PRELIMINARY INVESTIGATIONS OF *GANODERMA AUSTRALE* (SUBGEN. *ELFVINGIA*) IN TAIWAN

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Abstract: Twelve specimens of *Ganoderma*, subgen. *Elfvingia* (Karst.) Imazeki were collected from hardwoods at several locations in Taiwan, and pure cultures were isolated. Based on morphology of the basidiocarps, all specimens were identified as *Ganoderma australe* (Fr.) Pat. Monokaryotic cultures were obtained from basidiospores of artificially cultivated fruit-bodies of the isolate TAI-01. The mating system was determined as heterothallic and tetrapolar. Using cultural studies and compatibility by dikaryon-monokaryon mating reactions, these isolates could be separated into two groups. Isolates of Group 1 (including 7 isolates) had an average growth rate of 6.2 mm/day at its optimum temperature range of 28-32°C. The di-mon matings were compatible. Isolates of Group 2 (including 5 isolates from the high altitude collection) had an average growth rate of 4.0 mm/day at its optimum temperature range of 24-28°C. The di-mon matings were incompatible. It is concluded that there are two "intersterility groups" of *G. australe* in Taiwan.

Four monokaryotic isolates representing the mating types from Taiwanese collection of *G. australe* TAI-01 were mated with five isolates under the name of *G. applanatum* (Pers.) Pat. (=*G. lipsiense* (Batsch) Atk.) obtained from ATCC or CBS. ATCC 32585, isolated from a tropical hardwood in India, was compatible with monokaryotic isolate TAI-01, and had a similar growth temperature requirement than Group 1 of *G. australe* from Taiwan. The other four isolates of *G. lipsiense*, ATCC 32586, CBS 175.30, 187.31, 250.61, were incompatible with *G. australe* TAI-01. ATCC 32585 of *G. lipsiense* is, thus, probably identical to *G. australe*.

INTRODUCTION

The genus *Elfvingia* was established by Karsten (1889) with *Polyporus applanatus* (Pers. ex S.F. Gray) Wallr. as its type. Imazeki (1939) first proposed *Elfvingia* as subgenus. Pilát (1942) accepted it at the subgeneric level. Imazeki (1943) again recognized the genus *Elfvingia* and cited it as *Elfvingia* Karst. em. Imazeki.

In 1948, Donk proposed a new family the Ganodermataceae. Two genera, i.e. *Ganoderma* and *Amauroderma* were included in this family (Donk, 1948, 1964), and *Elfvingia* was treated as a synonym of *Ganoderma*. Ito (1955) recognized subgen. *Elfvingia* under the genus *Ganoderma*. Cunningham (1965) accepted the genus *Elfvingia* under the subfamily Fomitoideae, tribe Fomiteae. Steyaert (1980) accepted *Elfvingia* at the subgeneric level. Zhao *et al.* (1981) recognized *Elfvingia* at the subsectional level under the genus *Ganoderma*. Corner (1983) accepted

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Elfvingia as a subgenus and designated it as a name for the non-laccate species of *Ganoderma*.

Recently, Zhao (1988) followed Steyaert (1980) and Corner (1983) in recognizing *Elfvingia* at subgeneric level. He reported 16 species from mainland China and gave a detailed key to these fungi. In this report *Elfvingia* is treated as a subgenus.

The structure of the pileal crust is an important feature to distinguish subgenus *Elfvingia* from subgenus *Ganoderma*. Steyaert (1980) reported that "Subgenus *Elfvingia* (Karst.) Imazeki is clearly distinctive from subgenus *Ganoderma* in having a cutis anatomy of the trichoderm type which is, with the layer of melanoid substances, below the ramification of the terminal hyaline context hyphae". But Corner (1983) and Zhao (1988) did not agree with Steyaert's definition. Neither typical palisadoderm nor hymenioderm was present in this subgenus.

The type species of subgenus *Elfvingia* is *Ganoderma applanatum* (Pers. ex S. F. Gray) Pat. According to the present Code (Greuter *et al.* 1988), however, the unsanctioned epithet *applanatum* should be abandoned, and the correct name for the species is *Ganoderma lipsiense* (Batsch) Atk. Both Ryvarden (1980) and Corner (1983) stated that *G. lipsiense* was not known from the tropics and seemed to be confined to the Northern Temperate Zone only. Therefore, the species found in subtropical and tropical regions should be *G. australe* (Fr.) Pat., or some other species with a southern distribution. *G. lipsiense* and *G. australe* are two members of the *G. lipsiense* complex in which certain controversial taxonomic problems are present. The species concept and limitation of this complex based on macromorphology is difficult and confusing. For example, the basidiospore size was considered as the most stable character but Steyaert (1975) demonstrated that there was a remarkable variation in the spore size of *G. tornatum* (synonym of *G. australe*) related to geographical distribution. Spores become larger as the altitude increases and this held true in all of 170 specimens collected by Steyaert.

Ryvarden (1980) mentioned that "*G. applanatum* may be separated from *G. australe* by having a context that is dark brown close to the tubes, becoming gradually lighter towards the crust. The latter is also on average much thinner in *G. applanatum* than in *G. australe*. Further, the black bands found in the context of *G. australe* are as pointed out by Steyaert, not seen in *G. applanatum*."

Corner (1983) agreed with Ryvarden's interpretations and also pointed out a further distinction between *G. australe* and *G. lipsiense* viz. the absence of the black, hard, crustaceous lines or layers from the context of *G. lipsiense*. He recognized *G. europaeum* as a synonym of *G. australe*. The spore size of *G. australe* as given by Ryvarden (1980) are 6-13×4.5-9 μm, and 6.5-8.5×5-6 μm to 10.5-13×7-8.5 μm according to Corner (1983).

Zhao (1987) revised some taxa of *Elfvingia* species as reported from China, like *G. leucophaeum* (Mont.) Pat. as a synonym of *G. lipsiense*, and *G. tornatum* (Pers.) Bres. as a synonym of *G. australe*.

In subgenus *Ganoderma*, cultural morphology and compatibility were applied to distinguish difficult species. Adaskaveg and Gilbertson (1986) used cultural studies and genetic approach to distinguish *G. lucidum* and *G. tsugae* as separate species. Hseu and Wang (1987) applied di-mon mating tests to distinguish some different species of *Ganoderma* in Taiwan.

Kanehira (1923) first reported *G. australe* growing on fallen rotten log from U-lai area of Taiwan. Sawada (1931) confirmed the identification of Kanehira.

Since then, no other collections have been reported from Taiwan. The present investigation was made to clarify the distinction between *G. australe* (found in Taiwan) and *G. lipsiense*, and to check the distribution of the intersterility groups of *G. australe* in this island by genetic and cultural studies.

MATERIALS AND METHODS

1. Fruit-body collections

Table 1 lists collection data of the isolates from Taiwan used in this study. For a morphological survey, confirmed specimens of *G. lipsiense* (from Europe) and *G. australe* (from South America) listed in Table 2 were compared.

2. Cultural and temperature studies

Cultures were obtained from context tissue of the fruit-bodies and they were grown on 2% malt extract agar (MEA) media at 28°C.

Three cultures of *G. lipsiense* were obtained from the American Type Culture Center (ATCC), Maryland, U. S. A. and 2 cultures of the same species were from Centraalbureau voor Schimmelcultures (CBS), Baarn, the Netherlands for comparative studies (Table 4).

Tannic acid agar medium (0.5%) was used to test the polyphenol oxidases (Nobles, 1965). To study cultural characteristics, cultures were grown on 1.25% MEA and incubated at 24°C, in the dark, being brought into the light at weekly intervals for examination.

Optimal growth temperature ranges were determined by growing the isolates for 12 days on 2% MEA at six temperatures ranging from 16 to 36°C. The experiment had three replications and was repeated twice.

3. Basidiospore morphology studies

Basidiospores were observed by light microscope, using 3% KOH and 2% phloxine as the mountant. Spore length, width and index (length/width ratio) were determined for 20 spores from each fruit-body. For SEM observation, a small part of hymenophore of each specimen was cut and fixed in 2.5% glutaraldehyde in 0.1 M phosphate buffer at pH 7 for 1 h, rinsed in 2 changes of buffer, postfixed for 1 h with 2% osmic acid and dehydrated in ethanol. After dehydration the plugs were critical point dried using carbon dioxide, mounted on SEM stubs, sputter coated to a thickness of 20 nm with gold and observed in SEM (Hitachi, S-520).

Table 1. Isolates of *Ganoderma australe* and their sources

Isolate code number	Host	Locality in Taiwan	Altitude (m)	Date
TAI 01-02	*Livistona chinensis*	Taipei	—	Nov. 1987
03	*Acacia confusa*	Tainan	300	Jul. 1988
05-09	Hardwoods	Taoyuan	1650	Aug. 1988
10	*Fagaceae* sp.	Kenting	—	Aug. 1988
11	*Pittosporum formosanum*	Taipei	—	Jan. 1989
12	*Delonix regia*	Taitung	550	May 1989
13	*Eriobotrya japonica*	Taichung	500	May 1989

Table 2. Measurements of spores and pores of some species belonging to subgen. *Elfvingia*

Species and isolate No.	Collection	Spores				Pores			
		Length (μm)	Width (μm)	Average (μm)	L/W	No./per mm	Diameter (μm)	Wall thickness (μm)	Dia./wall
G. australe (Ryvarden 16101)	Colombia	8.4-11.2	5.6-7.2	9.7×6.4	1.51	4-5	120-200	100-192	1.37
G. australe (Ryvarden 24550)	Brazil	8.4- 9.4	5.2-6.6	8.8×5.7	1.52	5-6	132-180	60-120	1.92
G. australe TAI-01	Taiwan	8.4-10.4	5.4-6.6	9.5×6.2	1.53	4-5	128-220	72-236	1.16
G. australe TAI-07	Taiwan	8.4-10.4	5.6-6.4	9.5×6.0	1.58	5-7	80-140	72-136	1.09
G. australe TAI-08	Taiwan	8.4-10	4.8-7.2	9.4×6.0	1.57	5-6	88-200	80-120	1.33
G. australe TAI-10	Taiwan	7.6-11.2	4.8-6.4	9.7×5.8	1.68	5-6	120-280	45-160	2.22
G. lipsiense (Ryvarden 22009)	Norway	7.2- 9.2	4.0-6.4	8.5×5.7	1.51	4-6	140-232	40-200	1.57
G. lipsiense (Niemelä)	Finland	7.2- 9.2	4.8-5.6	8.1×5.3	1.53	5-6	104-200	52-120	1.86

Table 3. Mating reactions between monosporous mycelia isolated from *Ganoderma australe* TAI-01

Mating type		A1B1					A1B2		A2B1			A2B2	
		1	4	8	9	10	2	7	5	11	12	3	6
A1B1	1	−	−	−	−	−	−	−	(+)	(+)	(+)	+	+
	4		−	−	−	−	−	−	(+)	(+)	(+)	+	+
	8			−	−	−	−	−	(+)	(+)	(+)	+	+
	9				−	−	−	−	(+)	(+)	(+)	+	+
	10					−	−	−	(+)	(+)	(+)	+	+
A1B2	2						−	−	+	+	+	(+)	(+)
	7							−	+	+	+	(+)	(+)
A2B1	5								−	−	−	−	−
	11									−	−	−	−
	12										−	−	−
A2B2	3											−	−
	6												−

+: compatible, clamp formation, (+): pseudoclamp formation
−: incompatible, absence of clamps

4. Compatibility studies

Cultures were inoculated in sterilized artificial media which contained 1,500 ml hardwood saw-dust in each bottle, and were incubated at room temperature for about 120 days. As the fruit-bodies formed, fresh basidiospores were collected. Using single spore isolation tecnique, each spore was transferred with a glass needle to 2% MEA slants and incubated at 24 or 28°C.

Twenty monospores of the isolate TAI-01 germinated after 10 to 20 days. Twelve monosporous mycelia were then mated in all possible combinations. After 2-3 wk incubation, the mating system was determined by examining all crosses microscopically for clamp connections and macroscopically for reaction zones (Rapper, 1966; Deacon, 1984).

The four mating types of the isolate TAI-01 were then crossed with the other dikaryotic cultures, including the five cultures from ATCC and CBS.

All the materials are deposited in the Mycological Laboratory of the Department of Botany, National Taiwan University, Taipei, Taiwan, R.O.C.

RESULTS

1. Description of species

Ganoderma australe (Fr.) Pat. (Figs. 1-4)

Bull. Soc. Mycol. Fr. 5: 67, 1889. Ryvarden, L. Polypor. N. Eur. 1: 165, 1976. Ryvarden and Johansen, Prel. Polypore. Fl. E. Africa, 85, 1980. Corner, E.J.H. Ad Polyporaceas I—*Amauroderma* and *Ganoderma*. Nova Hedwigia Beih 75, 155, 1983. Zhao, J-D. Acta Mycol. Sinica 6(4): 200, 1987.

Fruit-bodies perennial, applanate, dimidiate or semicircular in outline, sessile or somewhat stipitate (isolates TAI-07, TAI-08), varible in size, projecting 62-150 mm, 45-155 mm wide and 16-76 mm thick.

Pileus whitish grey, light brown, or deep to dark brown, hard when dry, smooth or tuberculate, zoned with broad concentric sulcate rings or with oblique, irregular zones, somewhat cracking when dry, crust 0.5-2.5 mm thick.

Context brown to dark brown, 4-28 mm thick, in most specimens with black, hard, crustaceous lines or bands randomly distributed in context.

Tube layers with lighter color than context, 6-46 mm thick, without distinct separating context zones between each tube layer.

Pore surface white in actively growing specimens, but whitish grey, yellowish or light brown on aging, becoming chestnut brown when touched, 4-6 pores per mm (details see Table 2).

Hyphal system trimitic, generative hyphae with clamp connections, thin-walled, 1.5-3 μm wide, skeleto-binding hyphae (sens. Corner, 1983) golden brown, predominating in the fruit-body, thick-walled, up to 7 μm wide, *Bovista*-type binding hyphae much branched, 1-2 μm wide.

Basidiospores truncate, ellipsoid, ferruginous, (7.6)8.4-11.2×4.8-6.6(7.2) μm appearing echinulate in microscope (Figs. 8-9, details see Table 2).

2. Cultural and temperature studies

Tannic acid reactions of the dikaryotic cultures were positive. The mycelial mats were white but somewhat yellow to brown appeared in some parts of the

Table 4. Mating reactions between monokaryotic isolates of *Ganoderma australe* TAI-01 and dikaryotic isolates of *Ganoderma* sp.

Species and isolates No.	Isolates of monokaryon			
	TAI-01M1 (A1B1)	TAI-01M7 (A1B2)	TAI-01M11 (A2B1)	TAI-01M6 (A2B2)
G. australe TAI-01	+	+	+	+
TAI-02	+	+	−	+
TAI-03	+	+	−	+
TAI-10	+	+	+	+
TAI-11	+	+	+	+
TAI-12	+	+	+	+
TAI-13	+	+	(+)	(+)
G. lipsiense (ATCC 32585)	+	+	+	(+)
G. lipsiense (ATCC 32586)	−	−	−	−
G. lipsiense (CBS 175.30)	−	−	−	−
G. lipsiense (CBS 250.61)	−	−	−	−
G. lipsiense (CBS 187.31)	−	−	−	−
G. australe TAI-05	−	−	−	−
TAI-06	−	−	−	−
TAI-07	−	−	−	−
TAI-08	−	−	−	−
TAI-09	−	−	−	−

+: dikaryotic mycelia and clamp formation, (+): dikaryotic mycelia and pseudoclamp formation, −: monokaryotic mycelia.

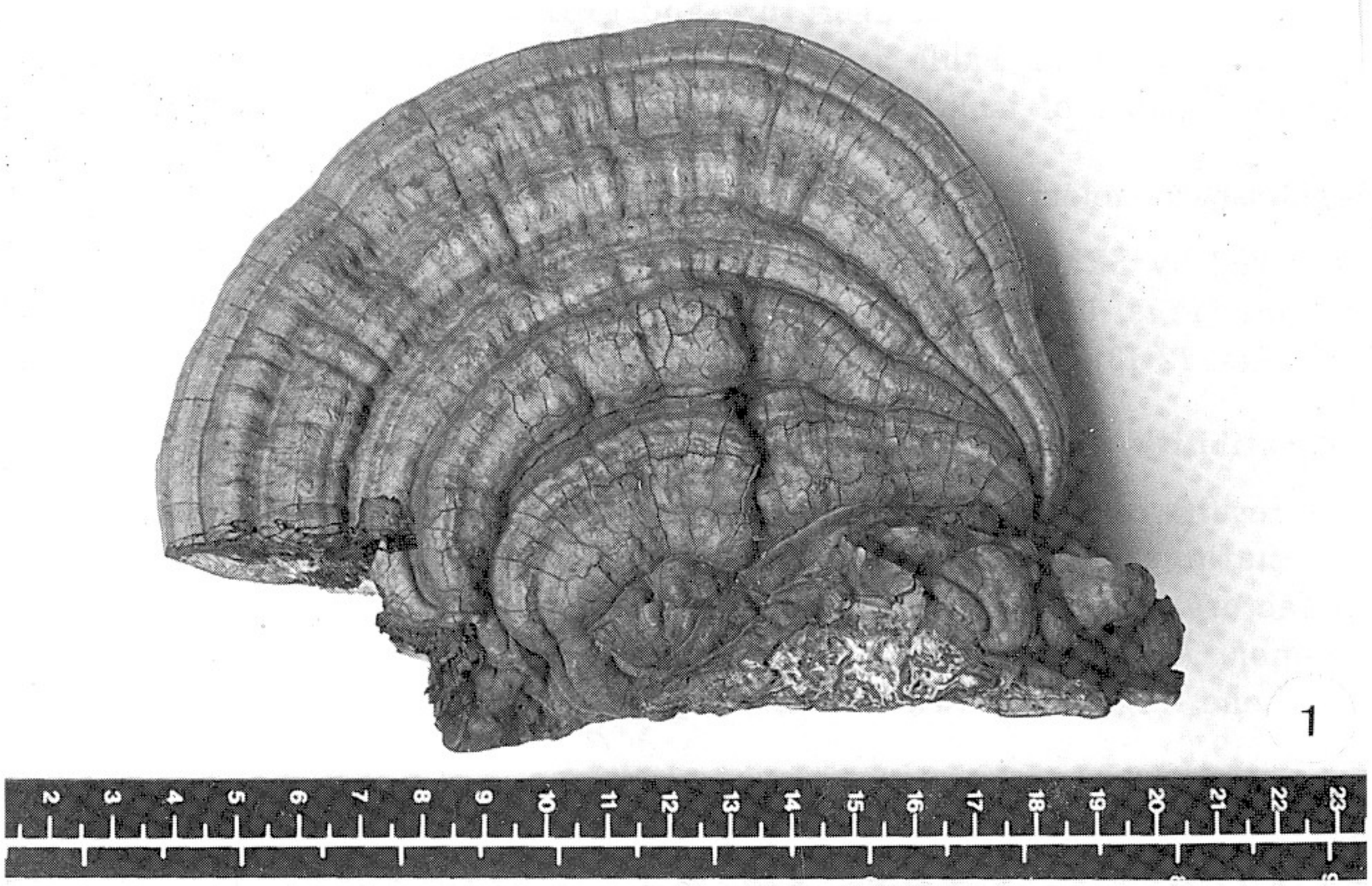
colonies, always smooth and dense. Generative hyphae were hyaline, nodose-septate, thin-walled, 1.6–4.8(9.2) μm in diam. Fiber hyphae were numerous, long and flexuous and interwoven to form a thick or tough mat. Cuticular cells were mostly spherical, a few were ellipsoid, 6–28(34) μm in diam. Group 1 (including isolates TAI-01, 02, 03, 10, 11, 12, 13) produced profusely branched hyphae (*Bovista*-type) in the colonies (Fig. 17). But Group 2 (including isolates TAI-05, 06, 07, 08, 09), lacked this type of hyphae. Species Code: 2, 3, 8, 10, (11), 32, 36, 39, 43, 44, 54, 60 (following Nobles, 1965).

The isolates could also be divided into two groups by temperature studies. Group 1 had an optimum temperature range between 28–32°C with growth rates

Table 5. Optimum temperature and growth rate of some isolates of subgen. *Elfvingia*

Species	Strain	Optimum temperature (°C)	Growth rate at opt. temp. (mm/day)
G. australe	*Group 1	28–32	6.0–6.4
	♯Group 2	24–28	3.6–4.4
G. lipsiense	CBS 175.30	24–28	3.1–3.3
	CBS 187.31	20–24	2.2–2.3
	CBS 250.16	20–24	2.6–3.2
	ATCC 32586	20–24	2.4–3.8
	ATCC 32585	28–32	6.7–6.9

*: including 7 isolates (TAI-01, 02, 03, 10, 11, 12, 13) from Taiwan.
♯: including 5 isolates (TAI-05, 06, 07, 08, 09) from Taiwan.



Figs. 1-2. Upper surface (Fig. 1) and lower surface (Fig. 2) of basidiocarps of *G. australe* TAI-01.

from 6-6.4 mm/day (Table 5, Figs. 5, 18) *and Group 2 had an optimum temperature* range between 24-28°C with growth rates from 3.6-4.4 mm/day (Table 5, Figs. 7, 18).

The range of optimal temperature and growth rate of cultures from ATCC and CBS are shown in Table 5. ATCC 32585 had the same optimum temperature (Fig. 6) as Group 1 of isolates from Taiwan, and a growth rate of 6.8 mm/day.

3. Basidiospores under SEM observation

Observed by SEM, basidiospores of *G. australe* always had longitudinal sulcate depressions (Figs. 10-11). Many large inter-wall pillars could be seen in fractured spores (Figs. 12-13).

4. Compatibility test

The results of mating test of *G. australe* TAI-01 are shown in Table 3. Compatible matings had clamp connections on generative hyphae (heterozygous A and B factors). Incompatible matings had no clamps (common A and B factor, or common A factor). Common B factor matings had pseudoclamps and a barrage zone (Fig. 14). Thus, *G. australe* proved to be heterothallic and tetrapolar. Stalpers (1978) reports *G. resinaceum* and *G. lipsiense* to be heterothallic and tetrapolar.

The results of di-mon matings are shown in Table 4. Monokaryons of *G. australe* TAI-01 were compatible with Group 1 of *G. australe* but incompatible with Group 2 of *G. australe* (Figs. 15, 16). Five isolates of *G. lipsiense* obtained from ATCC and CBS can also be divided in two groups. ATCC 32585 from a tropical hardwood in India was compatible with monokaryons of *G. australe* TAI-01 from Taiwan, the other four isolates were incompatible by di-mon matings.

Figs. 3-4. Upper surface (Fig. 3) and lower surface (Fig. 4) of basidiocarps of *G. australe* TAI-08.

Figs. 5-7. Mycelial growth of *G. australe* and *G. lipsiense* on MEA medium after 12 days at various temperatures. Fig. 5, *G. australe* TAI-01; Fig. 6, *G. lipsiense* ATCC 32585; Fig. 7, *G. australe* TAI-08.

Figs. 8-9. Basidiospores of *G. australe* TAI-01 under bright field microscopy. Fig. 9, showing the inter-wall pillars. (bar=10 μm)

Figs. 10-11. Basidiospores of *G. australe* TAI-01 (Fig. 10) and *G. australe* TAI-07 (Fig. 11) under SEM.

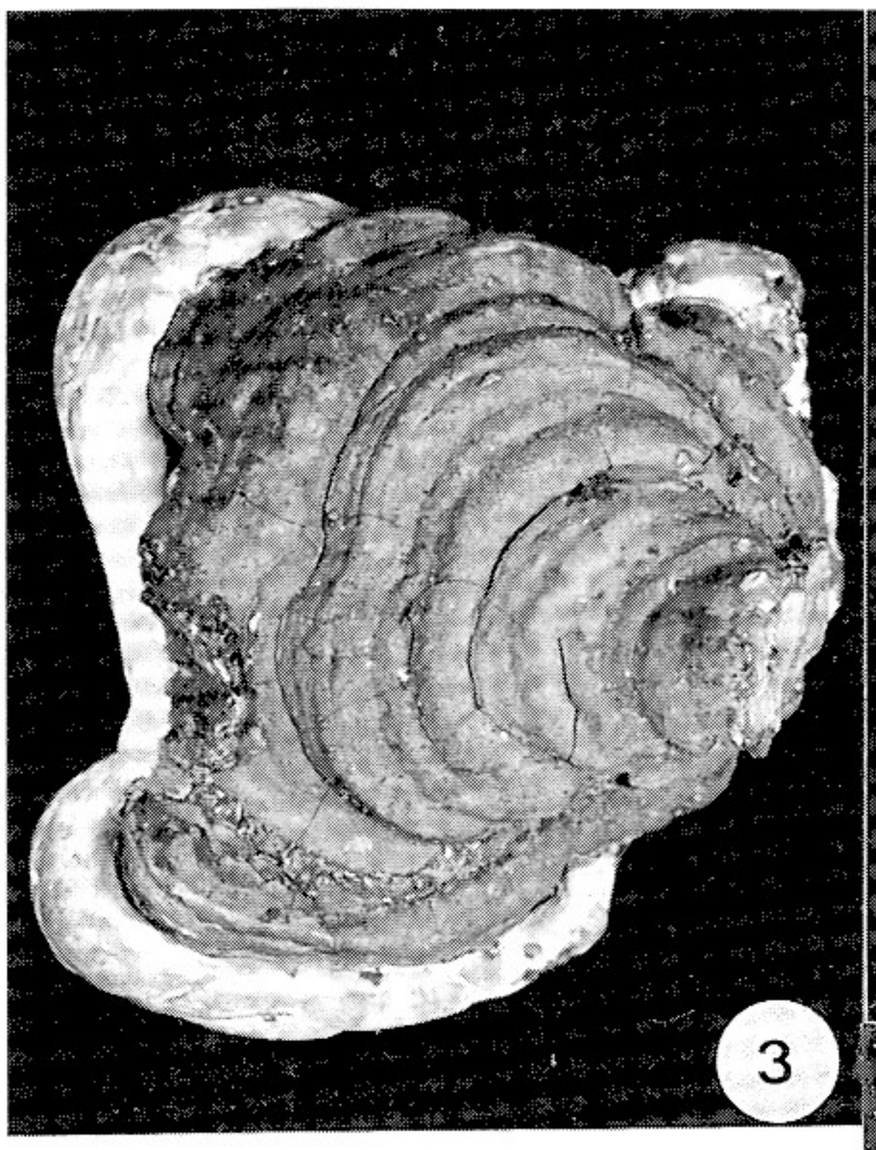
Figs. 12-13. Fractured basidiospores of *G. australe* TAI-02 (Fig. 12) and *G. australe* TAI-03 (Fig. 13) exposing large inter-wall pillars.

Fig. 14. Mating test reactions of *G. australe* TAI-01 monokaryons. A=B≒, showing common A factor; A≒B=, showing common B factor with barrage reaction; A=B= showing common A and B with flat barrier reaction; A≒B≒, showing uncommon A and B factors resulting in compatible reaction.

Fig. 15. Compatible reactions of di-mon mating between monokaryotic cultures of *G. australe* TAI-01 and dikaryotic cultures of *G. australe* TAI-02, 03, 10, 11, 12 and *G. lipsiense* ATCC 32585 (127).

Fig. 16. Incompable reactions of di-mon mating between monokaryotic cultures of *G. australe* TAI-01 and dikaryotic cultures of *G. australe* TAI-06, 07, *G. lipsiense* CBS 175.30 (112) and CBS 187.31 (156).

Fig. 17. Profusely branched hyphae (arrow) appeared in the culture of *G. australe* TAI-01.



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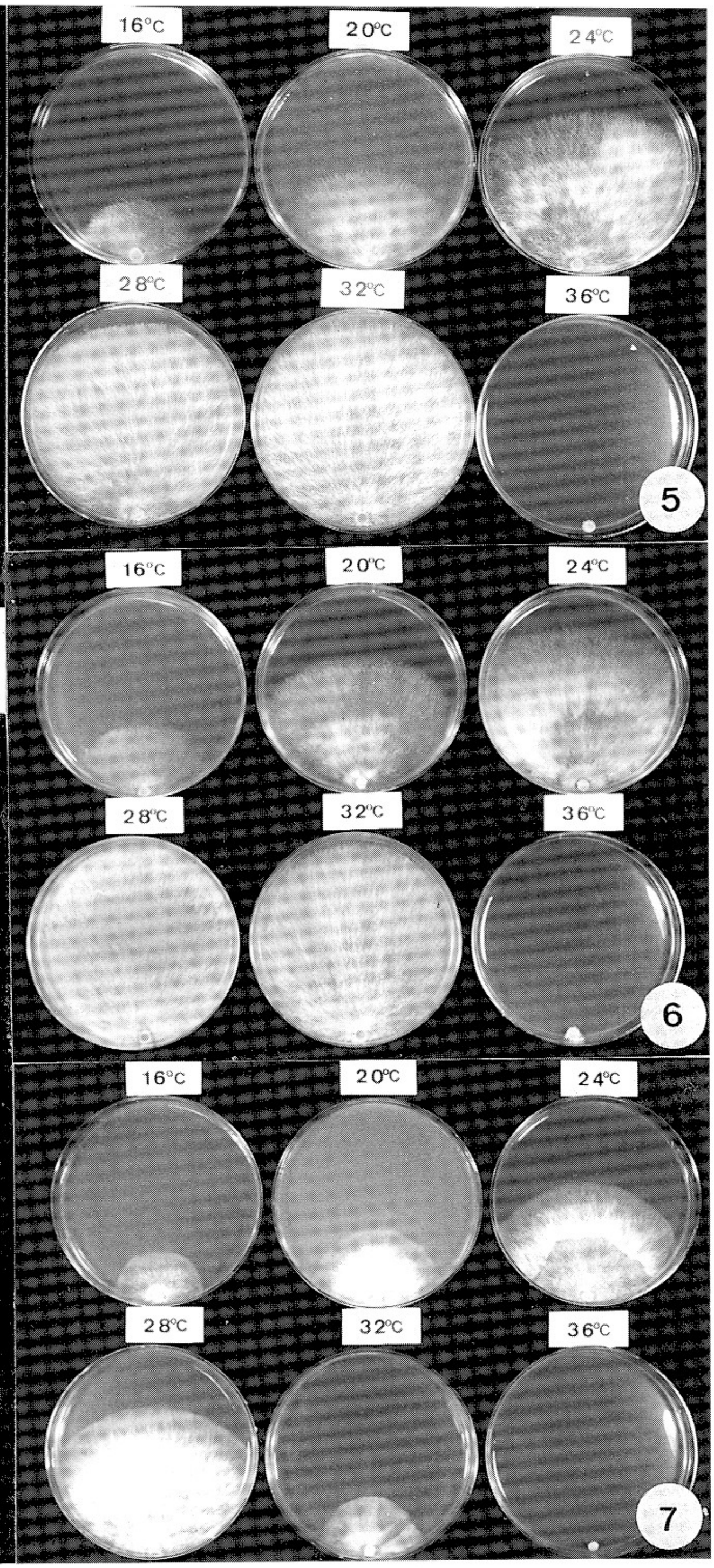
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5

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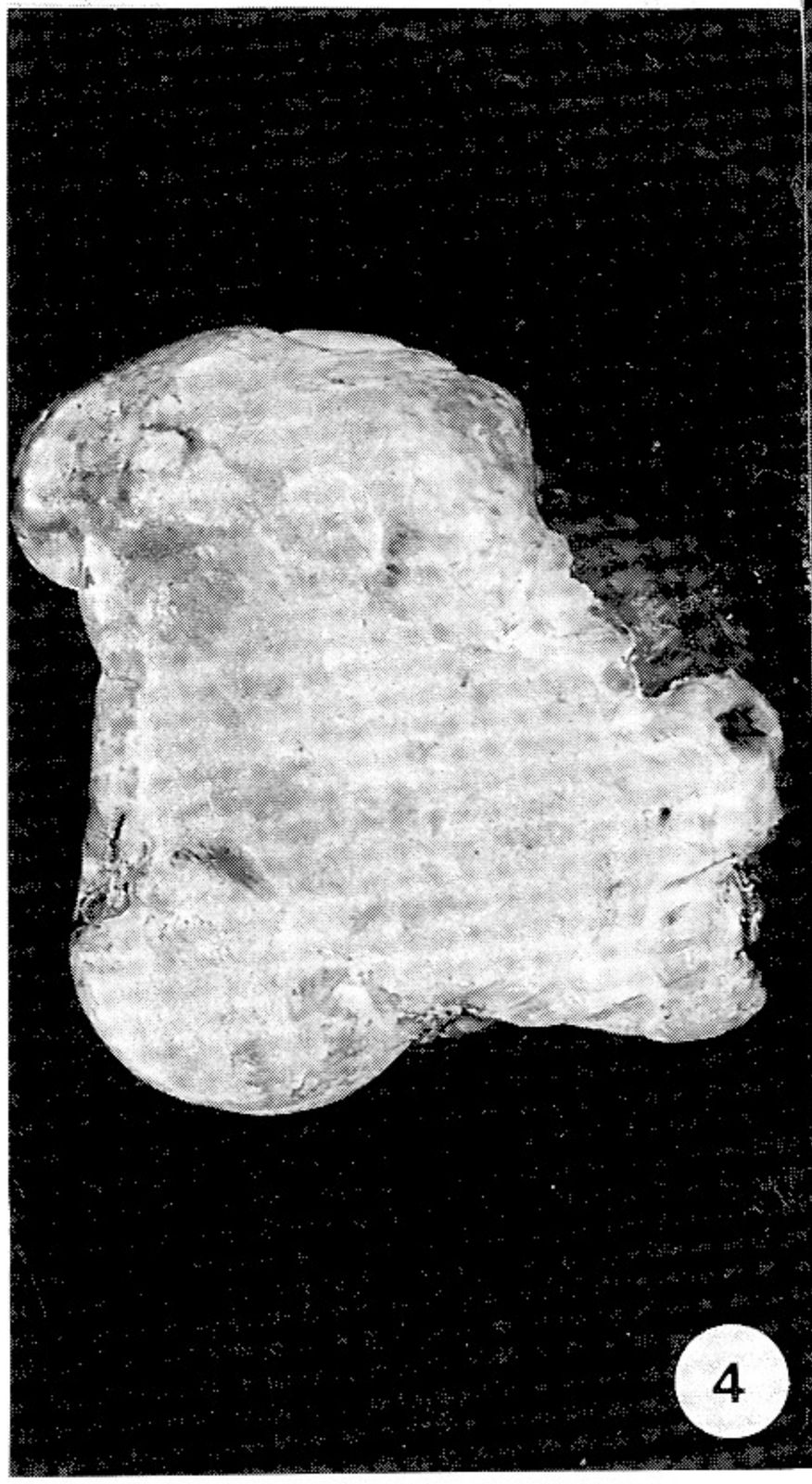

4

16°C
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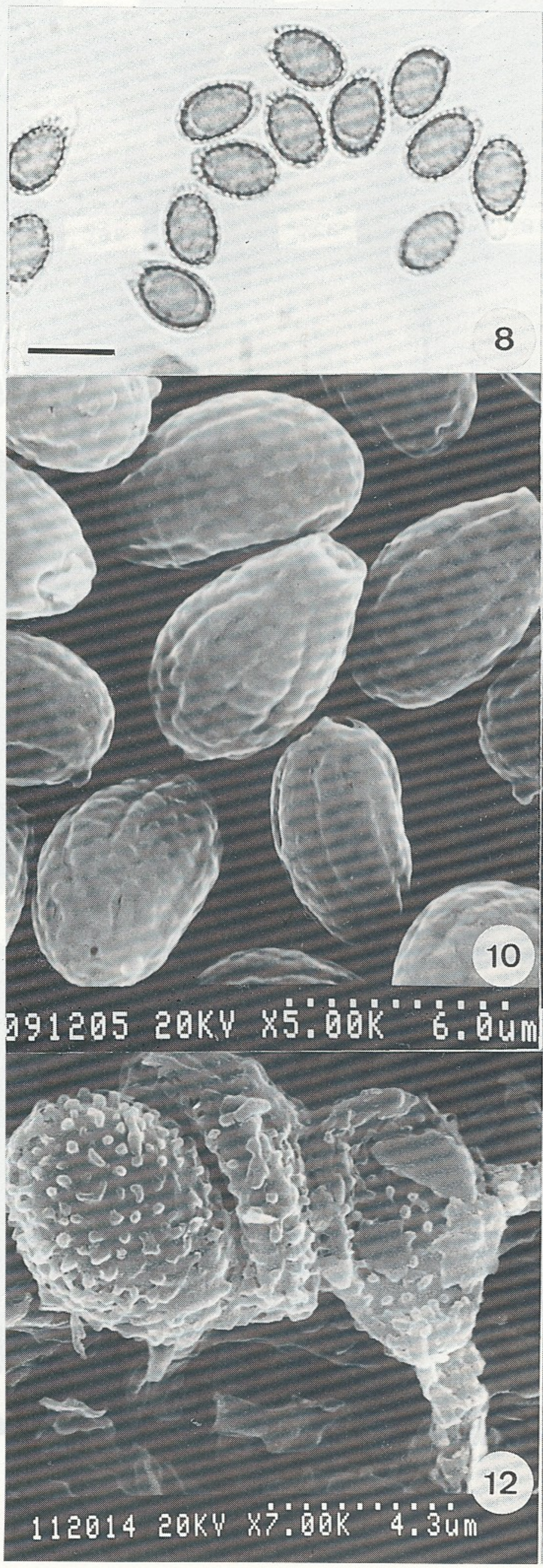
28°C
32°C
36°C

7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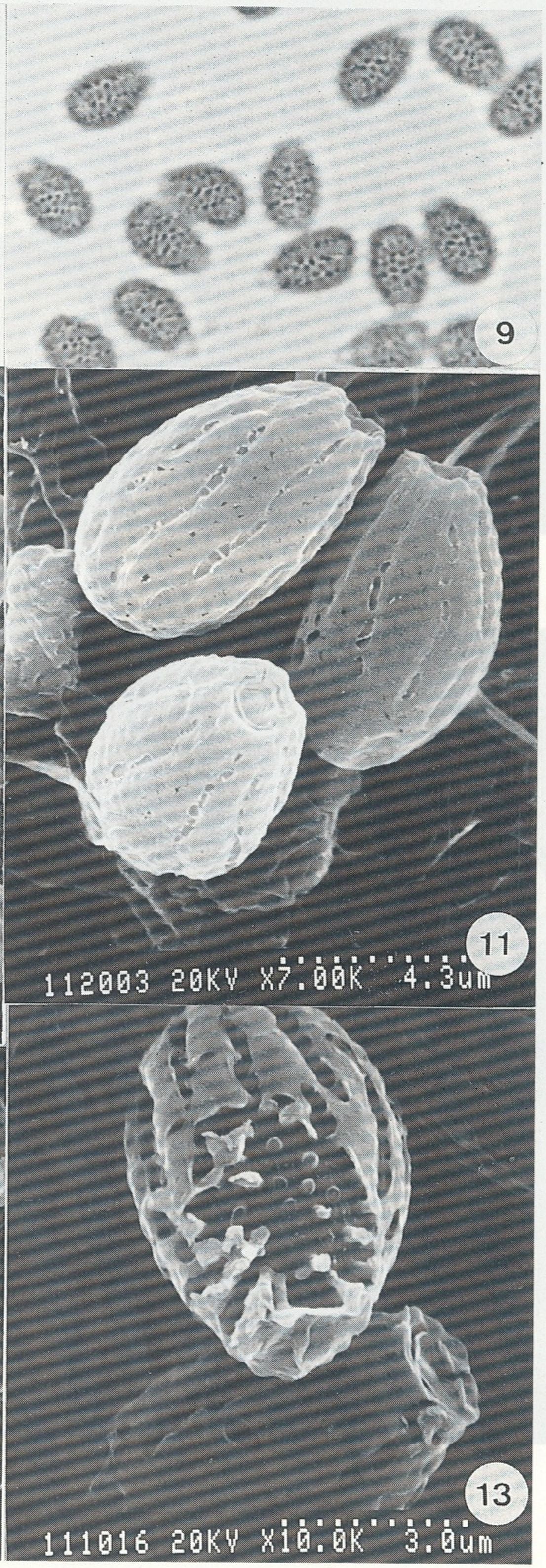
10
112014 20KV X7.00K 4.3um
12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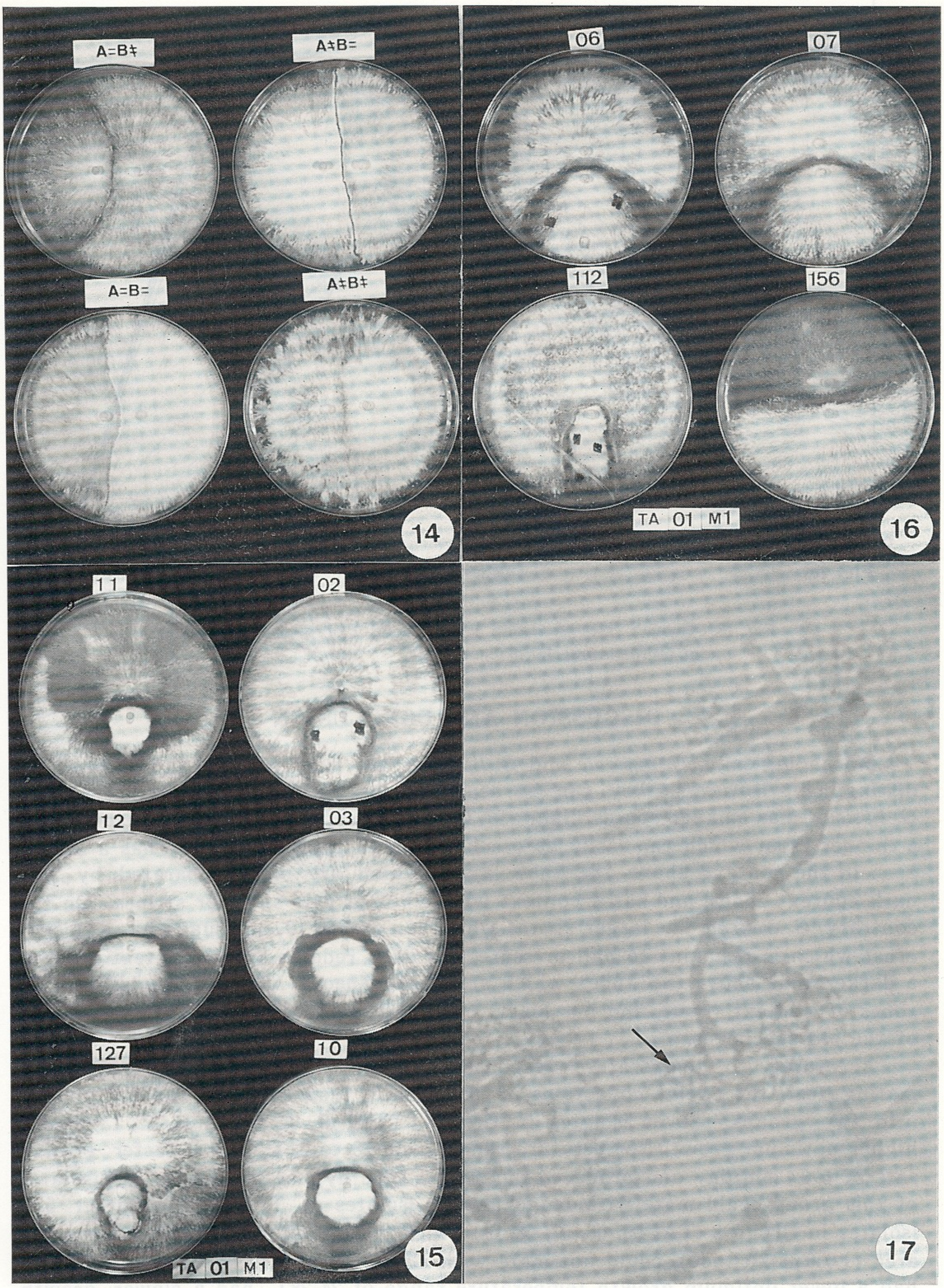
13


A=B‡
A‡B=
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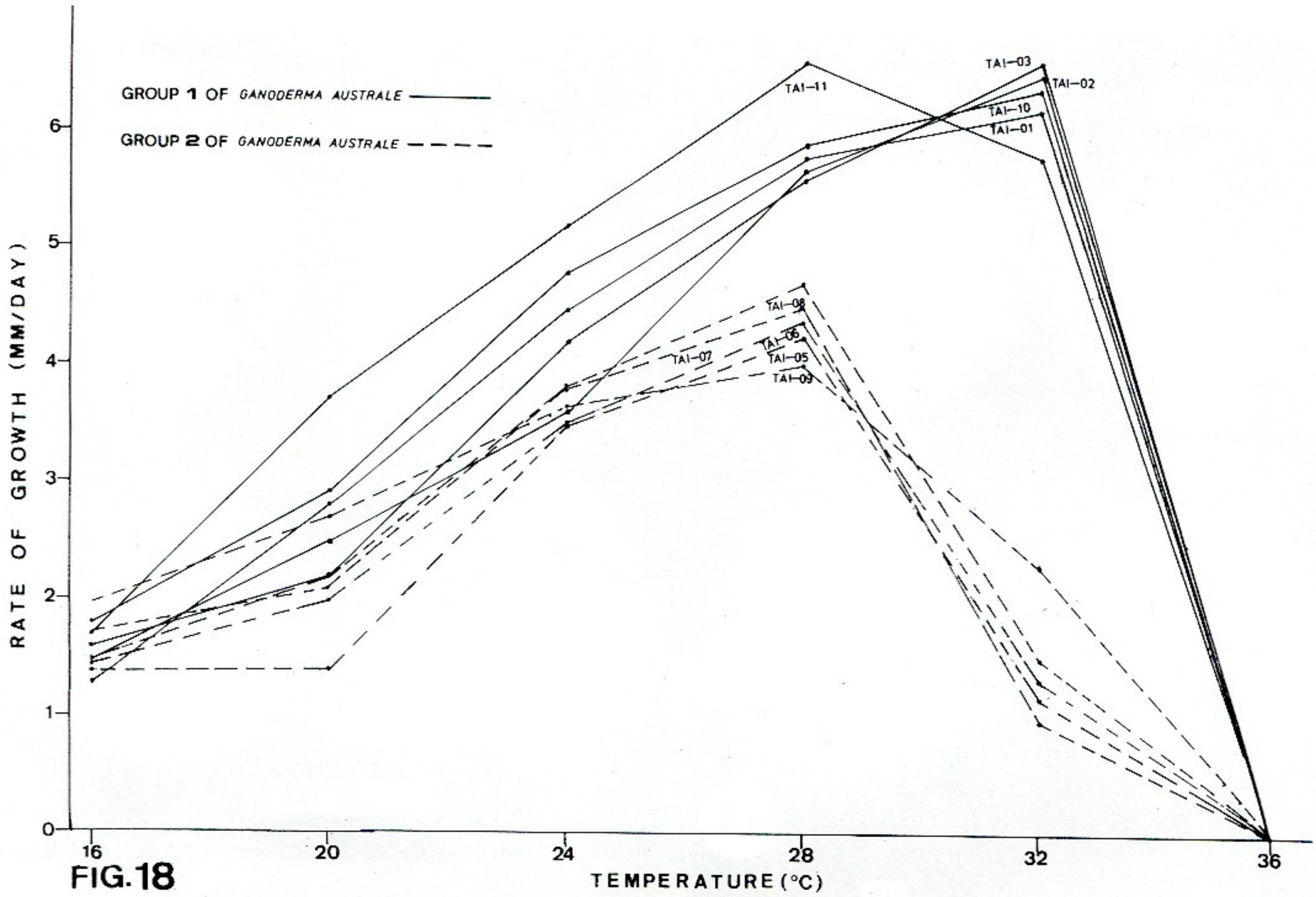

FIG. 18

Fig. 18. Growth rates of Group 1 and Group 2 of *G. australe* isolates at temperatures 16-36°C.

DISCUSSION AND CONCLUSION

Morphologically, *G. australe* and *G. lipsiense* are very similar and difficult to distinguish. However, they can be separated by the following characteristics: *G. lipsiense* has smaller spores (Jahn, 1963), mostly shorter than 10 μm, usually has a thinner crust which can easily be cracked by nail pressure, usually has a darker zone in the context above the tube layers which are often separated by thin dark context zones, and has a context with white or pale spots or stripes. On the contrary, *G. australe* has larger spores which can exceed 10 μm, usually has a thicker crust which is resistant to nail pressure, has dark reddish brown context without a darker zone above the tubes which are homogeneous without any separating zones of context tissue, and has black, hard and crustaceous lines in the context of the old specimens.

According to temperature responses, cultural morphology and results of mating test, the twelve collections of *G. australe* from Taiwan can be divided into two groups. Seven isolates in Group 1 (TAI-01, 02, 03, 10, 11, 12, 13) had a higher optimum growth temperature range from 28 to 32°C, had a faster growth rate of 6-6.4 mm/day and produced the *Bovista*-type hyphae in culture. All isolates of this group could mate with monokaryotic isolates of TAI-01. The other five isolates in Group 2 (TAI-05, 06, 07, 08, 09) which were from the northern mountain area (1,650 m altitude), could not mate with Group 1 isolates particularly TAI-01, had a lower optimum growth temperature range of 24-28°C, had a slower growth

rate of 3.6-4.4 mm/day, and did not produce profusely branched hyphae like *Bovista*-type in culture.

The morphology of basidiocarps of the two groups fits with the species concept of *G. australe* as proposed by Steyeart (1975), Ryvarden (1980), Corner (1983), and Zhao (1988). Evidently, there are two "intersterility groups" of *G. australe* distributed in Taiwan. Anderson and Ullrich (1979) reported at least 10 biological species to exist in the collective *Armillaria mellea* (Vahl: Fr.) Karsten. In the similar way, several intersterility groups or "biological species" have been found in the species complex *Heterobasidion annosum* (Fr.) Bref. (Korhonen, 1978). After closer studies it has turned out that the "biological species" are in fact real species which closely resemble each other but can finally be separated also macroscopically when large amounts of fruit bodies have been critically studied from the total distribution range.

Five isolates under the name of *G. lipsiense* were obtained from ATCC or CBS. Among them was ATCC 32585, isolated from a tropical hardwood in India, which was compatible with monokaryotic isolates of TAI-01, and had similar growth temperature requirement as Group 1 of *G. australe* from Taiwan. The results of this study suggest that this isolate might be identical to *G. australe*. The other four isolates of *G. lipsiense*, ATCC 32586, CBS 175.30, 187.31, 250.61, were incompatible with *G. australe* TAI-01. The compatibility between these four isolates of *G. lipsiense* and Group 2 of *G. australe* are still undetermined.

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臺灣產南方靈芝(樹舌亞屬，靈芝科)之初步研究

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摘　要

自臺灣各地區濶葉樹採獲樹舌亞屬之標本12個，並自菌體組織獲得純培養。依據形態特徵，鑑定本種爲南方靈芝 *Ganderma australe* (Fr.) Pat.。菌絲純培養經雜木屑人工培養基栽培，生成子實體。成功分離出菌株 TAI-01 之單孢系20個，由單孢系自身交配，顯示本種之交配系統爲異株型、四極性。利用人工純培養菌株生長特性及單——雙核交配反應，本種尚可區分二羣。第一羣（包括7個菌株）其最適生長溫度是 28-32°C，平均生長速率爲每日 6.2 mm，單——雙核交配成親和反應。第二羣（包括5個菌株）其最適生長溫度是 24-28°C，平均生長速率爲每日 4.0 mm，單——雙核交配成不親和反應。因此，作者認爲臺灣的南方靈芝已存在2個「雜交不孕性羣」。

由美國及荷蘭菌種中心購入之5株樹舌靈芝（*G. lipsiense*）參考菌株，其中 ATCC 32585 雙核菌株分離自印度熱帶地區的濶葉樹，能和臺灣的南方靈芝 TAI-01 單孢系菌株成親和反應，並且最適生長溫度及生長速率均類似於第一羣，推測本菌株可能和臺灣的南方靈芝同爲一種。

所有標本及純培養均貯存於國立臺灣大學植物學系，菌類實驗室。