in the Netherland East Indies, to study certain parasites of Sexava eggs recorded from that locality by Dr. Leefmans. Colonies of the principal one, *Leefmansia bicolor* (a species of *Encyrtidae*) were bred in Amboina to ensure freedom from hyperparasites and successfully landed on Manus in April, 1933.

Breeding operations were immediately commenced at the Research Station, and this wasp was proved to breed freely in the eggs of the *Sexava novae-guineae* (and later of *S. nubila*), a distinct species from that in Amboina (*S. coriacea*); breeding was carried out through three generations to ensure absolute freedom from hyperparasites. The numbers emerging were sufficiently large in June to permit of the first liberation in the field being made on 26th June on Mokareng Plantation. Later the area of liberations was enlarged to embrace several other plantations and kanaka groves; a large number of parasitized eggs were supplied to two planters in the Manus district at their own request, to enable them to breed these wasps for themselves for distribution over their properties, which were too far away to enable liberations to be made direct from the Research Station.

On 12th September, 1933, the first presumptive evidence was obtained that *Leefmansia bicolor* was apparently breeding under natural conditions in the field by an emergence in the storage jars of adults in a period markedly below the normal life-cycle. Later the breeding of *L. bicolor* in the field was definitely established. In conjunction with the mass breeding for liberation, a study was made of the life-history, habits, &c., of *L. bicolor*.

Mass breeding is carried out in glass preserving jars and small wire gauze cages (12 x 12 x 15 with three trays) as containers for submission of the Sexava eggs to the parasites, food being provided in the form of sugar syrup on blotting paper or calico. After 4-6 days in these jars, the eggs are taken out and placed

in large tubes or small bottles, in which they are stored until the parasites emerge. The wasps being strongly attracted to light, are then readily transferred by plugging the neck of the storage jar into that of the submission jar, and the base of the latter turned towards the light, the former being covered with a cloth to make it darker.

After removal from the submission jars the parasitized eggs are spread out to dry for a few hours, otherwise it was found that a degree of "sweating" was liable to occur during storage, leading to the death of considerable numbers of parasites. Under conditions of "sweating" a number of small Diptera (flies) emerged, apparently from the Sexava eggs, but the actual relationship between the two could not be determined.

The period from submission of eggs to first emergence of the wasps was 25-27 days in Manus, and 29-30 days in New Hanover, the difference being due to the lower temperature in the latter locality, especially at night.

The males measure about 1 mm. and the females 1.3 mm. in length; the head and abdomen are black with the thorex reddish yellow. The males are readily distinguished from the females by the antennae, those of the males being all black and those of the females having the club and two first apial segments white.

As many as 50 of the wasps have emerged from a single Sexava egg, the average being 20-30. All the wasps from one egg generally emerge within 24 hours of the first emergence. A number of instances, however, have been noted from mass lots of parasitized eggs in which a definite hiatus in emergence has occurred, varying from 14-56 days (average of 40 such cases being 25-26). After the first emergences are all completed a second series carries on for a period of 2-6 days.

All lots of parasitized Sexava eggs used in field liberations of *L. bicolor* in New Hanover have been divided into two parts, the larger portion is placed in wire gauze field liberation boxes, and the remainder held in the laboratory, partly for check observations on the degree of emergence of the parasites, and partly to use the emerging wasps for further breeding work; the eggs are not set out until a few days prior to the date of emergence. The boxes are returned to the laboratory about one week later, and the eggs so returned are held for a period of observation. From this work it has been found that the parasites emerge over markedly longer periods from the eggs set out in the field than they do from the check lots held in the laboratory; possibly parasites of relatively low vitality in the developmental stages resulting from a very heavy degree of parasitization of individual Sexava eggs succumb in storage in the laboratory, but emerge under the field conditions.

Sexava eggs in lots of 10-20 exposed to a single female *L. bicolor* have yielded as many as 19 parasites, the average being 17. These conditions being unnatural, it is probable that these figures do not represent the maximum number of eggs laid per female wasp in the field or even in mass infestation in the laboratory, but give an indication of a possible rate of increase.

There is a definite period after, and apparently before, which effective parasitism cannot take place, but the limits between which this is possible comprise at least two-thirds of the period for maturation of the egg.

Selected Sexava eggs parasitized in small lots gave an emergence of 64.5 per cent. with an actual parasitism of 82.4 per cent.; 17.9 per cent. died in the

larval stage, due apparently to the desiccation of the host. Under conditions of mass breeding, where all eggs collected are used in the submission jars without any selection being made, an average parasitization of 50-55 per cent. is obtained.

The adult wasps live for up to 14 days (average 8-9 days) when fed continuously on sugar syrup, but die within 24 hours when without food.

In order to test the ability of the wasps to emerge through soil, parasitized eggs were buried in moist soil at varying depths, and emergence readily took place, through up to three-quarters of an inch of moist sandy soil.

Field liberations were first made by liberating the live wasps soon after emergence, but this so limited the scope of the area that could be covered that small wire gauze cages (4 inches x 4 inches x 1 inch) were tested out with satisfactory results. It was later found that smaller cages (2 inches deep and 2 inches diameter) were more suitable, and are now the medium used for all field liberations. These are covered with a lid to keep out rain and hung by a wire to stakes driven into the ground at an angle sufficient to let the cages hang free.

A scheme has been prepared by which any planters who care to, can breed these wasps for themselves for liberation in plantations beyond reach of the Station, full particulars of which can be obtained on request to the Department of Agriculture, Rabaul.

It must be stressed that, in order to give a reasonable chance for the parasites to become established in any area, a series of liberations extending over at least 2-3 months, if not more, must be made.

The first liberations in New Hanover were made on 14th May, 1934, and the wasps have been recovered from several centres of liberation, and also from two centres in which no liberations have been made. These latter are up to three-quarters of a mile from the nearest site of liberation.

Local (Indigenous) Parasites.

Manus.

In the Manus area three parasites of Sexava eggs were bred from material collected in the field—

(1) A small species of *Mymaridae* (female about 7 mm. in length) was bred from eggs collected in the epiphytic growths on the palm trunks; however, this appeared to be rather a casual parasite of Sexava. The eggs of another species of *Orthopteron* present in the same situation in considerable numbers were regularly parasitized by this wasp.

(2) A species of *Eulophidae* (female about 1.8 mm. long) was bred from eggs collected in the soil, and although this appeared to be a primary parasite of Sexava it was comparatively rare.

(3) Two species of *Scelionidae* were also bred from eggs collected in the soil, but these also were comparatively rare, and only one wasp per egg was bred out. One of these Scelionids was *Prosapegus strellus*, also recorded from Dutch New Guinea. The smaller species measured about 3.8 mm. long and *P. atrellis* about 7.4 mm.

New Hanover.

Six local parasites have been bred from material collected in the field in this area, of which three are sufficiently prevalent as to offer economic possibilities worthy of testing out in areas in which they are not already present—

(1) Two species of minute *Trichogrammatidae,* one of which, *Doirania leefmansi* (about .65 mm. long) is very general and regular in occurrence. This species was first collected in this locality in 1930 by the Entomologist. It is also recorded from Amboina and the Bangaai Islands (east of Celebes), N.F.I. The other species has only been bred on one occasion, and is evidently rare. It is not yet known whether this is a primary or only a secondary parasite of Sexava eggs.

(2) A species of *Encyrtidae* (female about 1.3 mm. long) very closely resembling *L. bicolor,* but differentiated by the apical club and four joints of the antennae of the females being white. This wasp is also general and regular in occurrence.

(3) A species of *Mymaridae* (female about 7 mm. long) is also common; males of this species are apterous (wingless) and do not leave the outer surface of the Sexava eggs; they die within half an hour after emergence.

(4) *Prosapegus atrellus* (*Scellionidae*) has been bred in this locality also, but, as in Manus, is not prevalent.

(5) A species of *Eulophidae* (female about 1.8 mm. long), very similar to that bred in Manus, has also been found in New Hanover, but is comparatively scarce.

The following summary shows the relative prevalence of the three principal species of the above, the figures being given in percentage of the eggs examined :—

Species.	Eggs collected.			
	In soil.	In epiphytes.	In palm crown.	Total.
D. leefmansi	10.7	16.3	12.9	39.9
Encyrtid sp.	5.5	5.9	4.0	15.4
Mymaris sp.	7.7	5.2	6.9	19.8
Total for *spp.* ..	23.9	27.4	23.8	75.1

These figures have been arrived at by the dissection of a very large number of Sexava eggs collected from areas where they occur freely together in the field from the three situations as above, and kept in separate containers until dissected.

Of the above parasites from New Hanover, *D. leefmansi* and the species of *Encyrtid* have both been bred through their life cycles, that of the former being 38-41 days (average 39.5), and of the latter 30-38 days (average 32.5). Colonies of both these species are being maintained for transference to our next site of operations.

So far, although the *Mymaris sp.* parasitizes the Sexava eggs freely in the laboratory, we have not been successful in breeding it through the life cycle, apparently due to desiccation. Experiments are in hand to endeavour to overcome this difficulty, and if colonies can be maintained this species also will be included amongst those transferred to the new site of operations.

NEW BRITAIN.

A species of *Eulophidae* (female about 1.6 mm. long) was bred on two occasions from Sexava eggs collected from the same locality in the vicinity of Rabaul, but was not plentiful. An unsuccessful attempt was made to breed this wasp in the laboratory.

NEW IRELAND.

A species of *Mymaridae* (less than .5 mm. long) was bred from Sexava eggs collected in one locality on the Namatanai coast, but was scarce.

Prosapegus atrellus also bred out from the Sexava eggs referred to above.

Specimens of all the unidentified species have been forwarded to the Imperial Institute of Entomology, London, for determination.

Biological Races.

It is generally recognized that various species of insects may show different habits, although morphologically the same; some of these "races" may occur in pest form while others never develop such habits.

With Sexava, it is well known that in some localities it has been present for years and never developed in "plague" form, and it is quite possible that in this pest also we must recognize the presence of such biological races.

Predators.

No insect predators of Sexava have been found to date.

There are several species of birds that prey on these pests, the most prevalent of which is probably the crow (*Corvus orru*), although the white-headed fish hawk (*Accitiper sp.*) is another that feeds freely on Sexava. Unfortunately neither are sufficiently common to be able to make an appreciable difference in the pest population in any area, although they are not to be despised as a help; other birds have also been reported to feed on Sexava.

Several species of small lizards have been observed to devour the nymphs and adults; but these, also, are not numerous.

Mechanical Measures.

The use of fires along the rows of palms (when they are not too high) on still days will bring considerable numbers of both adults and nymphs down from the crowns of the palms, when they can be captured and destroyed.

In localities where the "hoppers" come down from the palms at night large numbers can be collected very readily; the proportion of females so destroyed at these times is much greater than in collections made during the day.

Thoroughly turning over the soil will lead to the exposure of eggs to ants, &c., and will also lead to the desiccation of still more, and may bury others at depths greater than that through which the vermiform larva can penetrate.

Climatological.

The advent of a dry spell during the occurrence of a "plague" will cause a material decrease in the infestation, if it does not effectually check it. This is probably brought about partly through desiccation of the eggs due to the drying up of the surface soil and of the epiphytes, and also the decrease of water

available for the necessary requirements of the adults and nymphs. In addition to this, it has been proved that dry climatological conditions have a decided deleterious effect on the nymphs, quite apart from the decrease of water requirements.

Areas in which a definite dry season occurs every year are not as subject to severe infestation as areas in which such does not occur.

Poison Baits.

Paris green and bran baits have been set out at the base of the palms, but gave entirely negative results. This was not altogether surprising, as these insects are not ground feeders, and only come down from the palms for oviposition.

"Tanglefoot" Bands.

Experiments have been carried out with a proprietary preparation of tree "tanglefoot" to test the possibilities of "trapping" the hoppers when ascending the palms. The material was applied to the palms in bands 4 inches wide about 5 feet from the ground; in some cases two bands were applied, one a few inches above the other.

The bands remained sticky for over four months, and on nineteen palms 2,706 nymphs, mostly in the first and second stages, were caught in that period. During the course of observations on this work, nymphs were seen to cross the bands, but obviously carried a certain amount of the material away on the feet, and fell an easy prey to ants.

In following up this line of work in the laboratory it was found that, by the addition of poison to the "tanglefoot" certain destruction of the nymphs was brought about. The results may be summarized as follows:—

Sodium arsenite gave 100 per cent. mortality in 39 hours.

Mercurie chloride apparently caused a rapid paralyzing effect on the nymphs, although death did not supervene for as long as 168 hours afterwards.

Sodium fluoride gave 100 per cent. mortality within 78 hours.

Paris green gave 100 per cent. mortality in only 120 hours.

The poisons were added to the tanglefoot, which was then spread in a band on boards in the laboratory and the nymphs allowed to walk over it; in other cases the nymphs were held by the antennae and a smear of the mixture applied to the tarsi (feet) with a glass rod; the results were materially the same in the two series of experiments.

This line of research is to receive further attention.

Although the cost of treatment by such means would be relatively high, and therefore impracticable on a large scale, yet where the infestation was in a small localized area, it might be employed with considerable benefit.

Tree Guards.

At the Research Station on Mokareng Plantation tin tree guards were used on the palm trunks, but proved quite ineffective.

Ostico bands placed above the trap and also on palms without the trap, yielded approximately equal numbers of nymphs.

SUMMARY.

1. Two species of Sexava have been recorded from the Mandated Territory of New Guinea.

2. The life cycle of Sexava occupies five months or even more; the egg stage varies from 42 to more than 100 days, but is mostly under 60 days, while the nymphal stages take from 70 to more than 90 days to reach the adult stage.

3. The adults live for from four to eight weeks when fed continuously.

4. Several indigenous parasites of the egg of Sexava have been bred out, two of which present decided economic possibilities.

5. The Sexava egg parasite, *Leefmansia bicolor,* introduced from Amboina, has been established in the field both in the Manus and New Hanover areas.