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Two Commonly Occurring Species of *Streptomyces* in Stored Wheat and Flour

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During a survey of microorganisms associated with stored wheat and flour, the genus *Streptomyces* was the common actinomycete isolated. *S. albus*, the predominant species, was found in 54% of grain and 44% of flour samples and *S. griseus* 23% and 17% of grain and flour samples, respectively. Three strains of *S. albus* and two of *S. griseus* were studied for their cultural, morphological and physiological characters.

Key Words - Flour Grain Storage Fungi Streptomyces

The actinomycetes form a small fraction of the total microbial content of stored wheat and flour as revealed by our survey in India (Mehrotra & Basu, 1975). The types of fungi and bacteria encountered in these substrates have already been reported (Mehrotra & Basu, 1976; Basu & Mehrotra, 1978). The present paper deals with the frequently encountered actinomycetes. The predominant genus was *Streptomyces* with *S. albus* the most common one and *S. griseus* next in importance. Similar was the finding of Graves et al. (1967), with wheat flour samples in U.S.A. Flannigan (1970) also found actinomycetes in British wheat grains.

MATERIALS & METHODS

The methods of isolation of these organisms have been outlined (Mehrotra & Basu, 1975). For studying various cultural, morphological and physiological properties, the methods followed were those of Hesseltine *et al.* (1954); Pridham *et al.* (1958); Manual of Microbiological Methods (1957) and Shirling Gottlieb (1964). Identifications were made following Breed *et al.* (1957); Pridham & Lyons (1961); Pridham (1963) and Waksman (1967)

RESULTS & DISCUSSION

Actinomycetes were found in 84% of grain and 69% flour samples, of which *S.albus* was present in 54% of grain and 44% of flour samples respectively. The different isolates of *S.albus* were placed in three groups and strains W-II, W-III, W-X were selected as representatives of each group. Similarly two strains, C-XIII and C-XIII were selected for *S.griseus* (Plate I, figures 4 to 7). The utilization of different carbon sources by 3 strains of *S.albus* and 2 of *S.griseus* has been presented in Table.1.

The results of morphological, cultural and physiological studies showed that strains W-II, W-III and W-X resembled closely the generally accepted description of *S. albus*. Of the three, some differences in cultural and physiological properties were observed.

The strains, C-XII and C-XIII matched with the description of *S. griseus* (Fig. 1 to 3) except in the production of light green soluble pigment and greenish - black substrate mycelium observed in case of (NH4)2 SO4 agar.

The cultures of the two species have been deposited in BSM Culture Collection, Department of Botany, University of Allahabad and at N R R L. Peoria, Illinois.

The utilization pattern of different carbon sources exhibited by the strains of *S. albus* was almost similar to the findings of Lyons & Pridham (1962) except for the strain W-III in which utilization of arabinose and raffinose was strongly positive. The nutritional requirements of the two strains of *S. griseus* were similar to the findings of Benedict *et al.* (1955) except for raffinose in which a positive utilization was rewarded instead of fair to negative and in lactose a doubtful utilization was observed instead of positive to fair.

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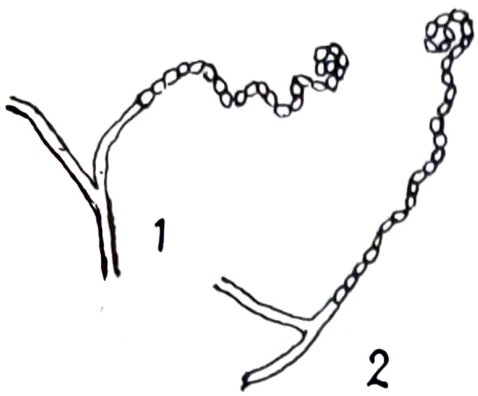


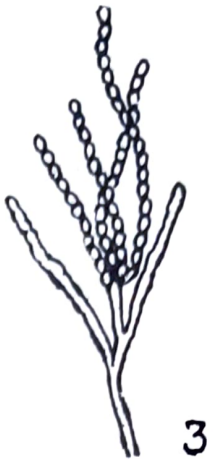
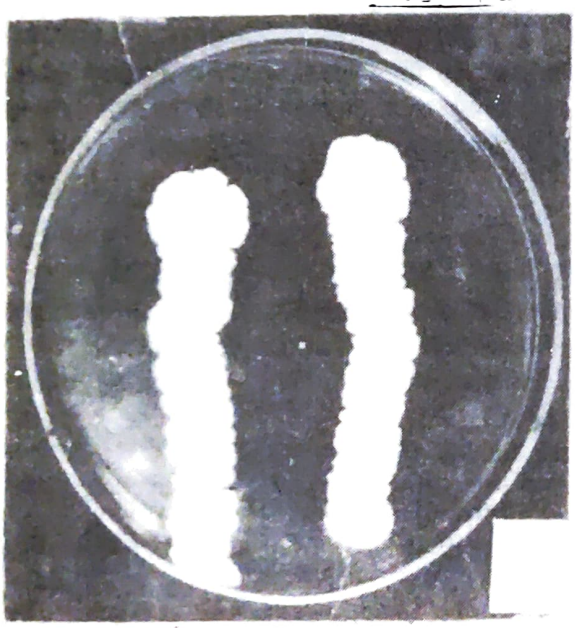
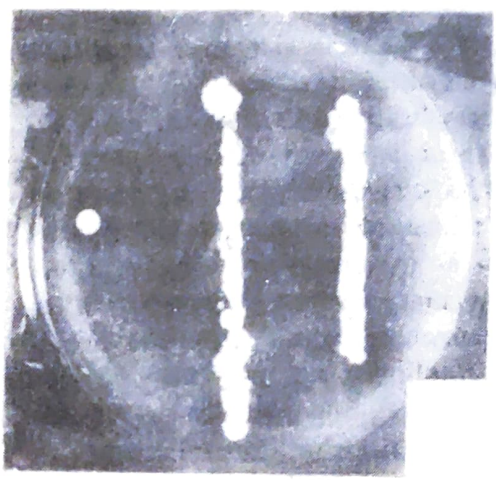
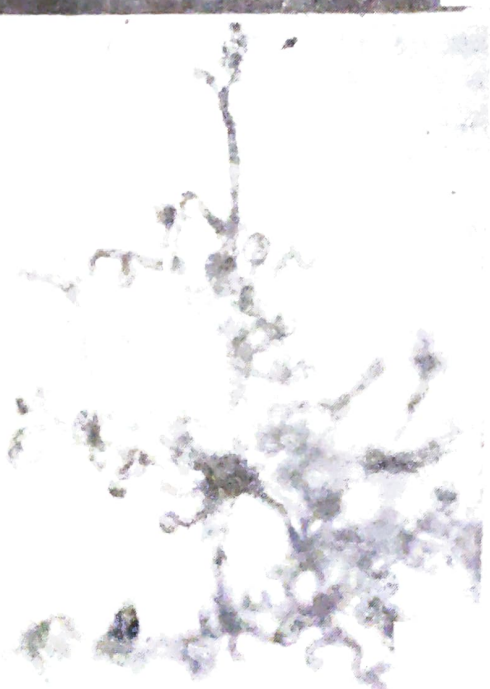


Fig.1-3. *S. albus* Sporophores small, closed and spiral.

Fig.3. *S. griseus* ; Sporophores in fascicles.







S. albus.

Fig.4 Fourteen days old colony on basal mineral salts agar with lactose as carbon source at 28*C.

Fig.5 Spiral sporophores on nutrient agar, X 596.

S. griseus

Fig.6 Fourteen days old colony on starch-(NH4)2SO4 agar at 28*C.

Fig.7. Flexuous sporophores on Czapek's agar, X 950.

Table I Utilization of Different Carbon Sources by three Strains of *S. albus* and two Strains of *S. griseus*.

Organisms	Strain	Arabi-nose	Rham-nose	Xy-lose	Fruc-tose	Suc-rose	Lac-tose	Raffi-nose	Manni-tol
Streptomyces albus	W-II	±	±	++	—	+	+	+	++
	W-III	++	-	++	++	+	++	++	++
	W-X	+	+	++	+	+	++	±	+
Streptomyces griseus	C-XII	±	+	+	±	±.	±	+	++
	C-XIII	±	±	+	+	±	+	+	++

++ = strongly positive utilization
\+ = positive utilization
\+ = utilization doubtful
\- = negative utilization

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