On a New Whirl-forming Species of *Streptomyces*

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A strain of *Streptomyces* (Label number No. 738) was isolated from the garden soil in Kishiwada City, Osaka Prefecture. Its characteristics were studied from morphological, as well as physiological stand points, and compared with those of the species described in the past.

According to the results obtained, No. 738 was decided to be a new species and the name "*Streptomyces kishiwadensis*" was given, after the name of Kishiwada City.

I. Morphology

1. Macrocolony: Chrysanthemum pattern (Fig. I, 1).
 2. Electron microscopical characteristic: Smooth type (Fig. I, 2).
 3. Microscopical characteristic: Whirls could be seen on many synthetic media and organic ones. Ammonium Czapek agar, glycerin starch glutamate agar, and glucose asparagine agar were used in parallel for the studies of the aerial mycelia. Among them, ammonium Czapek agar and glycerin starch glutamate agar were more suitable than glucose asparagine agar, because the aerial mycelia on the former two grew adequately enough to stick themselves to the cover glass and enough to be visible through the direct observation method. Next data were written on the mycelia on ammonium Czapek agar.
- Aerial mycelium: Long straight or flexuous; cottony, $0.8\ \mu$ in width. Many typical whirls (Nitella type whirls); primary and secondary, radial branches were usually many, 6-10, rarely 20-30 (Fig. I, 3 and II). No spiral.
- Conidium: Oval to short cylindrical; $0.8\ \mu$ in width; $1.0-1.2\ \mu$ in length (Fig. I, 2, 3).
- Substrate mycelium: Monopodial branches; no fragmentation; $0.5-0.6\ \mu$ in width.

Fig. I. *Streptomyces* No. 738. 1, colony cultivated on glycerin starch glutamate agar for 20 days; 2, electron-microscopical observation of the conidia, cultivated on ammonium Czapek agar for 10 days; 3, aerial mycelia cultivated on ammonium Czapek agar for 10 days.

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Fig. II. *Streptomyces* No. 738. Aerial mycelia cultivated on ammonium Czapek agar for 10 days.

II. Physiological characteristic

1. Tyrosinase reaction: Positive.
2. Nitrate reduction: Usually negative; sometimes positive, though weak.
3. Diastase reaction by iodine reaction: Clear zones were 6–10 mm on glycerin starch glutamate agar, incubated for 10 days. No growth on starch agar (Waksman's A).
4. Konjakmannase reaction: Negative.
5. Utilization of carbon sources: Sucrose, trehalose, and inositol were utilized. Xylose, rhamnose, lactose, raffinose, and mannitol were unutilized. Fructose and galactose were uncertain.

III. Cultural characteristic

Notes: { G: growth of the colony
 A: growth of the aerial mycelium and its color^{9,10)}
 S: color^{9,10)} of the substrate mycelium
 P: production of the soluble pigment

1. Ammonium Czapek agar
 G: good
 A: cottony; good; pale pink—pale brown—pale dull orange
 S: dull yellow orange—maple—pale brown
 P: none
2. Glycerin Czapek agar
 G: good
 A: good; pale brown—brownish white—pale orange
 S: dull yellow—buff
 P: buff—pale dull yellow
3. Glucose asparagine agar
 G: moderate

- A: moderate—poor; brownish white—pinkish white
 S: pale brown—pale dull yellow orange—maple—dull yellow—buff
 P: none
4. Ca-malate agar
 G: good
 A: partially cottony; good—moderate; brownish white—yellowish; white—pale orange
 S: dull yellow orange—buff
 P: none
5. Starch agar (Waksman's A)
 G: none—trace
 A: none—trace; none—pale pink
 S: none—buff—pale brown
 P: none
6. Urea glycerin agar
 G: good
 A: good; beige—brownish white
 S: buff—dull yellow
 P: pale dull yellow—buff
7. Tyrosine agar
 G: abundant
 A: sometimes some droplets; excellent; blush—beige—pale brown
 S: grayish brown—dark yellowish brown—buff
 P: grayish brown—pale buff
8. Glycerin starch glutamate agar
 G: good
 A: sometimes some droplets; good; pale brown—brownish white—ecru beige—beige—pale pink
 S: brown with dark shadow—maple sugar—ochre—brown—dull yellow—buff
 P: brown with dark shadow—ochre; sometimes uncertain

Besides the characteristics mentioned above, the following data were obtained.

This strain produced soluble brownish pigment on synthetic agar, bouillon agar, nutrient agar, potato plug, and egg medium, and showed the good growth on organic medium. The color of the aerial mycelia was brownish white—white—pinkish white on synthetic agar; and pale brown—pinkish white—brownish white—light brownish gray, on carrot and potato plugs. Gelatin reaction was unstable and cellulase reaction was negative. Coagulation of milk was partial, and liquefaction was positive.

When these characteristics of this strain were compared carefully in colors of the aerial mycelia and substrate ones with those of *Streptomyces* described so far, it resembled *Str. cinnamonomeus* f. *azacoluta*¹⁾, *Str. reticuli*²⁻⁶⁾, *Str. mashuensis*⁷⁾, and *Str. kitasatoensis*⁸⁾.

No. 738 produced the soluble pigment on glycerin Czapek agar, Ca-malate agar, urea glycerin agar, tyrosine agar, and glycerin starch glutamate agar, but *Str. cinnamonomeus* f. *azacoluta* did not do so. Consequently No. 738 was one species and *Str. cinnamonomeus* f. *azacoluta* another.

Next, the differences between No. 738 and *Str. reticuli*, *Str. mashuensis*, and *Str. kitasatoensis* are shown in the Table 1-3.

Moreover, No. 738 produced the soluble pigments of brown series on most organic

media, but *Str. mashuensis* did not.

No. 738 was, therefore, decided to be a new species of *Streptomyces* and named "*Streptomyces kishiwadensis*" after the name of Kishiwada City.

Table 1. Differences between No. 738 and *Str. reticuli*.

		No. 738	<i>Str. reticuli</i>
Glucose asparagine agar	Soluble pigment	none	brownish, diffusing through medium
Synthetic agar	Soluble pigment	buff	none
Egg media	Soluble pigment	ambergrow	purple zone around growth
Carrot plug	Growth and color of the aerial mycelia	good; pale brown —pinkish white —brownish white	none

Table 2. Differences between No. 738 and *Str. mashuensis*.

		No. 738	<i>Str. mashuensis</i>
Czapek agar	Growth	good	yellow colored, reverse of colony yellow-green colored
	Growth and color of the aerial mycelia	good; brownish white —purplish pink	numerous, powdery
	Soluble pigment	buff	none
Glucose asparagine agar	Growth	moderate	grayish white; powdery, reverse of colony yellowish-brown
	Growth and color of the aerial mycelia	moderate—poor; brownish white—pinkish white	none
Starch agar	Growth	none—trace	marguerite colony, margin cottony, primrose pink colored, reverse of colony yellow-brown, margin white
	Growth and color of the aerial mycelia	none—trace; pale pink	numerous, white cotton like
	Diastase reaction	none	strongly positive

Table 3. Differences among No. 738, *Str. kitasatoensis* (S-7) and *Str. kitasatoensis* (S-229).

		No. 738	<i>Str. kitasatoensis</i> (S-7)	<i>Str. kitasatoensis</i> (S-229)
Synthetic agar	Growth	good	poor	poor
	Growth of the aerial mycelia	good	none	poor
	Color of the substrate mycelia	buff—buff with dark shadow	transparent	?
Starch agar	Growth	none—trace	moderate	moderate
	Color of the aerial mycelia	none—pale pink	white, floccose	white, floccose
Glucose asparagine agar	Growth	moderate—poor	none	good
	Color of the aerial mycelia	brownish white—pinkish white		white—pale cream
	Soluble pigment	none	pale yellow	

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摘 要

信 夫 隆 治・萱 村 善 彦： 輪生体を形成する放線菌の一新種について

大阪府，岸和田市の庭園の土壌から分離した放線菌 No. 738 は輪生体を形成し，形態学的，生理学的および培養所見の研究から，従来発表された放線菌と異なることを認めたので新種と断定し，岸和田市の地名にちなんで *Streptomyces kishiwadensis* と命名した。(大阪学芸大学天王寺分校)