

5406 抗生素——泾阳链霉菌新种*

陶天申 岳莹玉 梁绍芬 桑金隆

(中国农业科学院土壤肥料研究所,北京)

尹 莘 耘

(中国农业科学院原子能利用研究所,北京)

对于我国广泛用作抗生素肥的两株属于粉红孢类群的链霉菌(菌株 5406 和 G₄)进行了形态、培养特征和生理生化特性的研究,结果与已知的近似种都不相同,是一个新种,定名为泾阳链霉菌 (*Streptomyces jingyangensis* n. sp. Tao et al., 1978),并指定菌株 5406 为这个新种的典型菌株。

链霉菌菌株 5406 和 G₄ 在我国作为抗生素肥料已有多年,其中菌株 5406 在全国农村许多地区广泛应用。据研究^[1-3], 5406 抗生素具有转化土壤营养,提高土壤肥力,刺激作物生长和抑制某些植物病害的作用。在各地的应用中表现了对多种作物良好的增产效果。

链霉菌菌株 5406 和 G₄ 是从我国陕西泾阳等地土壤中分离到的,通过分类研究认为应属于粉红孢类群链霉菌的一个新种,定名为泾阳链霉菌 (*Streptomyces jingyangensis* n. sp. Tao et al., 1978),并指定 5406 为这个新种的典型菌株,并保存于中国科学院微生物研究所(北京),编号为 4.891。

一、菌株来源

菌株 5406: 自陕西泾阳老苜蓿根际土壤中分离。

菌株 G₄: 自山西运城棉花根土中分离。

对比菌株: 弗氏链霉菌 (*Streptomyces fradiae* AS 4. 684), 由中国科学院微生物

研究所提供。

二、形态和培养特征

基内菌丝体呈分枝状,未观察到有菌丝断裂现象。孢子丝单糙分枝,年幼时直或波曲,成熟时呈 2—4 圈松散螺旋,有时可多至 6—7 圈(图 1—2)。孢子长椭圆形到柱形,1.4—1.6 × 0.8—1.0 微米。孢子表面光滑,形似稻种(图 3)。此外,未观察到轮生枝、游动孢子、孢囊和菌核。

菌株 5406 在琼脂培养基上,生长浅黄,反面木瓜黄到虎皮黄。气生菌丝体浅玫瑰粉到落英淡粉,可溶性色素微黄到浅粉。在六种培养基上的培养特征见表 1。

三、生理特性

黑素反应,在葡萄糖酪氨酸琼脂、酵母膏酪氨酸琼脂和试验所用其他有机培养基

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* 承中国科学院微生物研究所阎逸初教授审阅本文;山东医学院和北京钢铁研究院分别协助拍摄透射电子显微和扫描电子显微照片;吴大伦、李秀玉同志参加部分实验工作。



图1 泾阳链霉菌孢子丝

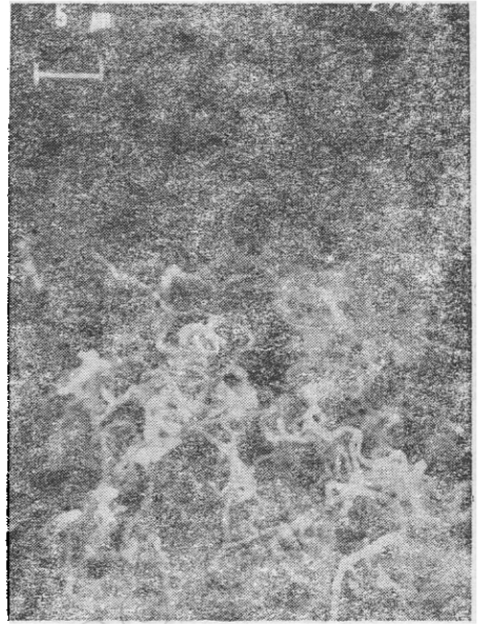


图2 泾阳链霉菌孢子丝,在扫描电镜下显示的孢子丝的自然生长状况(2000×)

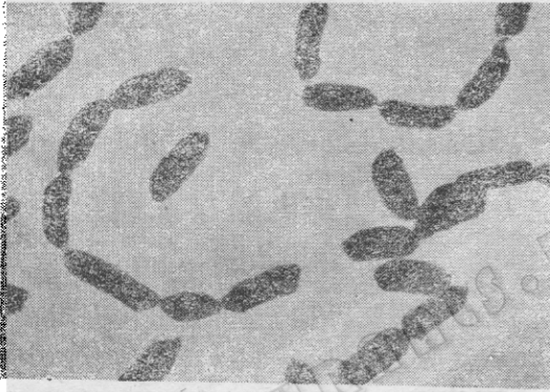


图3 泾阳链霉菌孢子形态(5000×)

表1 菌株5406在六种培养基上的培养特征*

培养基	特征	气生菌丝体	基内菌丝体	可溶性色素
高氏合成一号琼脂		绒毛状,荷花白(II 11') 至浅玫瑰粉(II 13')	初木瓜黄(I _b 26') 后虎皮黄(I _c 37')	浅粉
蔗糖察氏琼脂		绒状 落英淡粉(I _d 12')	浅黄褐(I _d 57')	微染黄橙
克氏合成一号琼脂		荷花白	麦秆黄(I 14') 至葵扇黄(I 24')	浅粉
葡萄糖天门冬素琼脂		绒状,初落英淡粉生孢后 浅玫瑰粉	初熟杏黄(I _c 26') 后至虎皮黄(I _c 37')	微黄
瓦氏营养琼脂		气丝稀少,白至落英淡粉	生长枯绿(I _b 57') 反面虎皮黄至土黄(I _c 47')	浅黄
马铃薯块		落英淡粉至浅玫瑰粉	炒米黄(I _b 24')	薯块染为 淡栗棕(II _b 75')

*《色谱》,科学出版社,1957。

上,黑素均为负反应。水解淀粉强烈。液化明胶明显。凝固并胨化牛奶。产生 H_2S 明显,使悬挂于培养液上的醋酸铅纸条变黑。纤维素,生长。硝酸盐还原为亚硝酸盐。利用葡萄糖、D-木糖、D-果糖和 D-甘露醇;不利用 L-阿拉伯糖、L-鼠李糖、棉籽糖和蔗糖。利用肌醇可疑。

讨 论

1. 菌株 5406 和菌株 G₄ 在所研究的全部性状上相同或极相似,可认为是同一菌种的不同菌株,本文报告仅以菌株 5406 的性状为主。

2. 仅选择相近已知种^[4-11]和菌株 5406 进行全面比较,结果列于表 2。从表 2 可见彼此之间都有显著差别,其中菌株 5406 与弗氏链霉菌密切相近,两者的气生菌丝充分成熟时,呈浅粉色(海贝浅粉),基内菌丝体黄橙色,孢子表面光滑和黑素负反应。但菌株 5406 无论是在合成培养基或有机培养基上,孢子丝初直或波曲,成熟时形成 2—4 圈松散螺旋,有时多至 5—7 圈,而弗氏链霉菌孢子丝通常直和波曲或勾状和环状,偶尔有松散螺旋。据 Waksman 认为无真正螺旋。此外在碳源利用和拮抗

性上也有不同,因此,菌株 5406 不能归入弗氏链霉菌。

3. 一度曾把菌株 5406 和 G₄ 暂定为细黄链霉菌。由表 2 可见,后者气生菌丝体杏仁黄、黄灰或苍黄色,孢子丝典型的波曲,因而菌株 5406 不能归属于细黄链霉菌,应建立为一新种,命名为泾阳链霉菌 (*Streptomyces jingyangensis* n. sp. Tao et al., 1978)。

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THE ANTIBIOTIC STRAIN 5406 — *STREPTOMYCES JINGYANGENSIS* N. SP.

Tao Tian-shen Yue Ying-yu Liang Shau-fen Sang Jin-lung

(Institute of Soils and Fertilizers, Chinese Academy of Agriculture Science, Beijing)

Yin Shen-yun

(Institute of Utilization of Atomic Energy, Chinese Academy of Agriculture Science, Beijing)

Streptomyces strains 5406 and G₄ are used as antibiotic fertilizer in China. Of all the taxonomic characters tested, both

strains 5406 and G₄ are similar, and are recognized as members of the same species.

Table 1 The Cultural Characteristics of Both Strains 5406 and G.

Media \ Characters	Aerial mycelium*	Substrate mycelium	Soluble pigment
Gauze's medium No. 1	Fluffy, abundant, sea-shell pink (XIV, 11', i.)	Orange buff (III, 15, d.) to Capucine orange (III, 13, d.)	Orange pink
Czapek's medium (Sucrose nitrate agar)	Velvety, nearly Pale Salmon (XX, 9', f.)	Pinkish cinnamon to (XXIX, 15'', b.) Mars orange (II, 7, i.)	Yellowish orange
Krassilinkov's medium No. 1	Partially, sea-shell pink with light yellow patches	Pale ochre buff (XV, 15', f.)	Pinkish
Glucose asparagin agar	Sea-shell pink	Picric acid yellow (IV, 23, d.) to pale ochre buff	Light yellow
Waksman's nutrient agar	Scant, white to sea-shell pink, partially bald	Growth wrinkled, reversed side Cadmium yellow (III, 17, -.)	Yellowish
Potato plug	White with pink tinge	Growth cream (XVI, 19', f.)	Plug was stained cinnamon (XV, 15, k.)

* Ridgway, R.: Color standards and nomenclature, 1912.

Table 2 The Physiological Properties of Both Strains 5406 and G.

Optimum temperature for growth	25°—37°C
Optimum pH range for growth	6—8
Tyrosinae reaction	negative
Melanoid pigment	negative
Reduction of nitrate	positive
Liquifaction of gelatin	fast
Coagulation of milk	positive
Peptonization of milk	positive
Production of H ₂ S	strong
Growth on cellulose	positive
Utilization of carbon sources	D-glucose, D-xylose, D-fructose, D-mannitol, were utilized for growth. No growth or only trace of growth on L-arabose, L-rhamnose, raffinose, and sucrose. Utilization of i-inositol doubtful.

Substrate mycelia of both strains are straight or flexuous, much branched, and do not fragment into bacillary or coccoid forms. Sporophores possess more or less regularly opened spirals consisting of 2—4 turns, sometimes as much as 6—7 turns. Spores elliptical to cylindrical $1.4—1.6 \times 0.8—1.0 \mu\text{m}$, with smooth surface. Whirls, zoospores, sporangia or sclerotia have not been observed.

Growth yellowish, and orange buff (Ridg. III, 15, d.) to capcine orange (III, 13, d.) on reverse side. Aerial mycelia velvety, sea-shell pink (XIV, 11', f.) with some yellowish patches. Cultural characteristics on six media are shown in the Table 1, and the physiological properties are shown in the Table 2.

Among the known species of *Streptomyces* described in literatures (No. 4—No. 11 and others), strains 5406 and G_4 appears closely related to *S. fradiae*, but differ in following points: the sporo-

phores of strains 5406 and G_4 always form open spirals, typical of S Section (*Spirales*), both on synthetic and organic media, whereas *S. fradiae* is usually wavy, with hooks or loops including occasionally open spirals, which is the morphology of sporophores of typical RA Section (*Retinaculiaperti*) as described in Bergey's manual (8th ed.). In addition, there are also significant differences in physiological properties and in antagonism.

According to the above mentioned characteristics, strains 5406 and G_4 are considered members of a new species, named *Streptomyces jingyangensis* sp. nov. Tao et al., 1978. Strain 5406 is designated as the type culture of this new species and is deposited in the Culture Collection of the Institute of Microbiology, Academia Sinica, Beijing, China, with accession number AS 4.891.