



Hunt Institute for Botanical Documentation
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About the Institute

The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

Cedar Grove,

Jan 25th 1939

Dear D. Popper,

We had been hoping to see you in Jamaica before this but it looks as though you have really deserted us. I heard that you were in the States and expected that you would call in here on your way South. I hope that you found the family well and spent an enjoyable Christmas.

As you are probably aware the folks here got a bit excited about Deep Spot towards the end of last year and about that time Messers Remondy & Polhan dropped in along with Dunlop. They spent about a week here and then pushed off to Honduras. They seemed very happy about our own farms in St. Catherine's.

Dunlop came back about a month ago along with Baldwin and they are at present making a tour of the island along with Mr. Shawne to see if any of these large banana growers can be taught how to handle *Gueneoforma*. There is no doubt about the fact that *Gueneoforma* has moved fast during the past few months and it looks very much as though our original estimate of 5 to 10 millions eventually is the correct one. Last year they piled up \$4,000,000 and this year I expect a drop of 9 to 10 millions.

Mr. Shawne has been transferred to the

general staff and is going to try to help out the independents. I am glad he got a break but we shall miss him a lot in St. Catherine's. We are awfully short of reliable men in Jamaica to my mind and a man like Mr. Shawne is bound to be missed.

Lucius had a disappointment in his home affairs & went all to pieces. He moped about for a week & then I asked Mr. Bradshaw to send him home. He was utterly useless to anyone the way he was. He is due back early next month & I hope he's snapped out of it by his time.

I sent three copies of our annual report to Mr. Bradshaw so I expect that you will have received a copy ere this. You will notice that we plan to do some research work on alkaline areas & although we have been going only a short time they look fairly promising. The boss has bought us a good lot of equipment & we are now equipped to do complete soil analyses. Although it was about 15 years since I did my last one I find I am getting back into it pretty fast. We are doing a lot of routine determinations of total soluble salts, chlorides & sodium. Although the sodium content at 26 inches of our good banana areas runs only about 50 parts per million we have pretty fine bananas now growing & fruiting on areas with 200 parts per million. Of course they won't be comparable with our best lands as regards fruit quality but they will be a lot better than much of the fruit we buy & ship.

I have been trying to get Dunlop out here for a day
to go over some of these soils but so far I've had no
luck whatever.

Our *Puccinia* studies are coming along well & we
are learning more things about it all the time. There is no
doubt about it to my mind climatic factors are responsible
for a partial control in St. Catherine's. I hate to make much
of a man in it at present because many of my statements
appear to be misunderstood either by accident or design.
It is perfectly true that if you do nothing in the way of
control even in the dry areas you will get no harvest.
The same thing applies to irrigation on any other farm
operation. However we would be very foolish if we
went on irrigating when it was raining about 7 inches
per week and we would be foolish if we applied large
amounts of fertilizers to good virgin soils. What we are
doing in Jamaica right now is to maintain a rigid three
week cycle with 5-5-50 Bordeaux even in areas
where there is little disease. Smoothing one cycle per
year saves us \$8,000 and you can hire a lot of
disease inspectors for \$8000. What I have been fighting
is the local attitude of rule of thumb. The farmers people
here would be content to spray on a three week
cycle with 5-5-50 Bordeaux for ever because once
it becomes a routine little on no supervision is given

However with development I am hoping that this year
we will be permitted to loosen the concentration on some
of our areas and save a bit of money. The boss is
openminded about it but naturally does not want
to do anything which may jeopardize the final
quality of St. Catherine's

I will close now. I am very busy and glad
to say we are all fit. Tolere had a daughter
last week. A sort of biological lesson.

Yours As ever,

Alfred H. Sully

Notes on Cercospora musae based on observations at Cedar Grove

Experiment Station, 1937 to 1940

Alfred F. Butler

The conditions most favourable to the germination and growth of conidiospores are:

1. Presence of abundant infection in the immediate vicinity.
2. Continuous supply of free water on leaf surfaces for 15 hour periods in quantities insufficient to carry away the free spores and fruiting bodies.
3. Temperature of 80 F.
4. Humidity never falling below 70%.
5. Roots of bananas located in soils of high available moisture content.

.....oo.....

Any deviation from the above results in increased mortality rate of conidiospores and less infection.

Conditions Nos. 2, 3, and 4 apply at all times of the year to the newly-developing or "unfurling" banana leaves. These take about ten days to develop in St. Catherine, and during that time possess all three requisites favourable to germination and penetration by the fungus. Whether or not they become infected depends largely upon conditions Nos. 1 and 5. In 300,000 observations made at Cedar Grove since May 1937, only 15% of all infection occurred during this first 10-day period in the life of the leaf, showing up on the leaves not more than 35 days old. In a sprayed area the liquid containing the spores, which drips from the infected leaves into the funnel of the new leaf, contains copper ions in sufficient quantity to prevent germination of the spores. In an unsprayed

area this is not true, of course; and in areas that are badly diseased, infection of the unfurled leaf occurs at all times of the year.

The following notes contain all the information at present available regarding the limiting factors governing germination of the conidiospores and penetration of the fungus.

Free Water on Leaf Surface

Conidiospores of Cercospora musae seem unable to germinate unless completely surrounded by free water. Too much water such as occurs during heavy rains flushes them off the leaves and in addition removes some of the spore-producing bodies from the Cercospora spots themselves. Conidiospores germinate best in the banana leaf juices. When there is free water on a leaf surface such as occurs during periods of light rains and heavy dews, osmosis occurs over each stoma and the leaf becomes covered with globules of weakened leaf juices. These globules may be observed with a lens or low-powered microscope during the night or early morning. If these globules are collected and sterilised by boiling they assume the same dark brown color as a weak leaf infusion, whereas dew collected on glass plates and sterilised in the same way remains colorless. Germination of conidiospores in sterile dew is much slower than in sterilised leaf moisture.

The time required for the germination of conidiospores is dependent upon

Temperature

At 80 F. germination of conidiospores freshly removed from the conidiophores is 10 to 12 hours in a sterile leaf infusion or sterilised leaf moisture. Extending the temperature above or below 80 F. increases this period considerably and germination ceases altogether above 95 F. and below 50 F. This means that the conidiospores must be surrounded by leaf moisture for a period of 10 to 12 hours before germination can occur

under even the most favorable conditions of temperature. Where conidia-spores fall upon a leaf immediately above a stoma, penetration by the germtube is almost coincident with germination. Where placed equidistant between two stomata some 4 to 5 hours growth of the germtube is essential before penetration can take place, even under optimum conditions of temperature. On leaves examined in St.-Catherine, stomata are spaced 120 to 200 microns apart on the upper surface and 65 to 100 microns apart on the lower surface. Conidiospores which had been exposed to six hours of humidity below 60% after removal from the conidiophores required just about double the time to germinate, and those subjected to six hours of temperature at 110 F. failed to germinate. After germination the germtube continues to grow until it finds an open stoma. The speed of growth is governed by temperature and is greatest at 80 F. Growth ceases at 50 F. and above 95 F. and a temperature of 110 F. for six hours is sufficient to destroy it. Growth of the germtube is also controlled by

Humidity.

After germination, the germtube of the conidiospore continues to grow if temperature is favorable and humidity does not fall below 70%. Below that figure growth ceases and exposure to humidity of 50% for one hour destroys the germtube. Humidity also has a controlling influence on infection through its action on the stomata. Penetration by the germtube occurs only through the stomata and can take place only when these are fully open. The stomata of the banana leaf open and shut in accordance with the relationship between relative humidity of the atmosphere and

Available Soil Moisture.

Where this is high, stomata remain open even below the 70% limit for growth of the germtube. Where the available soil moisture is low, the stomata close at 90% humidity. The actual humidity figure at which the

stomata close will vary with every soil, but in a general way is higher for clays than loams. In a light clay soil at Watson Grove a difference of 5% in moisture content is sufficient to change the humidity figure at which stomata close from 60 to 85%. Once shut, stomata do not reopen until the balance between moisture intake by the roots and transpiration through the leaves is again established, and in the case of a Watson Grove soil having a moisture content of 20%, this did not occur until after 4 hours of humidity at 100%. The total water holding capacity of this soil was 40%. This means that soils of high available water capacity keep the stomata open at low humidities, and penetration by the fungus is possible at any time that humidity and temperature are favorable for the growth of the germtube - that is, 70% humidity or higher, and temperatures between 50 and 95 F. With soils of lower water-holding capacity, the stomata are frequently closed when conditions for development of the germtube are still favorable. Thus under average conditions the time available for penetration by the germtube is greater on soils of high available moisture content than on soils of low available moisture capacity.

After penetration by the germtube has taken place, humidity exerts little influence upon the development of the fungus until the second epiphyllic stage when mycelium grows out through the stomata onto the surface of the leaf for the purpose of enlarging the spot. This occurs about 15 days after infection and under the most favorable conditions the entire leaf surface is covered with mycelium and "burned" patches appear in about 8 days. Where the periods of favorable humidity are broken by low humidities the mycelium growth is much slower and the spots remain small and individual. This second epiphyllic stage is the one most susceptible to spray control.

Production of conidia occurs only under conditions of 100% humidity and is fastest at temperatures of 70 F. At this temperature conidia are fully developed in 10 hours. At higher or lower temperatures the period is longer and production of conidia ceases entirely at 45 F and 100 F. Conidia remain firmly attached to conidiophores and we have been unable to remove them by air movements of a velocity normally experienced in banana farms unless they are covered with water. If the globules of water in which spores are suspended are blown off, the spores are naturally carried with them. This is possibly the explanation of the observed circumstance that infection rarely appears to be carried more than 30 or 40 feet from its source.

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Cedar Grove,
Sept 25th 1941

Dear Dr. Popenoe,

I had intended to write you the news from Jamaica but as Greene will be with you in a few weeks he can give it to you direct. He is fairly familiar with our latest developments in the leaf spot research. I think they are quite promising but we are keeping our fingers crossed.

Greene is leaving on October 7th for Trinidad. He is looking forward to it, as he should. This is a good opportunity for him to demonstrate what he can do & is the only way I know of discovering whether he has any real ability.

From what I remember of R.H.G. & his mango trees, he had better be good. His ability as a propagator is an unknown quantity but as you say he has had the training for it and should be O.K. You are going to be with him for some time I gather & can direct his efforts. Building up

a nursery of one kind of plants should
be child's play to anyone who has had
any real horticultural training. Anyway
I hope it turns out alright for all
of us. You reckon put us on a spot by
saying that Mr. Beadatan & I would
know best whether he can handle his
kind of a job. If we said no it would
count his style. If we say yes we
get kicked in Fall if it doesn't
work. So Re hors & I said yes
& kept our fingers crossed. So if
he slips don't let anyone know till
Re hors & I are ready to go on
pension, will you?

I had been hoping that you
would have been able to pay us a
visit before this. From what I can
see of the present state of the banana
industry here it needs someone to
do a little "expentin" around here.
My laboratory is nicely fixed
up here and we are doing a lot
of interesting work which I hope
may pay a few dividends one day.

But I find it increasingly hard
to supply all the ideas without
contact with others once in a
while. Last I get together
about once a month & have a
real session & now and then the
Boss comes out and gets himself
reacquainted with our latest
developments. I rather like that
because I can spread myself
a bit & know that the questions
he asks have got to have good
sound replies. So if I can
supply convincing arguments on
these occasions I feel assured
that my logic is good.

The business industry is
steadily slipping. They have
shipped about $4\frac{1}{2}$ million steels
to Canada & the U. S. This year &
have purchased a little over 12

millions. But the stuff they have bought has been terrible even for Jamaica. I cannot see more than 5 million reasonably good stems for next year. The whole business is nature depressing. Leaf spot is continuing its steady stride & rust spraying as is being done is pretty awful.

I often wonder how Sancti Spiritus is going these days. It must have come to life again. I should like to see it again one day but I hardly expect to. The job in Ecuador should be something like our efforts at Sancti Spiritus because even a cocoa nursery can be made to look attractive & one should propagate a few other plants on the side.

I had a very pleasant & welcome surprise this week. The boy wrote me a letter note that my

salary had been increased by
a substantial sum. It was
jolly refreshing for not only was
I glad of the money but also
glad to know that they didn't
regard me as a "pensioner". I
have had the rather depressing
feeling at times that they did
not rate my expectancy very
high and therefore could not
afford to waste time grooming
me for anything better. Getting
a boost always that feeling & gives
me a new initiative. If I can
only work out a spraying system
that saves the company about
1 million a year I shall be
really happy.

Jalene wrote to Mr. Popenoe.

The other day I guess she gave her
all the local scandal so far as we
know it. Hengell came down from
the states for a weeks leave the
other day previous to returning to
active service. He looked so fit
& happy that I felt a little envious of
his two whole legs. Box is out of
the army and is off to West Africa
for the Colonial Government. You
probably knew that already. I am
surprised that they got him out of
the army for in The London Daily
Mirror the other day there was a
photograph of Box & others marching
in company with some very nice
females in WRAF uniforms at
some parade. Sort of thing makes
war less dead than it used to
be I guess.

Hope to see you soon.

As always,

Butler

Antigua, Guatemala, 9 October 1941

Personal

Mr Alfred F Butler,
United Fruit Co.,
Kingston, Jamaica.

Dear Alfred:

Yours of Sept 25th has just come. Welcome as always. And it so happens that it has arrived just at the first moment I have had an opportunity to write you in a long time. I have been on the road almost steadily since the first of the year. This last trip, five countries in five weeks, almost took my breath away. I was asked to serve as a member of a committee of three which was charged with the responsibility of reporting on sites offered by Brazil, Venezuela, Ecuador, Costa Rica, and Salvador, for the proposed Interamerican Institute of Tropical Agriculture. This institute is a pet project of Vice President Wallace and promises to be a fine thing. The only hitch I can see is the personnel problem. There are not nearly enough technical workers in agriculture available for all the tropical jobs which are in the offing.

I had wanted to write you about Griggs, but figured that there was really no need of so doing. He has a real opportunity down there in Ecuador. I have been thinking that I might be able to go down next spring and help him get under way; and there is still a chance of this, but a radiotelephone call from Mr Pollan yesterday puts new light on my own plans and I may not be able to get away.

I think you know something about Mr Zemmurray's pet project - an all-Central-American agricultural school, to be located probably near Tegucigalpa. They have been looking around for a man to organize and develop this project and now seem to have decided that it is up to me. I rather like the idea, myself. It will be another Lancetilla on a glorified scale, for we shall build up collections of economic plants as well as a school. The Company means business and I don't think financial support will be lacking.

How I wish that you were going to be with me on this job! It will probably be the last piece of major tropical development work I will undertake

for the years are rolling by; and I believe we can make something good of it. A combined school and experiment station, I hope. It probably means dropping out of bananas but that doesn't worry me; I haven't had much to do with them for the past couple of years anyway. Dunlap will doubtless handle all Company research, a job into which he has been developing during these past years, as you know. With the present policy of de-centralization I don't suppose there will be any change at all in your own set-up. You know how things are set up at present and I have heard no intimation of any change.

Returning to brother Grieve: I didn't mean to put you and Mr Bradshaw on the spot, by suggesting that you were better qualified than myself to say whether or not he can handle the cacao job. I felt a bit vague regarding his knowledge of propagation, for I have never seen him do any of this work, and I thought perhaps you could give a better opinion than I. So far as I know, he has not done anything along this line in Jamaica; but he must have had pretty good training in Scotland, and after all, who else have we in the Company who has done anything along this line, except yourself, and I knew it would not be the job for you - nor would I have dared suggest you for it, in view of the important unit you are handling in Jamaica. You are doing a fine and important job there and if you are to be moved, somebody else will have to be responsible for making the suggestion!

As you say, it won't be a bed of roses down there in Ecuador. Jefe Davis runs Tenguel and you and I know from experience that he is not the easiest man in the world to work with. But I think Grieve is better adapted to the situation, by experience in Jamaica, than any one else would be.

Yes, Lancetilla has come to life again, and is mighty attractive. Ed Stanwood has tremendous rubber nurseries all over the place, and the old trees of all sorts are mature and very interesting. From the standpoint of climate the place is and always has been too wet for many fruit trees and I hope when we choose our new location in Honduras (for the school) we will be able to do more with such things as avocados and mangos and citrus than we could do at Lancetilla. But in my opinion, the latter has been a mighty good investment and I think it will carry on now, indefinitely.

Dont thinkmy taking up this school development will stop my interest in bananas. I hope to hear from you as in the past, and to keep more or less in touch with bananandevlopments in general. As ammatter of fact, Mr Pollan told me yesterday that the Company would still continue to send me off on trips from time to time, as they have been doing these past few years. Supply and demand will control this I suspect.

Congratulations on your "rise" as you boys pgt it. I am sure it was well deserved, and Mr Bradshaw is the sort of man who would see that you got it. You have a splendid set-up there, and when I look back on the origins and the history of that development I feel a certain satisfaction. You have made a real place for yourself and you arent through yet. One of these days you must take a few weeks off and come back to Central America for a visit. There are a lot of things over here which would interest you.

With this school on my hands I dont know when I will visit Jamaica again but I suspect that I will get there eventually. There really isnt much to be gained by visits from outsiders like myself, now. Looking back over the develop-ments of the past 15 years, it seems to me that al l the Divisions are now so well staffed, and the agricultural technique is in general so uniformly good, that the needs are quite different from those of 1925. Maybe some day another catcylism like Sigatoka will hit the industry, and cause us all to take a hitch in our trousers and start off along new lines; but for the present it seems to me things are well organised, well operated, and if the war doesnt hit us too hard we ought to go ahead very nicely.

We are mighty glad Teddy Box has pulled through so far, and seems likely to survive this nasty business. Gordon Smith's younger son has just been here, for a few days before going over to takeup active service in the RAF - has has been training in Canada for a year. By the way, Gordon (I think you knew of him, at least) died a few weeks ago. We shall miss him greatly. Ed Cobb passed out, too; I have no doubt you have heard. Heart trouble I believe.

Our regards to all the friends over there. I'm going to write Croucher soon.

Ever yours

11
Bedford Grove,
Gregory Pk P.O.

Oct 24th 1941.

Dear Dr. Popovici,

I was glad to get your
air mail letter written while in
Antigua. I am glad to see that you
have finally been able to snatch
a couple of weeks rest. However I am
sure that the various trips even
though exhausting must have been
extremely interesting & knowing you
as I do I am sure you just loved
them.

Demlap was through
here two weeks ago and told me
lots of the news about Honduras. He
even told me about his marriage.
After the eighth didn't he couldn't
keep it a secret any longer. He
has gone into marriage as a good
research man should, securing all

important facts in advance.

I was interested in the school project and I am sure you are going to have a really interesting time of it. Dunlap told me that he intended to try to get a trip for me to Honduras so if that materialises I will write you in advance and then perhaps you could arrange for Mr. Trumbull to send me up to Tegucigalpa. However that is if the trip materialises.

I had an airmail letter from Guene from Trinidad. He is apparently having a good time and an interesting one. He is planning to leave for Ecuador about October 31st.

How true is the French. The folks in England have asked me to

get them some vegetable seeds.
Apparently the ones they are getting
are poor; probably the seeds don't
like being soaked with water to put
out insecticides. Anyway whatever
the cause they don't care much about
the seeds they are getting. Due to
currency regulations I cannot
obtain funds to make these
purchases in the states. So I
am wondering if you would like
to make me a present of a
parcel of vegetable seeds from
Hastings to be sent to

A. G. Powell

Estace Hill,

Estace Hills.

I am probably breaking at least
18 different regulations by asking
you to do this and I may land up
in jail. However in view of the

fact that we are going to use your
money to buy the seeds I shall
not get more than six months I
am sure. The following is a likely
list Peas, Beans, onions, Carrots,
Turnips, Beet, Cauliflowen, Broccoli,
Cabbage, Tomatoes, Lettuce,
Parsnips, Vegetable marrow. Also
1 package of Turnips. When you
come to Jamaica again I will hum
ourds and ask W. F. V. Smith
if I can buy you drinks to the
extent of my indebtedness
without going to jail.

Anything you can do
will be much appreciated.

Best of luck,

As ever,

Dutley.