38049

1937

CO 533/478

KENYA

38049

COFFEE INDUSTRY.

(COLONIAL DEVELOPMENT FUND GRANT)

Previous 1936		Mr Carver	20/1
		R. 297	20/1
		309	26/1
		Mr Parkin	✓
		R. 299	26/1
		297	28/1
Subsequent 1938		Mr Gerson	31/1
		297	
R. 297	15/11/37		
R. 309	16/11		
Mr Davies	18/11		
Mr Parkin	✓		
297	25/4		
R. 309	27/11		
Mr Parkin	✓		
298	9/12		
298	15/12		
297	20/12		
309	21/12		
[illegible]	21/12		
R. 297	30/12		
309	31/12		

38049

C.1. 1. GOV. KENYA — 666 — 6.11.37.

AGRIC.
C.D.F.
Nominal(P & M)

Gives reasons why he requests sanction to utilize £145 unexpended balance of C.D.F. grant, towards expenses of Mr. Michelle whom it is proposed to send to T. T. Kampala & Bukoba Districts of Uganda, and afterwards to the Belgian Congo.

The CDF Grant of £1,400 for research into the Kenya Coffee Mealy Bug (CDF Scheme 411) has resulted in the discovery that the Kenya Mealy Bug is not susceptible to control by the natural parasitic enemies of the Mealy Bug found in the Far East. In order to control the Kenya Mealy Bug it is therefore necessary to investigate the possibility of there being a natural parasitic enemy to it in Africa. This it is proposed to do forthwith, and the request is made by Kenya that the unexpended balance of £145 from the CDF grant should be made available for this other purpose. I understand that it is not usual for the CDAC to allow moneys voted for one purpose to be transferred to another, but that the proper procedure would be for Kenya to apply for a new grant. As, however, this new investigation is, as it were, the child of the former, & as the sum involved is not great, & the purpose is still the same, perhaps the CDAC will in this case be able to sanction the proposed reallocation.

Clerk White.
16/11

It will be observed from No. 5 on the 1936 file that the Colonial Development Advisory Committee stated that they recommended the grant for the purpose of "providing for the cost of research in connection with the control of the Kenya Common Coffee Mealy Bug." The proposals which the Governor makes in the present despatch still fall under this heading and I do not think there is any need to re-submit the matter formally to the Committee. It should suffice if the Chairman is approached direct; I think he will be prepared to give approval on behalf of the Committee. The Treasury's covering approval would also be required.

I suggest, therefore, that a note should be prepared setting out the position, and ~~that~~ I ~~should~~ will send this to Sir Alan Rae Smith under cover of a minute asking for his approval to utilise the unexpended balance of £14 from the original Colonial Development Fund grant towards the cost of the proposed visit to the Belgian Congo.

Dane 18/11

[illegible] 20/11/37

Encls for info & transmission to C.D.A.C. provided no objection is found, 5 copies of Report by Dr Le Pelley & Mr McBride

I have spoken with Mr Dane and Mr [illegible] Smith, and submit a draft note to the C.D.A.C. accordingly.

No. 2 I understand from Mr [illegible] that no steps need be taken [illegible] to bring this formally to the notice of the C.D.A.C.

[illegible]

I agree with the action proposed. I had heard semi-officially of the results of Dr Le Pelley's tour & of the recent discoveries in Uganda.

A copy of the report should be sent to Sir Guy Marshall for the information of the I. Institute of Entomology and Mr Eason should see so that a short note may be prepared for the information of the Colonial Advisory Council of Agriculture & Animal Health.

Action here later [illegible]

Done [illegible] 19/1

F. A. Stockdale 1/12

The Chairman of the C.D.A.C. has agreed to this without formal reference to the Cttee, – see copy minute attached. The Treasury should now be asked to approve.

L. Smith 4/12/37

4. To Treas. (w/c 1 & 3) ~ cons – 15.12.37.
C/To a/cs. 15/12/37

Action as at X and Y above.

6o Sir G Marshall (u/c encl to 2) — 28/12/37

6. Treasury (S. 34609/0392) — 24.12.37
(4 Encl) Sanctions unexpended balance of £145 being used to defray part of cost of further research.

7. Sir Guy Marshall (86) — 29.12.37.
Acks (5) with comments.

8 C.A.C. 376 — 19.1.38

No 7 Put by as directed & slip above it.

No 8 ? May also be put by.

No 6 Draft desp telling Kenya submitted for concur.

Clarkson White 20/1

Yes & then return to Mr Garson to see that X in No 8 was out of date at the time when it was written.

J.J. Paskin
22/1

Answered.

9 To Kenya 51 - (w/c 3, 4, 6 & 8) — 26 JAN 1938
(1 & 2 Amend)

Mr Garson has seen as at X above

noted.

C.J. Jeffries 24/1

38049/37

4

9

C. O.

Mr. Cohen White 26/1/38
Mr. Parkin 22/1 [initials]
Mr.
Sir C. Parkinson.
Sir G. Tomlinson.
Sir C. Bottomley.
Sir J. Shuckburgh
Perml. U.S. of S.
Parly. U.S. of S.
Secretary of State.

~~84~~ 26 January 1938

DRAFT Curzon
Kenya.
No. 51
Gov.

(1)

Sir

I have etc to ack the receipt of your desp. No 666 of the 6th of November requesting that sanction be obtained for the ~~appropriation~~ utilisation of the unexpended balance of £145, remaining over from the grant of £1,400 ~~by~~ from the ~~CDAC~~ Colonial Development Fund to provide for research in connection with the control of an Kenya Mealy Bug, ~~to be in order~~ to meet ~~the~~ ~~expenses of~~ part of the cost of a visit by Mr Melville to Tanganyika, Uganda and the Belgian Congo for further research into the same problems, & to inform you that the Lords Commrs of the Treasury have approved the recommendation by the Chairman of the CDAC that this

Note (3) 13th Dec
to Treasury (4) 24th Dec
from Treasury (6)
Note (8)

FURTHER ACTION.

Return to Mr Garson.

proposal should be sanctioned.
Copies of the note to the
Chairman of the C.D.C., of a
letter to the Treasury, and
of the Treasury reply thereto,
are enclosed for your info.

2. I take this opportunity
to ack. the receipt of your
desp. no 698 of the 20th of (2)
November forwarding copies
of the Report compiled by Dr.
Le Pelley and Mr Melville, &
~~of the~~ I enclose a copy of
a note which has been prepared
for the information of the Colonial
Advisory Council of Agriculture &
Animal Health.

(SIR) W. ORMSBY GORE.

5c (1) 8.

COLONIAL ADVISORY COUNCIL OF AGRICULTURE AND ANIMAL HEALTH

C.A.C.576

Kenya Coffee Mealy Bug

In 1936 a grant of £1,400 was made from the Colonial Development Fund to the Government of Kenya to enable Dr.R.H.Le Pelley, Entomologist of the Department of Agriculture, to visit the Philippines, Java, Malaya, Ceylon and Southern India in search of the original home of the Kenya Common Coffee Mealy Bug and to investigate its natural specific parasites with a view to their introduction into Kenya for the entomological control of this pest there.

Dr.Le Pelley visited Honolulu for two weeks, Japan for a month, Hong Kong for a week, the Philippines for five months, the Dutch East Indies for four months, Malaya for two weeks, Ceylon for three weeks and India for six weeks. Dr.Le Pelley collected a mass of material (7,561 live insects being received in Nairobi) throughout his tour which was despatched to Kenya and which was received by Mr.A.R.Melville, Entomologist.

Bugs to Kenya (9)

Dr.Le Pelley and Mr.Melville have now reported the results of this search which are summarised as follows:-

(1) The Kenya coffee mealy bug was not identified during the extensive collecting done on the journey. It is certain that it is not a common insect in the Orient, and it is probably quite safe to assume that it is not present there. The large collections of mealy bugs made, of which only a proportion could be studied microscopically on the journey,

journey, will require identification before a completely definite statement can be made.

(2) No one of the seventy species of primary parasites of Pseudococcus lilacinus which were successfully shipped to Kairo, mainly attacks Pseudococcus kenyae. It should be stated that the Kenya mealy bug proved not only resistant but actually immune to attack of the parasites, none of which would oviposit in it.

(3) A number of predators including a Cecidomyid from the Philippines and Coccinellids from Java, Ceylon and India were reared for a number of generations in Nairobi, but owing to the differences in temperature between Nairobi and the localities from which they were sent, all the species bred very slowly, and it was not possible to build up large stocks of any of them. Some field liberations of certain species were made but it is not anticipated that these insects will become established.

It seems that the results of Dr. L. E. Hoy's research show that whereas it was thought previously that Pseudococcus lilacinus and Pseudococcus kenyae were alike and were till recently classed under the name Pseudococcus lilacinus, actually they are specifically far apart. There is now evidence that Pseudococcus kenyae is recorded in other parts of central Africa and that it is found there under adequate biological control.

It appears, therefore, that the home of the Kenya mealy bug must be sought elsewhere in Africa and an application to the Colonial Development Advisory Committee has been approved and only awaits the completion

journey, will require identification before a completely definite statement can be made.

(2) No one of the several species of primary parasites of Pseudococcus lilacinus which were successfully shipped to Nairobi would attack Pseudococcus kenyae. It should be noted that the Kenya mealy bug proved not only resistant but actually immune to attack of the parasites, none of which would oviposit in it.

(3) A number of predators including a Cecidomyid from the Philippines and Coccinellids from Java, Ceylon and India were reared for a number of generations in Nairobi, but owing to the differences in temperature between Nairobi and the localities from which they were sent, all the species bred very slowly, and it was not possible to build up large stocks of any of them. Some field liberations of certain species were made but it is not anticipated that these insects will become established.

It seems that the results of Dr. Le Pelley's research show that whereas it was thought previously that Pseudococcus lilacinus and Pseudococcus kenyae were one and were till recently classed under the name Pseudococcus lilacinus, actually they are specifically far apart. There is now evidence that Pseudococcus kenyae is recorded in other parts of Central Africa and that it is found there under adequate biological control.

It appears, therefore, that the home of the Kenya mealy bug must be sought elsewhere in Africa and an application to the Colonial Development Advisory Committee has been approved and only awaits the sanction

of the Lords Commissioners of His Majesty's Treasury to expend the balance of the previous grant on making a search in other parts of Africa, particularly Tanganyika, the Belgian Congo, and the Kampala and Bukoba areas of Uganda, where it is hoped to find the Kenya mealy bug controlled by its natural enemies as in the Central Province of Kenya particularly the insect is entirely uncontrolled.

It was considered that a short account of the position in regard to the search for a controller of this pest would be of interest to members of the Council.

A.D.GARSON
Secretary.

COLONIAL OFFICE.

Caxton House (East Block),
Rothill Street, S.W.1.

19th January 1938.

Imperial Institute of Entomology

Director:
SIR GUY A. K. MARSHALL, C.M.G., D.Sc., F.R.S.
Assistant Directors:
S. A. NEAVE, O.B.E., D.Sc.
W. R. THOMPSON, Ph.D., D.Sc., F.R.S.

Head Office at—
BRITISH MUSEUM (NATURAL HISTORY),
CROMWELL ROAD, LONDON, S.W.7.

29th December, 1937.

Dear Stockdale,

Many thanks for your letter of the 23rd December, and for the copy of the report by Le Pelley and Melville on their search for parasites of the Kenya Coffee Mealy Bug.

It is a pity that the results have proved negative, but I think the search was really justified.

Yours sincerely,

Guy A. K. Marshall

Sir Frank Stockdale, K.C.M.G., C.B.E.,
Colonial Office,
Caxton House (East Block),
Tothill Street,
S.W.1.

Telephone No.: WHITEHALL 1234.

Any reply to this letter should be addressed to—
THE SECRETARY,
TREASURY,
WHITEHALL, LONDON, S.W.1.
and the following number quoted:
S.34609/0392.

3c

RECEIVED
28 DEC 1937
C.O. REGY

6 9

TREASURY CHAMBERS.

24 December, 1937.

Sir, COPY SENT TO ACCOUNTS DEPARTMENT

I have laid before the Lords Commissioners of His Majesty's Treasury Mr. Flood's letter of the 15th instant (38049/37) regarding the grant of £1,400 from the Colonial Development Fund to the Government of Kenya, which was approved by the Treasury Letter of the 17th April, 1936 (S.34609/0392) in connexion with the control of the Kenya Coffee Mealy Bug, and forwarding a copy of a despatch from the Governor of Kenya requesting that the unexpended balance of £145 from the grant may be used to defray part of the cost of further research into the same subject.

4

Copy to Kenya (9) 2 Jan 1938

In reply I am to request you to inform Mr. Secretary Ormsby Gore that My Lords sanction the Governor's proposal, which They note has been approved by the Chairman of the Colonial Development Advisory Committee on behalf of the Committee.

A copy of this letter has been sent to the

Secretary

The Under Secretary of State,
Colonial Office.

Secretary of the Colonial Development Advisory Committee.

I am,

Sir,

Your obedient Servant,

F Phillips

38049/37

10

C. O.

Mr. Cottey White 4/12

Mr. Parker C.A.G. 6/12

Mr.

Sir H. Moore.

Sir G. Tomlinson.

Sir C. Bottomley.

Sir J. Shuckburgh.

Permt. U.S. of S.

Parly. U.S. of S.

Secretary of State.

C. D. R 7 DEC D 9

4

and (6)

~~85~~

15 December 1937

DRAFT.

The Secretary Treasury

(13) on -36 file

Sir

I am etc to refer to the letter from this Office No 38049/36 of the 30th April 1936 on the subject of the grant of £1,400 from the C.D.F. to the Govt of Kenya ~~for~~ in connection with the control of the Kenya Coffee Mealy Bug, and to transmit for the information of the Lords Commissioners of the Treasury a copy of a desp. from the Gov of Kenya containing the request that the unexpended balance of £145 from the grant may be used to defray ~~the~~ part of the cost of further research into the same subject.

Gov's approval to a/cs.

From Kenya Gov. No. D 1.

Memo. (2). (9)

Copy to Kenya

2. The Chairman of the CDAC ~~expressed his concurrence~~ has ~~given approval to the suggestion in the Governor's request on behalf of the Chair~~, and Mr Ormsby Gore would be obliged ~~will be requests that~~ if their Lordships ~~the Lords Commissioners of the Treasury~~ may be moved to ~~concur~~ ~~similarly~~ signify their

FURTHER ACTION.

(*801—150) Wt. 13958—47 10,000 6/37 T.S. 688
(*1085—150) Wt. 19897—38 10,000 6/37 T.S. 688

affirming their approval. A copy of a memorandum which was prepared for the Chairman of the Committee is enclosed.

I am etc.

Signed) J. E. W. FLOOD

38049/37

C.O.

Mr. Costley White 27/11
Mr. Paskin 30/11
Sir F. Stockdale 1/12 (5 on -/36)
Mr. Davies 2/12
Sir G. Tomlinson.
Sir C. Bottomley.
Sir J. Shuckburgh.
Perm. U.S. of S.
Parly. U.S. of S.
Secretary of State.

DRAFT. NOTE.
for the Chairman C.D.A.C.

Sir Alan Rae Smith

In their letter No.C.D.A.C.1953 of the 24th of March 1936 the Committee recommended a free grant of £1400 from the C. D. F. for the purpose of research in connection with the biological control of the Kenya Common Coffee Mealy Bug. This grant was used mainly to finance a visit by Dr. Le Pelley to the Far East with the object of discovering the native home and the natural parasitic enemies of the Kenya Mealy Bug. The Kenya species was not found in any of the countries during the extensive collecting tour of Dr. Pelley, and none of the various species of parasites of allied pests collected by him were found to attack the Kenya species.

As stated in the annexed despatch from the Governor of Kenya, there is now evidence to suggest the strong possibility that the Kenya Coffee Mealy Bug is indigenous to Africa, and it is proposed to continue the investigations in Tanganyika and Uganda and in areas in the Congo with a climate similar to that of the Central Province of Kenya. The Governor of Kenya requests that the unexpended balance of £145 from the original grant may be made available as a contribution towards

From Kenya - 6th November
1

Copy to Treas. 4.
Kenya (9)

FURTHER ACTION.

towards the cost of this further investigation, the balance to be found from Kenya funds. The S. of S. has no hesitation in supporting this proposal.

As no deviation from the original recommendation of the Committee appears to be entailed in the present proposals, the Department would be grateful if you would be kind enough to signify your approval of them on behalf of the Committee.

AIR MAIL

KENYA
No. 698

GOVERNMENT HOUSE
NAIROBI
KENYA

20 November 1937.

Sir,

With reference to my despatch No.666 of the 6th November on the subject of the free grant from the Colonial Development Fund of a sum of £1,400 to provide for research in connection with the control of the Kenya Coffee Mealy Bug (Serial No.411), I have the honour to enclose, for your information and for transmission to the Colonial Development Advisory Committee if you see no objection, five copies of the joint Report compiled by Dr. Le Pelley and Mr. Melville.

I have the honour to be,

Sir,

Your most obedient,
humble servant,

R Brooke Popham

AIR CHIEF MARSHAL

GOVERNOR.

THE RIGHT HONOURABLE
W. ORMSBY GORE, P.C., M.P.,
SECRETARY OF STATE FOR THE COLONIES,
DOWNING STREET,
LONDON. S.W. 1.

REPORT TO THE COLONIAL DEVELOPMENT ADVISORY COMMITTEE

BIOLOGICAL CONTROL OF THE KENYA COFFEE MEALYBUG 1936-1937.

by

R.H. Le Pelley, Entomologist
and A.R. Melville, Entomologist.

Kenya Colony & Protectorate.

BIOLOGICAL CONTROL OF THE KENYA COFFEE MEALYBUG.

1936 - 1937.

by

R.H. Le Pelley, Entomologist
and A.R. Melville, Entomologist.

Kenya Colony & Protectorate.

CONTENTS.

INTRODUCTION.

The present report deals with a project for the biological control of the Kenya coffee mealybug (Pseudococcus kenyae Le Pelley), the chief objects of which were to search as widely as possible in the Orient for the native home of the insect and to investigate the parasitic and predacious enemies of the related species Pseudococcus lilacinus Ckll., with a view to their introduction into Kenya and with the hope of their eventual establishment as enemies of the local mealybug. The project entailed work in the Orient (the collecting end) and in Kenya (the receiving end). The work at the collecting end was throughout in charge of Dr. R.H.Le Pelley ~~the writer~~ and at the receiving end at first of Mr. H. Wilkinson and after November 11th. the date of his arrival in Kenya in charge of Mr. A. R. Melville.

Part I of this report is prepared by R. H. Le Pelley Part II by A.R. Melville.

PART I. REPORT OF INVESTIGATIONS IN THE ORIENT.

This section of the report deals with the work at the collecting end. Technical details, such as the bionomics of parasites and details of the methods employed in the laboratory, have been generally excluded. These will be prepared later either for a further report or for publication, when identifications have been received of the numerous insects concerned. In respect of all shipments of insects mentioned in the body of the report, details will be found in an Appendix.

I left San Francisco on June 5th 1936 and arrived at Honolulu on June 11th. Here I did extensive collecting in three islands, Oahu, Hawaii and Kauai and three shipments of Pseudococcus krauhniae Kuw. parasitised by Pauridia peregrina Timb. were made. (Pseudococcus lilacinus Ckll. is not present in the Hawaiian islands but Pseudococcus krauhniae is also a somewhat close relative of P. kenyae). Also the mealybug collections of the Division of Plant Inspection at Honolulu, chiefly mealybugs intercepted from various parts of the world, were examined.

I left Honolulu on June 27th and arrived at Kobe on July 8th. Collecting was done in a number of different places in Japan between Okayama and Yokohama. One shipment was made, of Pseudococcus krauhniae Kuw. parasitised by Clausenia purpurea Ishii. and Anagyrus subalbipes Ishii

I left Japan at Kobe on July 25th and arrived at Hong Kong on July 30th spending one day (July 27th) collecting in and around Shanghai on the voyage. Collecting was done in and around Hong Kong Island and Territory and at Canton.

Hong Kong was left on August 9th and Manila reached on August 10th. Here after a short stay in Manila making the necessary official contacts, I made my headquarters at the School of Forestry, Los Baños. Collecting was immediately undertaken in and around Los Baños, and also in Manila and various parts of Laguna, Tayabas, Batangas, Cavite and Rizal provinces, and also in and around Baguio, Mountain Province, up to an elevation of over 5000 ft. An intensive study of Pseudococcus lilacinus in the neighbourhood of Los Baños was made and a number of parasites and predators were found to be present and certain of them were investigated in some detail.

The two chief primary parasites were new species, which have since been described by Dr. Ferrière as Pseudaphycus orientalis and Anagyrus lilacini. Of these the Pseudaphycus appeared to be particularly promising and large stocks of this (and of the Anagyrus) were bred up for shipment and large numbers were received alive in Nairobi. A total of seven shipments were made from Los Banos, the insects sent also including two species of Cecidomyid and one Coccinellid.

The work in Los Baños was concluded in February 1937 and I left Manila on February 18th. doing half a day's collecting in Macassar on February 23rd and arriving in Soerabaja on February 25th. In the Netherlands Indies I collected widely at Malang, Djamber, Samarang, Batavia, Buitenzorg, Bandoeng, Bali, Lombok and at other places, from sea level to about 5000 ft. My headquarters for the shipment of parasites and predators of P. lilacinus was Buitenzorg and ten shipments were made from there and others from Malang, Djamber and Lombok a total of thirteen from the Netherlands Indies. Soon after arriving in Java it was decided, on reports having been received from Kenya that the primary parasites from the Philippines would not attack P. kenyae and because of the time available did not allow of detailed investigations being undertaken in each place, to alter the plan of the work by shipping as many as possible from the whole complex of predators and parasites without detailed investigations into their bionomics. This greatly accelerated the work at the collecting end, while it greatly increased the work at the receiving end. It must be recorded that even with this method of shipping considerable selection was made and any undesirable species known to be present in the material were removed before shipment; nevertheless a number of hyperparasites were sent and these were intercepted in

Quarantine at Nairobi.

On conclusion of the work in Java, I left Batavia on June 9th. arriving at Singapore on June 11th. In Malaya collecting was done in and around Singapore and Penang and as widely as possible in the Federated States of Negri Sembilan and Selangor. P. lilacinus was found only in Penang there being apparently only one previous authentic record of this insect in Malaya.

I left Penang on June 19th. arriving at Colombo on June 23rd. In Ceylon collecting was done in a number of districts and over a wide area from sea level to about 6000 ft. In addition a shipment of parasites and predators was made from Peradeniya.

I left Ceylon for India on July 13th. arriving at Madras on July 14th. Collecting in India was intensively carried out in certain districts and also over wide areas, up to an altitude of over 7000 ft. The chief districts collected over were Coimbatore, the Nilghiri Hills and the Malabar Coast in Madras Presidency; Mysore, Bangalore and Balehonnur in Mysore State; and in Coorg. In addition some collecting was done in and around the towns of Poona, Bombay and Madras. All records of P. lilacinus were followed up, and headquarters for the work of shipping were made at Coimbatore where this mealybug was common, and three shipments were made from this locality.

I left Bombay on September 1st. and after one day's collecting around the island of Mahé, Seychelles, arrived in Mombasa on September 11th., and Nairobi on September 13th 1937.

PART II. REPORT ON WORK WITH INSECT MATERIAL RECEIVED IN NAIROBI.

I arrived in the Colony on 11th November 1936 and my contact with the project began with the second shipment from the Philippine Islands. Since that time I have been in charge of the work at the receiving end.

1. General.

Receipt of shipments.

Shipments of material were received from the following places: Hawaii, Japan, Philippine Islands, Java, Ceylon, India.

Most of these shipments arrived in Nairobi by Imperial Airways while a few arrived by sea at Mombasa being expedited there by the Government Coast Agent and collected in Nairobi. Arrangements were made for the immediate collection of all shipments on arrival.

Quarantine facilities at the Scott Agricultural Laboratories.

All shipments were dealt with in a quarantine insectary provided by the grant from the Colonial Development Fund. The insectary, a well built stone structure with a concrete floor, has windows and ventilators provided with very fine gauze and a double door entrance. In the interior of the building an iron rail runs round the wall at 3 ft. from the floor and similar rails also guard the doors. These rails are regularly greased and form a safeguard against the escape of

"crawlers" of any foreign mealybug which might be received in shipments.

Method of handling shipments.

All shipments received were opened in the Quarantine Insectary, the wrapping material being treated with kerosene and burnt. The actual shipment boxes themselves were opened inside a sleeved examination box. All living insects were collected and used for experiments. In the case of the Philippines material each mealybug was placed in a gelatine capsule pending emergence of parasites. With subsequent shipments the material remaining after the collection of adults, was placed in sealed jars with gauze lids surrounded by grease traps and further emergences were dealt with as they occurred.

After all material had been suitably treated the examination box, shipment tin and all in-contact materials were treated with kerosene.

General condition of shipments.

The shipping methods employed were quite satisfactory and the majority of shipments arrived in excellent condition, good numbers of parasites and predators being generally available for experiments.

General scheme of work.

With the shipments from Hawaii, Japan and the Philippine Islands only selected species were received for trial. Any other species appearing in the shipments were destroyed. With all subsequent shipments as many species as possible from the controlling complex of P. lilacinus were tried on P. kenyae. The work at the receiving end was greatly

increased by this procedure but it was possible to experiment with a relatively large number of species. The thoroughness of the trial naturally depended on the numbers of each species obtained.

Climatic conditions experienced at Nairobi.

During the course of the project some very cold weather was experienced in Nairobi particularly in the months of June, July and August 1937 Even during the warmer months the daily range of temperature was considerable. In the case of some of the predators received for trial, death took place almost immediately after emergence, this result being apparently due to the effects of cold. It will be seen below that those predators which have been bred, developed extremely slowly.

These results are not surprising when one considers that the climatic conditions prevailing in the habitat of P. lilacinus in the Far East and those of the mealybug area in Kenya are markedly different. The former are those characteristic of low altitudes in the humid tropics, with high humidities for long periods and relatively small temperature fluctuations whereas the latter are characterised by long periods of low humidity and wide temperature fluctuations consequent upon high altitudes in a continental area within the tropics.

2. Methods of experimentation with internal parasites.

(a) Observation test.

This has been regarded as the most important test. Whenever possible males and females of each species of parasite have been placed in glass tubes with a selection of mealybugs of different instars. The parasites were fed with honey water and in many cases lived for long periods. The behaviour of

the parasites was observed from time to time under a binocular microscope. The exposed mealybugs were subsequently transferred at intervals to potato shoots on which they continued development. Dissections of these mealybugs were carried out at various time intervals after exposure.

(b) Experiments in culture jars.

Whenever very large numbers of parasites were available they were placed in culture jars consisting of Diets lamp glasses superimposed on growing potato shoots infested with mealybug. In these experiments the parasites were fed on sugar and raisins and have lived for long periods (a month or more in some cases).

These experiments have provided confirmation for observations under (a) and have provided aged female parasites for dissection to discover the state of the ovaries. Dissections of mealybugs were also made subsequently in these experiments.

(c) Other tests.

Numerous deception tests have been carried out with many of these internal parasites in an attempt to induce oviposition. In some of these Pseudococcus kenyae was coated with wax taken from P. lilacinus while in others the coating material consisted of whole mealybugs ground to a powder.

In the case of some species experiments were conducted in a constant temperature cabinet, the temperatures used being similar to those prevailing in the countries of origin of the parasites.

3. Methods of experimentation with predators.

Attempts to breed predators have been conducted in large cages, in culture jars as in (b) above, and in some cases in glass tubes. The cages used were constructed of cloth and wood and were provided with glass lids. Sprouting potato tubers infested with mealybug were placed in these cages.

In the glass tube experiments about 50 mealybugs were placed in each tube. The number of predators placed in each tube varied with different species.

4. Hawaiian Material.

Six specimens of Pauridia peregrina Timb. and five specimens of Scymnus luteus (?) were obtained alive. These insects were tried on P. kenyae but failed to breed.

5. Japan.

A shipment containing two internal parasites of Pseudococcus Krauhniae Kuw. was received from Japan, but no adults were obtained alive.

6. Philippine Islands.

Nearly 5000 specimens of Pseudaphycus orientalis were obtained alive from the shipments of Pseudococcus lilacinus from the Philippine Islands. All mealybugs obtained in these shipments were placed singly in gelatine capsules and daily emergences were collected for experiments. As many as 28 Pseudaphycus were obtained from one P. lilacinus "mummy". This was the highest figure obtained. As an example of the emergences obtained, 103 "mummies" from the 4th shipment gave

909 parasites or an average of 3.8 per "mummy". These insects were active at laboratory temperatures. Copulation was observed to take place immediately after emergence.

A long series of observations were made on this insect in the presence of individuals of the various instars of P. kenyae. Oviposition was not observed. In one experiment, several specimens of P. kenyae were dusted with wax from dead P. lilacinus and these were placed with a few empty "mummies" of P. lilacinus in a tube with several specimens of Pseudaphycus. Oviposition was not observed in the disguised P. kenyae but the Pseudaphycus females were observed to examine the empty P. lilacinus "mummies" and in one case a female attempted to insert its ovipositor into one of these empty "mummies". The action was very swift. It is felt that this proves that conditions were quite suitable for oviposition, had the Pseudaphycus been inclined to ovipesit in P. kenyae.

All mealybugs exposed to Pseudaphycus were transferred at various time intervals to growing potato shoots and hundreds of these mealybugs were dissected subsequently at different times. No indications that oviposition had taken place were found and no Pseudaphycus ever bred through. Large numbers of Pseudaphycus were also placed in culture jars, as described in 2 (b) above. The parasites lived for at least fourteen days in some cases. Dissections of aged female parasites revealed that the ovaries were full of mature eggs and it is certain that few, if any, eggs had been laid. Newly emerged females were found to have the ovaries well developed with a few mature eggs present. Dissections of mealybugs exposed to Pseudaphycus in these culture jars were carried out but again the results were negative.

Large numbers of this parasite were liberated on infestations of mealybug on caged coffee trees at the Scott Agricultural Laboratories and also in one case in the open on an infestation of mealybug in a coffee estate.

Experiments were conducted at a constant mean temperature of 78°F. The insects lived for as long as 9 days under these conditions but no breeding took place.

Fifty specimens of Anagyrus lilacina emerged from material received at the laboratory. A similar series of experiments to those carried out with Pseudaphycus orientalis were conducted with this insect.

Oviposition was not observed and subsequent dissections showed that no oviposition had taken place.

Two species of Cecidomyidae and one Coccinellid sp. were sent from the Philippine Islands. Only two Coccinellids were obtained alive and as these were not alive together this insect could not be bred. One species of Cecidomyid was bred from a very small number of adults received alive. This species was found to multiply very slowly under laboratory conditions. One liberation has been made in the field.

7. Java Material.

Nine species of internal parasites were obtained from the Java shipments. Three of these species were known to be primary parasites while the status of the other species was uncertain. Very large numbers of two species were obtained and the trial of these was accordingly very thorough. Good numbers were obtained of three of the other species. Tests

as outlined in Sect. 2 above, were conducted whenever possible, the scope of the tests varying with the numbers of insects available. Observation and dissection tests were carried out with all species.

The results with all these species were entirely negative, Pseudococcus kenyae producing no response whatsoever. Dissections of aged female parasites were carried out with some species and these showed the presence of large numbers of mature eggs, indicating that it was unlikely that oviposition had taken place. With the two species obtained in large numbers, experiments were conducted in a constant temperature cabinet at a mean temperature of 78°F. but this made no difference to the reactions of the parasites.

Four species of predators were obtained from the Java material, namely, Scymnus apiciflavus, Spalgis epius, a Cecidomyid, and another Dipteron. Of these, Scymnus apiciflavus alone has been bred. It has bred extremely slowly taking about two months to complete its life cycle. At Djember, Java, these insects take 17-22 days from oviposition to adult. A total of 533 adults received in Kenya produced a second generation of only 149 adults.

It is considered that this insect will be of no value under Kenya conditions and work with it has been discontinued.

8. Ceylon Material.

One species of internal parasite was tried on P. kenyae. There was no response in the observation test until just before the parasites died at which time they were seen to examine P. kenyae with their antennae but no

oviposition was observed. None of the exposed mealybugs had any appearance of parasitism subsequently and dissections confirmed the view that no oviposition had taken place.

The predators comprised four species of Coccinellidae and a Cecidomyid. Two of the Coccinellids have been bred. In the case of the midges many deaths occurred immediately after emergence and it is considered that the climatic conditions prevailing in Nairobi at the time were quite unsuitable for the development of these insects.

9. Indian Material.

Relatively few insects were obtained alive from the Indian shipments. Three specimens of a species of Anagyrus were obtained but this would not breed. Two species of Scymnus were obtained and these are breeding slowly in the laboratory, and small liberations of these insects have been made in the field. Another Coccinellid, Brumus suturalis has not yet been found to be breeding but the adults are still alive and appear to feed on P. kenyae. Few specimens of a Cecidomyid emerged from the material and it is not yet known whether these are breeding. Four specimens of a species of Leucopis were obtained alive but these were not bred.

10. Staff.

The staff available to assist me with this work has been one trained Plant Inspector, Mr. H. Naismith Jones (part time) and two native laboratory assistants (part time).

11. Acknowledgments.

I should like to take this opportunity of thanking

Mr. H. Wilkinson, Entomologist-in-Charge, for help and advice freely given throughout the project and Mr. M. Naismith Jones, Plant Inspector, for his most able assistance.

SUMMARY.

Part I is a brief report on the journeys undertaken, with mention of the collecting done and the shipments of beneficial insects sent to Kenya.

Part II deals with the receipt of insect material in Nairobi and subsequent experimentation with the natural enemies of P. lilacinus on P. kenyae.

RESULTS OF THE PROJECT.

(1) The Kenya coffee mealybug was not identified during the extensive collecting done on the journey. It is certain that it is not a common insect in the Orient, and it is probably quite safe to assume that it is not present there. The large collections of mealybugs made, of which only a proportion could be studied microscopically on the journey, will require identification before a completely definite statement can be made.

(2) No one of the several species of primary parasites of Pseudococcus lilacinus which were successfully shipped to Nairobi would attack Pseudococcus kenyae. It should be stated that the Kenya mealybug proved not only resistant but actually immune to attack of the parasites, none of which would oviposit in it.

(3) A number of predators including a Cecidomyid from the Philippines and Coccinellids from Java, Ceylon and India were

reared for a number of generations in Nairobi, but owing to the differences in temperature between Nairobi and the localities from which they were sent, all the species bred very slowly, and it was not possible to build up large stocks of any of them. Some field liberations of certain species were made but it is not anticipated that these insects will become established.

Note by H. L. Le Pelley on reasons for the negative results.

(1) After my determination in 1935 that the Kenya mealybug was not identical with Pseudococcus lilacinus it was realised that, owing to the high degree of specificity of many mealybug parasites, the prospects of obtaining an efficient parasite for the Kenya insect were less promising. The decision to continue with the project was made on the assumption that, despite the differences between them, the insects were closely related and that one or more parasite species might transfer to the Kenya insect.

The observations made on the journey however added considerably to our knowledge of Pseudococcus lilacinus and we now know that there are not only morphological differences such as were brought out in my original description of Pseudococcus kenyae (Stylops, August 1935) but also a number of important biological differences details of which it is proposed to publish elsewhere at a later date. The conclusion drawn, as a result of this further knowledge, is that Pseudococcus lilacinus and Pseudococcus kenyae are not so closely related as was previously thought and the difference between them was demonstrated conclusively in practice by the fact that the Kenya mealybug proved completely immune to all the primary parasites of the other species received in Nairobi.

(2) With reference to the predators of which a number of species have been reared on the Kenya mealybug, the chief factor limiting their usefulness is temperature, and to a lesser extent probably, humidity. P. lilacinus is an insect that does not live ordinarily (if at all) above 3000 ft. elevation, and in the Philippines and Java its environment is marked by high humidity. The conditions of prolonged high temperatures and high humidities are not paralleled in Nairobi, and so we find, for example in the case of Scymnus apiciflavus from Java, that the insect takes approximately three times as long in Nairobi to complete its development, from egg to adult, as in its native home.

APPENDIX I.

Details of Shipments.

No. of Shipment.	From.	No. of tins sent.	Method and route.	Date Despatched.	Date Received.	Days on Journey.	Insects Sent.	Condi… ar…
				1936	1936			
1	Honolulu, T.H.	1	Air to New York, airship to London, air to Nairobi.	June 15th.	July 6th.	22	About 1000 Pseudococcus kraunhiae parasitised by Pauridia peregrina. Some Scymnus.	
2	- do -	1	Air to New York, ship to London, air to Nairobi.	June 22nd.	July 14th.	23	About 1000 Pseudococcus kraunhiae parasitised by Pauridia peregrina.	
3	- do -	1	Ship (cold storage) to Bombay, ship (cold storage) to Mombasa.	July 7th.	August 29th.	54	About 500 Pseudococcus kraunhiae parasitised by Pauridia peregrina.	
4	Okayama, Japan.	1	- do -	July 26th.	September 13th.	50	About 1000 Pseudococcus kraunhiae parasitised by Clausenia purpurea and Anagyrus subalbipes.	All mea… appeari…
5	Los Baños, [illegible]	1	Ship to Hong Kong, air to Nairobi.	October 12th.	October [illegible]th.	17	1000 Pseudococcus lilacinus parasitised by Pseudaphycus orientalis, 215 parasitised by Anagyrus lilacini.	excelle…
6	- do -	1	- do -	October 26th.	November 11th.	17	865 Pseudococcus lilacinus parasitised by Pseudaphycus orientalis, 575 parasitised by Anagyrus lilacini.	good

Date Received.	Days on Journey.	Insects Sent.	Condition on arrival.	Adult Insects Obtained Alive in Nairobi.	Results of Work.
1936 July 6th.	22	About 1000 Pseudococcus krauhniae parasitised by Pauridia peregrina. Some Scymnus.		Pauridia peregrina 6 adults Scymnus luteus (?) 5 "	Not bred.
July 14th.	23	About 1000 Pseudococcus krauhniae parasitised by Pauridia peregrina.		None.	
August 29th.	54	About 500 Pseudococcus krauhniae parasitised by Pauridia peregrina.		None.	-
September 13th.	50	About 1000 Pseudococcus krauhniae parasitised by Clausenia purpurea and Anagyrus subalbipes.	All mealybug appearing dead.	None.	-
October 28th.	17	1000 Pseudococcus lilacinus parasitised by Pseudaphycus orientalis, 215 parasitised by Anagyrus lilacini.	excellent.	Pseudaphycus orientalis 941 adults. Anagyrus lilacini. 1	Not bred in laboratory. Pseudaphycus liberated in field.
November 11th.	17	865 Pseudococcus lilacinus parasitised by Pseudaphycus orientalis, 575 parasitised by Anagyrus lilacini.	good	Pseudaphycus orientalis 1322 Anagyrus lilacini. 24	

No. of Shipment.	From	No. of time sent.	Method and route.	Date Despatched.	Date Received.	Days on Journey.	Insects Sent.	Condition on arrival.
7.	Los Baños, P.I.	1	Ship to Hong Kong, air to Nairobi.	1936 November 4th.	1936 November 19th.	16	535 *Pseudococcus lilacinus* parasitised by *Pseudaphycus orientalis*, 300 parasitised by *Anagyrus lilacini*.	excell
8.	- do -	1	- do -	November 9th.	November 24th.	16	525 *Pseudococcus lilacinus* parasitised by *Pseudaphycus orientalis*, 500 parasitised by *Anagyrus lilacini*.	excell
9.	- do -	1	- do -	1937 January 23rd.	1937 February 11th.	20	*Pseudococcus lilacinus* with about 1000 larvae of two species of Coccidoxenidae.	fair.
10.	- do -	1	- do -	February 1st.	February 19th.	19	- do -	many l adhesiv
11.	- do -	2	- do -	February 7th.	February 24th.	18	*Pseudococcus lilacinus* with about 1000 larvae of two species of Coccidoxenidae and 267 Coccinellidae.	many ad on adhes Coccino poor co

Date Despatched.	Date Received.	Days on Journey.	Insects Sent.	Condition on Arrival	Adult Insects Obtained Alive in Nairobi.	Results of Work.
1936. November 4th.	1936. November 19th.	16	535 *Pseudococcus lilacinus* parasitised by *Pseudaphycus orientalis*. 360 parasitised by *Anagyrus lilacini*.	excellent.	*Pseudaphycus orientalis* 1340 adults *Anagyrus lilacini*. 10 "	Not bred in laboratory. *Pseudaphycus* liberated in field.
November 9th.	November 24th.	16	525 *Pseudococcus lilacinus* parasitised by *Pseudaphycus orientalis*, 500 parasitised by *Anagyrus lilacini*.	excellent.	*Pseudaphycus orientalis* 1031 *Anagyrus lilacini*. 15 "	
1937. January 23rd.	1937. February 11th.	20	*Pseudococcus lilacinus* with about 1000 larvae of two species of Cecidomyidae.	fair.	Some larvae alive.	Not bred.
February 1st.	February 19th.	19	- do -	many larvae on adhesive tape.	Cecidomyidae 1 species 6 adults. Coccinellidae 1 species 1 adult.	Several generations reared; insect breeds slowly; one field liberation made.
February 7th.	February 24th.	18	*Pseudococcus lilacinus* with about 1000 larvae of two species of Cecidomyidae and 267 Coccinellidae.	many midge larvae on adhesive tape. Coccinellidae poor condition.	Coccinellidae 1 adult & few larvae.	Not bred.

No. of Shipment.	From.	No. of Containers	Method and Route.	Date Despatched.	Date Received.	Days on Journey.	Insects Sent.	Condition on Arrival.
12.	Buitenzorg, Java, N.E.I.	2	Air to Nairobi.	March 23rd.	April 1st.	10.	Aonidiella aurantii 161 larvae & pupae. Chrysomphalus dictyospermi 92 - do -	good.
13.	- do -	1	- do -	March 30th.	April 9th.	11.	Aonidiella aurantii 47 - do - Chrysomphalus dictyospermi 60 - do -	excellent.
14.	- do -	2	- do -	April 6th.	April 15th.	10.	Aonidiella aurantii 269 - do - Chrysomphalus dictyospermi 165 - do -	Aonidiella a Chrysomphalus d
15.	- do -	1	- do -	April 13th.	April 22nd.	10.	Aonidiella aurantii 30 - do - Chrysomphalus dictyospermi 118 - do -	excellent.
16.	- do -	1	- do -	April 20th.	April 28th.	9.	Experimental shipment of 39 adult parasites and thirty "mummies" in tubes.	-
17.	- do -	1	- do -	April 23rd.	May 3rd.	11.	500 Pseudococcus filamentosus parasitised in field by Parasite K. 32 adults K. 22 mummies K.	apparently satisfactory.
18.	- do -	1	- do -	April 27th.	May 7th.	11.	166 Pseudococcus filamentosus parasitised by Sp.P; 87 parasitised by Sp.Q; 12 mummies Sp.P; 18 mummies Sp.Q; 8 adult Sp.K; 100 mummies Sp.K.	good.

Date Dispatched.	Date Received.	Days on Journey.	Insects Sent.	Condition on Arrival.	Adult Insects Obtained Alive in Nairobi.	Results of Work.
[illegible] 23rd.	April 1st.	10.	Scymnus apiciflavus 161 larvae & pupae. Spalgis epius 92 - do -	good.	Scymnus apiciflavus 140 adults. Spalgis epius. 50 "	
[illegible] 30th.	April 9th.	11.	Scymnus apiciflavus 47 - do - Spalgis epius. 60 - do -	excellent.	Scymnus apiciflavus 47 Spalgis epius 30 "	
[illegible] 6th.	April 15th.	10.	Scymnus apiciflavus 269 - do - Spalgis epius 165 - do -	Scymnus excellent Spalgis fair.	Scymnus apiciflavus 235 " Spalgis epius 56 "	
[illegible] 13th.	April 22nd.	10.	Scymnus apiciflavus 30 - do - Spalgis epius 118 - do -	excellent.	Scymnus apiciflavus 22 " Spalgis epius 50 "	Scymnus apiciflavus
[illegible] 20th.	April 28th.	9.	Experimental shipment of 39 adult parasites and thirty "mummies" in tubes.	-	None.	alone bred.
[illegible] 23rd.	May 3rd.	11.	500 Pseudococcus lilacinus parasitised in field by Parasite K. 32 adults K. 22 mummies K.	apparently satisfactory.	Sp. K. 1.	
[illegible] 27th.	May 7th.	11.	166 Pseudococcus lilacinus parasitised by Sp.P; 87 parasitised by Sp.Q; 12 mummies Sp.P; 18 mummies Sp.Q; 8 adult Sp.K; 100 mummies Sp.K.	good.	Sp.K. 16 Sp.P. 1 Sp.Q. 3	

No. of Consignment.	From.	No. of tins sent.	Method and Route.	Date Despatched.	Date Received.	Days on Journey.	Insects Sent.	Condition on Arrival.
19.	Buitenzorg, Java, N.E.I.	3	Air to Nairobi.	May 4th.	May 13th.	10	250 Pseudococcus lilacinus parasitised by Sp.B. & 11 enemies; 127 parasitised by Sp.Q & 9 enemies; 85 enemies Sp.K; [illegible] 94; [illegible] 28; about 700 Cocc[illegible].	good.
20.	Malang, Java, N.E.I.	1	- do -	May 11th.	May 20th.	10	327 enemies Sp.P; 17 enemies Sp.K; about 4000 Pseudococcus lilacinus with various enemies.	good.
21.	Malang, & Djember, Java, N.E.I.	2	- do -	May 14th.	May 24th.	11	[illegible] spiniferus about 20[illegible] larvae, Coccidomyidae 2 spp. about 2[illegible] larvae, Diptera 1 sp. about 50 larvae, [illegible] of Sp.K, about 6000 Pseudococcus lilacinus with various enemies, Sp.P. 46 [illegible].	good.
22.	Malang & Lombok, N.E.I.	2	- do -	May 25th.	June 3rd.	10	About 600 enemies Sp.P. Diptera larvae, Coccidomyid larvae, several other parasites; about 5000 Pseudococcus lilacinus.	good.

Date Received.	Days on Journey.	Insects sent.	Condition on Arrival.	Adult Insects Obtained Alive in Nairobi.	Results of Work.
May 13th.	10	250 Pseudococcus lilacinus parasitised by Sp.R. & 11 mummies; 127 parasitised by Sp.Q & 9 mummies; 85 mummies Sp.K; Spalgis 96; Scymnus 28; about 700 Cecidomyidae.	good.	Scymnus apiciflavus 21 Spalgis epius 49 Sp. K. 5 Sp. P. 1 Cecidomyid 1.	
May 20th.	10	327 mummies Sp.P; 17 mummies Sp.K; about 4000 Pseudococcus lilacinus with various enemies.	good.	Scymnus apiciflavus 21 Pseudaphycus sp. 22 Sp. P. 291 Sp. K. 9 Miscellaneous parasites 2 spp. 135 Cecidomyid 1 Dipteron 1	
May 24th.	11	Scymnus apiciflavus about 200 larvae, Cecidomyidae 2 spp. about 200 larvae, Diptera 1 sp. about 50 larvae, mummies of Sp.K, about 6000 Pseudococcus lilacinus with various enemies, Sp.P. 46 mummies.	good.	Scymnus apiciflavus 28 Pseudaphycus sp. 12 Sp. P. 691 Sp. K. 14 Miscellaneous parasites 5 spp. 177. Cecidomyid 3 Dipteron 34	Scymnus apiciflavus alone bred.
June 3rd.	10	About 600 mummies Sp.P. Dipteron larvae, Cecidomyid larvae, several other parasites; about 5000 Pseudococcus lilacinus.	good.	Scymnus apiciflavus 19 ~~Pseudaphycus sp.~~ Sp. P. 142 Sp. K. 6 Miscellaneous parasites 5 spp. 87. Cecidomyid 2 Dipteron 1	

No. of Despatch.	From.	No. of times sent.	Method and route.	Date Despatched.	Date Received.	Days on Journey.	Insects Sent.	Condition Arrived.
23.	Buitenzorg. Java. N.E.I.	1	Air to Nairobi.	May 28th.	June 7th.	11.	Sp. P. 17 adults; Sp.Q. 5 adults; Aphycus other sp. 31.	all de
24.	- do -	1	- do -	June 4th.	June 14th.	11.	330 Pseudococcus filamimus parasitised by Aphycus sp.1 20 parasitised by Sp. 4 Aphycus sp.13; Sp.Q. 2; Sp.P. 14 mummies.	good.
25.	Peradeniya. Ceylon.	4	Ship Colombo to Mombasa.	July 10th.	July 21st.	12.	200 Pseudococcus filamimus parasitised by Sp.W; 7 adults Sp. W; Coccinellidae 4 spp., 347; Cecidomyid 209 larvae.	excell
26.	Coimbatore, India.	2	Train to Madras, air to Nairobi.	August 10th.	August 23rd.	14.	Coccinellidae 3 spp. 425. Leucopis 50. Parasite several. Cecidomyid 30. Anblemma 12.	material ma
27.	- do -	2	- do -	August 18th.	August 28th.	11.	Cecidomyid 50. Parasite 20 and 250 mealybugs parasitised. Leucopis 50. Hyperaspis maturalis 26, Hyperaspis Sp.1. 165. Sp.2. 150.	Good.
28.	- do -	2	- do -	August 25th.	September 4th.	11.	Coccinellidae 3 spp. 1474 larvae. Hyperaspis maturalis 8. Leucopis 95. Anblemma 22. Cecidomyid 150. Parasite 30 mummies.	1in 1 Bad. 1in 2 Good.

ed.	Date Received.	Days on Journey.	Insects Sent.	Condition on Arrival.	Adult Insects Obtained Alive in Nairobi.	Results of Work.
	June 7th.	11.	Sp. P. 17 adults; Sp.Q. 5 adults; Anagyrus other sp. 31.	all dead.	None.	
	June 14th.	11.	130 Pseudococcus lilacinus parasitised by Anagyrus sp.; 20 parasitised by Sp.Q; Anagyrus sp.13; Sp.Q. 2; Sp.P. 14 mummies.	good.	Anagyrus sp. 1. Sp.K. 1. Sp.P. 3. Sp.Q. 4.	Scymnus quisiflavus alone bred.
.	July 21st.	12.	200 Pseudococcus lilacinus parasitised by Sp.W; 7 adults Sp. W; Coccinellidae 4 spp.. 347; Cecidomyid 209 larvae.	excellent.	Sp. W. 9 Cecidomyid 139. Coccinellidae Sp. 1. 41 2. 8 3. 30 4. 73 Parasite, miscellaneous 1.	Two species Coccinellid bred.
th.	August 23rd.	14.	Coccinellidae 3 spp. 425, Leucopis 50. Parasite several. Cecidomyid 30. Anblemma 12.	material mouldy.	Anagyrus 1 Leucopis 2 Brumus suturalis 11 Scymnus Sp.1. 11 Sp.2. 16 Parasites, miscellaneous 36.	Two species Scymnus breeding.
th.	August 28th.	11.	Cecidomyid 50. Parasite 20 and 250 mealybugs parasitised. Leucopis 50. Brumus suturalis 26, Scymnus Sp.1, 165. Sp.2. 250.	good.	Coccinellid 10. Leucopis 2 Anagyrus 2 Parasite 3 Miscellaneous parasites 4.	
5th.	September 4th.	11.	Coccinellidae 3 spp. 1474 larvae, Brumus suturalis 8, Leucopis 95, Anblemma 22, Cecidomyid 150. Parasite 30 mummies.	Tin 1 Bad. Tin 2 Good.	Cecidomyid 4 Scymnus sp. 1. 11. sp. 2 4. Leucopis 1. Parasite 3. Miscellaneous Parasites 4	

APPENDIX 1.

Details of Insects Shipped.

Totals of insects obtained alive in Nairobi.

From: Hawaiian Islands.		Philippines		Netherlands Indies		Ceylon		India.	
Pauridia peregrina	6	Pseudaphycus orientalis	4,634	Scymnus apiciflavus	533	Cecidomyid	139	Anagyrus sp.	3
Scymnus sp.	5	Anagyrus Illasini.	50	Spalgis epius	235	Coccinellid Sp.1.	73	Brumus suturalis	11
Total	11	Cecidomyid	6	Anagyrus sp.1.	1,129	Sp.2.	41	Coccinellid Sp.1.	32
		Coccinellid	2	" sp.2.	7	Sp.3.	30	Sp.2.	20
			4,692	" sp.3.	1	Sp.4.	8	Cecidomyid	4
				Pseudaphycus sp.	34	Parasite W.	9	Leucopis sp.	4
				Parasite K.	52	Other	1	Dipteron	1
				Parasites (other) Sp.1.	319	Total	301	Parasites (other)	50
				Sp.2.	10			Total	125
				Sp.3.	5				
				Sp.4.	4				
				Parasites miscellaneous	59				
				Dipteron	36				
				Cecidomyid	7				
				Other	2				
				Total	2,433				

Totals:		
	Hawaiian Islands	11
	Philippines	4,691
	Netherlands Indies	2,433
	Ceylon	301
	India	125
	Total	7.561

37

APPENDIX 2.

Shipping Methods.

The first two shipments from Honolulu were sent by Pan American Airways to San Francisco; from San Francisco to New York also by air. Arrangements had been made with the Air Express International Agency to tranship and tend the parcel in New York, and they despatched the first by the Zeppelin Hindenburg and the second by R.M.S. Aquitania to England where their agents transhipped them again to Imperial Airways from London to Nairobi.

With the third shipment from Honolulu the material was taken on board the s.s. President Harrison, tended on board and packed up at the last date possible before leaving the ship at Kobe. The material was then placed in cool storage (min. 45°F.) till Bombay. Here arrangements had been made with Messrs. Mackinnon, Mackenzie who kept the material in cool storage pending transhipment to Mombasa.

The shipment from Japan was likewise tended on board the s.s. President Hayes and packed up and placed in cold storage on July 26th. This was similarly transhipped by Mackinnon Mackenzie at Bombay. ~~Both~~ These shipments were expedited from Mombasa to Nairobi by the Government Coast Agent.

The shipments from Philippines were despatched from Manila, being placed in cool storage on steamers for Hong Kong. On arrival at this port they were collected by Messrs. Thos. Cook & Son, kept in cool storage and despatched by Imperial Airways.

The shipments from Buitenzorg, Java were carried personally by train to Batavia and despatched by K.L.M. plane to Alexandria where they were transferred to Imperial Airways for Nairobi. Those from Malang were carried personally by train to Soerabaja, from there to the airport whence they were despatched by KNILM to Batavia, thence by K.L.M. to Alexandria

thence by Imperial Airways. The material from Djember was carried personally by train to Malang where it was packed with further material from Malang and despatched from Soerabaja as before. That from Lombok was carried personally by boat to Bali, by plane to Soerabaja by train to Malang where it was packed with further material from Malang and carried back by train to Soerabaja for despatch as before.

The shipment from Ceylon was carried personally by train from Peradeniya to Colombo, placed in cool storage on ship for Mombasa. From Mombasa to Nairobi it was expedited by Government Coast Agent.

The shipments from India were placed at Coimbatore on the train for Madras. They were there collected by Messrs. Thos. Cook & Son, and ~~were~~ sent by Tatas Airways from Madras finally connecting with Imperial Airways to Alexandria and Nairobi.

The insects were packed in tins measuring 6" x 4½" x 4½" between layers of absorbent tissues ("Kleenex"). The cover of the tin was at first simply fastened down all round with a piece of adhesive tape. It was found however that many midge larvae were able to find their way between the top of the tin and cover and became caught on the adhesive tape, also small mealybugs, produced on the journey by the adults enclosed in the tin as food for the predators, could escape completely from the tin at the corners where the tape did not make a perfect seal. The final method was completely satisfactory provided too many insects were not placed in a tin as was done in a few cases. After placing the insects in the tin between layers of tissue to absorb moisture generated, a piece of tissue was placed over the tin and the cover of the tin put on over it. Portions of this tissue remaining outside were cut off close to the tin and the cover and the slight external remains of this tissue were sealed to the tin with molten paraffin wax. This was then covered all round the tin by a broad piece of adhesive tape and the top and bottom

edges of this and the join were also sealed with paraffin wax. This formed an airtight and insect proof sealing and proved entirely satisfactory. The tin was then placed in a thin wooden box for protection and this was wrapped around completely with a good layer of cotton wool, and about four thicknesses of corrugated paper. The object of this wrapping was to minimise the effect of any temperary change of temperature, such as might be anticipated when the parcel had to be transferred from one plane to another. The parcel was then wrapped and addressed to the Departme t of Agriculture, Nairobi and in cases where it had to be collected en route for transhipment it was wrapped a second time and addressed to the agent performing this service. On receipt, the agent merely had to remove the outer wrapper, and the parcel was ready addressed on the under wrapper to the final consignee. In view of the somewhat complicated transhipments of such delicate material, it is gratifying to record that owing to the careful arrangements made in advance, and the efficient work of the agents throughout, not one parcel was lost or unavoidably delayed for any appreciable period, on the journey.

40

APPENDIX 3.

Diary of Journey.

1936.

June 5th	- 11th.	Journey from San Francisco to Honolulu.
" 12th	- 15th.	Oahu.
" 16th	- 20th.	Hawaii.
" 21st.		Oahu.
" 22nd	- 23rd.	Kauai.
" 23rd.	- 26th.	Oahu.
" 27th	- July 8th.	Journey from Hololulu to Kobe.
July 9th.	- 12th.	Kobe.
" 13th.	- 14th.	Yokohama.
" 15th.		Tokyo.
" 16th.	- 17th.	Yokohama.
" 18th.	- 19th.	Ninomyia, Miho.
" 20th.	- 22nd.	Okayama.
" 23rd.	- 24th.	Kobe.
" 25th.	- 26th.	Journey from Kobe to Shanghai.
" 27th.		Shanghai.
" 28th.	- 30th.	Journey from Shanghai to Hong Kong.
" 31st.	- August 2nd.	Hong Kong.
August 3rd.		Canton.
" 4th.	- 8th.	Hong Kong.
" 9th.	- 10th.	Journey from Hong Kong to Manila.
" 11th.	- 17th.	Manila.
" 17th.	- 1937. Febr. 10th.	Los Baños Headquarters, also collecting in Laguna, Batangas, Tayabas, Rizal and Cavite provinces.
Febr. 11th.	- 14th.	Baguio, Mountain province.
" 14th.	- 16th.	Los Baños.
" 16th.	- 18th.	Manila.
" 18th.	- 23rd.	Journey from Manila to Macassar.
" 23rd.		Macassar.
" 24th.	- 25th.	Journey from Macassar to Soerabaja

Febr.	25th.		Soerabaja.
"	26th.	- 27th.	Malang.
"	28th.	- March 1st.	Soerabaja.
March	1st.	- 2nd.	Journey from Soerabaja to Samarang.
"	2nd.	-	Samarang.
"	2nd.	- 3rd.	Journey from Samarang to Batavia.
"	3rd.	- 9th.	Batavia.
"	9th.	- May 8th.	Buitenzorg headquarters; collecting also in Bandoeng, Tjibodas, etc.
May	8th.	- " 10th.	Batavia.
"	10th.	-	Journey from Batavia to Soerabaja to Malang.
"	10th.	- " 11th.	Malang.
"	11th.		Soerabaja
"	12th.	- " 13th.	Djember.
"	14th.	-	Malang.
"	15th.	-	Soerabaja.
"	15th.	- " 19th.	Bali.
"	19th.		Journey from Bali to Lombok.
"	19th.	- " 22nd.	Lombok
"	23rd.		Bali.
"	23rd.	- " 24th.	Soerabaja.
"	24th.	- " 25th.	Malang.
"	25th.	- " 26th.	Soerabaja.
"	26th.		Batavia.
"	27th.	- June 4th.	Buitenzorg
June	4th.	- " 9th.	Batavia.
"	9th.	- " 11th.	Journey from Batavia to Singapore.
"	11th		Singapore.
"	12th.	- " 13th.	Seremban.
"	14th.	- " 18th.	Kuala Lumpur, Serdang, Jugra.
"	19th.	-	Penang.
"	19th.	- " 23rd.	Journey from Penang to Colombo.
"	23rd.	- July 10th.	Peradeniya; collecting also in [illegible], Hakgalla, Sigiria, Polwehera, etc.

July	10th.			Colombo
"	11th.	-	12th.	Peradeniya.
"	12th.	-	14th.	Journey from Peradeniya to Madras.
"	14th.			Madras.
"	14th.			Bangalore.
"	15th.			Bangalore.
"	16th.			Coimbatore.
"	17th.			Cotacamund.
"	18th.			Mysore
"	19th.			Mercara.
"	20th.	-	21st.	Mysore.
	22nd.			Bangalore.
"	23rd.	-	26th.	"Local leave" period.
"	27th.			Poona.
"	28th.	-	29th.	Balehonnur.
"	30th.			Mangalore.
"	31st.	-	August 2nd.	Tellicherry, Mahe.
August	2nd.	-	" 3rd.	Coimbatore.
"	4th.	-	7th.	Coonoor.
"	8th.	-	" 11th.	Coimbatore.
"	12th.			Cotacamund.
"	13th.	-	" 15th.	Coonoor.
"	16th.	-	" 26th.	Coimbatore.
"	26th.	-	" 27th.	Devarshola.
"	28th.			Mysore.
	29th.			Bangalore.
"	30th.	-	" 31st.	Journey from Bangalore to Bombay.
Sept.	1st.	-	Sept. 7th.	Journey from Bombay to Seychelles.
"	7th.	-	" 10th.	Journey from Seychelles to Mombasa.
"	11th.			Mombasa.
"	12th.			Nairobi.

APPENDIX 4.

Acknowledgments.

It would not be possible to acknowledge all the official help and personal kindness extended to me during the journey, but it is necessary to state that without this it would certainly not have been possible to complete the journey in as short a time nor cover the ground as effectively. In addition to laboratory accommodation and facilities available in every place visited without charge, many hundreds of miles were travelled also without charge in official and private cars for collecting and other duty trips. This was especially, but by no means only, the case in the Hawaiian Islands where transportation was furnished both by the United States and Territorial Governments and also by the kindness of non-official friends.

I owe official acknowledgments especially to the following gentlemen :-

Mr. L.A. Strong, Chief U.S. Bureau of Entomology & Plant Quarantine; Mr. C.F. Clausen, Senior Entomologist in charge of Foreign Parasite Introduction, U.S. Bureau of Entomology & Plant Quarantine; Professor H.S. Smith, Head of Beneficial Insect Investigations, University of California; Mr. D.T. Fullaway, Board of Agriculture & Forestry, Honolulu T.H.; Mr. S. Matsumoto, Entomologist, Agricultural Expt. Station, Okayama, Japan; Mr. H.W. Burrell, Entomologist in charge Parasite Laboratory of U.S. Bureau of Entomology Plant Quarantine, Yokohama, Japan; Mr. A.F. Fischer, Director, Bureau of Forestry (now Adviser in Natural Resources) Manila, P.I.; Dr. L.B. Uichanco, Head of Dept. of Entomology, College of Agriculture, Los Banos, P.I.; Dr. J.G. Betrem, Entomologist, Proefstation, Malang, Java; Dr. J. van der Vecht, Entomologist, Instituut voor Plantenziekten, Buitenzorg, Java; Mr. H.C.E. Miller, Entomologist, Dept. of Agriculture, Kuala Lumpur, F.M.S.; Mr. J.C. Haigh, Economic Botanist, Dept. of Agriculture, Peradeniya, Ceylon;

Mr. M.C. Cherian, Entomologist, Agricultural College, Coimbatore, Madras; Mr. C.C. Mansbridge, U.S. Bureau of Entomology & Plant Quarantine, Honolulu T.H.; Mr. L.A. Whitney, Division of Plant Inspection, Honolulu T.H.; Mr. K.K. Nishimura, County Extension Agent, West Hawaii T.H.; Mr. R.K. Pahau, Superintendent, Experiment Station, Kona, Hawaii T.H.; Mr. C. Akiyama, Chief Plant Inspector, Imperial Plant Quarantine Service, Kobe, Japan; Mr. A. Kumito, Imperial Dept. of Agriculture, Tokyo, Japan; Dr. S. Kinoshita, Chief Entomologist, Imperial Agricultural Expt. Station, Tokyo, Japan; Mr. K. Sato, U.S. Bureau of Entomology & Plant Quarantine, Yokohama, Japan; Mr. H. Green, Superintendent of Botany & Forestry, Botanic Garden, Hong Kong; Mr. T. Twemlow, Dept. of Botany & Forestry, Hong Kong; Dr. Metcalf, Lingnan University, Canton, China; Professor H. Gusner, School of Forestry, Los Baños, P.I.; Professor H.M. Curran, School of Forestry, Los Baños, P.I.; Professor A de Mesa, Entomologist, School of Forestry, Los Baños, P.I.; Mr. G.Merino, Bureau of Plant Industry, Manila, P.I.; Mr. A.M. Cenabre, Forester-at-large, Bureau of Forestry, Manila, P.I.; Mr.M.B. Farrar, Managing Director, J.A. Wattie & Co., Soerabaja, Java; Dr. P. van der Goot, Director, Instituut voor Plantenziekten, Buitenzorg, Java; Dr. J. Schweizer, Director, Proefstation, Djember, Java; Dr. H. de Fluiter, Entomologist, Proefstation, Djember, Java; Mr. R.E. Holttum, Director, Botanic Gardens, Singapore, S.S.; Dr. J.C. Hutson, Entomologist, Dept. of Agriculture, Peradeniya, Ceylon; Mr. H.T. Pagden, Entomologist, Dept. of Agriculture, Kuala Lumpur, F.M.S.; Mr. R.C.Broadfoot, Principal, Agricultural College, Coimbatore, Madras; Mr. V.A. Subramaniam, Asst. Coffee Scientific Officer, C.P.A.S.I. Balehonnur, Mysore; Mr. T.V. Subramaniam, Entomologist, Agricultural College, Coimbatore, Madras; Dr. N.S. Shaw, Tea Experiment Station, Devarshola, Nilghiris, India; Mr. L.H. Foulds, British Consul General, Manila, P.I.; Mr. McDermot, British Consul, Manila, P.I.; The British Consul General, Batavia, Java; The Staff of Imperial

Mr.S. Ramachandran, Agricultural College, Coimbatore, Madras;

Airways in Nairobi; The Government Coast Agent, Mombasa; Also to Sir Guy A.K. Marshall, Director, Dr. W.R. Thompson, Asst. Director, and the staff of the Imperial Institute of Entomology, for helpful advice and for the identifications of insects.

AIR MAIL

KENYA
No: 666

RECEIVED

GOVERNMENT HOUSE
NAIROBI
KENYA

6 November 1937.

Sir,

(10) on 38047/36

I have the honour to refer to Mr. Thomas's despatch No.265 of the 23rd April, 1936, in which it was intimated that sanction had been accorded to a free grant from the Colonial Development Fund of a sum of £1,400 to provide for research in connection with the control of the Kenya Coffee Mealy Bug.

2. As you are aware, this scheme (Serial Number 411) involved the visit of Dr. Le Pelley, of the Kenya Department of Agriculture, to the Philippines, Java, Malaya, Ceylon and Southern India, with the object of searching for the original home of the Kenya Common Coffee Mealy Bug and of investigating its natural specific parasites with a view to their introduction into Kenya for the biological control of this pest.

Copy to Treas 4 Financial (9)

3. I am advised by the Acting Director of Agriculture that a report will shortly be submitted which will show that the search for the natural enemies of the Common Coffee Mealy Bug in the Far East has not been successful. The Acting Director of Agriculture states:-

"The reason for this failure lies mainly in the fact that the two mealybugs, Pseudococcus lilacinus and Pseudococcus kenyae have proved to be specifically far apart. This in itself is an important discovery when it is recalled that these two mealybugs have gone under the name of P.lilacinus until quite recently. This

marked/

The RIGHT HONOURABLE
W. ORMSBY GORE, P.C., M.P.,
SECRETARY OF STATE FOR THE COLONIES,
DOWNING STREET,
LONDON, S.W. 1.

"marked specific difference accounts largely for the failure of the parasites from the Far East to attack the Kenya mealybug.

2. There is now evidence to suggest the strong possibility that Pseudococcus kenyae is indigenous in Africa. This species of mealybug is recorded from Uganda and from Bukoba in Tanganyika and it is highly likely that it exists in the Belgian Congo as well. It is now certain that this mealybug is an introduced pest in the Central Province of Kenya and it is believed that the reason for the difference in the status of the pest in Kenya on the one hand and the Central African countries on the other is that in the latter it is controlled by natural enemies and in Kenya it is not so controlled. It is now proposed to carry out a detailed investigation of the pest in Uganda and Bukoba as well as a search for it in areas in the Congo with a climate similar to that of the Central Province of Kenya. The aim is to find the indigenous habitat of this insect and to introduce natural enemies attacking P.kenyae to the mealybug area in Kenya.

3. It can be stated here that the case for a campaign of biological control is now even stronger than before. Pseudococcus kenyae, an introduced insect, is confined to a well defined area or "climatic island" in the Central Province of Kenya, thus offering ideal conditions for this method of control. It is not necessary again to point out the seriousness of this pest to the Coffee Industry but a recent survey of Native Reserves in the Central Province has

shown/

"shown Pseudococcus kenyae to be a severe pest of native food and cash crops over an extensive area. In some areas yams have gone out of cultivation completely, and pigeon peas suffer considerably from this pest. Cotton, wherever it is grown in the mealybug area, is open to serious attack by Pseudococcus kenyae. The indications from this investigation are that much of any native coffee grown in the Central Province is likely to suffer in due course from this mealybug. The Embu experimental coffee area has mealybug but it is not at present a pest because the attendant ant, Pheidole punctulata, is not yet in the coffee, though as this area (at 5,000 feet) is well within the range of this ant it is expected that Pheidole punctulata will ultimately appear in the coffee area and that the mealybug will then become an important pest.

4. In the case of the Meru experimental coffee areas the mealybug has not yet appeared though climatic conditions appear to be favourable for it, and Pheidole punctulata has been found to be present already. When the mealybug spreads to this area it is likely to become an important pest. It is felt that this survey has at least doubled the importance of P.kenyae as a pest in Kenya".

4. In the circumstances it is now proposed to send an Entomologist (Mr. Melville) to Tanganyika Territory and to the Kampala and Bukoba Districts of Uganda, and afterwards to the Belgian Congo for about four months. He is

likely/

49
END

likely to be absent from the Colony for six months in all, and the estimated cost of the proposal is as follows:-

Motor car allowance:	£150.
subsistence:	140.
Incidental expenses:	50.
TOTAL.	£345.

Dr. Le Pelley would remain at headquarters to handle the material forwarded by this Entomologist.

5. There remains from the original Colonial Development Fund grant an unexpended balance of £145, and I shall be glad if sanction can be obtained to utilize this amount towards the cost of the proposed visit to the Belgian Congo.

6. Every endeavour will be made to provide the balance of the cost of this visit and of the visits to Uganda and Tanganyika Territory within the sum allocated to Coffee Team Services in the draft Estimates for 1938.

I have the honour to be,

Sir,

Your most obedient,
humble servant,

R B Brooke Popham

AIR CHIEF MARSHAL

GOVERNOR.