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Progress Report  
Microorganism Study  
JPL Contract No. 950783  
Systematic Description and Key to  
Streptomyces Isolants from Chile, Arizona  
and Antarctica Desert Soils  
Professor W. B. Bollen, Microbiologist and,  
Sumie Nishikawa, Assistant in Microbiology  
Oregon State University, Corvallis, Oregon  
February 18, 1969

**CASE FILE  
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JET PROPULSION LABORATORY  
CALIFORNIA INSTITUTE OF TECHNOLOGY  
PASADENA, CALIFORNIA

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California Institute of Technology, sponsored by the  
National Aeronautics and Space Administration under  
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## PREFACE

Sixty-seven isolants from Chile, Arizona, and Antarctica desert soils have been examined. Of these, thirty-seven have been identified; nine were cultured on the various media but these could not be classified and were designated "indeterminate"; twenty could not be subcultured from the original slants, (they were either excessively contaminated with mold or they were no longer viable); one, a psychrophilic mold, was forwarded to E. E. Staffeldt (New Mexico State University).

With the exception of two, non-sporulating cultures, all the streptomycete cultures isolated from Antarctica desert soil were identified as Streptomyces longisporoflavus. The non-sporulating cultures may be variants of S. longisporoflavus as their colony characteristics are similar to other cultures which have been identified as S. longisporoflavus.

The materials and methods used to characterize the isolants listed in this report are identical to those described in the first of the reports on the streptomycetes (April 25, 1968). The characteristics used to differentiate the Streptomyces are those described by Hutter, Ralf, "Systematik der Streptomyceten". S. Karger, Basel and New York, 1967. 382 p. and have been listed in the first report.

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Key to identification of isolants	4
Magnification standards	6
Descriptive charts (in order of laboratory numbers, 28-121, excluding isolants that failed to grow on subsequent transfers)	13

Streptomyces Isolants Identified

<u>Culture No.</u>	<u>JPL No.</u>	<u>Species</u>	<u>Source</u>	<u>Invoice No.</u>	<u>Page</u>
28	246Bb (#24)	<u>S. caelestis</u>	Chile	D-44829	13
32	248Aa (#24)	<u>S. longisporuber</u>	Chile	D-44829	18
40	245TAe	indeterminate	Chile	D-38463	23
56	277TAA	indeterminate	Chile	D-38463	28
58	245Ag	contaminated, no growth	Chile- Atacama	D-38463	
59	245Ah	no growth	Chile- Atacama	D-38463	
60	245Ai	mold contamination	Chile- Atacama	D-38463	
61	245Aj	no growth	Chile- Atacama	D-38463	
62	245A1	<u>S. albogriseolus</u>	Chile- Atacama	D-38463	30
63	245Bc	indeterminate	Chile- Atacama	D-38463	35
64	245Be	contaminated	Chile- Atacama	D-38463	
65	245Bf	no growth	Chile- Atacama	D-38463	
66	245Bi	no growth	Chile- Atacama	D-38463	
67	246Bf	no growth	Chile- Atacama	D-38463	
68	246Bg	no growth	Chile- Atacama	D-38463	
69	381Ba (Thorton)	indeterminate	Arizona	D-44799	40
70	245Ad (#30)	no growth	Chile	cameron 10-17-67	

71	245Af (#30)	<u>S. exfoliatus</u>	Chile	cameron 10-17-67	44
72	245Ba (#10)	<u>S. albogriseolus</u>	Chile	cameron 10-17-67	49
73	245Bb (#10)	indeterminate	Chile	cameron 10-17-67	54
74	246Bc (#4)	indeterminate	Chile	cameron 10-17-67	
75	248Ac (#30)	<u>S. exfoliatus</u>	Chile	cameron 10-17-67	59
76	248Ad (#30)	no growth	Chile	cameron 10-17-67	
77	249Ad (#30)	no growth	Chile	cameron 10-17-67	
78	249Ae (#30)	no growth	Chile	cameron 10-17-67	
79	Wh 7	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	64
80	Wh 10	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	69
81	Wh 11	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	74
82	Wh 12	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	79
83	Wh 13	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	84
84	Wh 14	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	89
85	Wh 35	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	94
86	Wh 36	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	99
87	Wh 37	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	103
88	Wh 46	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	107

89	Wh 62	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	112
90	Wh 65	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	117
91	Wh 66	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	122
92	Wh 68	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	127
93	Wh 69	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	132
94	Wh 71	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	136
95	Wh 72	Non-sporulating culture (probably <u>S. longisporoflavus</u> )	Antarctica Wheeler Val.	D-56445	141
96	Wh 74	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	143
97	Wh 75	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	147
98	Wh 76	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	152
99	Wh 77	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	157
100	Wh 78	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	161
101	Wh 80	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	165
102	Wh 85	<u>S. longisporoflavus</u>	Antarctica Wheeler Val.	D-56445	169
103	Wh 67	psychrophilic mold (sent to Staffeldt)	Antarctica Wheeler Val.	D-56445	
104	639d.01	indeterminate*	Antarctica King-David	D-56445	174
105	644a.1	<u>S. longisporoflavus</u>	Antarctica King	D-56445	177

\*nonsporulating S. longisporoflavus

106	268Ae (#24)	no growth contaminated	Chile	D-29927	
107	274Ab (#13)	no growth	Chile	D-29927	
108	274Ba (#13)	<u>S. olivaceus</u>	Chile	D-29927	182
109	274Bc (#13)	no growth	Chile	D-29927	
110	276Ac (#24)	no growth	Chile	D-29927	
111	276Bb (#24)	no growth	Chile	D-29927	
112	278Ae (#24)	no growth	Chile	D-29927	
113	278Ba (#24)	<u>S. antibioticus</u>	Chile	D-29927	187
114	278Bc (#24)	<u>S. michiganensis</u>	Chile	D-29927	192
115	370Ba (#30)	indeterminate	Arizona	D-44799	
117	246Aa (#10)	contaminated	Chile- Atacama	cameron 10-17-67	
118	246Ba (#10)	<u>S. azureus</u>	Chile- Atacama	cameron 10-17-67	197
119	245TAc	<u>S. antibioticus</u>	Chile	D-38463	201
120	246Ad	<u>S. caelestis</u>	Chile	D-38463	206
121	mc-1-2	<u>S. exfoliatus</u>	Antarctica	D56445	211

Key to the Identification of Streptomyces

## Isolants 28-121

- I. True mycelium produced, spores formed but not in sporangia.  
Substrate mycelium non-septate, not fragmenting into bacillary  
or coccoid components.....Streptomycetaceae
- II. Aerial mycelium produced  
Spores formed in chains.....Streptomyces
- A. Spores with hairy enation.  
Aerial mycelium gray to brownish-gray (cinereus)  
Sporophores produce spirals.  
Melanin-negative.....S. albogriseolus  
(245A1) - #62  
(245Ba) - #72
- B. Spores with smooth or warty surfaces.
1. Aerial mycelium gray to brownish-gray (cinereus)  
Sporophores straight or wavy (rectus-flexibilis)
- a. Melanin-positive.....S. antibioticus  
(278Ba) - #113  
(245TAc) - #119
- b. Melanin-negative.....S. olivaceus  
(274Ba) - #108
2. Aerial mycelium pale-carmine to cinnamon-brown (cinnamomeus)  
Sporophores straight or wavy (rectus-flexibilis)  
Melanin-negative.....S. exfoliatus  
(245Af) - #71  
(248Ac) - #75  
(mc-1-2) - #121
3. Aerial mycelium blue to bluish-green (azureus-glaucus)
- a. Sporophores form loose, open twists  
(retinaculum-apertum).....S. caelestis  
(246Bb) - #28  
(246Ad) - #120
- b. Sporophores form mostly narrow, closed spirals...S. azureus  
(246Ba) - #118
4. Aerial mycelium yellow-greenish-gray to olive-sand  
color (griseus)

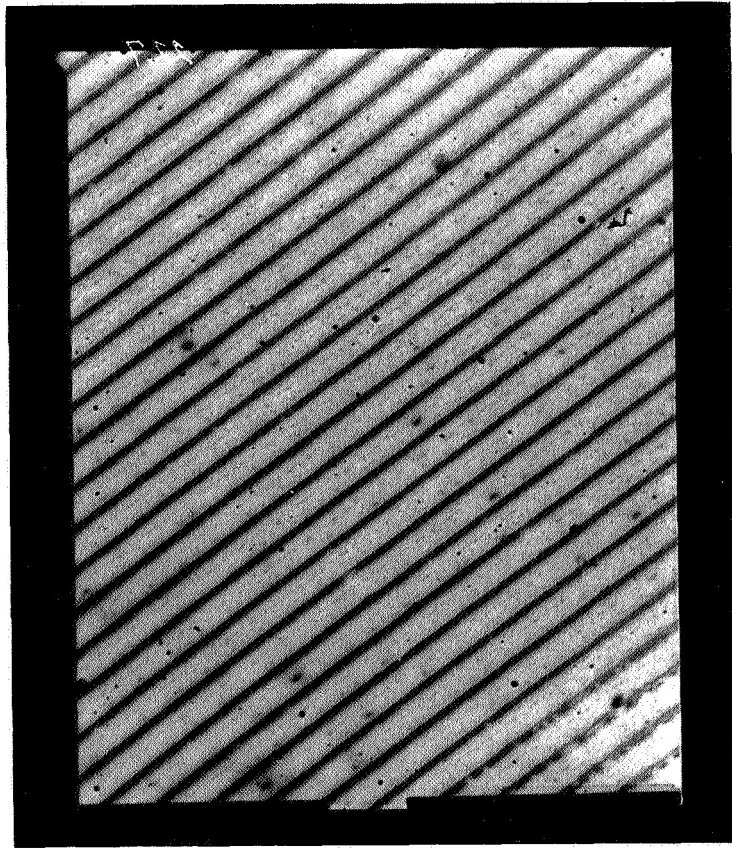
- a. Sporophores form long, loose screws  
 (spira, type b).....S. longisporoflavus  
 (Antarctica cultures)  
 #79 → #105
- b. Sporophores straight or wavy (rectus-flexibilis)  
 Melanin-positive.....S. michiganensis  
 (278Bc) - #114
5. Aerial mycelium snow white to chalk white (niveus)  
 Sporophores form open twists (retinaculum-apertum)...S. longisporuber  
 (248Aa) - #32



#1000 carbon replica grating

28,800 lines/inch

Magnification = 5,053X



Used in determining dimensions of the following cultures:

#62 - (245A1)

#73 - (245Bb)

#75 - (248Ac)

#82 - (Wh 12)

#92 - (Wh 68)

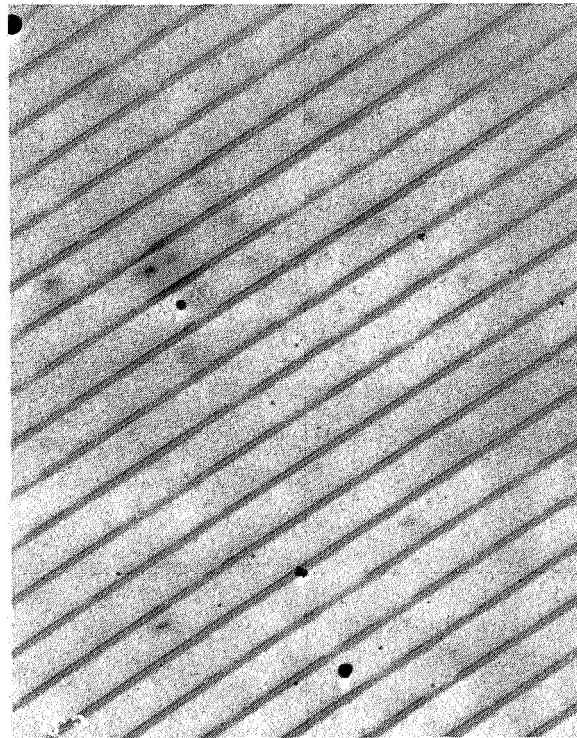
#102 - (Wh 85)

#113 - (278Ba)

#1000 carbon replica grating

28,800 lines/inch

Magnification = 6,545X



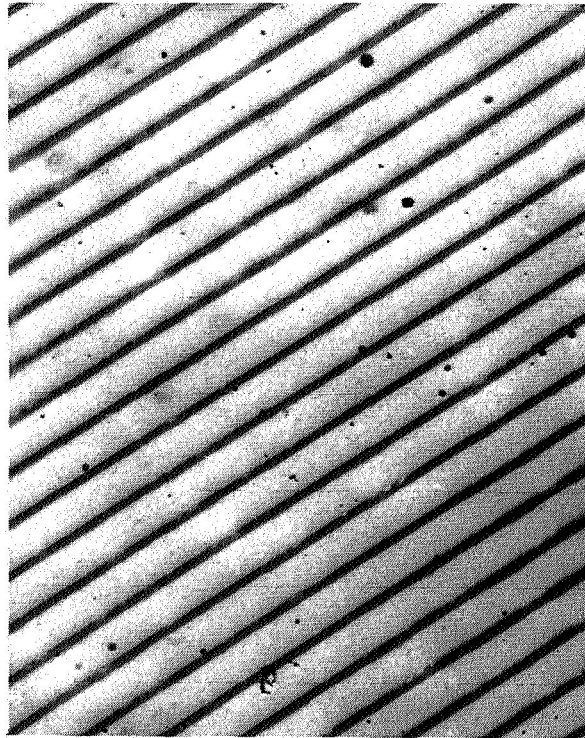
#28 - (246Bb)  
#32 - (248Aa)  
#40 - (245TAe)  
#63 - (245Bc)  
#83 - (Wh 13)

#85 - (Wh 35)  
#88 - (Wh 46)  
#98 - (Wh 76)

#1000 carbon replica grating

28.800 lines/inch

Magnification = 6,545X



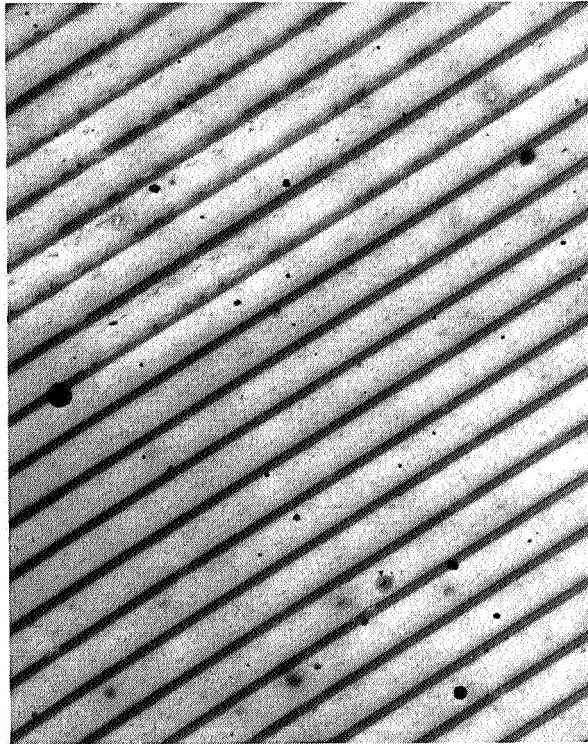
#71 - (245Af)  
#72 - (245Ba)  
#80 - (Wh 10)  
#81 - (Wh 11)  
#105 - (644a.1)

#108 - (274Ba)  
#114 - (278Bc)  
#118 - (246Ba)  
#119 - (245TAc)

#1000 carbon replica grating

28.800 lines/inch

Magnification = 6,698X



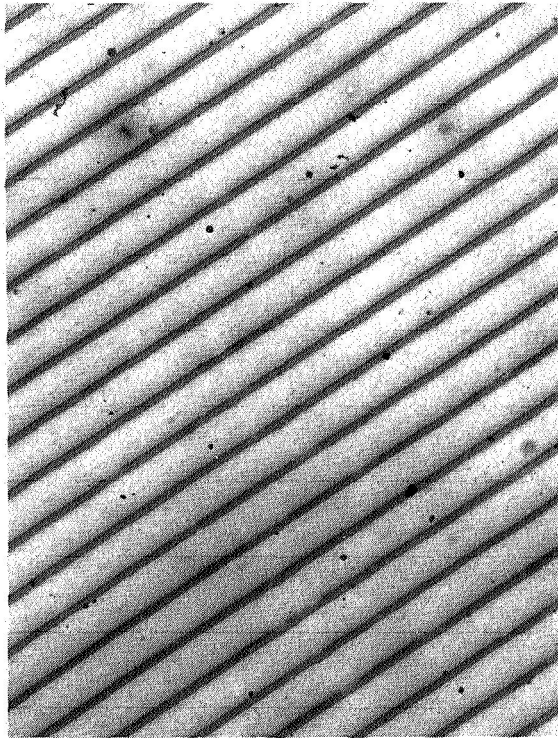
#84 - (Wh 14)  
#86 - (Wh 36)  
#87 - (Wh 37)  
#89 - (Wh 62)  
#90 - (Wh 65)

#91 - (Wh 66)  
#94 - (Wh 71)  
#96 - (Wh 74)  
#97 - (Wh 75)  
#120 - (246Ad)

#1000 carbon replica grating

28,800 lines/inch

Magnification = 6,545X



Used in determining dimensions of the following cultures:

#69 - (381Ba)

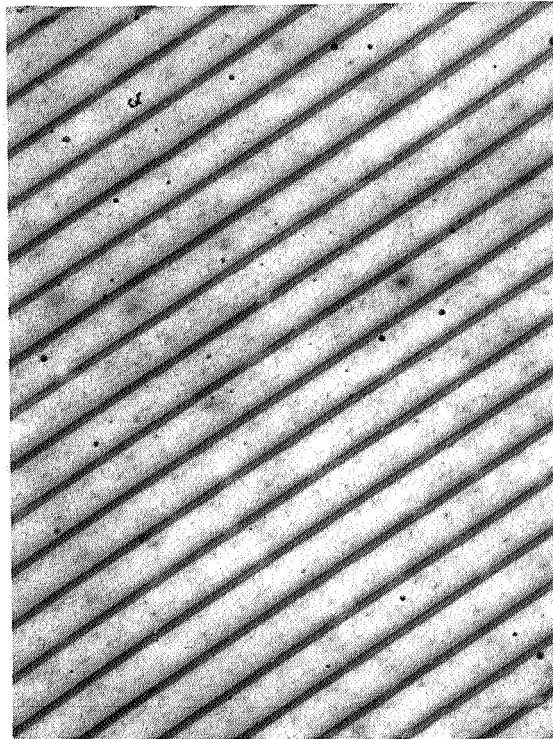
#99 - (Wh 77)

#101 - (Wh 80)

#1000 carbon replica grating

28,800 lines/inch

Magnification = 6,605X



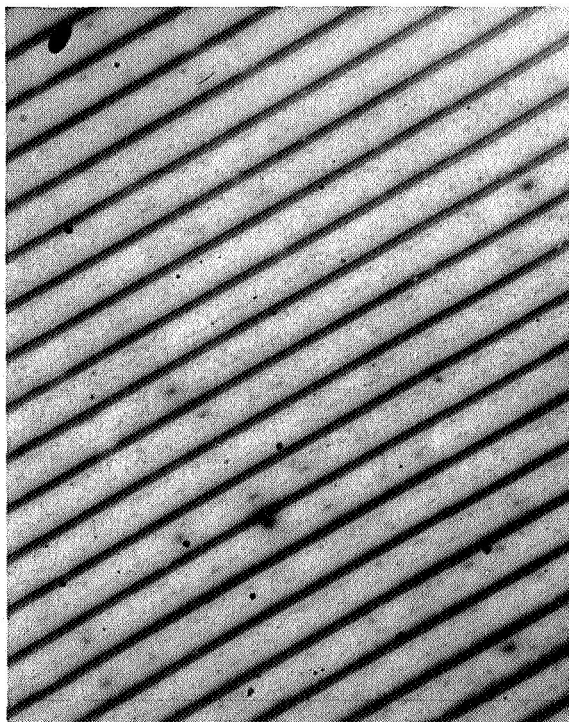
Used in determining dimensions of the following cultures:

- #93 - (Wh 69)
- #100 - (Wh 78)
- #121 - (mc-1-2)

#1000 carbon replica grating

28,800 lines/inch

Magnification = 6,545X



Used in determining the dimension of culture #79 - (Wh 7)

Culture No. 28

Source Chile

JPL No. 246 Bb (#24)

Invoice # D-44829

Species Streptomyces caelestis

1. Cultural properties: Temp. 26°C

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	none	none
	14	a = white	none	a = white (sparse)	none
	21	a = white with specks of blue	none	a = white, with specks of blue	none
	30	a = white to 14 ge (cadet gray, dusty blue, Lt. gray blue, mist blue)			
substrate mycelium	7	2ic = {honey gold lt. gold	2ca = {lt. ivory egg shell	2ca = {lt. ivory egg shell	5ca = {flesh pink pale peach shell pink tea rose
	14	3gc = lt. tan	3ca = {pearl pink shell	3ic = lt. amber	3ic = lt. amber
	21	3ic = lt. amber	3ca = {pearl pink shell	3ic = lt. amber	3ic = lt. amber
soluble pigment	7	none	none	none	none
	14	3ic = lt. amber	3gc = lt. tan	3gc = lt. tan	3gc = lt. tan
	21	3nc = amber	3ic = lt. amber	3gc = lt. tan	3ic = lt. amber

\*Color Harmony Manual, 4th edition, Container Corporation of America, Chicago, Illinois, 1958.



II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	---	---	---
	14	none	---	---	---
	21	retinaculum-apertum	---	retinaculum-apertum	---
Spore Number	7	---	---	---	---
	14	---	---	---	---
	21	> 10	---	> 10	---
Verticils	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

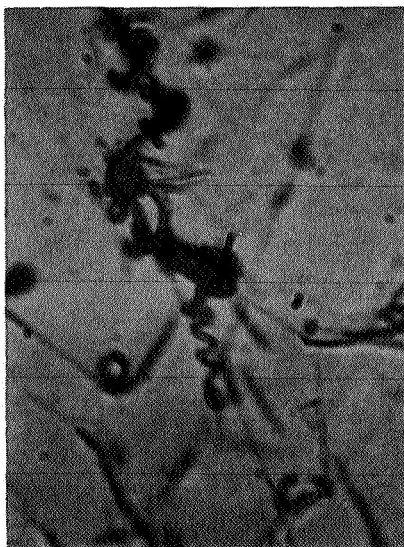
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

none observed.

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Culture No. 28JPL No. 246Bb (#24)Species *S. caelestis*

## Photographs.

Medium: malt-extract agarAge of culture: 30 daysMagnification: 1000X

Page 4

Culture No. 28  
JPL No. 246Bb (#24)  
Species *S. caelestis*

## III. Spore morphology and surface:

Surface: smooth  
Dimensions: 0.61-0.99 x 0.30-0.46 $\mu$   
Medium: starch agar  
Age of culture: 28 days  
Magnification: 6545



Culture No. 28JPL No. 246Bb (#24)Species S. caelestis

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	++	++
D-mannitol	++	++
I-inositol	++	++
D-fructose	++	++
Rhamnose	++	++
Raffinose	++	++
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days - negative  
 4 days - negative  
 Medium 6 - 2 days - negative  
 4 days - negative  
 Medium 7 - 2 days - negative  
 4 days - negative

C. Starch hydrolysis  
positive

Culture No. #32Source Chile 18JPL No. 248 Aa (#24)Invoice # D-44829Species Streptomyces longisporuber1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	a = white	a = white	none
	14	a = white	a = white	a = white (cotton textured)	none
	21	a = white	a = white	a = white (cotton textured)	none
substrate mycelium	7	3ic = lt. amber	3ca = {pearl pink shell	2ic = {honey gold lt. gold	4ea = lt. apricot
	14	3ic = lt. amber	3ca = {pearl pink shell	3gc = lt. tan	4ea = lt. apricot
	21	3ic = lt. amber	3ca = {pearl pink shell	3gc = lt. tan	4ea = lt. apricot
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

II. Morphological observations: **sporophore**

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none
	30	retinoculum- apertum	none	retinaculum- apertum	none
Spore No.	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---
	30	> 10	---	> 10	---
Verticil	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---
	30	pseudoverticillus	---	pseudoverticillus	---

special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

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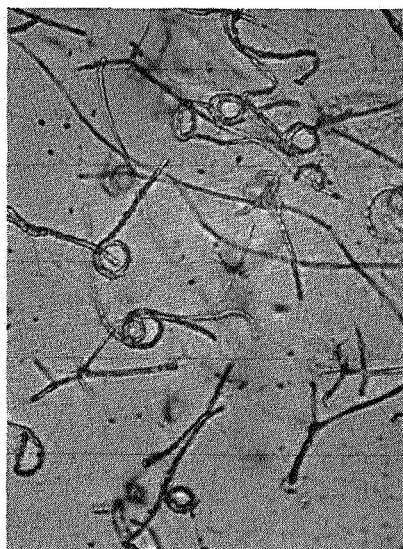
Culture No. 32  
JPL No. 248 Aa  
Species S. longisporuber

Photographs: Sporophore

Medium: #4: Starch agar

Age of culture: 30 days

Magnification: 1000X

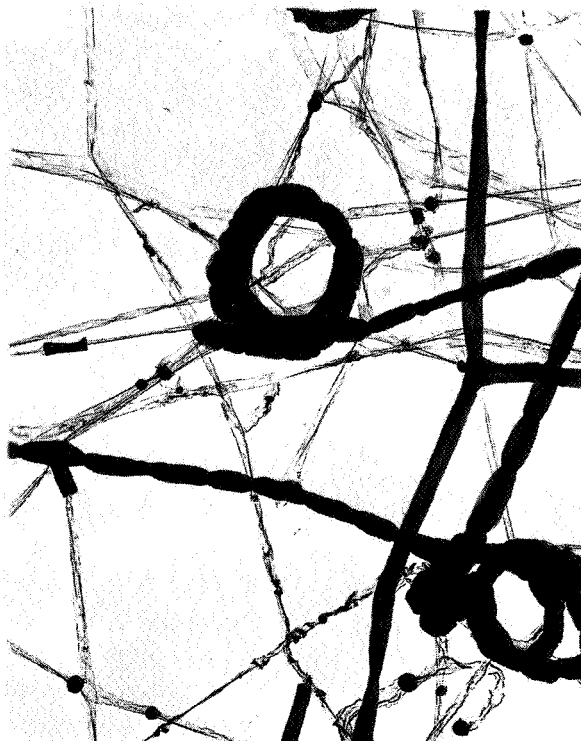


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Culture No. 32  
JPL No. 248 Aa  
Species S. longisporuber

## III. Spore morphology and surface:

Surface: smooth  
Dimensions: 1.53-0.76 x 0.61-0.30 $\mu$   
Medium: 4 - starch agar  
Age of culture: > 30 days  
Magnification: 6545X





Culture No.     #32    JPL No.     248 Aa    Species     *S. longisporuber*    

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	+	++
L-arabinose	++	++
Sucrose	+	+
D-mannitol	-	-
I-inositol	++	++
D-fructose	±	±
Rhamnose	++	++
Raffinose	++	++
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
           4 days-negative  
 Medium 6 - 2 days-negative  
           4 days-negative  
 Medium 7 - 2 days-negative  
           4 days-negative

## C. Starch hydrolysis

positive

Culture No. 40Source Chile-AtacamaJPL No. 245 TAeInvoice # D-38463Species indeterminate1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	b = oyster white	a = white ↓ c = gray	c = gray
	14	g = gray	e = gray	a = white ↓ f = gray	c = gray
	21	3ih = { beige gray mouse	3fe = silver gray	e = gray ↓ g = gray	e = gray
substrate mycelium	7	3pg = golden brown	2ic = { honey gold light gold	2ea = { lt. wheat lt. maize	3le = { cinnamon yellow maple
	14	7po	e = gray ↓ 4pi = { oak brown russet brown	2ie = lt. mustard tan ↓ 2pn = dk. brown	3pi = { golden brown tobacco brown
	21	7po	3ec = { bisque lt. beige ↓ 3pn = { sepia brown seal brown dk. brown	3ge = { beige camel ↓ 4pn = { chocolate br. dk. brown	4pl = { dk. spice brown deep brown
soluble pigment	7	4pe = orange rust	none	none	none
	14	4pg = dk. luggage tan	4ie = cork tan	2gc = { bamboo chamois	4ne = luggage tan
	21	5pg = { henna lt. copper brown russet rust brown	4ic = cork tan	3pg = golden brown	4ne = luggage tan

## II. Morphological observations: Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	spirals	none
	14	spira	spira	spira	none
	21	spira = as above	spira	as above	none
Spore No.	7	---	---	> 10	---
	14	> 10	> 10	> 10	---
	21	> 10	> 10	> 10	---
Verticils	7	---	---	none	---
	14	verticillus-spira	none	verticillus-spira	---
	21	verticillus-spira	none	verticillus-spira	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

none observed.

Page 3

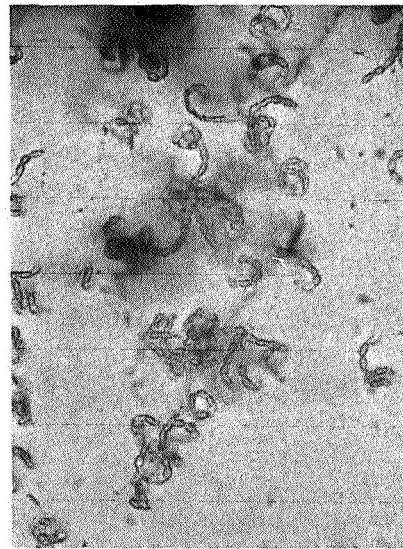
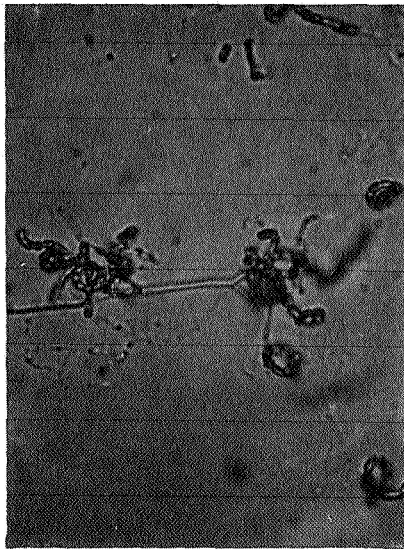
Culture No. 40  
JPL No. 245 TAe  
Species indeterminate

Photographs: ; Sporophore

Medium: Malt extract (mx) and Starch (St)

Age of culture: 14 and 21 days

Magnification: 1000X

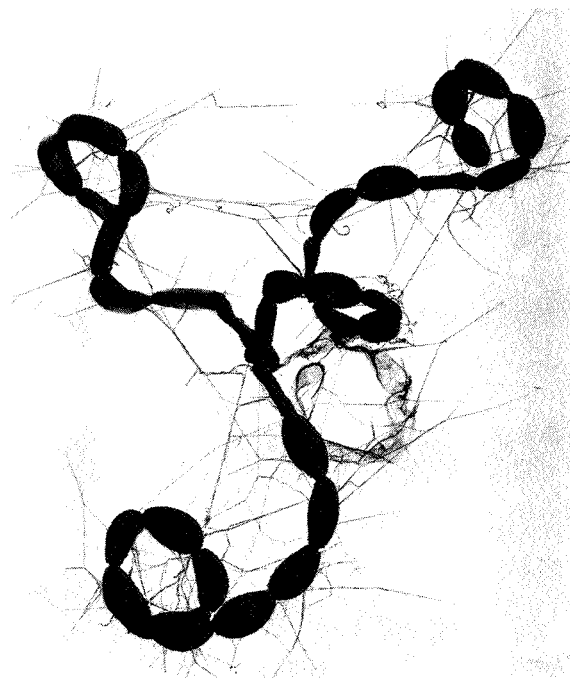


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Culture No. 40  
JPL No. 245TAe  
Species indeterminate

## III. Spore morphology and surface:

Surface: hairy  
Dimensions: 0.92-1.53 x 0.30-0.76 $\mu$   
Medium: 4-starch agar  
Age of culture: 8 days  
Magnification: 6545



Culture No. 40JPL No. 245 TAeSpecies indeterminate

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	±	±
D-mannitol	++	++
I-inositol	++	++
D-fructose	++	++
Rhamnose	++	++
Raffinose	+	+
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

positive

Culture No. 56

Source Chile-Atacama 28

JPL No. 277 TAa

Invoice # D-38463

Species indeterminate

1. Cultural properties: Temp. 26°C

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	no growth	none	no growth	no growth
	14	no growth	none	no growth	no growth
	21	no growth	none	no growth	no growth
substrate mycelium	7	no growth	2ba = {pearl shell tint	no growth	no growth
	14	no growth	2ba = {pearl shell tint	no growth	no growth
	21	no growth	2ba = {pearl shell tint	no growth	no growth
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

II. Morphological observations: **sporophore**

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---
Spore No.	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---
Verticils	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.



Species Streptomyces albogriseolus

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	a = white (sparse)	none
	14	none	none	a = white	none
	21	a = white (specks)	none	a = white	none
substrate mycelium	7	2ea = {lt. wheat lt. maize	colorless	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell
	14	2ic = {honey gold lt. gold	2ba = {pearl shell tint	3le = {cinnamon yellow maple	2ca = {lt. ivory eggshell
	21	2ne = {mustard gold old gold	2ba = {pearl shell tint	2pg = mustard gold	2ea = {lt. wheat lt. maize
soluble pigment	7	none	none	none	none
	14	2ne = {mustard gold old gold	none	none	none
	21	2ne = {mustard gold old gold	none	2pg = mustard gold	none

## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	none	none
	14	none	none	none	none
	21	none	none	spira-type a	none
Spore No.	7	---	----	---	---
	14	---	---	---	---
	21	---	---	> 10	---
Verticils	7	---	---	---	---
	14	---	---	---	---
	21	---	---	none	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

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Culture No. 62

JPL No. 245 A1

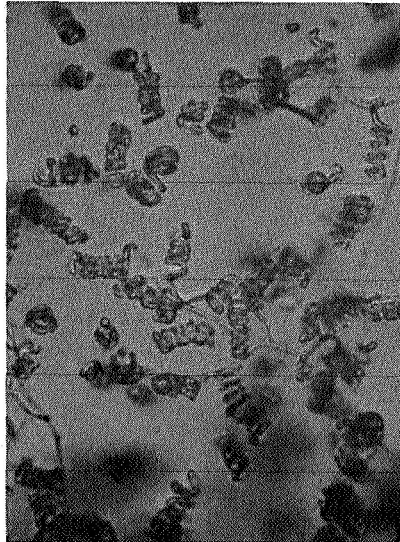
Species S. albogriseolus

**Photographs:**

Medium: 4 - Starch agar

Age of culture: 14 days

Magnification: 1000X

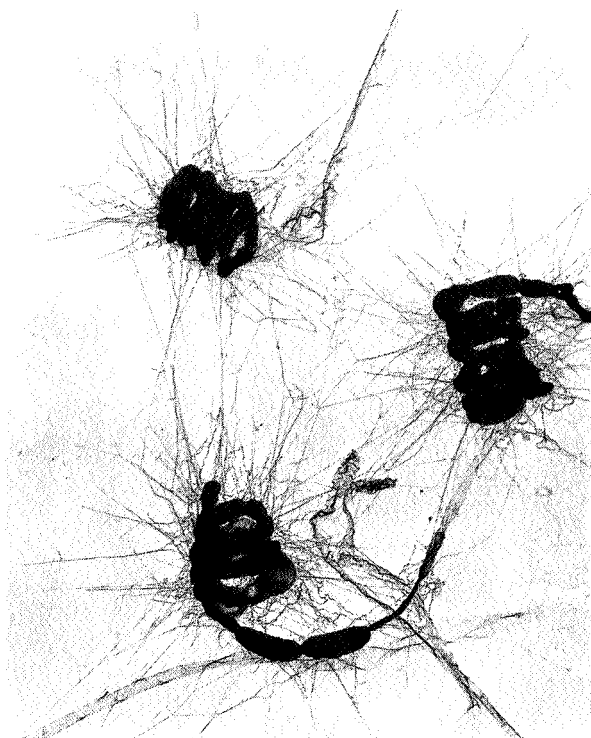


Page 4

Culture No. 62  
JPL No. 245 A1  
Species S. albogriseolus

### III. Spore morphology and surface:

Surface: hairy  
Dimensions: 0.79-1.78 x 0.30-0.69  $\mu$   
Medium: 4: Starch  
Age of culture: 21 days  
Magnification: 5053X



## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	±	+
D-mannitol	++	++
I-inositol	-	±
D-fructose	++	++
Rhamnose	++	++
Raffinose	-	±
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
4 days-negative  
Medium 6 - 2 days-negative  
4 days-negative  
Medium 7 - 2 days-negative  
4 days-negative

## C. Starch hydrolysis

positive

Culture No. 63

Source Chile-Atacama

JPL No. 245 Bc

Invoice # D-38463

Species indeterminate

1. Cultural properties: Temp. 26°

	Da.	CHM *number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	5cb	none	b = oyster white	none
	14	3fe = silver gray	3dc = natural	3dc = natural	none
	21	f = gray	2dc = { natural string	d = gray	none
substrate mycelium	7	7½ng = old wine	7½le = rose wine	7½le = rose wine	7½gc = dusty rose
	14	7½pl = { burgundy cordovan deep maroon	7½le = rose wine	10pl = { deep plum deep egg plant	7gc = { lt. colonial rose old rose
	21	8pl = { burgundy cordovan	8le = rose wine	7ni = rose brown	6½gc = dusty coral
soluble pigment	7	none	none	none	none
	14	4le = luggage tan	none	none	none
	21	4ne = luggage tan	7ec = rose mist	7cb = cloud pink	none

## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	retinaculum- apertum and spirals	none
	14	retinaculum- apertum and spirals	retinaculum- apertum and spirals	as above	none
	21	as above	as above	as above	none
Spore No.	7	none	none	> 10	---
	14	> 10	> 10	> 10	---
	21	> 10	> 10	> 10	---
Verticils	7	none	none	none	none
	14	biverticillus- spira	biverticillus- spira	biverticillus- spira	none
	21	biverticillus- spira	biverticillus- spira	biverticillus- spira	none

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

none observed.

Page 3

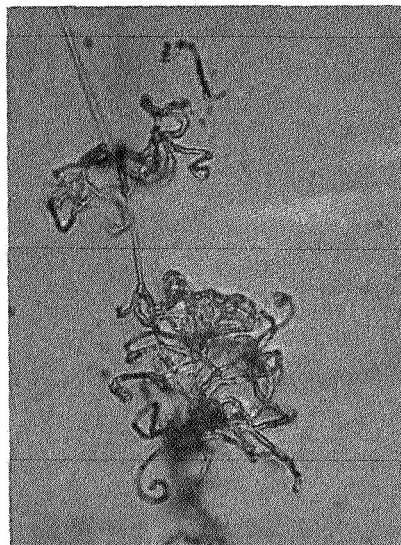
Culture No. 63  
JPL No. 245 Bc  
Species indeterminate

Photographs: Sporophore

Medium: 3 - oatmeal agar

Age of culture: 14 days

Magnification: 1000X



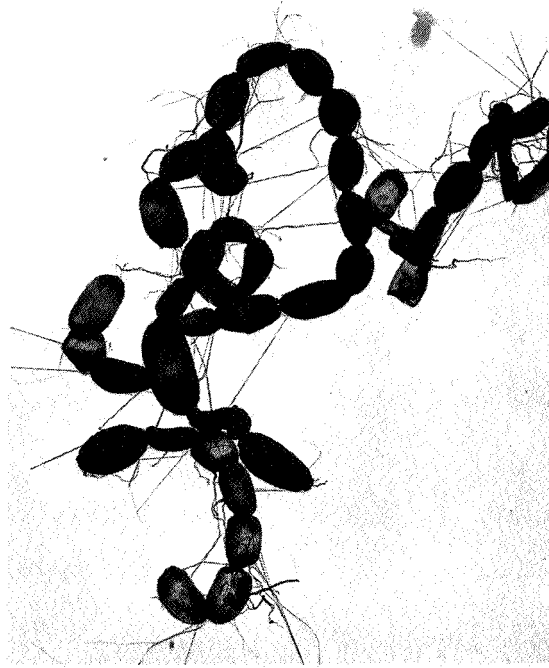


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Culture No. 63  
JPL No. 245 Bc  
Species indeterminate

### III. Spore morphology and surface:

Surface: hairy  
Dimensions: 0.46-2.14 x 0.46-0.92  $\mu$   
Medium: 4 - starch agar  
Age of culture: 16 days  
Magnification: 6545



Culture No. 63JPL No. 245 BcSpecies indeterminate

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	-	±
D-mannitol	+	++
I-inositol	+	++
D-fructose	+	++
Rhamnose	++	++
Raffinose	-	+
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

**positive**

Species indeterminate

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	a = white	a = white	a = white
	14	3ca = {pearl pink shell	a = white	2ca = {lt. ivory eggshell	a = white
	21	4ec = {Bisque Lt. rose beige	a = white	2ca = {lt. ivory eggshell	a = white
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint
	14	3ic = lt. amber	2ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint
	21	3ne = {Topaz Butterscotch	2ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

II. Morphological observations: **Sporophore**

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	none	none
	14	none	none	none	none
	21	rectus-flexibilis	rectus-flexibilis	rectus-flexibilis	none
Spore No.	7	---	---	---	---
	14	---	---	---	---
	21	> 10	> 10	> 10	---
Verticils	7	---	---	---	---
	14	---	---	---	---
	21	none	none	none	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Culture No. 69

JPL No. 381Ba

Species indeterminate

Photographs: Sporophore

Medium: starch agar

Age of culture: 31 days

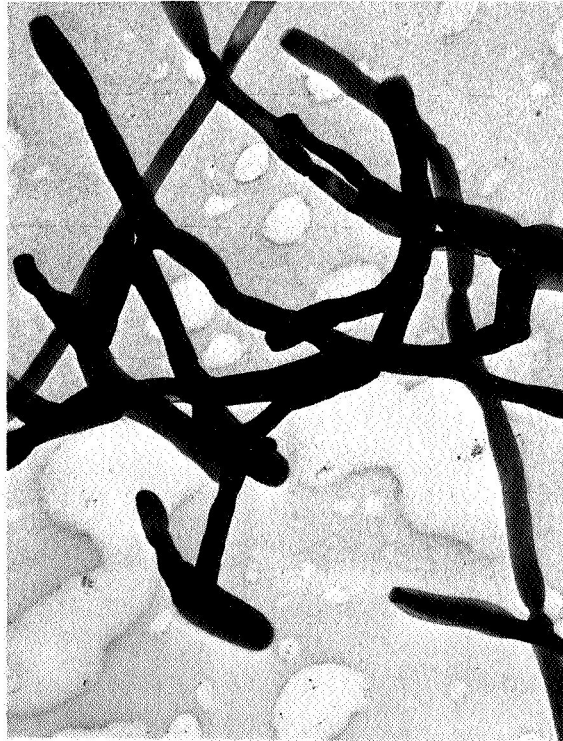
Magnification: 1000X



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Culture No. 69JPL No. 381BaSpecies indeterminate

## III. Spore morphology and surface:

Surface: smoothDimensions: 2.29-4.38 x 0.46-0.61 $\mu$ Medium: starchAge of culture: 18 daysMagnification: 6545

Culture No. #71Source Chile-AtacamaJPL No. 245 AF (#30)Invoice # Cameron 10-17-67Species S. exfoliatus1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelia	7	a = white	none	none	none
	14	a = white ↓ ↓ 8ec = rose mist	none	a = white ↓ ↓ 10ba = orchid tint	none
	21	8ge = dusty mauve	none	10cb = orchid mist	none
substrate mycelium	7	2ea = {lt. wheat lt. maize	1½ca = cream	1½ca = cream	2ba = {pearl shell tint
	14	2ic = {honey gold lt. gold	1ba = yellow tint	2ea = {lt. wheat lt. maize	1ca = pale yellow
	21	2ic = {honey gold lt. gold	1½ca = cream	2ea = {lt. wheat lt. maize	1ca = pale yellow
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

Culture No. 71JPL No. 245 Af

## II. Morphological observations: Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	none	none
	14	rectus-flexibilis	none	rectus-flexibilis	none
	21	as above	none	as above	none
Spore No.	7	---	---	---	---
	14	> 10	---	> 10	---
	21	> 10	---	> 10	---
Verticils	7	---	---	---	---
	14	none	---	none	---
	21	none	---	none	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

none observed.



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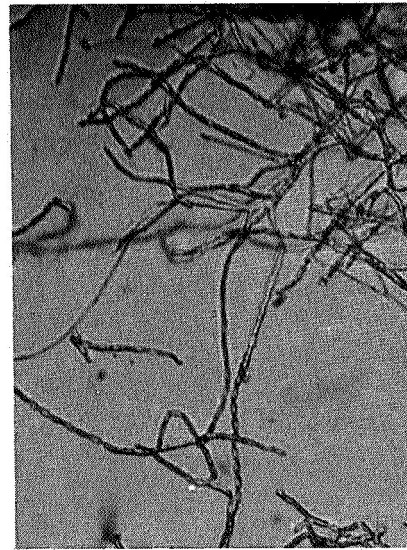
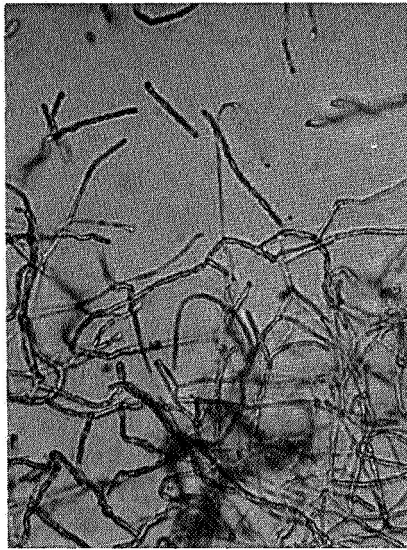
Culture No. 71  
JPL No. 245 Af  
Species S. exfoliatus

Photographs: Sporophore

Medium: Starch and malt-extract

Age of culture: 14 days

Magnification: 1000X



Page 4

Culture No. 71  
JPL No. 245 Af  
Species S. exfoliatus

### III. Spore morphology and surface:

Surface: smooth  
Dimensions: 0.92-1.199 x 0.46-0.76 $\mu$   
Medium: 2 - malt extract agar  
Age of culture: 13 days  
Magnification: 6545X



Culture No. 71JPL No. 245 AfSpecies S. exfoliatus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	++	++
D-mannitol	-	-
I-inositol	-	-
D-fructose	++	++
Rhamnose	++	++
Raffinose	+	+
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

positive

Culture No. 72

Source Chile-Atacama 49

JPL No. 245 Ba

Invoice # Cameron 10-17-67

Species Streptomyces albogriseolus

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	1½ca = cream	a = white	none
	14	a = white ↓ 2dc = {natural string	1½ca = cream ↓ 3fe = silver gray	a = white 2ih = {dk convert gray	none
	21	3ih = {beige gray mouse	3ih = {beige gray mouse	3ih = {beige gray mouse	none
substrate mycelium	7	1½lc = gold	1½gc = dusty yellow	lcb = parchment	1½ca = cream
	14	3le = {cinnamon yellow maple	2ea = {lt. wheat lt. maize	3gc = lt. tan	2ea = {lt. wheat lt. maize
	21	3le = {cinnamon yellow maple	2ea = {lt. wheat lt. maize	2le = {mustard old gold	2ea = {lt. wheat lt. maize
Soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	2ic = {honey gold lt. gold	2gc = {bamboo chamois	3le = {cinnamon yellow maple	lea = pale yellow

## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	none	none
	14	none	spira (type a)	spira, type a	none
	21	spira, type a	as above	as above	none
Spore No.	7	---	---	---	---
	14	---	> 10	> 10	---
	21	> 10	> 10	> 10	---
Verticils	7	---	---	---	---
	14	---	none	none	---
	21	none	none	none	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

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Culture No. 72JPL No. 245 BaSpecies S. albogriseolus

Photographs: Sporophore

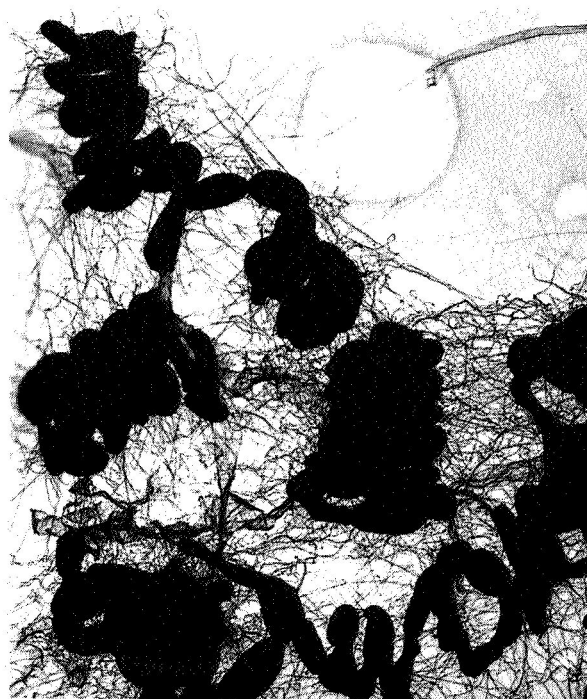
Medium: Starch agarAge of culture: 14 daysMagnification: 1000X

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Culture No. 72  
JPL No. 245 Ba  
Species S. albogriseolus

## III. Spore morphology and surface:

Surface: hairy  
Dimensions: 0.92-1.68 x 0.46-0.84  $\mu$   
Medium: Starch agar  
Age of culture: 13 days  
Magnification: 6545X



Culture No. 72JPL No. 245 BaSpecies S. albogriseolus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	+	++
D-mannitol	+	++
I-inositol	±	+
D-fructose	+	++
Rhamnose	++	++
Raffinose	-	±
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

positive



Culture No. 73

Source Chile 54

JPL No. 245 Bb (#10)

Invoice # Cameron 10-17-67

Species indeterminate

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
Aerial mycelia	7	a = white	a = white	a = white	a = white
	14	d = gray ↓ 3ih = { beige gray mouse	b = oyster white ↓ lfe = { griege citron gray	d = gray ↓ 3ih = { beige gray mouse	a = white
	21	b = oyster white ↓ 3ih = { beige gray mouse	b = oyster white ↓ 3fe = silver gray	d = gray 3ih = { beige gray mouse	a = white
Substrate	7	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint	1½ca = cream	1½ca = cream
	14	2ea = { lt. wheat lt. maize	2ca = { lt. ivory eggshell	1½ca = cream	1½ca = cream
	21	2ea = { lt. wheat lt. maize	2ca = { lt. ivory eggshell	2ea = { lt. wheat lt. maize	1½ca = cream
Soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	spira, RA	RA	none
	14	spira, RA	spira, RA	spira, RA	none
	21	as above	as above	as above	none
Spore No.	7	none	> 10	> 10	none
	14	> 10	> 10	> 10	none
	21	> 10	> 10	> 10	none
Verticils	7	none	none	none	none
	14	biverticillus-spira	biverticillus-spira	biverticillus-spira	none
	21	biverticillus-spira	biverticillus-spira	biverticillus-spira	none

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

none observed.

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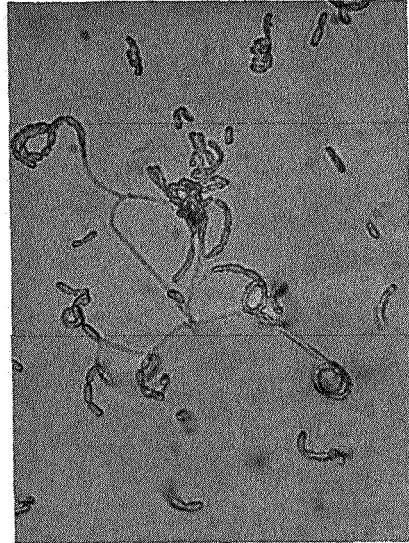
Culture No. 73  
JPL No. 245 Bb  
Species indeterminate

Photographs: Sporophore

Medium: Starch and oatmeal

Age of Culture: 14 days

Magnification: 1000X



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Culture No. 73  
JPL No. 245 Bb  
Species indeterminate

### III. Spore morphology and surface:

Surface: hairy  
Dimensions: 0.79-1.98 x 0.39-0.89 $\mu$   
Medium: Starch  
Age of culture: 16 days  
Magnification: 5053X



Culture No. 73JPL No. 245 BbSpecies indeterminate

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	+	++
D-mannitol	++	++
I-inositol	+	+
D-fructose	++	++
Rhamnose	-	-
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

**positive**

Species Streptomyces exfoliatus

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
Aerial mycelium	7	a = white ↓ 5cb = { flesh pink pale pink petal pink shell pink	a = white	a = white ↓ 5cb = { flesh pink pale pink petal pink shell pink	none
	14	a = white ↓ 7cb = cloud pink	a = white ↓ 7cb = cloud pink ↓ 5dc = pussywillow gray	a = white ↓ 7cb = cloud pink	a = white (sparse)
	21	6ec = powder rose	5cb	5cb = { ashes of rose rose gray	a = white
Substrate mycelium	7	2ca = { lt. ivory eggshell	2ba = { pearl shell tint	2ba = { pearl shell tint ↓ 1½ge = lt. olive gray	colorless
	14	2ne = { mustard gold old gold	2ba = { pearl shell tint	2ba = { pearl shell tint	2ba = { pearl shell tint
	21	3le = { cinnamon yellow maple	2ba = { pearl shell tint	3ca = { pearl pink shell	2ba = { pearl shell tint
Soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	3ic = lt. amber	none	none	none

## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	Rectus-flexibilis	Rectus-flexibilis	Rectus-flexibilis	none
	14	as above	as above	as above	none
	21	as above	as above	as above	Rectus-flexibilis
Spore number	7	> 10	> 10	> 10	---
	14	> 10	> 10	> 10	---
	21	> 10	> 10	> 10	> 10
Verticils	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

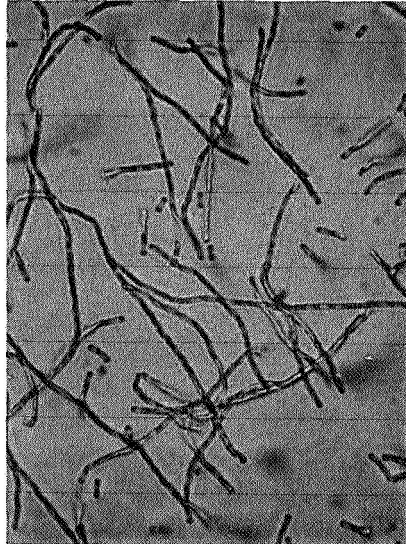
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 75JPL No. 248 Ac (30)Species S. exfoliatus

Photographs: Sporophore

Medium: 4-StarchAge of culture: 14 daysMagnification: 1000X



Page 4

Culture No. 75JPL No. 248 AcSpecies S. exfoliatus

## III. Spore morphology and surface:

Surface: smoothDimensions: 1.19-2.18 x 0.39-0.69 $\mu$ Medium: 4-StarchAge of culture: 12 daysMagnification: 5053X

Culture No. 75JPL No. 248 AcSpecies S. exfoliatus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	±	±
L-arabinose	±	±
Sucrose	++	++
D-mannitol	±	±
I-inositol	±	±
D-fructose	±	±
Rhamnose	±	±
Raffinose	±	±
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

C. Starch hydrolysis  
positive

Culture No. 79Source Antarctica, Wheeler Valley 64JPL No. Wh 7Invoice # D-56445Species Streptomyces longisporoflavus1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white (sparse)	a = white (sparse)	a = white (sparse)	a = white (sparse)
	14	a = white (sparse)	a = white	a = white (sparse)	a = white (sparse)
	21	a = white (sparse)	a = white	a = white	a = white (sparse)
substrate mycelium	7	2ca = {lt. ivory eggshell	2ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint
	14	2ca = {lt. ivory eggshell	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	21	2ca = {lt. ivory eggshell	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	21c = gold	none	none	none

## II. Morphological observations: Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	rectus-flexibilis	none	none
	14	none	none	rectus-flexibilis	none
	21	none	rectus-flexibilis	rectus-flexibilis & spira	none
Spore No.	7	none	< 10	---	---
	14	---	---	> 10	---
	21	none	> 10	> 10	---
Verticil	7	none	none	---	none
	14	none	none	none	none
	21	none	none	none	---

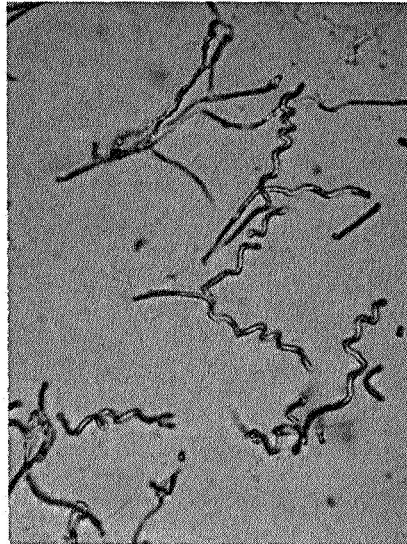
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 79JPL No. Wh 7Species S. longisporoflavus

Photographs: Sporophore

Medium: starch agarAge of culture: 21 daysMagnification: 1000X

Page 4

Culture No. 79JPL No. Wh 7Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.53-0.99 x 0.38-0.53 $\mu$ Medium: starchAge of culture: 21 daysMagnification: 6545X

Culture No. 79JPL No. Wh 7Species S. longisporoflavus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	±	±
Sucrose	++	++
D-mannitol	±	±
I-inositol	+	+
D-fructose	+	+
Rhamnose	±	±
Raffinose	±	±
Cellulose	±	±

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days - negative  
 4 days - negative  
 Medium 6 - 2 days - negative  
 4 days - negative  
 Medium 7 - 2 days - negative  
 4 days - negative

C. Starch hydrolysis  
positive

Culture No. 80Source Antarctica, Wheeler Valley 69JPL No. Wh 10Invoice # D-56445Species Streptomyces longisporoflavus1. Cultural properties: Temp. 20°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelia	7	a = white	none	none	none
	14	a = white	a = white	lba = yellow tint	none
	21	a = white	a = white	lcb = parchment	none
substrate mycelium	7	2ic = {honey gold lt. gold	2ba = {pearl shell tint	2ba = {pearl shell tint	2ca = {lt. ivory eggshell
	14	2ic = {honey gold lt. gold	2ba = {pearl shell tint	2ba = {pearl shell tint	2ca = {lt. ivory eggshell
	21	2pe = {mustard gold old gold	2ba = {pearl shell tint	2gc = {bamboo chamois	2ca = {lt. ivory eggshell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	2 ic = {honey gold lt. gold	none	none	none



## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	---	---	---	---
	14	none	none	loose spirals rectus-flexibilis	none
	21	open twists & RF	none	mostly spirals	none
Spore No.	7	---	---	---	---
	14	---	---	> 10	---
	21	> 10	---	> 10	---
Verticils	7	---	---	---	---
	14	---	---	none	---
	21	none	---	none	---

special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 80  
JPL No. Wh 10  
Species S. longisporoflavus

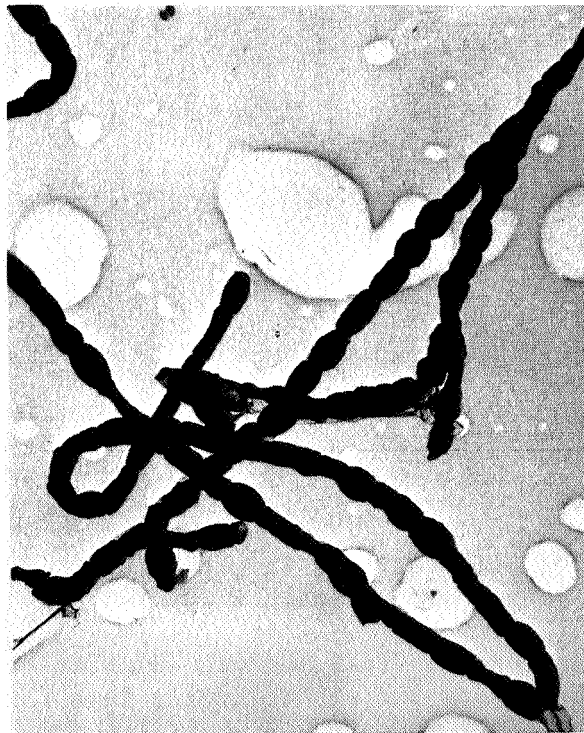
Photographs: Sporophore

Medium: Starch agarAge of culture: 14 daysMagnification: 1000X

Culture No. 80  
JPL No. Wh 10  
Species *S. longisporoflavus*

III. Spore morphology and surface:

Surface: smooth  
Dimensions: 0.61-1.07 x 0.30-0.69 $\mu$   
Medium: Starch  
Age of culture: 13 days  
Magnification: 6545X



Culture No. 80JPL No. Wh 10Species S. longisporoflavus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	++	++
D-mannitol	-	-
I-inositol	±	+
D-fructose	+	+
Rhamnose	±	±
Raffinose	+	+
Cellulose	±	±

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

positive

Culture No. 81

Source Antarctica, Wheeler Valley 74

JPL No. Wh 11

Invoice # D-56445

Species Streptomyces longisporoflavus

1. Cultural properties: Temp. 26°

	Da.	CHM *number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	none	none
	14	a = white	a = white	a = white	none
	21	a = white	a = white	a = white	a = white
substrate mycelium	7	1½ca = cream	2ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint
	14	2ea = {lt. wheat lt. maize.	2ca = {lt. ivory eggshell	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	21	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	---	---	---	---
	14	rectus-flexibilis	rectus-flexibilis	spirals & rectus-flexibilis	---
	21	as above	as above	as above	none
Spore No.	7	---	---	---	---
	14	> 10	< 10	> 10	---
	21	> 10	< 10	> 10	---
Verticils	7	---	---	---	---
	14	none	none	none	---
	21	none	none	none	---

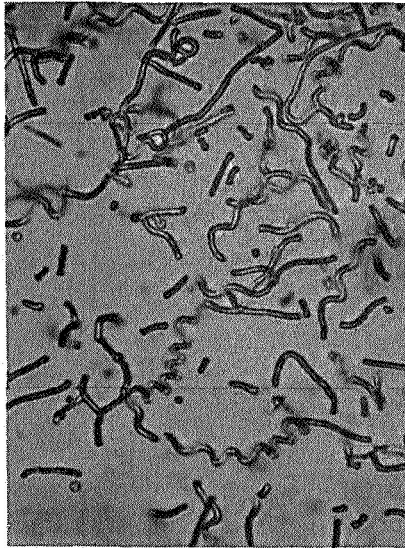
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 81JPL No. Wh 11Species S. longisporoflavus

Photographs: Sporophore

Medium: StarchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 81JPL No. Wh 11Species S. longisporoflavus

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.46-1.37 x 0.38-0.61 $\mu$ Medium: Starch agarAge of culture: 28 daysMagnification: 6545X



Culture No. 81JPL No. Wh 11Species S. longisporoflavus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	+	+
L-arabinose	±	±
Sucrose	+	+
D-mannitol	-	-
I-inositol	±	±
D-fructose	±	±
Rhamnose	+	+
Raffinose	+	+
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

Positive

Culture No. 82Source Antarctica, Wheeler Valley<sup>79</sup>JPL No. Wh 12Invoice # D-56445Species Streptomyces longisporoflavus1. Cultural properties: Temp. 20°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	none	a = white	a = white
	14	a = white	a = white	1ba = yellow tint	a = white
	21	a = white ↓ 1ba = yellow tint	a = white	1ba = yellow tint	a = white
substrate mycelium	7	2ca = { lt. ivory eggshell	2ba = { pearl shell tint	2ca = { lt. ivory eggshell	2ba = { pearl shell tint
	14	2ca = { lt. ivory eggshell	2ba = { pearl shell tint	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint
	21	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	---	none	none
	14	spira & rectus-flexibilis	rectus-flexibilis	spira & rectus-flexibilis	none
	21	as above	rectus-flexibilis	as above	rectus-flexibilis & spira
Spore No.	7	---	---	---	---
	14	> 10	< 10	> 10	---
	21	> 10	< 10	> 10	> 10
Verticil	7	---	---	---	---
	14	none	none	none	---
	21	none	none	none	none

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

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Culture No. 82JPL No. Wh 12Species *S. longisporoflavus*

Photographs: Sporophore

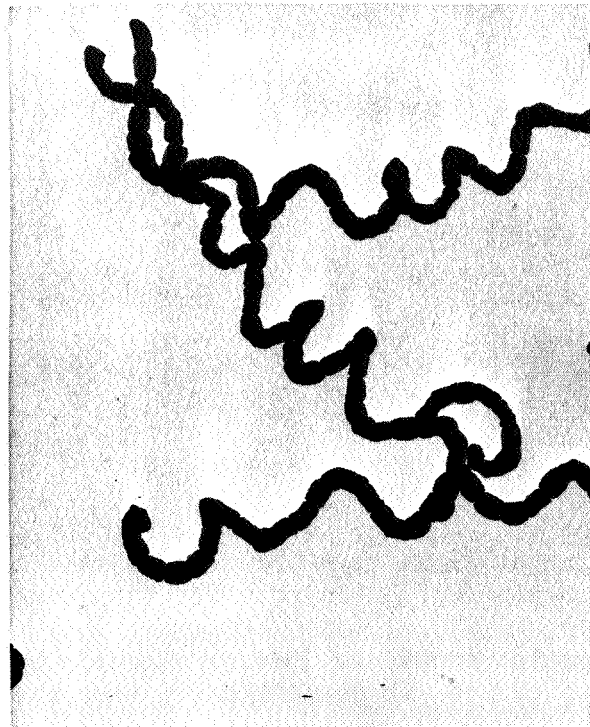
Medium: 4: starchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 82  
JPL No. Wh 12  
Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smooth and warty  
Dimensions: 0.59-0.79 x 0.39-0.59 $\mu$   
Medium: 4 - starch agar  
Age of culture: 15 days  
Magnification: 5053X



Culture No. 82JPL No. Wh 12Species S. longisporoflavus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	±	±
L-arabinose	-	-
Sucrose	+	++
D-mannitol	-	-
I-inositol	±	±
D-fructose	±	±
Rhamnose	±	±
Raffinose	-	±
Cellulose	±	±

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

2 days-negative  
 Medium 1 - 4 days-negative  
 2 days-negative  
 Medium 6 - 4 days-negative  
 2 days-negative  
 Medium 7 - 4 days-negative

## C. Starch hydrolysis

Positive

Culture No. 83

Source Antarctica, Wheeler Valley

JPL No. Wh 13

Invoice # D-56445

Species Streptomyces longisporoflavus

1. Cultural properties: Temp. 20°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white (sparse)	a = white	a = white (sparse)	none
	14	a = white (sparse)	a = white	1ba = yellow tint	none
	21	3ba = { pearl shell tint	a = white	1ba = yellow tint	none
substrate mycelium	7	2ca = { lt. ivory eggshell	2ba = { pearl shell tint	1½ca = cream	2ba = { pearl shell tint
	14	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint	2ca = { lt. ivory eggshell	2ba = { pearl shell tint
	21	2ic = { honey gold lt. gold	2ba = { pearl shell tint	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	3ic = lt. amber	none	none	none

## II. Morphological observations: Sporophores

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	none	none
	14	none	none	RA & RF & spira	none
	21	RA, RA, spirals	none	RF and spira	none
Spore No.	7	---	---	---	---
	14	---	---	> 10	---
	21	> 10	---	> 10	---
Verticils	7	---	---	---	---
	14	---	---	none	---
	21	none	---	none	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.



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Culture No. 83

JPL No. Wh 13

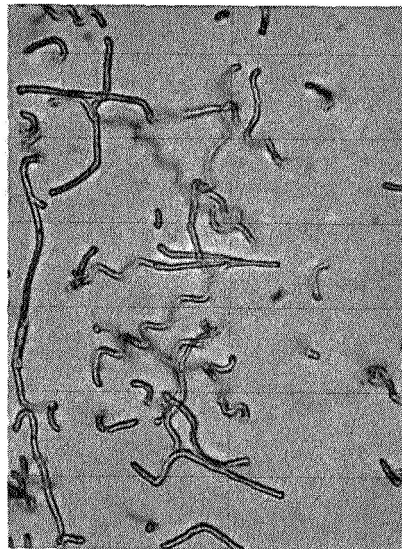
Species S. longisporoflavus

Photographs: Sporophore

Medium: 4 - starch agar

Age of culture: 14 days

Magnification: 1000



Page 4

Culture No. 83JPL No. Wh 13Species S. longisporoflavus

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.61-1.07 x 0.38-0.61 $\mu$ Medium: StarchAge of culture: 14 daysMagnification: 6545

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	++	++
D-mannitol	-	-
I-inositol	-	±
D-fructose	-	-
Rhamnose	-	-
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
4 days-negative

Medium 6 - 2 days-negative melanin production. Positive H<sub>2</sub>S production  
4 days-negative melanin production. Positive H<sub>2</sub>S production

Medium 7 - 2 days-negative  
4 days-negative

## C. Starch hydrolysis

Positive

Culture No. 84

Source Antarctica, Wheeler Valley<sup>89</sup>

JPL No. Wh 14

Invoice # D-56445

Species Streptomyces longisporoflavus

1. Cultural properties: Temp. 20°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5+ glucose
aerial mycelium	7	a = white	a = white	a = white	none
	14	a = white	a = white	lba = yellow tint	a = white
	21	a = white	a = white	lba = yellow tint	a = white
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ca = {lt. ivory eggshell
	14	2ic = {honey gold lt. gold	2ba = {pearl shell tint	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell
	21	2ne = {mustard gold old gold	2ba = {pearl shell tint	2ic = {honey gold lt. gold	2ca = {lt. ivory eggshell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

II. Morphological observations: **Sporophore**

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	none	none	none
	14	none	none	rectus-flexibilis & spirals. Broom-shape arrangement	none
	21	none	none	as above	none
Spore No.	7	---	---	---	---
	14	---	---	> 10	---
	21	---	---	> 10	---
verticils	7	---	---	---	---
	14	---	---	none	---
	21	---	---	none	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 84  
JPL No. Wh 14  
Species S. longisporoflavus

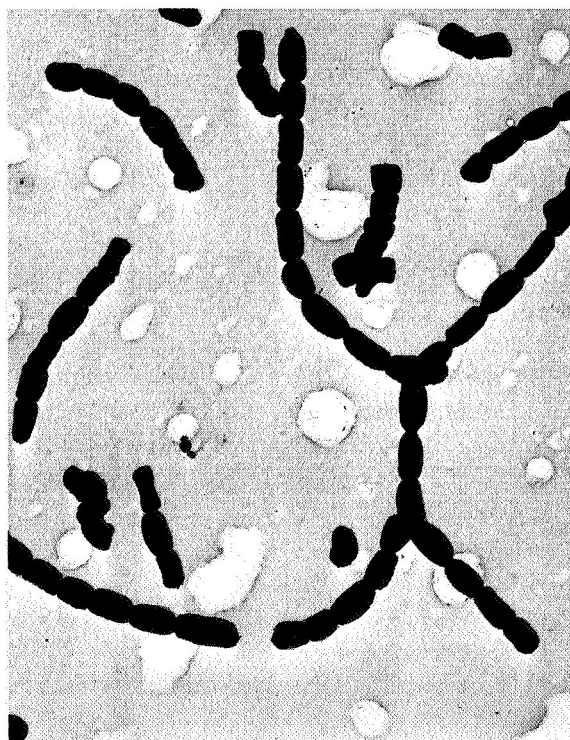
Photographs: Sporophore

Medium: starchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 84JPL No. Wh 14Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.60-1.34 x 0.37-0.60 $\mu$ Medium: starchAge of culture: 17 daysMagnification: 6698X

Culture No. 84JPL No. Wh 14Species *S. longisporoflavus*

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	+	+
D-mannitol	±	±
I-inositol	±	±
D-fructose	±	±
Rhamnose	-	-
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

**Positive**



Culture No. 85

Source Antarctica, Wheeler Valley<sup>94</sup>

JPL No. Wh 35

Invoice # D-56445

Species Streptomyces longisporoflavus

1. Cultural properties: Temp. 20°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	a = white	a = white	none
	14	a = white	a = white	lba = yellow tint	none
	21	a = white ↓ lba = yellow tint	a = white	lba = yellow tint	none
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	14	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	21	2ic = {honey gold lt. gold	2ba = {pearl shell tint	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations : Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	rectus-flexibilis and loose, open spirals	none
	14	none	none	as above	none
	21	rectus-flexibilis and loose, open spirals	none	as above	none
Spore No.	7	---	---	>10	---
	14	---	---	> 10	---
	21	> 10	---	> 10	---
Verticils	7	---	---	none	---
	14	---	---	none	---
	21	none	---	none	---

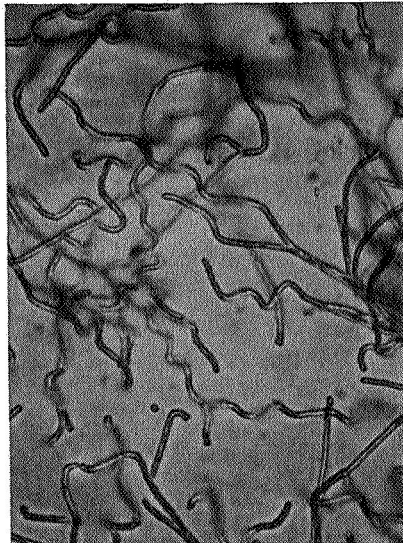
special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 85JPL No. Wh 35Species S. longisporoflavus

Photographs: Sporophore

Medium: 4 - starchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 85JPL No. Wh 35Species S. longisporoflavus

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.61-1.07 x 0.46-0.61 $\mu$ Medium: 4 - starchAge of culture: 15 daysMagnification: 6545X

Culture No. 85JPL No. Wh 35Species S. longisporoflavus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	++	++
D-mannitol	-	-
I-inositol	±	±
D-fructose	±	±
Rhamnose	-	-
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

Positive

Culture No. 86

Source Antarctica, Wheeler Valley 99

JPL No. Wh 36

Invoice # D-56445

Species S. longisporoflavus

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	a = white	a = white	none
	14	a = white	a = white	1ba = yellow tint	a = white
	21	a = white	a = white	1ba = yellow tint	a = white
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ca = {lt. ivory egg shell	2ca = {lt. ivory egg shell
	14	2ic = {honey gold lt. gold	2ba = {pearl shell tint	2ea = {lt. wheat lt. maize	2ca = {lt. ivory egg shell
	21	2ic = gold	2ca = {lt. ivory egg shell	2ea = {lt. wheat lt. maize	2ca = {lt. ivory egg shell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations: Sporophores

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	none	none
	14	none	none	rectus-flexibilis and spira	none
	21	none	none	as above	none
Spore No.	7	---	---	---	---
	14	---	---	> 10	---
	21	---	---	> 10	---
Verticils	7	---	---	---	---
	14	---	---	none	---
	21	---	---	none	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 86JPL No. Wh 36Species S. longisporoflavus

## Photographs: Sporophore

Medium: starch agarAge of culture: 13 daysMagnification: 1000X



Page 4

Culture No. 86JPL No. Wh 36Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.60-1.05 x 0.37-0.60 $\mu$ Medium: starch agarAge of culture: 21 daysMagnification: 6698

Culture No. 87

Source Antarctica, Wheeler Valley 103

JPL No. Wh 37

Invoice # D-56445

Species S. longisporoflavus

1. Cultural properties: Temp. 20°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	a = white	a = white	none
	14	a = white	a = white	lba = yellow tint	none
	21	a = white	a = white	lba = yellow tint	none
substrate mycelium	7	2ea = { lt. wheat lt. maize	2ca = { lt. ivory egg shell	2ca = { lt. ivory egg shell	2ba = { pearl shell tint
	14	2ic = { honey gold lt. gold	2ca = { lt. ivory egg shell	2ea = { lt. wheat lt. maize	2ca = { lt. ivory egg shell
	21	2ic = { honey gold lt. gold	2ea = { lt. wheat lt. maize	2ea = { lt. wheat lt. maize	2ca = { lt. ivory egg shell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations : Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	none	none
	14	none	rectus-flexibilis	rectus-flexibilis and spira	none
	21	rectus-flexibilis	rectus-flexibilis	as above	none
Spore No.	7	---	---	---	---
	14	---	< 10	> 10	---
	21	> 10	> 10	> 10	---
Verticil	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

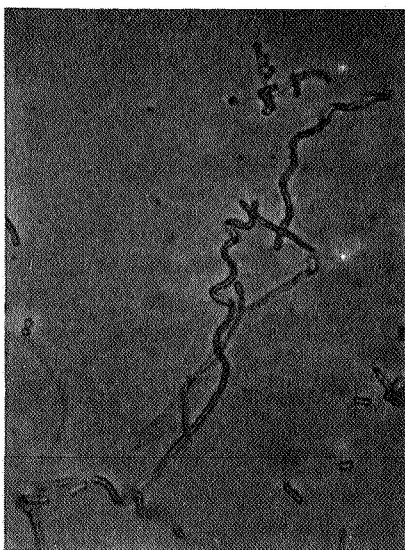
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 87JPL No. Wh 37Species *S. longisporoflavus*

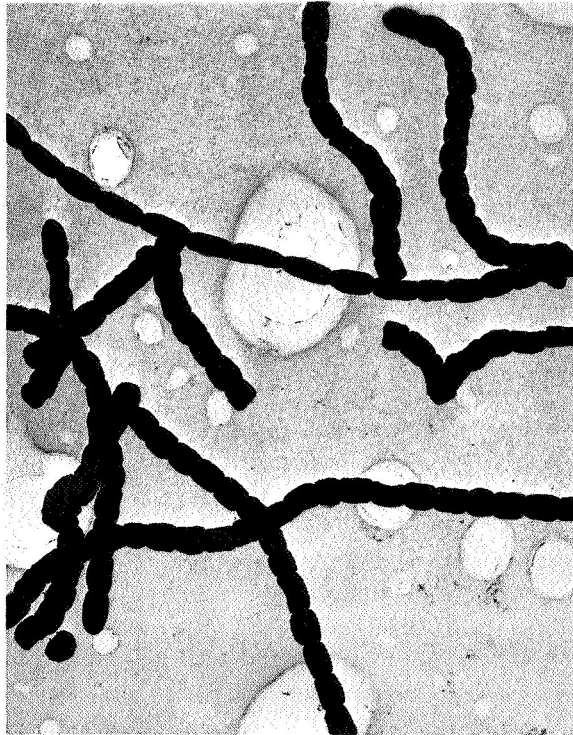
Photographs: Sporophore

Medium: starch agarAge of culture: 13 daysMagnification: 1000X

Page 4

Culture No. 87JPL No. Wh 37Species S. longisporoflavus

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.60-0.89 x 0.37-0.60 $\mu$ Medium: starch agarAge of culture: 21 daysMagnification: 6698

Culture No. 88Source Antarctica, Wheeler Valley <sup>107</sup>JPL No. Wh 46Invoice # D-56445Species Streptomyces longisporoflavus1. Cultural properties: Temp. 20°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5 + G
aerial mycelium	7	a = white	a = white	a = white	none
	14	a = white	a = white	a = white	a = white
	21	a = white	a = white	1ba = yellow tint	a = white
substrate mycelium	7	2gc = {bamboo chamois	2ba = {pearl shell tint	2ba = {pearl shell tint	2ca = {lt. ivory eggshell
	14	2ic = {honey gold lt. gold	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ca = {lt. ivory eggshell
	21	2ne = {mustard gold old gold	2ba = {pearl shell tint	2gc = {bamboo chamois	2ca = {lt. ivory eggshell
soluble pigment	7	none	none	none	none
	14	2ic = {honey gold lt. gold	none	none	none
	21	2ic = {honey gold lt. gold	none	none	none

## II. Morphological observations : Sporophores

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophores	7	none	---	---	---
	14	rectus-flexibilis	rectus-flexibilis	rectus-flexibilis & open spirals. Broom-shape arrangement	none
	21	rectus-flexibilis & loose, open spirals. Broom- shape arrangement	rectus-flexibilis & open twists. Broom shape arrangement	as above	none
Spore No.	7	---	---	---	---
	14	> 10	> 10	> 10	---
	21	> 10	> 10	> 10	---
Verticils	7	---	---	---	---
	14	none	none	none	---
	21	none	none	none	---

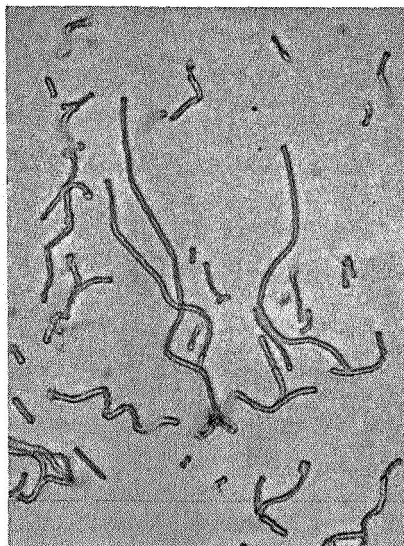
special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 88JPL No. Wh 46Species S. longisporoflavus

Photographs: Sporophore

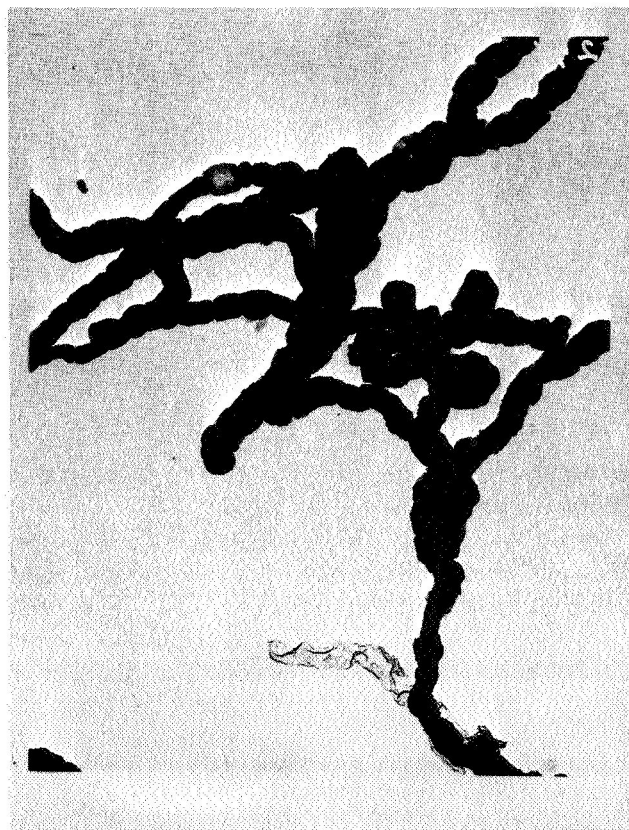
Medium: starchAge of culture: 14 daysMagnification: 1000X



Page 4

Culture No. 88JPL No. Wh 46Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: warty and smoothDimensions: 0.61-0.76 x 0.30-0.76 $\mu$ Medium: StarchAge of culture: 14 daysMagnification: 6545X

Culture No. 88JPL No. Wh 46Species S. longisporoflavus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	±	±
L-arabinose	±	±
Sucrose	++	++
D-mannitol	-	-
I-inositol	±	±
D-fructose	+	+
Rhamnose	-	-
Raffinose	+	+
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

Positive

Culture No. 89

Source Antarctica, Wheeler Valley 112

JPL No. Wh 62

Invoice # D-56445

Species Streptomyces longisporoflavus

1. Cultural properties: Temp. 20<sup>0</sup>

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	a = white	a = white	a = white
	14	a = white	a = white	lba = yellow tint	a = white
	21	lba = yellow tint	a = white	lba = yellow tint	a = white
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell	2ca = {lt. ivory eggshell	2ca = {lt. ivory eggshell
	14	2lc = gold	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell
	21	2lc = gold	2ea = {lt. wheat lt. maize	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

II. Morphological observations: **Sporophore**

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	open spirals	open spirals & rectus-flexibilis	---
	14	rectus-flexibilis & spirals. Broom shape arrangement	rectus-flexibilis & spirals. Broom shape arrangement	rectus-flexibilis & spirals. Broom shape arrangement	none
	21	as above	as above	as above	rectus-flexibilis
Spore No.	7	---	> 10	> 10	---
	14	> 10	> 10	> 10	---
	21	> 10	> 10	> 10	> 10
verticils	7	---	none	none	---
	14	none	none	none	---
	21	none	none	none	none

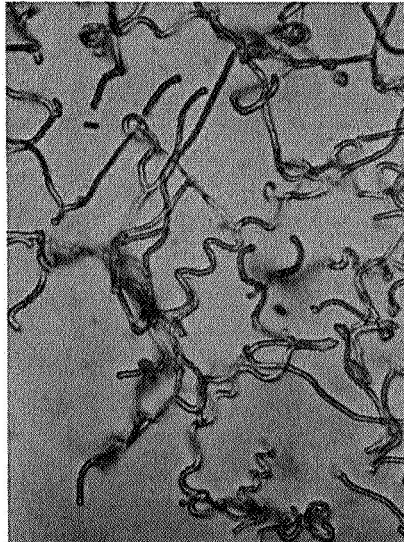
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 89JPL No. Wh 62Species *S. longisporoflavus*

Photographs: Sporophore

Medium: starchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 89JPL No. Wh 62Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.60-0.75 x 0.45-0.60 $\mu$ Medium: starchAge of culture: 17 daysMagnification: 6698X

Culture No. 89JPL No. Wh 62Species S. longisporoflavus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	-	-
D-mannitol	-	-
I-inositol	-	-
D-fructose	-	-
Rhamnose	-	-
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative, H<sub>2</sub>S positive  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

positive

Culture No. 90Source Antarctica, Wheeler Valley 117JPL No. Wh 65Invoice # D-56445Species Streptomyces longisporoflavus1. Cultural properties: Temp. 26

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5G
aerial mycelium	7	a = white	a = white	a = white	none
	14	a = white	a = white	lba = yellow tint	none
	21	a = white	a = white	lba = yellow tint	none
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint
	14	2ic = {honey gold lt. gold	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell
	21	2ic = {honey gold lt. gold	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none



## II. Morphological observations: Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	none	none	none
	14	none	none	rectus-flexibilis & open spirals. Broom shape arrangement	none
	21	none	none	as above	none
spore no.	7	---	---	---	---
	14	---	---	> 10	---
	21	---	---	> 10	---
verticils	7	---	---	---	---
	14	---	---	none	---
	21	---	---	none	---

special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 90JPL No. Wh 65Species S. longisporoflavus

Photographs: Sporophore

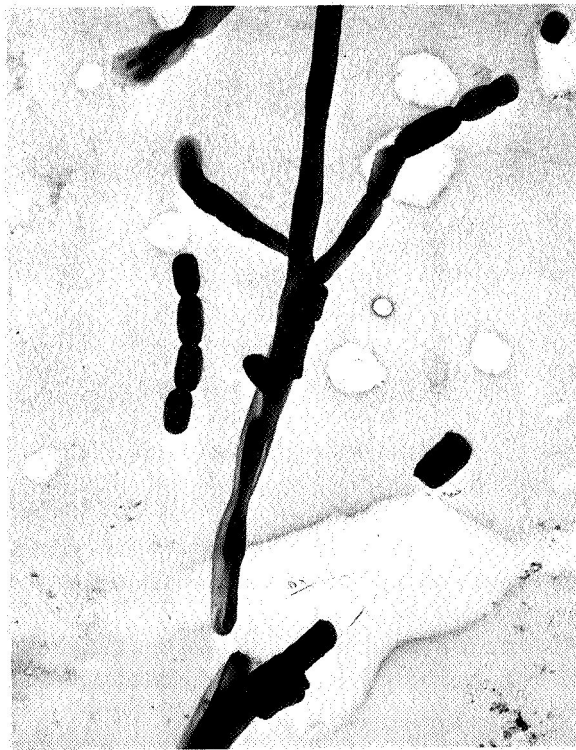
Medium: starchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 90  
JPL No. Wh 65  
Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smooth  
Dimensions: 0.76-1.49 x 0.37-0.46 $\mu$   
Medium: starch  
Age of culture: 15 days  
Magnification: 6698X



## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	±	±
D-mannitol	-	-
I-inositol	±	+
D-fructose	±	+
Rhamnose	-	±
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
4 days-negative

Medium 6 - 2 days-negative  
4 days-negative

Medium 7 - 2 days-negative  
4 days-negative

## C. Starch hydrolysis

**positive**

Culture No. 91Source Antarctica, Wheeler Valley 122JPL No. Wh 66Invoice # D-56445Species S. longisporoflavus1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	a = white	a = white	none
	14	none	a = white	1ba = yellow tint	none
	21	a = white	a = white	1ba = yellow tint	none
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	14	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell
	21	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	1ca = {lt. ivory eggshell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

II. Morphological observations: **Sporophore**

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	none	none	none
	14	none	none	rectus-flexibilis & none open spirals. Broom shape arrangement	none
	21	rectus-flexibilis	none	as above	none
Spore No.	7	---	---	---	---
	14	---	---	> 10	---
	21	> 10	---	> 10	---
verticil	7	---	---	---	---
	14	---	---	none	---
	21	none	---	none	---

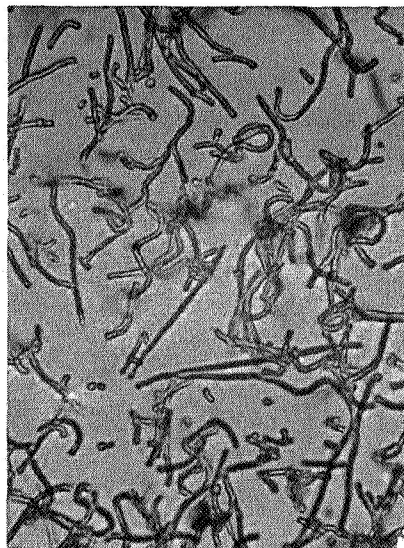
special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 91JPL No. Wh 66Species *S. longisporoflavus*

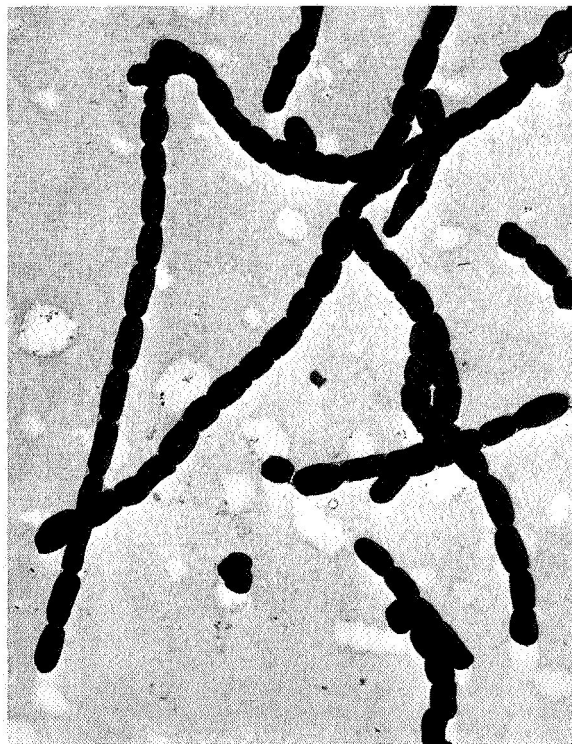
Photographs: Sporophore

Medium: starchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 91  
JPL No. Wh 66  
Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.60-1.19 x 0.46-0.60 $\mu$ Medium: starchAge of culture: 15 daysMagnification: 6698X



## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	-	-
D-mannitol	-	-
I-inositol	-	-
D-fructose	-	-
Rhamnose	-	-
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
           4 days-negative  
 Medium 6 - 2 days-negative  
           4 days-negative  
 Medium 7 - 2 days-negative  
           4 days-negative

## C. Starch hydrolysis

**Positive**

Culture No. 92Source Antarctica, Wheeler Valley 127JPL No. Wh 68Invoice # D-56445Species Streptomyces longisporoflavus1. Cultural properties: Temp. 20°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	a = white	a = white	none
	14	a = white	a = white	lba = yellow tint	none
	21	lba = yellow tint	a = white	lba = yellow tint	none
substrate mycelium	7	2ca = {lt. ivory eggshell	2ba = pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	14	2ea = {lt. wheat lt. maize	1½ca = cream	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint
	21	2ea = {lt. wheat lt. maize	1½ ca = cream	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	21c = gold	none	none	none

## II. Morphological observations: Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	none	---
	14	none	rectus-flexibilis & open spirals. Broom-shape arrangement	rectus-flexibilis & open spirals. Broom-shape arrangement	none
	21	rectus-flexibilis & open spirals. Broom-shape arrangement	as above	as above	none
Spore No.	7	---	---	---	---
	14	---	> 10	> 10	---
	21	> 10	> 10	> 10	---
Verticil	7	---	---	---	---
	14	---	none	none	---
	21	none	none	none	---

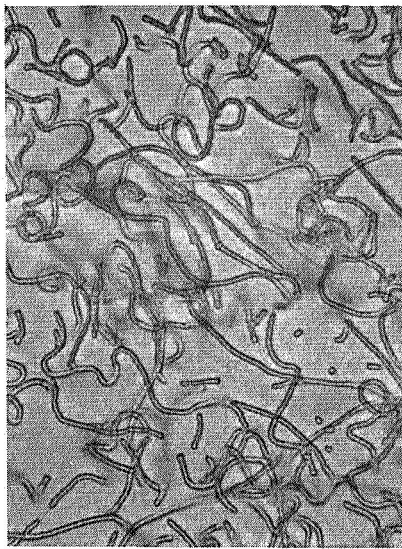
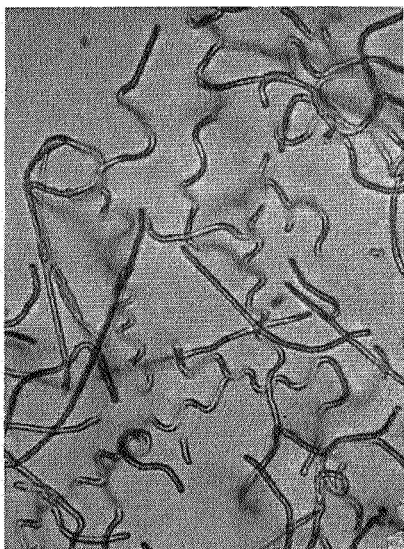
special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 92JPL No. Wh 68Species S. longisporoflavus

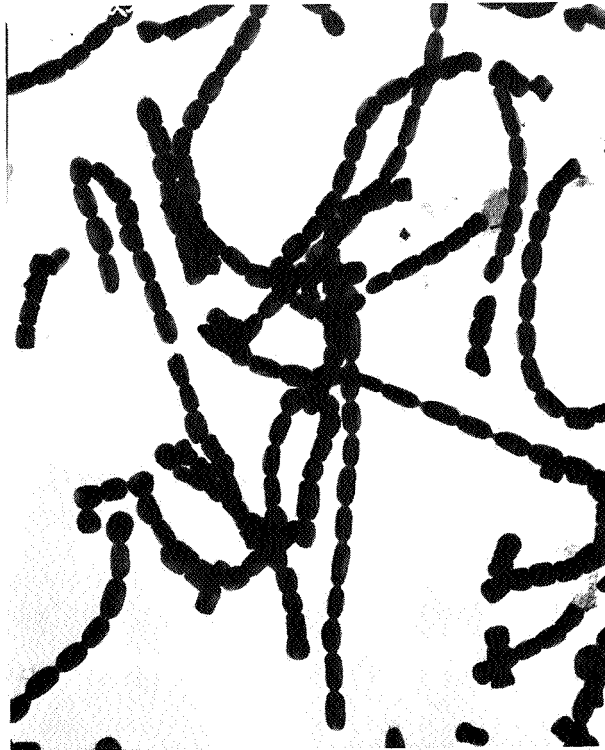
Photographs: Sporophore

Medium: StarchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 92  
JPL No. Wh 68  
Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.60-0.89 x 0.39-0.59 $\mu$ Age of culture: 15 daysMagnification: 5053X

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	++	++
D-mannitol	-	-
I-inositol	-	-
D-fructose	+	+
Rhamnose	-	-
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 r days-negative

## C. Starch hydrolysis

Positive

Culture No. 93Source Antarctica, Wheeler Valley 132JPL No. Wh 69Invoice # D-56445Species Streptomyces longisporoflavus1. Cultural properties: Temp. 20°

	Da.	CHM *number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	none	a = white	none
	14	a = white	a = white	a = white	none
	21	a = white	a = white	1ba = yellow tint	a = white
substrate mycelium	7	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint	2ba = { pearl shell tint	2ba = { pearl shell tint
	14	2ic = { honey gold lt. gold	2ba = { pearl shell tint	2ca = { lt. ivory eggshell	2ba = { pearl shell tint
	21	2ic = { honey gold lt. gold	2ca = { lt. ivory eggshell	2ea = { lt. wheat lt. maize	2ca = { lt. ivory eggshell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations : Sporophores

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	---	none	---
	14	none	none	rectus-flexibilis	---
	21	none	none	rectus-flexibilis and spira	none
Spore No.	7	---	---	---	---
	14	---	---	< 10	---
	21	---	---	> 10	---
Verticils	7	---	---	---	---
	14	---	---	---	---
	21	---	---	none	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

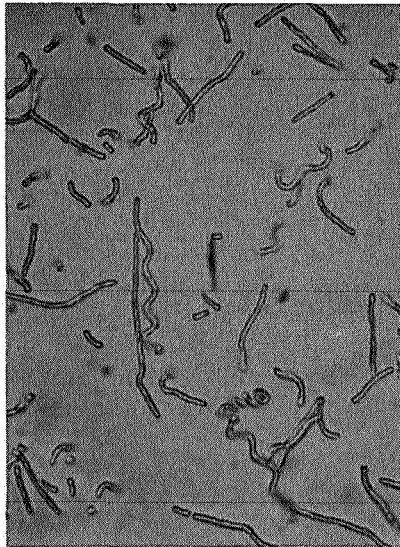
noneobserved.



Page 3

Culture No. 93JPL No. Wh 69Species S. longisporoflavus

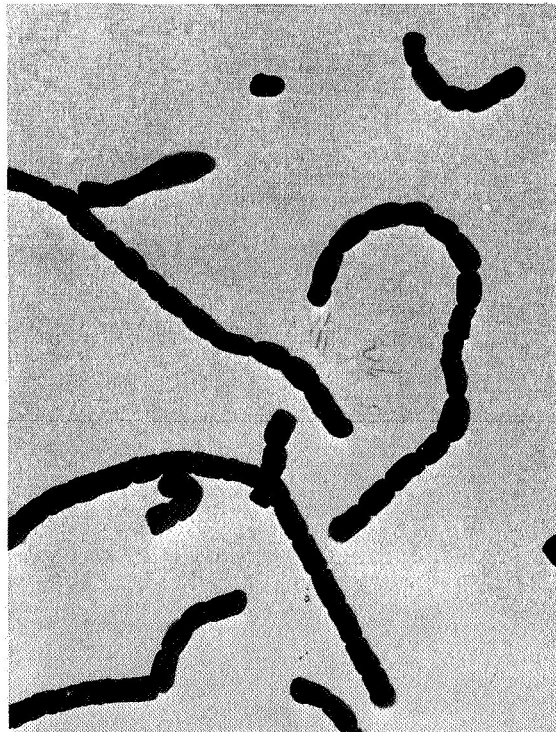
Photographs: Sporophore

Medium: starchAge of culture: 21 daysMagnification: 1000X

Page 4

Culture No. 93  
JPL No. Wh 69  
Species S. longisporoflavus

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.61-0.91 x 0.38-0.45 $\mu$ Medium: starchAge of culture: 14 daysMagnification: 6605

Culture No. 94Source Antarctica, Wheeler ValleyJFL No. Wh 71Invoice # D-56445Species Streptomyces longisporoflavus1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	a = white	a = white	none
	14	a = white	a = white	1ba = yellow tint	none
	21	a = white	a = white	1ba = yellow tint	a = white
substrate mycelium	7	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint	2ca = { lt. ivory eggshell	2ba = { pearl shell tint
	14	2ic = { honey gold lt. gold	2ba = { pearl shell tint	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint
	21	2ic = { honey gold lt. gold	2ba = { pearl shell tint	2ea = { lt. wheat lt. maize	2ca = { lt. ivory eggshell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

II. Morphological observations : **Sporophore**

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	none	rectus-flexibilis & open spirals. Broom shape arrangement	---
	14	none	none	as above	none
	21	none	none	as above	rectus-flexibilis
Spore No.	7	---	---	> 10	---
	14	---	---	> 10	---
	21	---	---	> 10	> 10
verticil	7	---	---	none	---
	14	---	---	none	---
	21	---	---	none	none

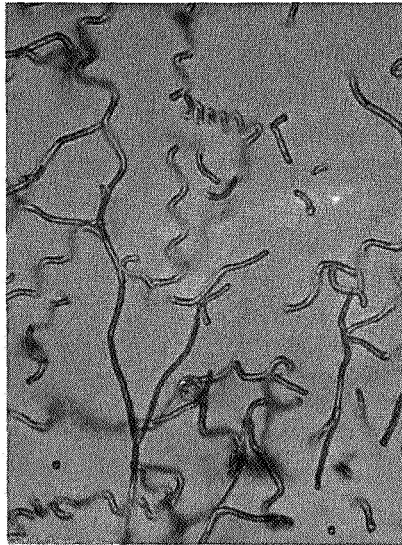
special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 94JPL No. Wh 71Species S. longisporoflavus

Photographs: Sporophore

Medium: starchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 94  
JPL No. Wh 71  
Species S. longisporoflavus

## III. Spore morphology and surface:

Surface: smooth  
Dimensions: 0.46-1.27 x 0.37-0.60 $\mu$   
Medium: starch  
Age of culture: 15 days  
Magnification: 6698X



Culture No. 94JPL No. Wh 71Species **S. longisporoflavus**

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	±	+
D-mannitol	-	-
I-inositol	-	±
D-fructose	-	±
Rhamnose	-	-
Raffinose	-	±
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative

4 days-negative

Medium 6 - 2 days-negative

4 days-negative

Medium 7 - 2 days-negative

4 days-negative

## C. Starch hydrolysis

**positive**

Culture No. 95Source Antarctica, Wheeler Valley <sup>141</sup>JPL No. Wh 72Invoice # D-56445Species indeterminate \*1. Cultural properties: Temp. 20°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none
	60	none	none	none	none
substrate mycelium	7	2ca = {lt. ivory eggshell	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	14	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	21	2ic = {honey gold lt. gold	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

\*Characteristics of the non-sporulating colonies of Wh 72 are similar to other cultures isolated from Antarctica. This culture is probably a non-sporulating S. longisporoflavus.



II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none
	60	none	none	none	none
spore no.	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---
verticils	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Culture No. 96

Source Antarctica, Wheeler Valley 143

JPL No. Wh 74

Invoice # D-56445

Species S. longisporoflavus

1. Cultural properties: Temp. 20°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	none	none
	14	none	none	a = white	none
	21	none	none	a = white	none
	25	a = white	none	lba = yellow tint	none
substrate mycelium	7	2ca = {lt. ivory eggshell	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	14	2ca = {lt. ivory eggshell	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	21	2ea = {lt. wheat lt. maize lt. wheat	2ba = {pearl shell tint	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint
	25	2ea = {lt. maize		2ea = {lt. wheat lt. maize	
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	none	none	none
	14	none	none	none	none
	21	none	none	rectus-flexibilis	none
	25	none		rectus-flexibilis & spira	
spore no.	7	---	---	---	---
	14	---	---	---	---
	21	---	---	< 10 > 10	---
verticils	7	---	---	---	---
	14	---	---	---	---
	21	---	---	none	---
	25	---		none	

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

none observed.

Page 3

Culture No. 96  
JPL No. Wh 74  
Species S. longisporoflavus

**Photographs: Sporophore**

Medium: starch

Age of culture: 26 days

Magnification: 1000X



Page 4

Culture No. 96JPL No. Wh 74Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.76-1.79 x 0.46-0.76 $\mu$ Medium: starchAge of culture: 21 daysMagnification: 6698

Culture No. 97

Source Antarctica, Wheeler Valley <sup>147</sup>

JPL No. Wh 75

Invoice # D-56445

Species Streptomyces longisporoflavus

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	a = white	a = white	none
	14	a = white	a = white	lba = yellow tint	none
	21	a = white	a = white	lba = yellow tint	none
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	14	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell
	21	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

II. Morphological observations: **Sporophore**

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
<b>sporophore</b>	7	none	none	none	---
	14	none	none	rectus-flexibilis & open spirals. Broom shape arrangement.	---
	21	rectus-flexibilis	none	as above	---
<b>Spore No.</b>	7	---	---	---	---
	14	---	---	> 10	---
	21	> 10	---	> 10	---
<b>verticils</b>	7	---	---	---	---
	14	---	---	none	---
	21	---	---	---	---

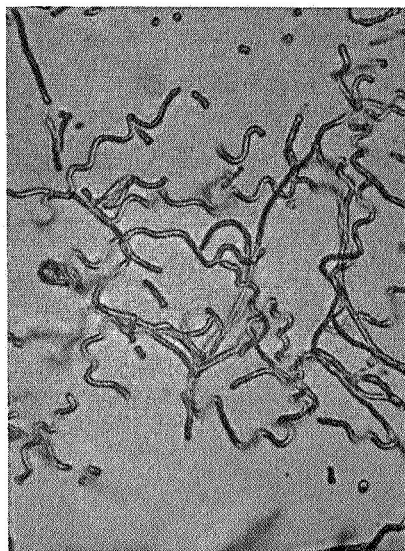
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

none observed.

Page 3

Culture No. 97JPL No. Wh 75Species S. longisporoflavus

Photographs: Sporophore

Medium: starchAge of culture: 14 daysMagnification: 1000X



Page 4

Culture No. 97  
JPL No. Wh 75  
Species *S. longisporoflavus*

**III. Spore morphology and surface:**

Surface: smooth  
Dimensions: 0.60-1.05 x 0.46-0.82 $\mu$   
Medium: starch  
Age of culture: 15 days  
Magnification: 6698X



Culture No. 97JPL No. Wh 75Species S. longisporiflavus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	±	+
D-mannitol	-	-
I-inositol	±	+
D-fructose	-	-
Rhamnose	-	-
Raffinose	±	±
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
                   4 days-negative  
 Medium 6 - 2 days-negative  
                   4 days-negative  
 Medium 7 - 2 days-negative  
                   4 days-negative

C. Starch hydrolysis  
positive

Culture No. 98

Source Antarctica, Wheeler Valley<sup>152</sup>

JPL No. Wh 76

Invoice # D-56445

Species Streptomyces longisporoflavus

1. Cultural properties: Temp. 26°

	Da.	CHM* number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white	a = white	a = white	a = white
	14	a = white	a = white	a = white	a = white
	21	a = white	a = white	a = white	a = white
substrate mycelium	7	1½ea = { lt. yellow pastel yellow sunlight yellow	2ba = { pearl shell tint	2ba = { pearl shell tint	2ba = { pearl shell tint
	14	2ca = { lt. ivory eggshell	2ba = { pearl shell tint	1½ca = cream	2ba = { pearl shell tint
	21	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	rectus-flexibilis	none	none
	14	none	as above	rectus-flexibilis and open spira	none
	21	none	as above	as above	none
spore no.	7	none	> 10	none	none
	14	none	> 10	> 10	none
	21	none	> 10	> 10	none
verticils	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 98JPL No. Wh 76Species *S. longisporoflavus*

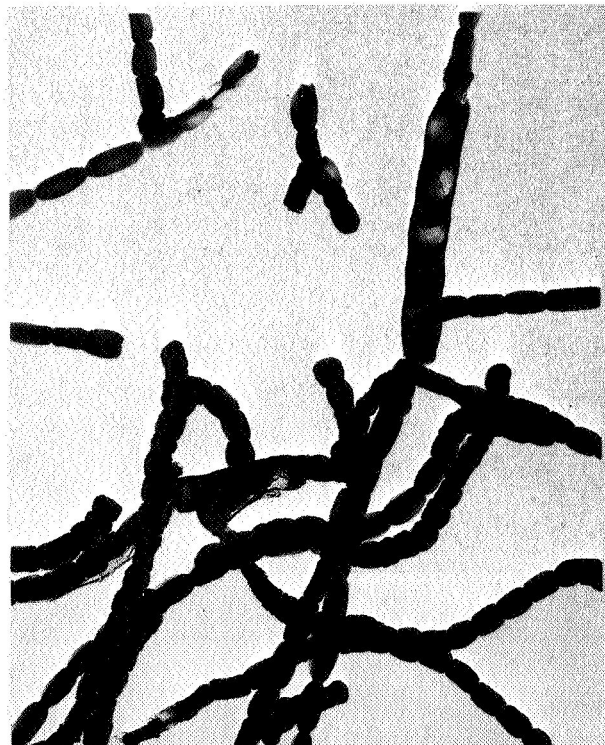
Photographs: Sporophore

Medium: oatmeal agarAge of culture: 21 daysMagnification: 1000X

Page 4

Culture No. 98JPL No. Wh 76Species S. longisporoflavus

## III. Spore morphology and surface:

Surface: smooth and wartyDimensions: 0.53-1.53 x 0.46-0.76 $\mu$ Medium: oatmeal agarAge of culture: 23 daysMagnification: 6545X

Culture No. 98JPL No. Wh 76Species S. longisporoflavus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	++	++
D-mannitol	-	-
I-inositol	-	-
D-fructose	+	+
Rhamnose	-	-
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days - negative  
 4 days - negative  
 Medium 6 - 2 days - negative  
 4 days - negative  
 Medium 7 - 2 days - negative  
 4 days - negative

C. Starch hydrolysis  
positive

Culture No. 99

Source Antarctica, Wheeler Valley <sup>157</sup>

JPL No. Wh 77

Invoice # D-56445

Species Streptomyces longisporoflavus

1. Cultural properties: Temp. 20°

	Da.	CHM *number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	none	none
	14	a = white	none	a = white	none
	21	a = white	none	1ba = yellow tint	none
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	14	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint
	21	2ic = {honey gold lt. gold	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none



## II. Morphological observations: Sporophores

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	none	none	none
	14	none	none	rectus-flexibilis	none
	21	none	none	rectus-flexibilis and spira	none
spore no.	7	---	---	---	---
	14	---	---	< 10	---
	21	---	---	> 10	---
verticils	7	---	---	---	---
	14	---	---	none	---
	21	---	---	none	---

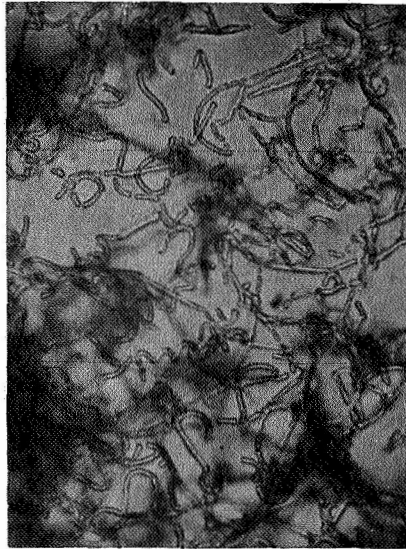
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 99JPL No. Wh 77Species S. longisporoflavus

## Photographs: Sporophore

Medium: starchAge of culture: 21 daysMagnification: 1000X

Page 4

Culture No. 99JPL No. Wh 77Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.611-1.22 x 0.30-0.61 $\mu$ Medium: starchAge of culture: 28 daysMagnification: 6545

Culture No. 100

Source Antarctica, Wheeler Valley 161

JPL No. Wh 78

Invoice # D-56445

Species Streptomyces longisporoflavus

1. Cultural properties: Temp. 20°C

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	a = white	none
	14	a = white	none	1ba = yellow tint	none
	21	a = white	a = white	1ba = yellow tint	none
substrate mycelium	7	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint	2ca = { lt. ivory eggshell	2ba = { pearl shell tint
	14	2ic = { honey gold lt. gold	2ca = { lt. ivory eggshell	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint
	21	2lc = gold	2ca = { lt. ivory eggshell	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations : Sporophores

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	---	---	rectus-flexibilis	---
	14	none	---	rectus-flexibilis and spira	---
	21	none	none	as above	---
spore no.	7	---	---	< 10	---
	14	---	---	> 10	---
	21	---	---	* 10	---
verticils	7	---	---	none	---
	14	---	---	none	---
	21	---	---	none	---

special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 100JPL No. Wh 78Species S. longisporoflavus

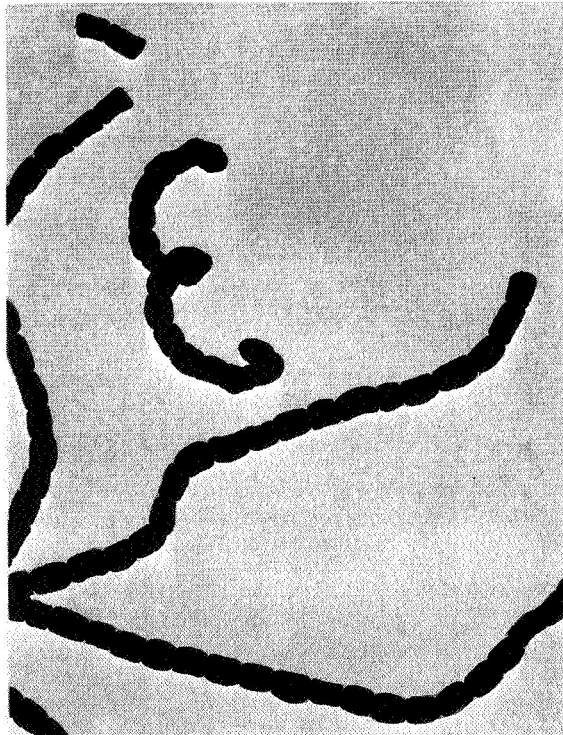
## Photographs: Sporophore

Medium: starch agarAge of culture: 21 daysMagnification: 1000X

Page 4

Culture No. 100JPL No. Wh 78Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smooth and wartyDimensions: 0.60-0.91 x 0.45-0.53 $\mu$ Medium: starchAge of culture: 18 daysMagnification: 6605X

Culture No. 101

Source Antarctica, Wheeler Valley 165

JPL No. Wh 80

Invoice # D-56445

Species Streptomyces longisporoflavus

1. Cultural properties: Temp. 20

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	a = white	none
	14	none	none	a = white	none
	21	none	none	1ba = yellow tint	none
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ca = {lt. ivory eggshell	2ba = {pearl shell tint
	14	2ea = {lt. wheat lt. maize	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint
	21	2ic = {honey gold lt. gold	2ca = {lt. ivory eggshell	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none



II. Morphological observations: Sporophores

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	---	---	none	---
	14	---	---	rectus-flexibilis	---
	21	---	---	rectus-flexibilis and spira	---
spore no.	7	---	---	---	---
	14	---	---	< 10	---
	21	---	---	> 10	---
verticils	7	---	---	---	---
	14	---	---	none	---
	21	---	---	none	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 101JPL No. Wh 80Species S. longisporoflavus**Photographs: Sporophore**Medium: starchAge of culture: 21 daysMagnification: 1000X

Page 4

Culture No. 101  
JPL No. Wh 80  
Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smooth  
Dimensions: 0.61-0.92 x 0.30-0.61 $\mu$   
Medium: starch  
Age of culture: 21 days  
Magnification: 6545



Culture No. 102Source Antarctica, Wheeler Valley 169JPL No. Wh 85Invoice # D-56445Species Streptomyces longisporoflavus1. Cultural properties: Temp. 20°

	Da.	CHM *number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	a = white	a = white	none
	14	a = white	a = white	1ba = yellow tint	none
	21	1ba = yellow tint rough form	a = white	1ba = yellow tint	a = white (sparse)
Substrate mycelium	7	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint	2ba = { pearl shell tint	2ba = { pearl shell tint
	14	2ea = { lt. wheat lt. maize	1½ ca = cream	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint
	21	2ea = { lt. wheat lt. maize	1½ ca = cream	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	3ic = lt. amber	none	none	none

## II. Morphological observations

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	---	none	rectus-flexibilis and retinaculum- apertum	none
	14	rectus-flexibilis & open spirals. Broom-shape arrangement	rectus-flexibilis	rectus-flexibilis & open spirals. Broom-shape arrangements	none
	21	as above	rectus-flexibilis & open spirals. Broom-shape arrange- ment	as above	none
Spore No.	7	---	---	> 10	---
	14	> 10	> 10	> 10	---
	21	> 10	> 10	> 10	---
Verticil	7	---	---	none	---
	14	none	none	none	---
	21	none	none	none	---

special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 102JPL No. Wh 85Species *S. longisporoflavus*

Photographs: Sporophore

Medium: starchAge of culture: 14 daysMagnification: 1000X

Culture No. 102  
JPL No. Wh 85  
Species *S. longisporoflavus*

III. Spore morphology and surface:

Surface: smooth and warty

Dimensions: 0.69-0.89 x 0.39-0.59 $\mu$

Medium: Starch agar

Age of culture: 14 days

Magnification: 5053



## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	++	++
D-mannitol	-	±
I-inositol	±	±
D-fructose	-	±
Rhamnose	-	-
Raffinose	-	±
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
           4 days-negative  
 Medium 6 - 2 days-negative  
           4 days-negative  
 Medium 7 - 2 days-negative  
           4 days-negative

## C. Starch hydrolysis

Positive



Culture No. 104Source Antarctica, King-David 174JPL No. 639d.01Invoice # D-56445Species indeterminate\*1. Cultural properties: Temp. 26

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none
	72	none	none	a = white	none
substrate mycelium	7	2ca = {lt. ivory eggshell	2ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint
	14	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	1½ca = cream	2ba = {pearl shell tint
	21	2ic = {honey gold lt. gold	2ca = {lt. ivory eggshell	2gc = {bamboo chamois	2ca = {lt. ivory eggshell
	72				
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none
	72	none	none	none	none

\*This culture may be a non-sporulating variant of S. longisporoflavus. Colony characteristics are similar to that observed for the latter.

## II. Morphological observations: Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none
	72	none	none	none	none
spore no.	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---
verticils	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---

special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	+	+
D-mannitol	-	-
I-inositol	-	-
D-fructose	-	+
Rhamnose	-	-
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days - negative  
 4 days - negative  
 Medium 6 - 2 days - negative  
 4 days - negative  
 Medium 7 - 2 days - negative  
 4 days - negative

C. Starch hydrolysis  
positive

Culture No. 105Source Antarctica, King 177JPL No. 644 a-1Invoice # D-56445Species Streptomyces longisporoflavus1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	none	none
	14	none	none	a = white	none
	21	none	none	3ba = { pearl shell tint	a = white
substrate mycelium	7	2ca = { lt. ivory eggshell	2ba = { pearl shell tint	2ca = { lt. ivory eggshell	2ba = { pearl shell tint
	14	2ea = { lt. wheat lt. maize	2ba = { pearl shell tint	2ca = { lt. ivory eggshell	2ba = { pearl shell tint
	21	2ic = { honey gold lt. gold	2ba = { pearl shell tint	2gc = { bamboo chamois	2gc = { bamboo chamois
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

Culture No. 105JPL No. 644a.1

## II. Morphological observations : Sporophores

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophores	7	none	none	none	none
	14	none	none	rectus-flexibilis & open twists. Broom-shape arrangement	none
	21	none	none	as above	none
Spore No.	7	---	---	---	---
	14	---	---	> 10	---
	21	---	---	> 10	---
Verticils	7	---	---	---	---
	14	---	---	none	---
	21	---	---	none	---

special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 105JPL No. 644 a.1Species S. longisporoflavus

Photographs: Sporophore

Medium: starchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 105  
JPL No. 644a.1  
Species *S. longisporoflavus*

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.46-0.92 x 0.30-0.46 $\mu$ Age of culture: 1 monthMagnification: 6545X

Culture No. 105JPL No. 644a.1Species S. longisporoflavus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	-	-
L-arabinose	-	-
Sucrose	++	++
D-mannitol	-	-
I-inositol	-	-
D-fructose	±	±
Rhamnose	-	-
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

**Positive**



Species Streptomyces olivaceus

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a = white ↓ 4ge = {lt. fawn rose beige	a = white ↓            ↓ 5dc = pussywillow gray	5fe = ashes	a = white
	14	5fe = ashes	5fe = ashes	5fe = ashes	5dc = pussywillow gray
	21	5fe = ashes	3fe = silver gray	5fe = ashes	5fe = ashes
substrate mycelium	7	2le = {mustard old gold	2ca = {lt. ivory eggshell	2ic = {honey gold lt. gold	1½ca = cream
	14	3ie = {camel maple sugar tan	2ca = {lt. ivory eggshell	2ic = {honey gold lt. gold	2ea = {lt. wheat lt. maize
	21	3ie = {camel maple sugar tan	2gc = {bamboo chamois	2gc = {bamboo chamois	1ba = yellow tint
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

## II. Morphological observations: Sporophores

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	rectus-flexibilis	rectus-flexibilis	rectus-flexibilis	rectus-flexibilis
	14	as above	as above	as above	as above
	21	as above	as above	as above	as above
Spore No.	7	> 10	> 10	> 10	> 10
	14	> 10	> 10	> 10	> 10
	21	> 10	> 10	> 10	> 10
Verticils	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

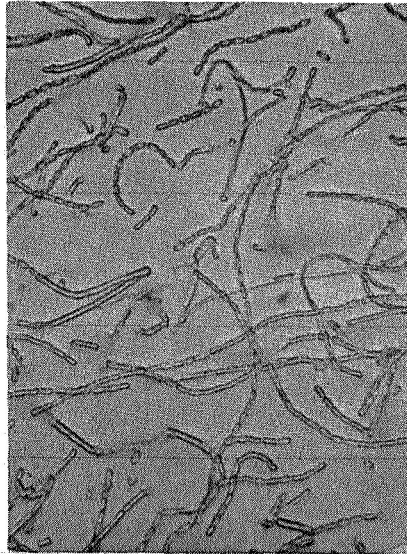
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 108JPL No. 274 BaSpecies S. olivaceus

Photographs: Sporophore

Medium: starch agarAge of culture: 7 daysMagnification: 1000X

Page 4

Culture No. 108JPL No. 274 BaSpecies S. olivaceus

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.61-1.83 x 0.30-0.61 $\mu$ Medium: StarchAge of culture: 8 daysMagnification: 6545X

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	++	++
D-mannitol	++	++
I-inositol	++	++
D-fructose	++	++
Rhamnose	++	++
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

2 days-negative  
 Medium 1 - 4 days-negative  
 2 days-negative  
 Medium 6 - 4 days-negative  
 2 days-negative  
 Medium 7 - 4 days-negative

## C. Starch hydrolysis

Positive

Species Streptomyces antibioticus

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	a (white), turning to 2ec (biscuit, ecru, oatmeal, sand)	a (white) turning to c (gray)	a (white) turning 2ge (covert tan, griege)	a = white
	14	2ec = {biscuit, ecru, oatmeal, sand}	2ec = {biscuit, ecru, oatmeal, sand}	2ec = {biscuit, ecru, oatmeal, sand} ↓ 2ge = {covert tan, griege}	2dc = {natural, string}
	21	3dc = natural	3dc = natural	2ec = {biscuit, ecru, oatmeal, sand} ↓ 2ge = {covert tan, griege}	3dc = natural
substrate mycelium	7	2ic = {honey gold, lt. gold}	1½ca = {lt. ivory, eggshell}	2lc = gold	2la = {brite yellow, squash yellow, maize}
	14	2pg = mustard gold	1½ca = {lt. ivory, eggshell}	2ne = {mustard gold, old gold}	2ic = {honey gold, lt. gold}
	21	3ng = yellow maple	2ea = {lt. wheat, lt. maize}	3ec = {bisque, lt. beige}	2ic = {honey gold, lt. gold}
soluble pigment	7	3ic = lt. amber	none	none	none
	14	3pe = {amber, topaz}	none	none	none
	21	3pi = {golden brown, tobacco brown}	none	none	none

## II. Morphological observations Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	rectus-flexibilis	rectus-flexibilis	rectus-flexibilis	none
	14	as above	as above	as above	rectus-flexibilis
	21	as above	as above	as above	as above
Spore No.	7	> 10	> 10	> 10	none
	14	> 10	> 10	> 10	> 10
	21	> 10	> 10	> 10	> 10
Verticil	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

none observed.

Page 3

Culture No. 113JPL No. 278 BaSpecies S. antibioticus

Photographs: Sporophore

Medium: starch agarAge of culture: 14 daysMagnification: 1000X



Page 4

Culture No. 113JPL No. 278 BaSpecies S. antibioticus

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.89-1.68 x 0.30-0.59 $\mu$ Medium: starchAge of culture: 16 daysMagnification: 5053X

Culture No. 113JPL No. 278 BaSpecies S. antibioticus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	-	-
Sucrose	++	++
D-mannitol	++	++
I-inositol	+	+
D-fructose	++	++
Rhamnose	+	+
Raffinose	-	-
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-positive  
 4 days-positive  
 Medium 6 - 2 days-positive  
 4 days-positive  
 Medium 7 - 2 days-positive  
 4 days-positive

## C. Starch hydrolysis

Positive

Culture No. 114

Source Chile 192

JPL No. 278 Bc (#24)

Invoice # D-29927

Species Streptomyces michiganensis

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	2ca = {lt. ivory eggshell	none
	14	a = white	a = white	3ca = {pearl pink shell	none
	21	a = white ↓ 3dc = natural	a = white	3ba = {pearl shell tint	a = white
substrate mycelium	7	2gc = {bamboo chamois	colorless	2ea = {lt. wheat lt. maize	2gc = {bamboo chamois
	14	2gc = {bamboo chamois	2ba = {pearl shell tint	2ic = {honey gold lt. gold	2gc = {bamboo chamois
	21	2ne = {mustard gold old gold	2ba = {pearl shell tint	2gc = {bamboo chamois	2gc = {bamboo chamois
soluble pigment	7	2ne = {mustard gold old gold	none	none	none
	14	3pg = golden brown	none	none	none
	21	2ne = {mustard gold old gold	none	none	none

## II. Morphological observations: Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
Sporophore	7	none	none	rectus-flexibilis	none
	14	none	none	as above	none
	21	rectus-flexibilis	rectus-flexibilis	as above	rectus-flexibilis
Spore No.	7	---	---	> 10	---
	14	---	---	> 10	---
	21	> 10	> 10	> 10	> 10
verticils	7	---	---	none	---
	14	---	---	none	---
	21	none	none	none	none

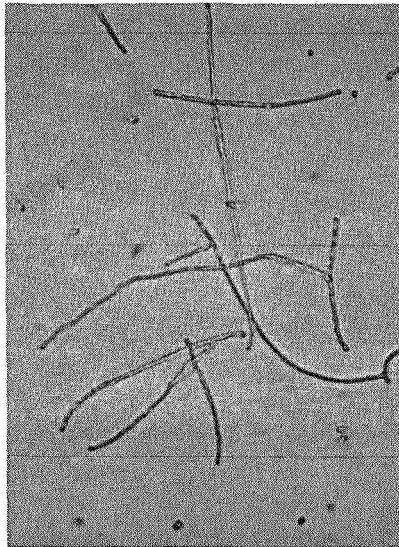
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

none observed.

Page 3

Culture No. 114JPL No. 278 BcSpecies *S. michiganensis*

Photographs: Sporophore

Medium: glycerol-asparagine agarAge of culture: 21 daysMagnification: 1000X

Page 4

Culture No. 114JPL No. 278 BcSpecies S. michiganensis

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.53-1.37 x 0.30-0.61 $\mu$ Medium: starchAge of culture: 13 daysMagnification: 6545X

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	++	++
D-mannitol	+	++
I-inositol	++	++
D-fructose	++	++
Rhamnose	-	-
Raffinose	+	+
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-positive  
 4 days-positive  
 Medium 6 - 2 days-positive  
 4 days-positive  
 Medium 7 - 2 days-positive  
 4 days-positive

## C. Starch hydrolysis

Positive

Culture No. 118

Source Chile-Atacama

JPL No. 246 Ba (#10)

Invoice # Cameron 10-17-67

Species Streptomyces azureus

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	none	none	a = white	none
	14	none	none	a = white & specks of 10ih = olive gray	a = white
	21	none	none	19fe= aqua gray	b = oyster white
substrate mycelium	7	2ea = {lt. wheat lt. maize	2ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint
	14	2ga = {colonial yellow maize	2ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint
	21	lca = pale yellow	lca = pale yellow	2ec = {biscuit ecru oatmeal sand	2ec = {biscuit ecru oatmeal sand
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	2gc = {bamboo chamois



## II. Morphological observations : Sporophore

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	none	none	none	none
	14	none	none	spirals	none
	21	none	none	spirals	spirals and retinaculum-apertum
Spore No.	7	---	---	---	---
	14	---	---	> 10	---
	21	---	---	> 10	> 10
verticils	7	---	---	---	---
	14	---	---	none	---
	21	---	---	none	none

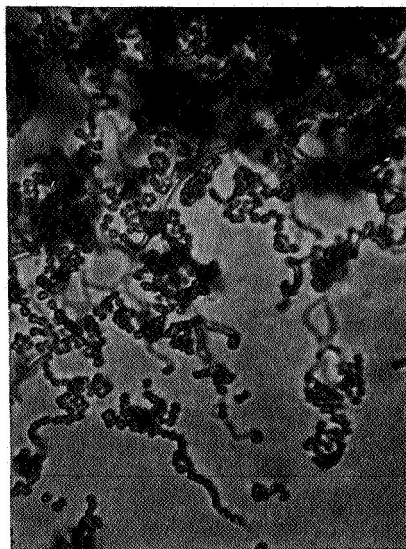
special observations: e.g. globular sporangia; flagellated spores;  
spores on substrate hyphae; mycelia frag-  
mentation; schlerotia.

noneobserved.

Page 3

Culture No. 118JPL No. 246 BaSpecies S. azureus

Photographs: Sporophore

Medium: starchAge of culture: 14 daysMagnification: 1000X

Page 4

Culture No. 118JPL No. 246 BaSpecies S. azureus

## III. Spore morphology and surface:

Surface: smoothDimensions: 0.76-1.07 x 0.61-0.76 $\mu$ Medium: glycerol-asparagineAge of culture: 1 monthMagnification: 6545

Culture No. 119

Source Chile

JPL No. 245 TAc

Invoice # D-38463

Species Streptomyces antibioticus

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5
aerial mycelium	7	5fe = ashes	5ih = {lead gray shadow gray	none	a = white sparce
	14	3fe = silver gray	3fe = silver gray	5dc = pussywillow gray	b = oyster white
	21	f = gray	f = gray	3fe = silver gray	3dc = natural
substrate mycelium	7	2pi = mustard brown	2le = {mustard old gold	2ba = {pearl shell tint	2ea = {lt. wheat lt. maize
	14	3ni = clove brown	2gc = {bamboo chamois	2gc = {bamboo chamois	2ea = {lt. wheat lt. maize
	21	3ni = clove brown	2gc = {bamboo chamois	2gc = {bamboo chamois	2ea = {lt. wheat lt. maize
soluble pigment	7	none	none	none	none
	14	3le = {cinnamon yellow maple	none	none	none
	21	3le = {cinnamon yellow maple	none	none	none

II. Morphological observations: **Sporophore**

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
sporophore	7	retinaculum- apertum	retinaculum- apertum	none	none
	14	as above	as above	retinaculum- apertum	retinaculum- apertum
	21	as above	as above	as above	as above
Spore No.	7	> 10	> 10	---	---
	14	> 10	> 10	> 10	> 10
	21	> 10	> 10	> 10	> 10
verticil	7	none	none	---	---
	14	none	none	none	none
	21	none	none	none	none

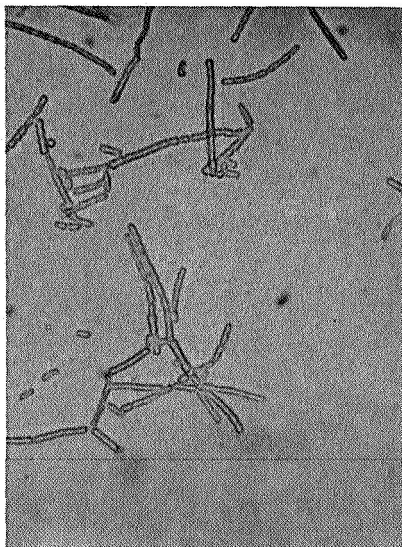
special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

none observed.

Page 3

Culture No. 119JPL No. 245 TAcSpecies S. antibioticus

Photographs: Sporophore

Medium: oatmeal agarAge of culture: 21 daysMagnification: 1000X

Page 4

Culture No. 119JPL No. 245 TAcSpecies S. antibioticus

## III. Spore morphology and surface:

Surface: smoothDimensions: 1.37-0.61 x 0.76-0.30 $\mu$ Medium: oatmeal agarAge of culture: 10 daysMagnification: 6545X

Culture No. 119JPL No. 245 TAcSpecies S. antibioticus

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	++	++
D-mannitol	++	++
I-inositol	++	++
D-fructose	++	++
Rhamnose	++	++
Raffinose	++	++
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
           4 days-negative  
 Medium 6 - 2 days-negative  
           4 days-negative  
 Medium 7 - 2 days-negative  
           4 days-positive

## C. Starch hydrolysis

**positive**



Culture No. 120

Source Chile 206

JPL No. 246 Ad

Invoice # D-38463

Species Streptomyces caelestis

1. Cultural properties: Temp. 26°

	Da.	CHM*number and color			
		Medium 2	Medium 3	Medium 4	Medium 5+ G
aerial mycelium	7	none	none	none	none
	14	a = white	none	a = white	none
	21	a = white	a = white	a = white	none
	40	a = white	a = white	mostly white. Faint signs of blue	none
	50	white with specks of blue	a = white	white with specks of blue	none
substrate mycelium	7	3ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint	2ba = {pearl shell tint
	14	3ec = {bisque lt. beige	2ba = {pearl shell tint	2ba = {pearl shell tint	3gc = lt. tan
	21	3ic = lt. amber	lga = {lt. lemon yellow mimosa yellow sulfur yellow lt. yellow	lca = pale yellow	2ca = {lt. ivory eggshell
soluble pigment	7	none	none	none	none
	14	none	none	none	none
	21	none	none	none	none

II. Morphological observations: **Sporophore**

	Da.	Medium 2	Medium 3	Medium 4	Medium 5
<b>sporophore</b>	7	---	---	---	---
	14	none	---	none	---
	21	none	---	none	---
	40	none	---	short chains	---
	50	retinaculum-apertum	---	retinaculum-apertum	---
<b>Spore No.</b>	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---
	40	---	---	>10	---
	50	> 10	---	>10	---
<b>verticils</b>	7	---	---	---	---
	14	---	---	---	---
	21	---	---	---	---
	40	---	---	none	---
	50	none	---	none	---

special observations: e.g. globular sporangia; flagellated spores; spores on substrate hyphae; mycelia fragmentation; schlerotia.

noneobserved.

Page 3

Culture No. 120

JPL No. 246 Ad

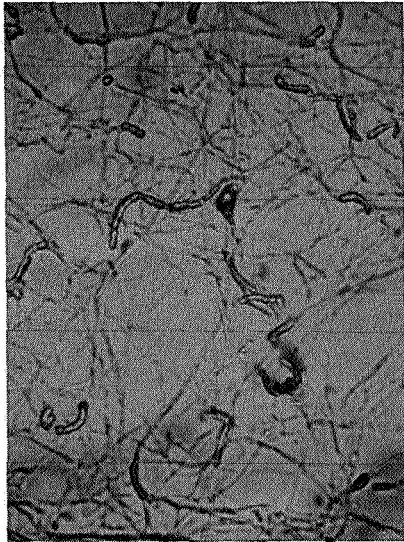
Species S. caelestis

Photographs: Sporophore

Medium: malt-extract agar

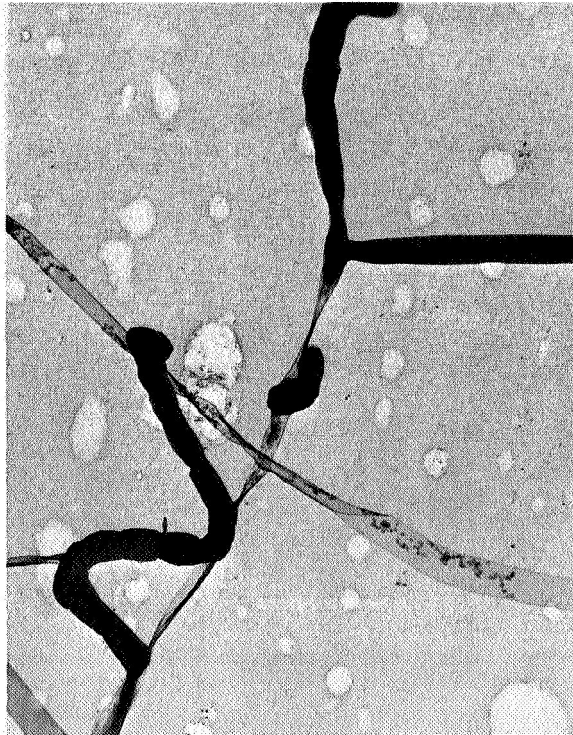
Age of culture: 54 days

Magnification: 1000X



Page 4

Culture No. 120  
JPL No. 246 Ad  
Species S. caelestis

**III. Spore morphology and surface:**Surface: smoothDimensions: 0.89-1.34 x 0.60-0.89 $\mu$ Medium: starch agarAge of culture: 45 daysMagnification: 6698X

Culture No. 120JPL No. 246 AdSpecies S. caelestis

## IV. Physiological characteristics

## A. Carbohydrate utilization

Carbohydrate	Growth after 10 days	Growth after 16 days
Negative control	-	-
D-glucose	++	++
D-xylose	++	++
L-arabinose	++	++
Sucrose	++	++
D-mannitol	++	++
I-inositol	++	++
D-fructose	++	++
Rhamnose	++	++
Raffinose	++	++
Cellulose	-	-

(++) = Strongly positive utilization. Growth equal to or greater than glucose growth.

(+) = Positive utilization. Growth is significantly better than on basal medium without carbon but less than on glucose.

(±) = Utilization doubtful. Growth slightly better than on basal medium without carbon but significantly less than with glucose.

(-) = Growth similar to or less than growth on basal medium without carbon.

## B. Melanin production

Medium 1 - 2 days-negative  
 4 days-negative  
 Medium 6 - 2 days-negative  
 4 days-negative  
 Medium 7 - 2 days-negative  
 4 days-negative

## C. Starch hydrolysis

positive

Culture No. 121  
JPL No. mc-1-2  
Source McKolver Valley Antarctica  
Invoice No. D-56445  
Temperature 20°C  
Species Streptomyces exfoliatus

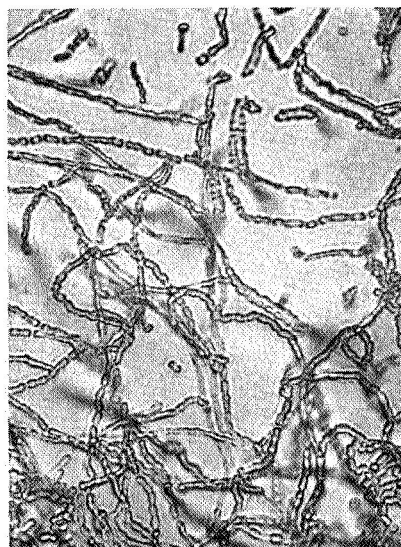
Cultural characteristics on trypticase soy agar.

1. Aerial mycelium: 5cd = pussywillow gray
2. Substrate mycelium: 3gc = lt. tan
3. Spore surface: smooth
4. Sporophores: rectus-flexibilis
5. Melanin production: none

Page 3

Culture No. 121JPL No. mc-1-2Species S. exfoliatus

## Photographs: Sporophore

Medium: trypticase-soy agarAge of culture: 32 daysMagnification: 1000X

Page 4

Culture No. 121  
JPL No. mc-1-2  
Species *S. exfoliatus*

## III. Spore morphology and surface:

Surface: smooth  
Dimensions: 0.60-1.51 x 0.30-0.83 $\mu$   
Medium: TSA  
Age of culture: 44 days  
Magnification: 6605X

