On the *Cladosporium* Stain of Coated Insulating Boards Observed in Japan*

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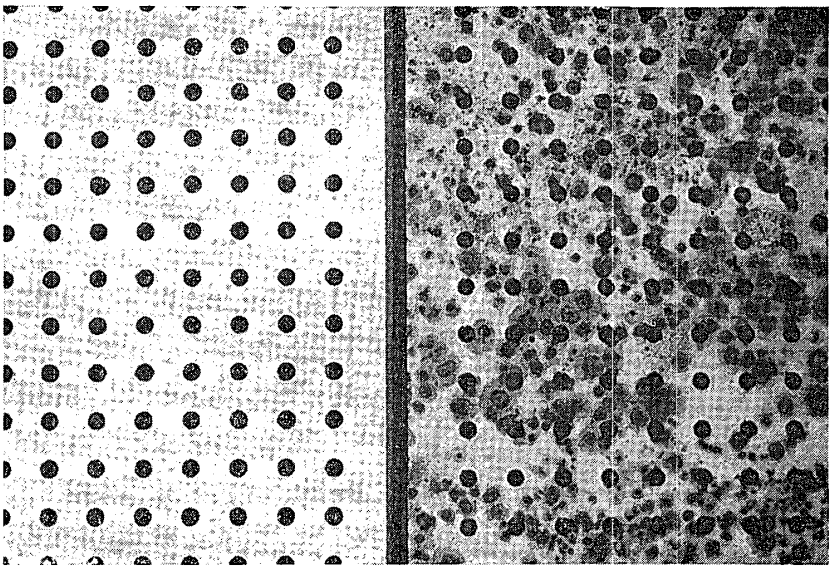
赤井重恭・上山昭則：*Cladosporium* 属のカビによるインシュレーションボードの汚染

Abstract

A dark gray and brown spotting of coated insulating board was found to be associated with a *Cladosporium* sp. This fungus was readily isolated on artificial media, where mycelial growth took place between 10°C. and 28°C. The optimum temperature for germination of conidia of the fungus was at 20°C. Inoculation of boards with the fungus under high atmospheric humidity reproduced the original spotting condition within ten days.

Specimens of a degradation of coated insulating board were received from Dr. Y. KUROKI of the Nippon Hardboard Co., Ltd. in January, 1960.

The main characteristic of this degrade was a pronounced dark gray and brown spotting (Fig. 1), individual spots varying between 0.5 and 1.5 cm in diameter. Micro-



not stained stained

Fig. 1. *Cladosporium* stain of coated insulating boards in service.

* Studies on the microbial-stain and -decay of building boards and their prevention (II). Contribution from the Laboratory of Phytopathology, Kyoto University, Kyoto, No. 141.

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scopic examination revealed abundant conidia in the affected regions. These were globose, subglobose or ellipsoid in shape, 3～6 ×3.7～5.0 μ, warty and sometimes catenated, one or two celled and pale to yellowish brown in colour. Conidiophores were simple or branched, darkcoloured. The basal conidia in a chain were long, ellipsoid or subcylindrical, with one to three hila at the apices.

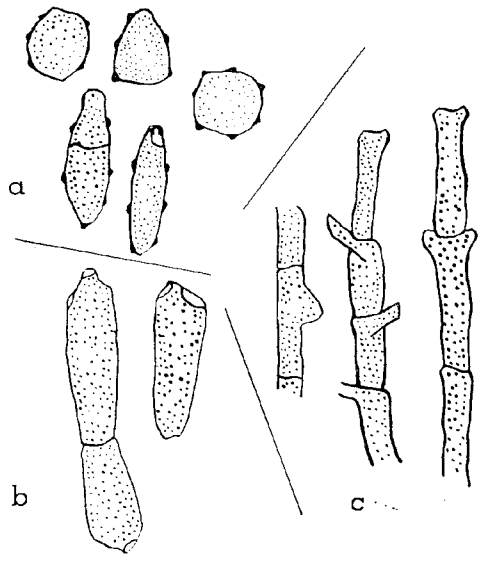

Fig. 2. *Cladosporium* sp.
a : conidia ×915
b : basal conidia of conidial chain ×915
c : conidiophores ×665

The morphology of this fungus corresponds closely with that described for *Cladosporium sphaerospermum* PENZIG[2], which is known to invade timber of *Pinus densiflora* and bamboo slat (*Phyllostachys reticulata*)[3]. However, identification of the fungus with *C. sphaerospermum* has not yet been completely settled.

In addition to these spots, some red-stained areas on the specimens were also noted and a bacterium has been isolated from these. This has not yet been identified.

The *Cladosporium* sp. was readily isolated on to Ebios-glucose agar where mycelial growth was not vigorous, giving a colony of hyphae of width 3.0～4.5 μ (Fig. 2). These cultures were used in the experiments described below.

Effects of Temperature on Mycelial Growth of the Fungus

Experiments to determine this relationship were made using cultures grown on

Table 1. Relation of temperatures to the mycelial growth of *Cladosporium* sp. appeared on stained insulating boards.

Temperature °C	Dry weight of mycelium per flask* mg	Final pH of filtrate**
2～ 5	0	5.6
10～13	279	5.4
20± 0.5	305	5.4—5.2
22± 0.5	299	5.4—5.2
24± 0.5	290	5.4—5.2
26± 0.5	288	5.4—5.2
28± 0.5	265	5.4
32± 0.5	0	5.6
36± 0.5	0	5.6

* Average of 5 flasks. ** Initial pH 5.6.

50 ml. aliquots of 0.5% Ebios/1% Glucose solution, which had been adjusted to a pH of 5.6, contained in 200 ml. flasks. After nine days growth the mycelial mat was filtered off, dried and weighed. The results obtained from this are given in Table 1.

These show little difference in growth between 10°C and 28°C with a slight peak at 20°C. Below 5°C and above 32°C no growth occurred.

Effects of Temperature on Germination of Conidia

Germination tests at a range of temperature were made with routine method using one-celled conidia from cultures grown for ten days at 20°C.

The results, shown in Table 2, give an optimum temperature for germination

Table 2. Germination of conidia of *Cladosporium* sp. in deionized water in darkness.

Temperature °C	Plot No.	Number of conidia measured	Germination Percentage*
2～ 5	1	660	0
	2	454	0
	3	640	0
10～13	1	588	4
	2	512	0
	3	509	2
20±0.5	1	510	41
	2	612	28
	3	519	17
24±0.5	1	480	16
	2	556	11
	3	402	14
28±0.5	1	400	5
	2	576	4
	3	432	9
32±0.5	1	581	0
	2	614	0
	3	513	0
36±0.5	1	415	0
	2	423	0
	3	680	0

* Measured after 24 hours.

after 24 hours at 20°C, conforming with the results obtained for mycelial growth.

Inoculation Trials

Trials to determine how far the *Cladosporium* sp. was the cause of the spotting described above, were made in the following way.

Three sample boards, 9×9 cm square, were immersed in deionized water for about one hour. Twenty five drops of a conidial suspension in 0.5% Ebios/1% Glucose solution were applied to each board by micropipette which were then enclosed in a vinyl bag, placed in a moist chamber and incubated at 20–22°C.

After ten days spots developed on the test boards which were very similar to those observed on the original material. Microscopic examination showed that conidia of the *Cladosporium* sp. were present on these spots.

Discussion

The results of this preliminary investigation show that a spotting of coated insulating board was caused by a *Cladosporium* sp. close to *C. sphaerospermum* PENZIG[2]. The effect of temperature on growth of this fungus make it likely that this staining will be most likely to develope under damp wintry conditions.

A similar spotting, found by FRENCH and CHRISTENSEN[1] to be caused by *Aspergillus restrictus*, was tolerant of pentachlorophenol between 0.29 and 0.51%, and it is thought that the staining under study may not be susceptible to preservative treatment. Experiments are being continued with special attention to the carbon metabolism of the fungus and the prevention of staining.

We are indebted to Dr. Y. KUROKI for his kind help in supplying specimens and also to Dr. I. A. S. Gibson, Nairobi, for reading the manuscript.

Literature Cited

1) FRENCH, D. W. and C. M. CHRISTENSEN: TAPPI 41: 309-12 (1958)
2) SACCARDO, P. A.: Syll. Fung. 4: 355 (1886)
3) YAMAMOTO, W.: Sci. Rept. of Hyōgo Univ. of Agric.: 4: 1-6 (1959)

摘　　要

Cladosporium 属のカビによつてひきおこされたボードの汚染を報告する。ボード上の斑点は直径 0.5～1.5cm, 暗灰色または暗褐色であつて, 容易に人工培地上に分離し得る。菌糸の発育温度範囲は 10～28°C, 分生胞子の発芽適温は 20°C である。過湿状態にして, 新しいボードに再接種すると10日以内に特有の斑点を生ずる。このカビは好低温群に入るので, ボードの供用条件によつては冬期にも汚染を来たす可能性がある。