Revenue (1897) Department.

PRESS SERIES.

G.O., No. 279

Dated 28th April

[Despatch Abstract.]

Recording with remarks Board's Proceedings submitting report on the Sugarcane disease.

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.
	3633/98 - 422/8-99						
	4464/98						

Revenue (1899) Department.

CURRENT No. 2313

Before determining what action (if any) should be taken in the directions suggested in para 9 of Mr. Barber's enclosure letter, Govt. also desire the further report which he promises after he has inspected some of the districts in which sugarcane is largely cultivated.

H.W. 24-4-99

Order

Leg

From

The Board of Revenue
Rev. Sett: L.D. & Agri
Madras.

No. 97 Proc.

Dated 29th March 1899.

Received } 5/4/99
Registered }

Enclosures 3

Spare copies

With this Proc. the Bd submits with its remarks a preliminary report by Mr C.A. Barber Govt Botanist in reply to G.O. 720 & 16 Feb 99 (C) in which Mr Bourne & Mr Benson reports on Sugarcane disease in Godaveri were referred to him. A printed copy of the pp is flagged X.

Submitted that the Govt may agree with the Bd's remarks in para 3 of the covering. It does not seem necessary to carry out any elaborate microscopical examinations at present.

H.W. 21/4/99 Geo. 21/4/99

SUBJECT,

Sugar cane.

Submitting, with remarks for the information of Government report from Government Botanist regarding disease in ——.

W 22/4

BACK PAPERS.

G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.

(Sett. 13—2,000—25-4-98.

REVENUE BOARD OFFICE MADRAS

Proceedings of the Board of Revenue

(Revenue Settlement, Land Records and Agriculture),

Dated 29th March 1899.

No. 97 Revs.

Read letter from C. A. Barber Esquire, Government Botanist, Madras, No. 67, dated 22nd March 1899.

Copy attached.

Resolution

The report read above will be submitted for the information of Government with reference to G.O. No. 720 Revenue, dated 16th February 1899.

2. On the receipt of G.O. No. 719 Rev: of the same date, the Board requested the Government Botanist to undertake the local enquiries which it had pointed out in its Proceedings no: 311, dated 22nd August 1898, should be made by an expert to determine whether the disease reported by the Reve-

officers to exist in almost all districts is the Trichosphaeria saccharii n no. This work Mr. Barker has recently commenced, and he is visiting the more important cane growing centres in Bellary, Coimbatore and Trichinopoly. The absolute necessity for such an investigation is shown by the remarks made in para 3 of the letter read above.

3. It will be seen that Mr. Barker does not doubt that the Trichosphaeria saccharii is established in Godavari, but he points out that there is a good deal of divergence of opinion regarding the disease itself. Paras 5 and 6 of the above report will be referred to Dr. Bourne for favour of remarks on the question whether, in the Godavari the disease is, or is not, parasitic. As regards other localities, it will be for the Government Botanist to decide the question in the course of his investigations. These investigations will also gradually determine the question whether this Presidency possesses any varieties of cane that are not attacked by this fungus. Until this point is determined, it does not seem necessary or advisable to undertake the wider investigation suggested in the concluding para of the report. Should it seem advisable to carry out such an investigation, the matter is of such general interest that the assistance of the Government of India may, it is suggested, be obtained.

4. In connection with this subject, the Board begs to submit for perusal the supplements to the Leeward Islands Gazette Nos. XXIX and XXX of 1894, from the the Library of this Department, which contain information regarding cane disease in the West Indies and of the measures taken to combat them there,

one ... by the

one paper being written by
Mr. Barber.

(True Extract)

C Benson

For Secretary.

To

The Secretary to Govt. Revenue Deptt.
with 2 papers to be returned.

Dr. A. G. Bourne F. R. S.

Copy to the Government Botanist, Madras.

MC.
3.4.99.

No. 67

Government Museum,
Pantheon Road, Egmore.
Madras 22nd March 1899.

From

C. A. Barber Esqr.
Government Botanist
Madras

To

The Secretary, Board of Revenue
Revenue Settlement, Land Records and
Agriculture

Sir,

In reply to Proceedings of the Board
of Revenue, No. 1140 Mis, dated 24 February 1899,
C forwarding Government Order, No. 720. Mis, dated
16th February 1899, referring Certain papers to
the Government Botanist and Proceedings
of Board of Revenue, No. 1091, dated 23rd
February 1899, forwarding Government Order,
D No. 719 Mis, dated 16th February 1899, Suggesting
that the Government Botanist might be

On the question of Cane disease, I have the honour to make the following remarks. I do so before having seen any Cane cultivation in the Presidency, understanding that the Board desires me to send an immediate answer. Further remarks may be expected after the visit projected in Proceedings of Board of Revenue Nº 1454, dated 16th March 1899 para 2 have been made.

Passing orders on the Govt. Botanist's report on the sugar-cane disease, Godavari, and requesting him to visit certain other districts and report the prevalence of cane disease in those districts.

2. It is true that I have had considerable experience in Cane disease investigation in the Leeward Islands. It is now four years since I left that Colony but I made a Special Study of the whole question of disease of the Sugar Cane - especially the Java work - after my return to England. I propose to forward for the information of the Board such papers as I have published on the Subject as soon as I get them unpacked

Yes. Sir, it is referred to in para 4 of B.P. 1457 dd 11-3-99 laying down a programme of work for the Govt. Botanist. The orders on this B.P. is being issued under ms. as 7-4-99. Go 232 dd 7-4-99 is forthwith below.

B

3. From the perusal of the papers before it appears to be undoubted that the "Rind fungus", Trich. sp. also the Trichosphaeria Sacchari is to be found on the Canes in the Presidency. At the same time the occurrence of red spots and areas in the tissues must not be regarded as diagnostic of its presence because in Canes attacked by almost any of the numerous vegetable and animal parasites, one of the first signs of ill health is this red Coloration of the tissues.

4. There are it is probable many other fungi attacking the Cane besides Trichosphaeria and a Study of these would undoubtedly prove of great interest and advantage. From Dr Bourne's description, I judge that Colleto trichum falcatum (probably erroneously Called a "root-fungus") is present among the Canes as well as Trichosphaeria Sacchari These two forms Massee regards as different stages of the same fungus. This view is however, strongly opposed by the Java-Botanists, and to be deploring their eminence as fungologists a prosecution [illegible]

been Studying Cane diseases Continuously for many years past in the fields themselves, their protest Cannot be ignored. It is probable in my opinion that Colletotrichum falcatum and Trichosphaeria Sacchari Cause entirely different diseases.

5. The "rind fungus" is Spread over the whole Sugar growing world and its presence in the Madras Presidency was a foregone Conclusion. It appears however to vary in the intensity of its action and there is considerable doubt in many quarters as to what part it really plays in the fields. In the West Indies it is universally distributed and is Said to be and probably is a dangerous parasite. There appears to be Some doubt in Mauritius whether it is really parasitic (i.e) killing and then feeding upon the cells of the plant, or Saprophytic i.e. living upon cells already killed by Some other agent. In Java lastly it has been emphatically declared as the result of repeated inoculation experiments that Trichosphaeria of Sacchari does not attack living Canes although doubtless to be found in dead fields [illegible] the

6. This distinction is of first importance. Is the Trichosphaeria of the Madras Cane fields parasitic as in the West Indies or is it a Saprophyte as is the case in the much nearer Java fields? In the latter Case, attention must be directed to the task of finding the real enemy, whether climatic or living which destroys the Canes. If on the other hand the Rind fungus is really the Cause of the mischief as well as its accompaniment, I Cannot hold out much hope of a diminution of the pest. It is Said to belong to an alliance of Saprophytic fungi which may acquire parasitism, and if it has Commenced on this downward path itself its parasitism will probably increase. Cases of this kind are Common in all Cultivations.

7. The measures usually adopted in Such Cases may hold the disease in Check for a Season. For various reasons I Cannot expect much aid from burning the Canes or their refuse. The advantage to be obtained by this measure is indirect. It is a [illegible]

be other, especially animal parasites, and, as I have elsewhere repeatedly stated, insects attacking the canes frequently produce the disease by affording an entrance to the spores of the fungus. For thus keeping the fungus in check the measures suggested by Dr Bourne are excellent, - careful agriculture, selection of sound tops for planting, the abolition of ratooning and, best of all, rotation of crops.

The Cultivators of India have a great advantage in being able to carry out the latter. This is perfectly impossible in a purely sugar growing country.

8. But if the rind fungus has really got a good grip of the Canes, the only hope of stamping it out, according to my mind, is to replace the attacked variety by one which is immune. This experiment has been made a great many times in the history of Cane cultivation both in India and elsewhere.

One of the most recent examples may be refered to. The small island of St. Kitts is entirely under cane cultivation, the fields forming a green girdle all around from the sea to the limit imposed by the mountain forests. It is 32 miles round, so, although the area is small, a great deal of cane is grown. About 18 years ago, a single plant of a new variety was introduced from Jamaica. It found a congenial home in the dry volcanic soil and its cultivation rapidly extended under the name of "Caledonian Queen". When the recent outbreak of diseases attacked the West Indian cane fields St. Kitts suffered greatly. As a result of visiting every estate in the island I was able to demonstrate that the healthy area corresponded almost exactly with that of the introduced variety, the old Bourbon being everywhere diseased. Plants of the Caledonian Queen from St. Kitts and other similar varieties have of late years been very largely cultivated in Barbados and have

undoubtedly saved that island from total destruction. This accedental replacement of an old worn out cane by a new and more vigorous one may serve as a ~~useful~~ useful object lesson.

9. The only safe remedy then which I can suggest if Trichosphaeria Sacchari has established itself firmly in the cane fields is the introduction of an immune variety as has been done in these West Indian Islands. The necessary steps are:—

(1) Determine accurately the varieties of sugarcane grown in South India.

(2) Are any unattacked? If so, determine whether they are immune. This may be done:

(a) by starting a nursery forplant cane in the locality where the unattacked plants grow (as is regularly done in Java.)

(b) by introducing plants from this and other nurseries into an experimental garden in the midst of the diseased area (as is done in all sugar growing

(3) -tict Java canes. The mind fungus is said to be Saprophytic there and as this is largely a question of varieties, their immunity may be due to the absence of canes which Trichosphaeria Saccharí can destroy. Care must, of cours be taken not to bring our Java diseases. This should be avoidable because Java is at present the real centre of our knowledge of cane diseases.

I have &c.

(Signed) C. A. Barber.
Government Botanist.

(True Copy)

For Secretary.

Exd: 1RE 3-4-29.

Same as C.No. 2313/99

REVENUE DEPARTMENT.

1899.

Board of Revenue

(Revenue Settlement, Land Records and Agriculture),

MADRAS.

Recd.	1899.	*Enclosures*
Regd.		*Spare copies*

GOVERNMENT OF MADRAS
17 MAR 99
REVENUE DEPT.

Printed April th.

Proceedings, No. 97, 29th March 1899.

MARCH.

Sugar-cane disease.—Submitting, with remarks, report from the Government Botanist regarding —.

1899
REVENUE DEPT.
Rect. No. 3
2313

PROCEEDINGS OF THE BOARD OF REVENUE

(Revenue Settlement, Land Records and Agriculture).

Read—the following letter from C. A. BARBER, Esq., Government Botanist, to the Secretary to the Commissioner of Revenue Settlement, Land Records and Agriculture, dated Madras, 22nd March 1899, No. 67 :—

In reply to Proceedings of the Board of Revenue, Mis. No. 1140, dated 24th February 1899, forwarding G.O., Mis. No. 720, dated 16th February 1899, referring certain papers to the Government Botanist and Proceedings of Board of Revenue, No. 1091, dated 23rd February 1899, forwarding G.O., Mis. No. 719, dated 16th February 1899, suggesting that the Government Botanist might be consulted on the question of cane disease, I have the honour to make the following remarks. I do so before having seen any cane cultivation in the Presidency, understanding that the Board desires me to send an immediate answer. Further remarks may be expected after the visit projected in Proceedings of Board of Revenue, Mis. No. 1454, dated 16th March 1899, paragraph 2, have been made.

2. It is true that I have had considerable experience in cane disease investigation in the Leeward Islands. It is now four years since I left that Colony, but I made a special study of the whole question of disease of the sugar-cane, especially the Java work, after my return to England. I propose to forward, for the information of the Board, such papers as I have published on the subject as soon as I get them unpacked.

3. From the perusal of the papers before me it appears to be undoubted that the "Rind fungus," *Trichosphæria sacchari* is to be found on the canes in the Presidency. At the same time the occurrence of red spots and areas in the tissues must not be regarded as diagnostic of its presence, because in canes attacked by almost any of the numerous vegetable and animal parasites, one of the first signs of ill health is this red coloration of the tissues.

4. There are it is probable many other fungi attacking the cane besides *Trichosphæria* and a study of these would undoubtedly prove of great interest and advantage. From Dr. Bourne's description, I judge that *Colletotrichum falcatum* (probably erroneously called a "root fungus") is present among the canes as well as *Trichosphæria sacchari*. These two forms Massee regards as different stages of the same fungus. This view is, however, strenuously opposed by the Java Botanists, and, considering their eminence as fungologists, and the fact that they have been studying cane diseases continuously for many years past in the fields themselves, their protest cannot be ignored. It is probable in my opinion that *Colletotrichum falcatum* and *Trichosphæria sacchari* cause entirely different diseases.

5. The "Rind fungus" is spread over the whole sugar-growing world and its presence in the Madras Presidency was a foregone conclusion. It appears, however, to vary in the intensity of its action and there is considerable doubt in many quarters as to what part it really plays in the fields. In the *West Indies* it is universally distributed and is said to be and probably is a dangerous parasite. There appears to be some doubt in *Mauritius* whether it is really parasitic, *i.e.*, killing and then feeding upon the cells of the plant, or *Saprophytic*, *i.e.*, living upon cells already killed by some other agent. In *Java* lastly it has been emphatically declared as the result of repeated inoculation experiments that *Trichosphæria sacchari* does not attack living canes although it is to be found in dead pieces scattered about the fields.

6. This distinction is of first importance. Is the *Trichosphæria* of the Madras cane fields parasitic as in the West Indies or is it a *Saprophyte* as is the case in the much nearer Java fields? In the latter case attention must be directed to the task of finding the real enemy, whether climatic or living which destroys the canes. If, on the other hand, the rind fungus is really the cause of the mischief as well as its accompaniment; I cannot hold out much hope of a diminution of the pest. It is said to belong to an allience of *Saprophytic fungi* which may acquire parasitism; and if it has commenced on this downward path itself, its parasitism will probably increase. Cases of this kind are common in all cultivations.

7. The measures usually adopted in such cases may hold the disease in check for a season. For various reasons I cannot expect much aid from *burning* the canes or their refuse. The advantage to be obtained by this measure is indirect. It is a protection against many other especially animal parasites, and, as I have elsewhere repeatedly stated, insects attacking the canes frequently produce the disease by affording an entrance to the spores of the fungus. For thus keeping the fungus in check, the measures suggested by Dr. Bourne are excellent,—*careful agriculture*, *selection of sound* tops for planting, the *abolition of ratooning* and, best of all, *rotation of crops*. The cultivators of India have a great advantage in being able to carry out the latter. This is perfectly impossible in a purely sugar-growing country.

8. But if the rind fungus has really got a good grip of the canes, the only hope of stamping it out, according to my mind, is to replace the attacked variety by one which is immune. This experiment has been made a great many times in the history of cane cultivation both in India and elsewhere. One of the most recent examples may be referred to. The small Island of W. Kitts is entirely under cane cultivation, the fields forming a green girdle all around from the sea to the limit imposed by the mountain forests. It is 32 miles round, so, although the area is small, a great deal of cane is grown. About 18 years ago, a single plant of a new variety was introduced from Jamaica. It found a congenial home in the dry volcanic soil and its cultivation rapidly extended under the name of "Caledonian Queen." When the recent outbreak of diseases attacked the West Indian cane fields, W. Kitts suffered greatly. As a result of visiting every estate in the island I was able to demonstrate that the healthy area corresponded almost exactly with that of the introduced variety, the old Bourbon being everywhere diseased. Plants of the Caledonian Queen from W. Kitts and other similar varieties have of recent years been very largely cultivated in Barbados and have undoubtedly saved that island from total destruction. This accidental replacement of an old worn out cane by a new and more vigorous one may serve as a useful object lesson.

9. The only safe remedy then which I can suggest if *Trichospæria sacchari* has established itself firmly in the cane fields is the introduction of an immune variety as has been done in these West Indian Islands. The necessary steps are—

(1) Determine accurately the varieties of sugar-cane grown in South India.

(2) Are any unattacked? If so determine whether they are immune. This may be done—

(*a*) By starting a nursery for plant cane in the locality where the unattacked plants grow (as is regularly done in Java).

(*b*) By introducing plants from this and other nurseries into an experimental garden in the midst of the diseased area (as is done in all sugar-growing countries).

(3) Get Java canes. The rind fungus is said to be *Saprophytic* there and as this is largely a question of varieties, their immunity may be due to the absence of canes which *Trichosphæria sacchari* can destroy. Care must, of course, be taken not to bring over Java diseases. This should be avoidable because Java is at present the real centre of our knowledge of cane diseases.

Resolution—No. 97, dated 29th March 1899.

The report read above will be submitted for the information of Government with reference to G.O., No. 720, Revenue, dated 16th February 1899.

2. On the receipt of G.O., No. 719, Revenue, of the same date, the Board requested the Government Botanist to undertake the local enquiries which it had pointed out in its Proceedings, No. 311, dated 22nd August 1898, should be made by an expert, to determine whether the disease reported by the Revenue officers to exist in almost all districts is the *Trichosphæria sâcchari* or no. This work Mr. Barber has recently commenced and he is visiting the more important cane-growing centres in Bellary, Coimbatore and Trichinopoly. The absolute necessity for such an investigation is shown by the remarks made in paragraph 3 of the letter read above.

3. It will be seen that Mr. Barber does not doubt that the *Trichosphæria sacchari* is established in Gódávari, but he points out that there is a good deal of divergence of opinion regarding the disease itself. Paragraphs 5 and 6 of the above report will be referred to Dr. Bourne for favour of remarks on the question whether, in the Gódávari, the disease is or is not parasitic. As regards other localities, it will be for the Government Botanist to decide the question in the course of his investigations. These investigations will also gradually determine the question whether this Presidency possesses any varieties of cane that are not attacked by this fungus. Until this point is determined, it does not seem necessary or advisable to undertake the wider investigation suggested in the concluding paragraph of the report. Should it seem advisable to carry out such an investigation, the matter is of such general interest that the assistance of the Government of India may, it is suggested, be obtained.

4. In connection with this subject, the Board begs to submit for perusal the supplements to the *Leeward Islands Gazette* Nos. XXIX and XXX of 1894, from the library of this department, which contain information regarding cane disease in the West Indies and of the measures taken to combat them there; one paper being written by Mr. Barber.

(True Copy and Extract.)

R. V. Srinivasan

Secretary.

To the Secretary to Government, Revenue Department,
with two papers to be returned.
„ Dr. Bourne, F.R.S.
Copy to Government Botanist.

Ezd. Md. Pahilwan.

Revenue (1899) Department.

CURRENT No. 2616

From The Board of Revenue
Revenue Settlement,
Land Records and Agriculture
Madras

Order

Leu

Muse pp may it submitted
to read along with proceedings
with the pp in the enclosed file
(Dr Barber's preliminary report
& the Bd remarks thereon
BP No 97 d 29- March 99)

No. 1938 Misc.

Dated 13th April 1899
Received 18th —do—
Registered 20th —do—
Enclosures 1.
Spare copies

21/4/99

SUBJECT.

Submitting for the information of Government in continuation of B.P. No 486 dated 23rd January 1899, report from the Director of Botanical Survey of India on the examination of certain diseased sugar cane sent to him.

BACK PAPERS.

G.O.	No.	Department.	Date.
	Ro No 719/46-2-28		

FURTHER PAPERS.

G.O.	No.	Department.	Date.

(Sett. 13—2,000—25-4-98.

REVENUE BOARD OFFICE MADRAS

Proceedings of the Board of Revenue

(Revenue Settlement, Land Records and Agriculture),

Dated 13th April 1899.

No. 1938 Misc.

READ ..... the following report from the Director of Botanical Survey of India and Superintendent, Royal Botanic Garden, Calcutta, No 95 B.S.I. dated 21st March 1899.

With reference to Government of Madras (Revenue) G.O No 683, 683a, dated 16th November 1898 regarding Sugar cane disease and to the Specimens of Sugar cane sent to me under that order, I have the honour to inform you that the Specimens have been carefully

carefully examined in this department by Lieut. Gage and to report as follows.

2. On certain of the canes sent, scattered black dots somewhat larger than a pin's head were seen externally at the base of several of the internodes. Inspected with a lens, these blackish dots were seen to consist of little tufts of small blackish stiff hairs or bristles; several of these spots were surrounded by a very pale pink or white deposit on the stem. No other external indications of disease were detected, except here and there reddish discoloured spots and patches.

3. On laying open a stem diseased patches

patches were visible in the tissues. These patches varied a good deal in size, from half an inch or less to several inches in length, and occupied a good deal of the transverse section of the cane. The patches varied also in colour, from light red to blackish brown or almost black. In the lighter coloured patches the fibrovascular bundles of the stem were frequently marked out by their much darker tint. Microscopic examination of these patches showed that their cells were extensively invaded by the hyphae of a fungus.

4. These hyphae varied considerably in appearance according to their situation. In the younger diseased patches they were very delicate and colourless, septate here

here and there; the finer amongst them showing a beaded appearance from the closeness of the refractile granules in their interior. These hyphae showed a tendency to keep to the walls of the tissue cells. In other regions the hyphae were less delicate, were tinged with brown, and branched freely through the cells. In older portions the hyphae were brown, with thicker and stronger walls, and now ran with little or no branching in practically parallel lines up and down the stem of the cane, keeping close to the walls of the cells. They were frequently septate and possessed few granules.

5. On making a longitudinal section near a node through one of the tufts of hairs mentioned in the second paragraph

paragraph, it was found that the epidermis and cortex of the cane were replaced by hyphae more or less closely interwoven. These hyphae appeared to be in connection with the hyphae in the general tissue of the stem described in the fourth paragraph. Towards the level of the epidermis of the stem the hyphae were very dark coloured and very densely interwoven forming a pseudo-parenchymatous mass. Towards the exterior of this mass the hyphae formed the brownish-black septate hairs that constitute the tufts described in the second paragraph. From the surface of the pseudo-parenchymatous mass there also appeared to project a number of very short hyphae, each of which

which ended in a navicular "conidium".
The very light pink or white deposit
seen on the surface of the stem, as men-
tioned in the second paragraph, surrounding
the blackish tufts, was composed of vast
numbers of these "conidia".

6. A "hanging drop" cultivation of some
of these "conidia" was made in a solution
prepared by soaking sugarcane in water;
this solution was first sterilised by
repeated boilings. The conidia germi-
nated within 24 hours giving rise
to filaments at one or both ends.
The filaments thus obtained were in-
distinguishable from those observed
in the general tissue of the sugar-
cane stem. Some of the "conidia" in
the germinating condition, showed a
transverse

transverse septum. Growth was
fairly rapid; a single "conidium"
within 24 hours gave rise to a
filament equal in length to twice
the diameter of the field of view
under the magnification of $\frac{340}{1}$. Septa
in these hyphae were infrequent;
here and there highly refractile
granules occurred. After 36 hours growth
some of the hyphae showed peculiar
thickenings as if attempting to form
larger conidial looking fructifications.
Others of the hyphae seemed rather
more delicate than the rest and gave
rise within 36 hours to long strings
of conidial-looking bodies. No further
development

development was obtained in 'hanging-drop' cultivation.

7. A sterilized sugarcane solution in a test-tube was inoculated with several of the navicular shaped — "conidia". In a few days a dense mass of hyphae resulted; these hyphae presented precisely the appearance of those in the tissues of the cane. About three weeks later these hyphae formed several black-masses; these masses presented precisely the appearance of the black tufts of hairs described in the second paragraph as being present at the base of certain of the internodes of the sugarcane stems. No further development was detected.

8. A sterilized sugarcane solution inoculated

inoculated with a small piece of diseased tissue developed within a few days a flocculent looking mass of hyphae growing rapidly from the piece of diseased cane in the solution. After 5 days growth the mass consisted of long delicate colourless hyphae. As their course was followed up across the field of view, the hyphae were found to become gradually thicker and ultimately to terminate in an olive-coloured moniliform row of large conidial-looking bodies (perhaps "macroconidia"). No further development has as yet been made out.

9. The general naked eye appearance

appearance of the diseased tissue and the microscopic appearance of the hyphae both in the tissues and in the cultivation solutions correspond with the description of Colletotrichum falcatum Went which is given (Kew Bulletin 1893 p 347) as the cause of what is known as the "Root-disease" of cane sugar. It is however stated (Kew Bulletin 1895. p83.) that Colletotrichum falcatum Went is only a form of the polymorphous Trichosphaeria Sacchari Mass. and if this be so the disease affecting the sugar-cane sent from the Godavari district is due to the presence of Trichosphaeria

Trichosphaeria Sacchari Mass.

The measures to be adopted in combating this cause of disease are fully given in the Kew Bulletin for 1893 p.p. 152 and 348, for 1894 p. 82 and for 1895 p. 85. What success may have attended their application it will be for those officers and gentlemen who come directly in contact with the Sugar cane industry to say

Read also the following letter from H. D. Taylor Esquire I. C. S., Acting Collector of Ganjam;

Dis No 846 D/Ver dated 30th March 1899

With reference to para 2 of Board's Proceedings 609 Dis dated 30th January 1899. I have the honor to

Ag No 719
16-2-99

to submit herewith copy of a report from the Superintendent, Royal Botanic Garden, Calcutta, on the Specimens of canes which were sent to him for examination *

2. The canes were, I may note, sent at a somewhat late period of the season and overripe so that they apparently did not stand the journey very (much) well.

Resolution.

The papers read above will be submitted for the information of Government, in continuation of B.P. 486 dated 23rd January 1899. The first report has reference to Specimens sent to Howrah from the Godavari with reference to para 3 of G.O. 683 Revenue dated 16th November 1898.

(True copies and extract)

R. E. Smidaras
Secretary
Secretary to Government, Revenue Department

* Copy attached

Copies of Gr 770 11-1-99

No. 50 H of 1899 88

From The Superintendent, Royal Botanic Garden Calcutta

To The Ag Collector of Ganjam
Chatrapur
Ganjam

Royal Botanic Garden Sibpur
(Botanic Garden P.O.) near Calcutta
The 21st March 1899.

Sir,

With reference to the Sugar cane Specimens sent for investigation from Ganjam, I have the honor to report as follows.

2. The majority of the canes sent were in a somewhat decayed condition and a good few of them had been tunnelled by ants that had formed nests and were rearing numerous young ants within them. The tissues of a number of the canes had been reduced to dust by

by reason of their presence. The outer shell showed distinct circular perforations caused by these insects.

3. In some of the canes there was marked evidence of the existence of a fungal disease. No spores or conidia were seen externally but the tissues within were full of red patches. Some of these patches were more or less disintegrated.

4. Examined under the microscope, the cells showed clearly the presence of a mycelium, the hyphae of which had exactly the appearance of Rodi described in this office letter No 95 dated as occurring in the tissues of the canes sent from the Godavari District. No cultures have been made but there is good reason for suspecting that these canes may be affected by one of the forms of Trichosphaeria Sacchari mass.

I have etc
(Sd) D. Prain
Supdt. Royal Bot. Garden
Calcutta

(True copy)
(Signed) D. Srinivasa Row
for Collector

(True copy)

R. V. Srinivasan
Secretary

1899
REVENUE DEPT.
Rec. No. 1
Oct 25 2616

Revenue (1897) Department.

CURRENT No. 2700.

From The Board of Revenue,
Rev: Sett: & Ads. & Agre:,
Madras.

Order

Levy

No. 2011. Misc:

Dei current was received after the two currents below had gone in circn. A draft order on all three currents is put up Slip Y.

Recorded as directed
Hills
27/4/99

Dated 18th April 1899.
Received 22nd —do—
Registered 24th —do—
Enclosures 1 and with file returned from circn & 1 memo put up Slip B 25/4
Spare copies

SUBJECT.

Submitting for the information of Government the remarks of Dr Bourne on the report from the Government Botanist regarding sugar-cane disease.—

W.A. 24/4

BACK PAPERS.

G.O.	No.	Department.	Date.
Cur	2313	of 99	

FURTHER PAPERS.

G.O.	No.	Department.	Date.

(Sett. 13—3,000—25-4-98.

REVENUE BOARD OFFICE MADRAS

Proceedings of the Board of Revenue

(Revenue Settlement, Land Records and Agriculture),

Dated 18th April 1899.

No. 2011 Misc:—

READ the following letter from Dr A.G. Bourne, Presidency College, Madras, dated 11th April 1899:—

With reference to the Board's Proceedings, No. 97 Press dated 29th ultimo, I have the honor to submit the following remarks—

I found a fungus in canes which appeared to be otherwise healthy. Wherever any cells showed signs of disease, this fungus was to be seen not many cells distant. If this fungus is saprophytic, it must be following a diseased condition brought about by some other agency, and I do not think it likely that it would

would follow it so closely - I have not seen the report on the experiments in Java. Mr. Barber leads one to infer that Trichosphaeria is there found only in dead pieces lying on the ground "scattered about the fields". If this is true, its presence or absence would seem to be a matter of little consequence so long at any rate as it retains these habits, and if Trichosphaeria sacchari does not occur in living canes, the fungus I found is not Trichosphaeria saccharii.

I have no doubt the fungus which I found in the Godavari, in Madras and in all the other samples of diseased cane that have been sent to me is causing disease, is therefore parasitic. I have never succeeded in getting it to go on growing in cut pieces of cane nor in cultivating it beyond a very early stage in any other

other medium; this is again in favour of its being a true parasite. I assumed that it was Trichosphaeria saccharii, depending upon the accuracy of Massee's observations. If the authorities in Java are correct, and I should attach great weight to their opinion, the fungus I found is probably Colletotrichum falcatum

Resolution

Submitted for the information of Government, in continuation of Board's Proceedings, No 97 dated 29th March 1899.

True Copy Extract

C Benson

for Secretary.

To

The Secretary to Government,

Revenue Department

C.R. 2616/98
Circ 214-99

Rev Dept

Read B.P. No 97 Press
& 29 March 1899 (CNo 2214/99)
also B.P. No 1938 misc & 13 Apr 99
(CNo 2614/99)
also B.P. No 2011 misc & 18 Apr 99
(CNo 2706/99)

all in full show mkd proof

Shown as Imm in B.P.W.

D/f 28-4-99

11P

Mis E.O. Press No 279 & 28th April 1899.
Recorded.

2. The Govt agrees generally with the Bd's remarks in the first & the Prop read above. Before deciding what action should be taken in the direction suggested by the Govt Botanist, the further report of this Officer to be made after inspection of sugar cane in other districts will be awaited.

fpo
Ale
27.4.99

To the Bd of Rev RS. DMcL
(With enclosures) 28.4.99.

Sent ?

BRD-2-5.99

D/f
287

Government {1899} of Madras.

REVENUE.

Recd.	} 1899.	*Enclosures*
Regd.		*Spare copies*

G.O., No. 279, 28th April 1899.

APRIL.

Sugarcane Disease.

Recording, with remarks, Board's Proceedings submitting reports on the —.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

Read—the following Proceedings of the Board of Revenue (Revenue Settlement, Land Records and Agriculture), No. 97, dated 29th March 1899:—

Read—the following letter from C. A. BARBER, Esq., Government Botanist, to the Secretary to the Commissioner of Revenue Settlement, Land Records and Agriculture, dated Madras, 22nd March 1899, No. 67:—

In reply to Proceedings of the Board of Revenue, Mis. No. 1140, dated 24th February 1899, forwarding G.O., Mis. No. 720, dated 16th February 1899, referring certain papers to the Government Botanist and Proceedings of Board of Revenue, No. 1091, dated 23rd February 1899, forwarding G.O., Mis. No. 719, dated 16th February 1899, suggesting that the Government Botanist might be consulted on the question of cane disease, I have the honour to make the following remarks. I do so before having seen any cane cultivation in the Presidency, understanding that the Board desires me to send an immediate answer. Further remarks may be expected after the visit projected in Proceedings of Board of Revenue, Mis. No. 1454, dated 16th March 1899, paragraph 2, have been made.

2. It is true that I have had considerable experience in cane disease investigation in the Leeward Islands. It is now four years since I left that Colony, but I made a special study of the whole question of disease of the sugar-cane, especially the Java work, after my return to England. I propose to forward, for the information of the Board, such papers as I have published on the subject as soon as I get them unpacked.

3. From the perusal of the papers before me it appears to be undoubted that the "Rind fungus," *Trichosphæria sacchari* is to be found on the canes in the Presidency. At the same time the occurrence of red spots and areas in the tissues must not be regarded as diagnostic of its presence, because in canes attacked by almost any of the numerous vegetable and animal parasites, one of the first signs of ill health is this red coloration of the tissues.

4. There are it is probable many other fungi attacking the cane besides *Trichosphæria* and a study of these would undoubtedly prove of great interest and advantage. From Dr. Bourne's description, I judge that *Colletotrichum falcatum* (probably erroneously called a "root fungus") is present among the canes as well as same fungus. This view is, however, strenuously opposed by the Java Botanists, and, considering their eminence as fungologists, and the fact that they have been studying cane diseases continuously for many years past in the fields themselves, their protest cannot be ignored. It is probable in my opinion that *Colletotrichum falcatum* and *Trichosphæria sacchari* cause entirely different diseases.

5. The "Rind fungus" is spread over the whole sugar-growing world and its presence in the Madras Presidency was a foregone conclusion. It appears, however, to vary in the intensity of its action and there is considerable doubt in many quarters as to what part it really plays in the fields. In the *West Indies* it is universally distributed and is said to be and probably is a dangerous parasite. There appears to be some doubt in *Mauritius* whether it is really parasitic, *i.e.*, killing and then feeding upon the cells of the plant, or *Saprophytic*, *i.e.*, living upon cells already killed by some other agent. In *Java* lastly it has been emphatically declared as the result of repeated inoculation experiments that *Trichosphæria sacchari* does not attack living canes although it is to be found in dead pieces scattered about the fields.

6. This distinction is of first importance. Is the *Trichosphæria* of the Madras cane fields parasitic as in the West Indies or is it a *Saprophyte* as is the case in the much nearer Java fields? In the latter case attention must be directed to the task of

finding the real enemy, whether climatic or living which destroys the canes. If, on the other hand, the rind fungus is really the cause of the mischief as well as its accompaniment; I cannot hold out much hope of a diminution of the pest. It is said to belong to an alliance of *Saprophytic fungi* which may acquire parasitism; and if it has commenced on this downward path itself, its parasitism will probably increase. Cases of this kind are common in all cultivations.

7. The measures usually adopted in such cases may hold the disease in check for a season. For various reasons I cannot expect much aid from *burning* the canes or their refuse. The advantage to be obtained by this measure is indirect. It is a protection against many other especially animal parasites, and, as I have elsewhere repeatedly stated, insects attacking the canes frequently produce the disease by affording an entrance to the spores of the fungus. For thus keeping the fungus in check, the measures suggested by Dr. Bourne are excellent,—*careful agriculture*, *selection of sound* tops for planting, the *abolition of ratooning* and, best of all, *rotation of crops*. The cultivators of India have a great advantage in being able to carry out the latter. This is perfectly impossible in a purely sugar-growing country.

8. But if the rind fungus has really got a good grip of the canes, the only hope of stamping it out, according to my mind, is to replace the attacked variety by one which is immune. This experiment has been made a great many times in the history of cane cultivation both in India and elsewhere. One of the most recent examples may be referred to. The small Island of St. Kitts is entirely under cane cultivation, the fields forming a green girdle all around from the sea to the limit imposed by the mountain forests. It is 32 miles round, so, although the area is small, a great deal of cane is grown. About 18 years ago, a single plant of a new variety was introduced from Jamaica. It found a congenial home in the dry volcanic soil and its cultivation rapidly extended under the name of "Caledonian Queen." When the recent outbreak of diseases attacked the West Indian cane fields, St. Kitts suffered greatly. As a result of visiting every estate in the island I was able to demonstrate that the healthy area corresponded almost exactly with that of the introduced variety, the old Bourbon being everywhere diseased. Plants of the Caledonian Queen from St. Kitts and other similar varieties have of recent years been very largely cultivated in Barbados and have undoubtedly saved that island from total destruction. This accidental replacement of an old worn out cane by a new and more vigorous one may serve as a useful object lesson.

9. The only safe remedy then which I can suggest if *Trichosphæria sacchari* has established itself firmly in the cane fields is the introduction of an immune variety as has been done in these West Indian Islands. The necessary steps are—

(1) Determine accurately the varieties of sugar-cane grown in South India.

(2) Are any unattacked? If so determine whether they are immune. This may be done—

(*a*) By starting a nursery for plant cane in the locality where the unattacked plants grow (as is regularly done in Java).

(*b*) By introducing plants from this and other nurseries into an experimental garden in the midst of the diseased area (as is done in all sugar-growing countries).

(3) Get Java canes. The rind fungus is said to be *Saprophytic* there and as this is largely a question of varieties, their immunity may be due to the absence of canes which *Trichosphæria sacchari* can destroy. Care must, of course, be taken not to bring over Java diseases. This should be avoidable because Java is at present the real centre of our knowledge of cane diseases.

———

Resolution—No. 97, dated 29th March 1899.

The report read above will be submitted for the information of Government with reference to G.O., No. 720, Revenue, dated 16th February 1899.

2. On the receipt of G.O., No. 719, Revenue, of the same date, the Board requested the Government Botanist to undertake the local enquiries which it had

pointed out in its Proceedings, No. 311, dated 22nd August 1898, should be made by an expert, to determine whether the disease reported by the Revenue officers to exist in almost all districts is the *Trichosphæria sacchari* or no. This work Mr. Barber has recently commenced and he is visiting the more important cane-growing centres in Bellary, Coimbatore and Trichinopoly. The absolute necessity for such an investigation is shown by the remarks made in paragraph 3 of the letter read above.

3. It will be seen that Mr. Barber does not doubt that the *Trichosphæria sacchari* is established in Gódávari, but he points out that there is a good deal of divergence of opinion regarding the disease itself. Paragraphs 5 and 6 of the above report will be referred to Dr. Bourne for favour of remarks on the question whether, in the Gódávari, the disease is or is not parasitic. As regards other localities, it will be for the Government Botanist to decide the question in the course of his investigations. These investigations will also gradually determine the question whether this Presidency possesses any varieties of cane that are not attacked by this fungus. Until this point is determined, it does not seem necessary or advisable to undertake the wider investigation suggested in the concluding paragraph of the report. Should it seem advisable to carry out such an investigation, the matter is of such general interest that the assistance of the Government of India may, it is suggested, be obtained.

4. In connection with this subject, the Board begs to submit for perusal the supplements to the *Leeward Islands Gazette* Nos. XXIX and XXX of 1894, from the library of this department, which contain information regarding cane disease in the West Indies and of the measures taken to combat them there; one paper being written by Mr. Barber.

(True Copy and Extract.)

(Signed) R. V. SRINIVASIAR,
Secretary.

To the Secretary to Government, Revenue Department,
with two papers to be returned.

„ Dr. Bourne, F.R.S.

Copy to Government Botanist.

Read—also the following Proceedings of the Board of Revenue (Revenue Settlement, Land Records and Agriculture), Mis. No. 1938, dated 13th April 1899 :—

Read—the following report from the Director of Botanical Survey of India and Superintendent, Royal Botanic Garden, Calcutta, dated 21st March 1899, No. 95-B.S.I. :—

With reference to Government of Madras (Revenue) G.O., Nos. 683, 683A, dated 16th November 1898, regarding sugarcane disease and to the specimens of sugarcane sent to me under that order, I have the honour to inform you that the specimens have been carefully examined in this department by Lieutenant Gage, and to report as follows.

2. On certain of the canes sent, scattered black dots somewhat larger than a pin's head were seen externally at the base of several of the internodes. Inspected with a lens, these blackish dots were seen to consist of little tufts of small blackish stiff hairs or bristles; several of these spots were surrounded by a very pale pink or white deposit on the stem. No other external indications of disease were detected, except here and there reddish discoloured spots and patches.

3. On laying open a stem diseased patches were visible in the tissues. These patches varied a good deal in size, from half an inch or less to several inches in length, and occupied a good deal of the transverse section of the cane. The patches varied also in colour, from light red to blackish brown or almost black. In the lighter-coloured patches the fibrovascular bundles of the stem were frequently marked out by their much darker tint. Microscopic examination of these patches showed that their cells were extensively invaded by the hyphæ of a fungus.

4. These hyphæ varied considerably in appearance according to their situation. In the younger diseased patches they were very delicate and colourless, septate here and there, the finer amongst them showing a beaded appearance from the closeness of the refractile granulus in their interior. These hyphæ showed a tendency to keep to the walls of the tissue cells. In other regions the hyphæ were less delicate, were tinged with brown, and branched freely through the cells. In older portions the hyphæ were brown, with thicker and stronger walls, and now ran with little or no branching in practically parallel lines up and down the stem of the cane, keeping close to the walls of the cells. They were frequently septate and possessed few granules.

5. On making a longitudinal section near a node through one of the tufts of hairs mentioned in the second paragraph, it was found that the epidermis and cortex of the cane were replaced by hyphæ more or less closely interwoven. These hyphæ appeared to be in connection with the hyphæ in the general tissue of the stem, described in the fourth paragraph. Towards the level of the epidermis of the stem the hyphæ were very dark coloured and very densely interwoven forming a pseudo-parenchymatons mass. Towards the exterior of this mass the hyphæ formed the brownish black septate hairs that constitute the tufts described in the second paragraph. From the surface of the psendo-parenchymatons mass there also appeared to project a number of very short hyphæ, each of which ended in a navicular "conidium." The very light pink or white deposit seen on the surface of the stem, as mentioned in the second paragraph, surrounding the blackish tufts, was composed of vast numbers of these "conidia."

6. A "hanging drop" cultivation of some of these "conidia" was made in a solution prepared by soaking sugarcane in water; this solution was first sterilised by repeated boilings. The conidia germinated within 24 hours giving rise to filaments at one or both ends. The filaments thus obtained were indistinguishable from those observed in the general tissue of the sugarcane stem. Some of the "conidia" in the germinating condition showed a transverse septum. Growth was fairly rapid, a single "conidium" within 24 hours gave rise to a filament equal in length to twice the diameter of the field of view under the magnification of $\frac{3}{4}{}^{0}$ septa in these hyphæ were infrequent; here and there highly refractile granules occurred. After 36 hours' growth some of the hyphæ showed peculiar thickenings as if attempting to form larger conidial looking fructifications. Others of the hyphæ seemed rather more delicate than the rest and gave rise within 36 hours to long strings of conidial-looking bodies. No further development was obtained in "hanging-drop" cultivation.

7. A sterilised sugarcane solution in a test-tube was inoculated with several of the navicular-shaped "conidia." In a few days a dense mass of hyphæ resulted; these hyphæ presented precisely the appearance of those in the tissues of the cane. About three weeks later these hyphæ formed several black-masses; these masses presented precisely the appearance of the black tufts of hairs described in the second paragraph as being present at the base of certain of the internodes of the sugarcane stems. No further development was detected.

8. A sterilised sugarcane solution inoculated with a small piece of diseased tissue developed within a few days a flocculent looking mass of hyphæ growing rapidly from the piece of diseased cane in the solution. After five days' growth the mass consisted of long, delicate colourless hyphæ. As their course was followed up across the field of view, the hyphæ were found to become gradually thicker and ultimately to terminate in an olive-coloured moniliform row of large conidial-looking bodies (perhaps "macroconidia"). No further development has as yet been made out.

9. The general naked-eye appearance of the diseased tissue and the microscopic appearance of the hyphæ both in the tissues and in the cultivation solutions correspond with the description of *Colletotrichum falcatum, Went* which is given (*Kew Bulletin* 1893, page 347) as the cause of what is known as the "root-disease" of cane sugar. It is, however, stated (*Kew Bulletin* 1895, page 83) that *Colletotrichum falcatum, Went* is only a form of the polymorphous *Trichosphæria Sacchari, Mass* and if this be so, the disease affecting the sugarcane sent from the Gódávari district is due to the presence of *Trichosphæria Sacchari, Mass.* The measures to be adopted in combating this cause

of disease are fully given in the *Kew Bulletin* for 1893, pages 152 and 348, for 1894, page 82 and for 1895, page 85. What success may have attended their application it will be for those officers and gentlemen who come directly in contact with the sugarcane industry to say.

Read—also the following letter from H. D. TAYLOR, Esq., I.C.S., Acting Collector of Ganjám, to the Secretary to the Commissioner of Revenue Settlement and Director of the Department of Land Records and Agriculture, dated 30th March 1899, Dis. No. 846-D. Ver. :—

With reference to paragraph 2 of Board's Proceedings, Mis. No. 609, dated 30th January 1899, I have the honour to submit herewith copy of a report * from the Superintendent, Royal Botanic Garden, Calcutta, on the specimens of canes which were sent to him for examination.

* Copy attached.

2. The canes were, I may note, sent at a somewhat late period of the season and overripe so that they apparently did not stand the journey very well.

Enclosure.

From Major D. PRAIN, Superintendent, Royal Botanic Garden, Calcutta, to the Acting Collector of Ganjám, dated the 21st March 1899, No. 50-H. of 1899.

With reference to the sugarcane specimens sent for investigation from Ganjám, I have the honour to report as follows.

2. The majority of the canes sent were in a somewhat decayed condition and a good few of them had been tunnelled by ants that had formed nests and were rearing numerous young ants within them. The tissues of a number of the canes had been reduced to dust by reason of their presence. The outer shell showed distinct circular perforations caused by these insects.

3. In some of the canes there was marked evidence of the existence of a fungal disease. No spores or conidia were seen externally, but the tissues within were full of red patches. Some of these patches were more or less disintegrated.

4. Examined under the microscope, the cells showed clearly the presence of a mycelium, the hyphæ of which had exactly the appearance of those described in this office letter, No. 95-B.A.G., as occurring in the tissues of the canes sent from the Gódávari district. No cultures have been made, but there is good reason for suspecting that these canes may be affected by one of the forms of *Trichosphæria Sacchari, Mass.*

Resolution—Mis. No. 1938, dated 13th April 1899.

The papers read above will be submitted for the information of Government, in continuation of Board's Proceedings, No. 486, dated 23rd January 1899. The first report has reference to specimens sent to Howrah from the Gódávari, with reference to paragraph 3 of G.O., No. 683, Revenue, dated 16th November 1898.

(True Copies and Extract.)

(Signed) R. V. SRINIVASIAR,
Secretary.

To the Secretary to Government, Revenue Department.

Read—also the following Proceedings of the Board of Revenue (Revenue Settlement, Land Records and Agriculture), Mis. No. 2011, dated 18th April 1899 :—

Read—the following letter from Dr. A. G. BOURNE, Presidency College, Madras, to the Secretary to the Commissioner of Revenue Settlement and Director of the Department of Land Records and Agriculture, dated 11th April 1899 :—

With reference to the Board's Proceedings, No. 97, Press, dated 29th ultimo, I have the honour to submit the following remarks.

I found a fungus in canes which appeared to be otherwise healthy. Wherever any cells showed signs of disease, this fungus was to be seen not many cells distant. If this fungus is saprophytic, it must be following a diseased condition brought about by some other agency, and I do not think it likely that it would follow it so closely. I have not seen the report on the experiments in Java. Mr. Barber leads one to infer that *Trichosphæria* is there found only in dead pieces lying on the ground "scattered about the fields." If this is true, its presence or absence would seem to be a matter of little consequence so long at any rate as it retains these habits, and if *Trichosphæria Sacchari* does not occur in living canes, the fungus I found is not *Trichosphæria Sacchari.*

I have no doubt the fungus which I found in the Gódávari, in Madras and in all the other samples of diseased cane that have been sent to me is causing disease is therefore parasitic. I have never succeeded in getting it to go on growing in cut pieces of cane nor in cultivating it beyond a very early stage in any other medium; this is again in favour of its being a true parasite. I assumed that it was *Trichosphæria Sacchari*, depending upon the accuracy of Massee's observations. If the authorities in Java are correct, and I should attach great weight to their opinion, the fungus I found is probably *Colletotrichum falcatum.*

Resolution—Mis. No. 2011, dated 18th April 1899.

Submitted for the information of Government in continuation of Board's Proceedings, No. 97, dated 29th March 1899.

(True Copy and Extract.)

(Signed) C. BENSON,
for Secretary.

To the Secretary to Government, Revenue Department.

Order—No. 279, Revenue, dated 28th April 1899.

Miscellaneous.

Recorded.

2. The Government agrees generally with the Board's remarks in the first of the Proceedings read above. Before deciding what action should be taken in the direction suggested by the Government Botanist, the further report of this officer to be made after inspection of sugarcane in other districts will be awaited.

(True Extract.)

(Signed) G. S. FORBES,
Secretary to Government.

To the Board of Revenue (Revenue Settlement, Land Records and Agriculture).

Exd. Shaik Karim.

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Current No.

Enclosure to C. No.

Order of Government.

Letter of Government.

Statement with ditto.

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N.B.—

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B = Not to be printed.
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