

## Notes on Zygomycetes of Taiwan (III): Two *Blakeslea* Species (Choanephoraceae) New to Taiwan

Hsiao-Man Ho<sup>(1, 3)</sup> and Ling-Lan Chang<sup>(2)</sup>

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**ABSTRACT:** Two species of *Blakeslea* (Choanephoraceae, Mucorales) are reported as new records for Taiwan. They are *Blakeslea monospora* B. S. Mehrotra & Bajjal and *B. trispora* Thaxter isolated from soil and fallen flowers. The morphological characters of both fungi are described.

**KEY WORDS:** *Blakeslea*, Choanephoraceae, Taiwan, Zygomycetes.

### INTRODUCTION

*Blakeslea* Thaxter is a member of the family Choanephoraceae Schroter (Mucorales, Zygomycetes). Some constituents of this family are weak facultative parasites of flowers, especially Cucurbitaceae, causing a blossom blight of squash which often results in serious economic loss. This family is characterized by producing two morphologically distinctive asexual fructifications on separate sporangiophores: columellate sporangia and acolumellate sporangiola. There are three genera in Choanephoraceae: *Blakeslea*, *Choanephora* Currey and *Poitrasia* P. M. Kirk. Species of all three genera produce persistent-walled columellate sporangia that dehisce along preformed sutures at maturity. The genus *Blakeslea* contains those species belonging in the Choanephoraceae that produce persistent walled sporangiola, containing one to several spores, which dehisce along preformed sutures at maturity. The sporangiola are borne on short pedicels over the surface of spherical enlargements at the apices of dichotomously or subdichotomously divided sporangiophors. The zygospores are borne on apposed tongs-like suspensors (Chang, 1997; Cheng and Wu, 1964; Fitzpatrick, 1930; Kirk, 1984; Kirk *et al.*, 2001; Zycha *et al.*, 1969).

Among the Choanephoraceae, only four species of *Choanephora* have been described in Taiwan (Chang, 1997; Wu and Chien, 1980). In the present paper, the authors describe two species of *Blakeslea* new to Taiwan, which were found during serial investigations of Taiwan Zygomycetes (Ho, 2000; 2002). They also might be the only two constituents of *Blakeslea*.

### MATERIALS AND METHODS

The fungi were isolated either from soil or from the fallen flowers of cucurbitaceous or malvaceous plants. The soil samples were collected from country roadside, farm, garden or forest, brought to laboratory in plastic bags. Two to three milligrams of soil particles were placed on corn meal agar (CMA) plates. The plates were left on bench at room temperature,

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1. Department of Natural Science Education, National Taipei Teachers College, No. 134, Sect. 2, Ho-Ping E. Rd., Taipei, Taiwan, R.O.C.

2. Taipei Municipal Chen Yuan Senior High School, No. 235, Sect. 2, Cheng-Te Rd., Taipei, Taiwan, ROC.

3. Corresponding author. E-Mail: [ho@tea.ntptc.edu.tw](mailto:ho@tea.ntptc.edu.tw)

incubated for ca. 1 week, then observed using a dissecting microscope. The flower samples were collected from farms around the islands. Fallen flowers were brought back to the laboratory in plastic bags. Each flower was put on sterilized moist filter paper in a sterilized Petri-dish. The plate was left in dark at 25°C, incubated for ca. 1 week, and then observed using a dissecting microscope.

When the sporangia or sporangiola of *Blakeslea* were found, they were transferred by touching the spores with a sterilized needle to another fresh corn meal agar (CMA) plate. The plate was left in dark at 25°C. After 3-4 days, a white colony with dark sporangia or sporangiola of *Blakeslea* was found. Pertinent materials were selected under a dissecting microscope and mounted in water or lactose cotton blue. Photographs were taken with a Leica MPS32 light microscope.

## TAXONOMY

***Blakeslea monospora*** B. S. Mehrotra & Baijal, J. Elisha Mitritell scient. Soc. 84: 207, 1968.

Plate 1

*Choanephora monospora* (B. S. Mehrotra & Baijal) Milko & Belyakova, Mikrobiologiya 38: 901, 1969.

*Choanephora trispora* (Thaxter) Sinha pro parte sensu Sinha, Proc. Indian Acad. Sci., Sec. B 11: 171, 1940. (misapplied name)

Colonies rapidly growing on CMA at 25 °C, with dense aerial mycelium, at first white, later becoming orange colored. Sporangiphores bearing sporangia arising from substrate mycelium, erect or ascending, non-septate, unbranched, 1-4 mm high, 11-14 µm wide, hyaline, curved at the apex. Sporangia spherical, 30-90 µm diameter, initially white but turning to very dark brown with age. At maturity, sporangial wall persistent, encrusted with short spines, dehiscing at maturity into 2 segments. Spores ellipsoid to broadly ellipsoid, reddish-brown, longitudinally striate, 16-22 µm long, 8-12 µm wide, with a group of fine appendages at each pole often up to twice the length of the spore.

Sporangiophores bearing sporangiola arising from substrate mycelium or aerial hyphae, erect or ascending, 1-5 mm high, unbranched at the basal portion, non-septate, smooth walled, 36-44 µm wide, dichotomously branched at the apex once to twice. Branches with irregular successive constrictions, ultimate branches terminating in spherical enlargements, 30-44 µm diameter, upon which the sporangiola are borne over the entire surface, each sporangiophore bearing 1-4 enlargements. Sporangiola ellipsoid to broadly ellipsoid, 14-25 µm long, 10-14 µm wide, containing one (rarely two) sporangiospore, with a persistent wall, hyaline, breaking along a preformed suture at maturity, attached to the spherical enlargements by a small, cylindrical pedicel, 2-5 µm long, 2.5 µm wide. Sporangiospores from sporangiola ellipsoid to broadly ellipsoid, reddish brown, longitudinally striate, 12-24 µm long, 8-12 µm wide, with a group of fine, hyaline appendages at each pole often equal to the length of the spore. Zygosporangia were not found.

Note: This isolate was identified as *Blakeslea monospora* based on its characteristic mono-spored sporangiola with persistent wall that dehiscence at maturity.

Specimen examined: K006, from fallen flowers of *Luffa cylindrical* (L.) Loem., Kaohsiung city, May, 1996, collected by L.-L. Chang.

Distribution: India; Taiwan.

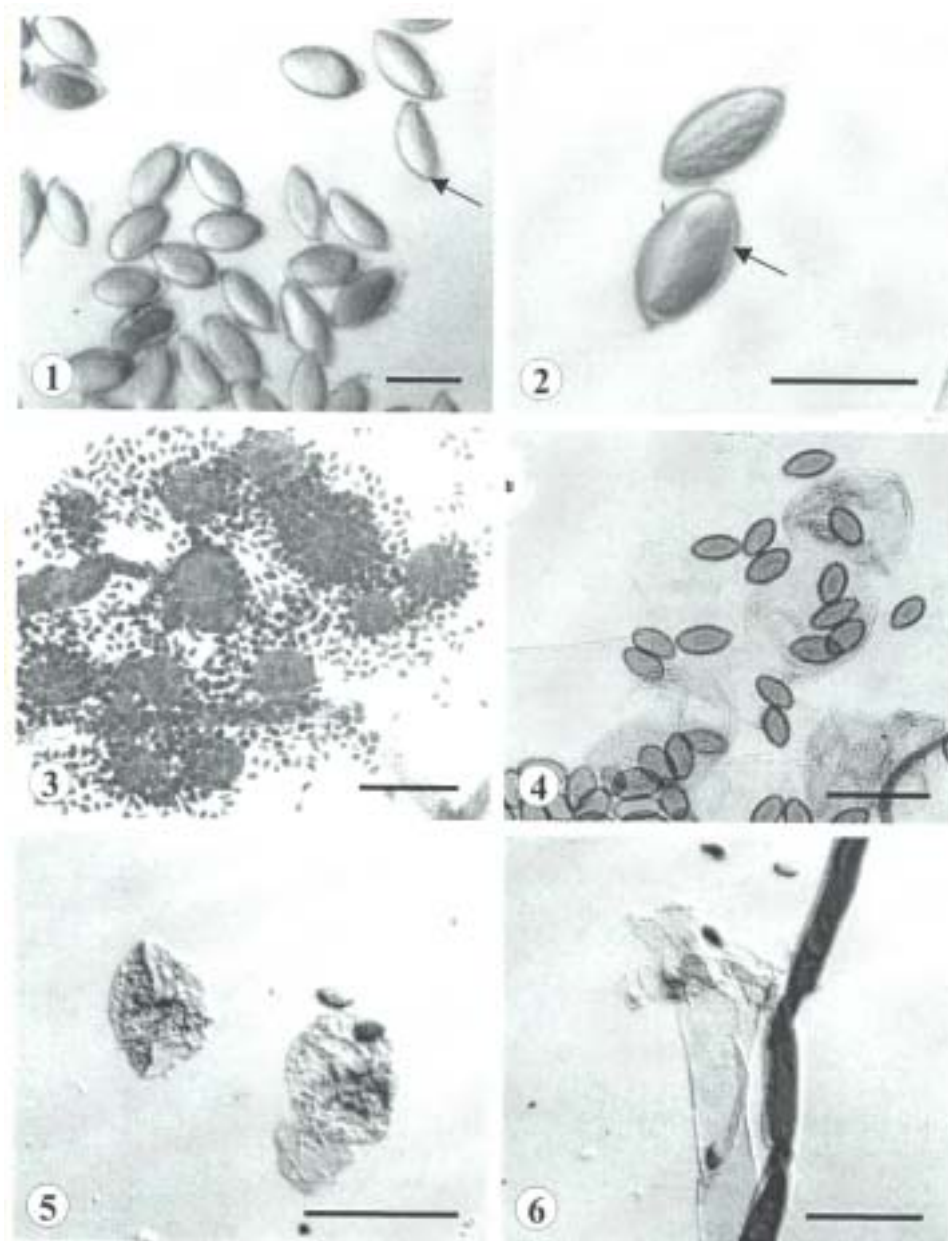


Plate 1. *Blakeslea monospora*, LM (Differential Interference Contrast). 1. Detached mono-spored sporangiola illustrating longitudinal striations and the spherical pedicels (arrow). Bar = 20  $\mu\text{m}$ . 2. Sporangiolum showing persistent wall (arrow). Bar = 20  $\mu\text{m}$ . 3. Apex of a sporangiophore showing terminal spherical enlargements (fertile vesicles) and the sporangiola attached. Bar = 50  $\mu\text{m}$ . 4. Vesicles after the sporangiola detached. Bar = 30  $\mu\text{m}$ . 5. Detached vesicles and sporangiola. Bar = 50  $\mu\text{m}$ . 6. Dichotomously branching sporangiophore. Bar = 50  $\mu\text{m}$ .

**Blakeslea trispora** Thaxter, Bot. Gaz. 58: 353, 1914.

Plates 2 & 3

*Choanephora trispora* (Thaxter) Sinha, Proc. Indian Acad. Sci. Sec. B 11:167, 1940.

*Choanephora dichotoma* Gandrup, Meded. Besoek. Proefstn 35: 6, 1923. [nom. nud. Art. 36.1]

*Blakeslea tandonii* M. D. Mehrotra, Sydowia 17: 34, 1964.

*Choanephora tandonii* (M. D. Mehrotra) Milko, Nov. Sist. Nizsh. Rast. 1968: 84, 1968.

*Blakeslea circinans* Naganishi & Kawakami sensu M. D. Mehrotra, Sydowia 17: 25, 1964. [as

*Blakeslea circinans* (Naganishi an Kawakami) Mehrotra']. (misapplied name).

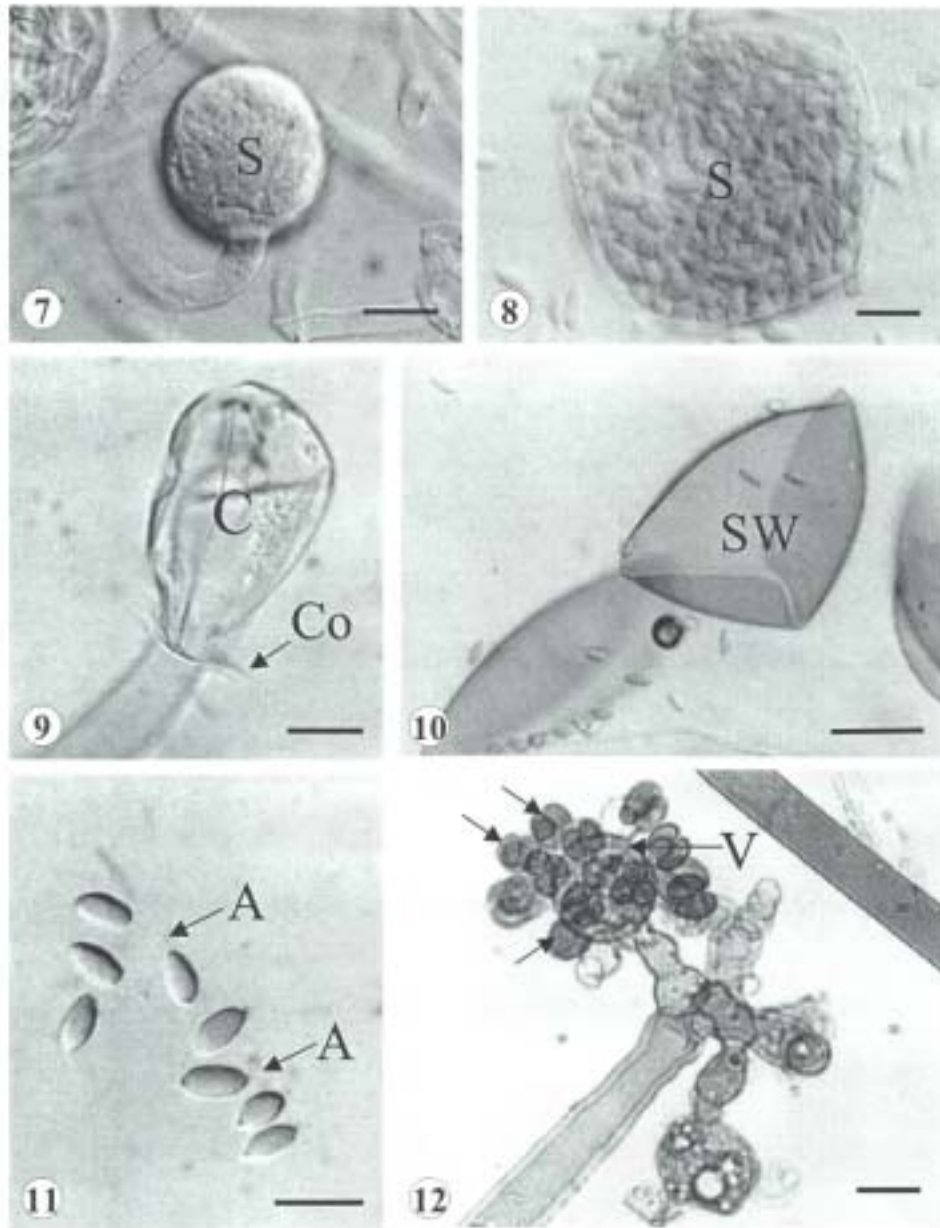


Plate 2. *Blakeslea trispora*, LM (DIC). 7. A circinate sporangiophore with a terminal developing sporangium (S). Bar = 20  $\mu\text{m}$ . 8. A mature sporangium (S) with many spores inside. Bar = 20  $\mu\text{m}$ . 9. Columella (C) with collar (Co). Bar = 20  $\mu\text{m}$ . 10. A dehiscent sporangial wall (SW) after liberation of the sporangiospores. Bar = 50  $\mu\text{m}$ . 11. Liberated sporangiospores from sporangium illustrating longitudinal striations and appendages (A). Bar = 20  $\mu\text{m}$ . 12. Apex of the sporangiophore illustrating irregular successive constrictions and the terminal spherical vesicles (V) with some sporangiola (arrows) still attached on the surface. Bar = 20  $\mu\text{m}$ .

Colonies rapidly growing on CMA at 25  $^{\circ}\text{C}$ , aerial mycelium white, abundant, densely curved and highly branched in places. Sporangiophores bearing sporangia usually arising from substrate mycelium, erect or ascending, unbranched, 1-4 mm high, hyaline, smooth walled, 13-20  $\mu\text{m}$  wide. Sporangia circinate borne when young, sub-globose, (30-) 60-90 (-210)  $\mu\text{m}$  diameter, initially white, turning to very dark brown with age. At maturity, sporangial wall persistent, brown in colour, encrusted with fine spines, dehiscent into two

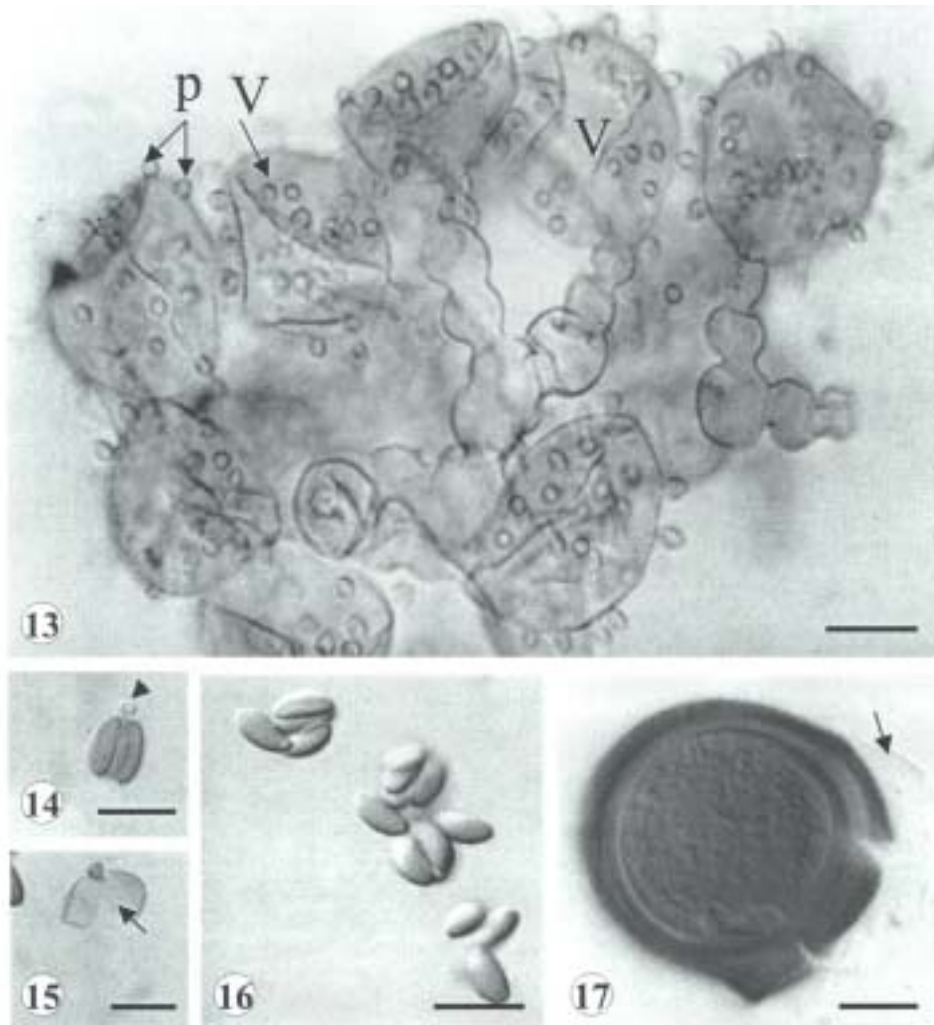


Plate 3. *Blakeslea trispora*, LM (DIC). 13. The terminal spherical vesicles (V) after sporangiola detached, showing small spherical pedicels (P) over the surface. Bar = 20  $\mu$ m. 14. A three-spored sporangium with its pedicel (arrow) still attached. Bar = 20  $\mu$ m. 15. A breaking, empty sporangium wall (arrow) and the pedicel. Bar = 20  $\mu$ m. 16. Liberated sporangiospores illustrating longitudinal striations. Bar = 20  $\mu$ m. 17. Zygospore with tongs-shaped suspensors (arrow). Bar = 20  $\mu$ m.

segments, columella absent in smaller sporangia, when present, obovoid to pyriform, hyaline, (40-) 55-90 (-100)  $\mu$ m long, 30-40  $\mu$ m wide, usually with a collar in the dehisced sporangium. Sporangiospores from sporangia, ellipsoid to broadly ellipsoid, reddish-brown, longitudinally striate, (10) 12-18  $\mu$ m long, (5-) 6-8  $\mu$ m wide, with a group of fine, hyaline appendages at each pole, up to twice the length of the spore. Sometimes, however, the fine appendages were not easy to be observed.

Sporangiophores bearing sporangiola arising from substrate mycelium or aerial hyphae, erect or ascending, 1-5 mm high, 13-20  $\mu$ m wide, proximally unbranched, smooth-walled throughout, hyaline, dichotomously or subdichotomously divided distally up to 5 times, non-septate, branches usually with irregular successive constrictions, ultimate branches terminating in spherical enlargements, 22-35  $\mu$ m diameter upon which the sporangiola are borne over their entire surface, each sporangiophore bearing (1-) 8-16 (-32) enlargements. Sporangia broadly ellipsoid, attached to the spherical enlargements by a small spherical

pedicel 3-5  $\mu\text{m}$  long, 2.5  $\mu\text{m}$  wide, containing 3 (-4) sporangiospores, with a fragile but persistent wall, hyaline, breaking along preformed sutures at maturity into 2 segments. Sporangiospores from sporangiola ellipsoid to broadly ellipsoid, reddish-brown, longitudinally striate, 12.5-15 (-18)  $\mu\text{m}$  long, 6-7.5 (-8) wide, with a group of fine, hyaline appendages at each pole often equal to the length of the spore. Zygosporangia usually formed below the surface of the medium, 40-80  $\mu\text{m}$  diameter, spherical to slightly flattened, often with a large central oil droplet at maturity, outer wall layer thin, with striation, inner wall layer thick, smooth, suspensors tongs-like and apposed, non-appendaged, arising from twisted and distorted hyphae, up to 10-20  $\mu\text{m}$  diameter, often slightly unequal, heterothallic.

Note: This species is characterized by the 3-4 spored sporangiola. The difference between *B. monospora* and *B. trispora* is the sporangiola which are with three to four spores in the later species.

Specimen examined: *S11701*, isolated from soil, orange garden, **Yunlin** County, July, 2003, collected by C.-C. Lin; *S41201*, isolated from soil, pear garden, **Taichung** County, August, 2003, collected by C.-C. Lin; *N001*, isolated from fallen flower of *Luffa cylindrical* (L.) Loem., **Nantou** County, May, 1996, collected by L.-L. Chang.; *N002*, isolated from fallen flower of *Luffa cylindrical* (L.) Loem., Nantou County, May, 1996, collected by L.-L. Chang.

Distribution: Brunei; China; India; Malaya; Nigeria; Sierra Leone; Taiwan; USA.

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## 台灣接合菌紀錄 (III)：兩種布拉黴屬 (*Blakeslea*) 新紀錄種

何小曼<sup>(1, 3)</sup>、張鈴蘭<sup>(2)</sup>

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### 摘 要

布拉黴屬 (*Blakeslea*) 係屬笄黴菌科 (Choanephoraceae)，毛黴目 (Mucorales)，接合菌綱 (Zygomycetes)。本文紀錄由臺灣本島土壤及落花中分離出的兩種布拉黴菌，分別為單孢布拉黴 (*Blakeslea monospora* B. S. Mehrotra & Baijal) 及三孢布拉黴 (*Blakeslea trispora* Thaxter)，上述兩種均為在臺灣第一次被發表，文中描述其形態特徵。

關鍵詞：布拉黴屬、笄黴菌科、接合菌綱、臺灣。

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1. 國立台北師範學院自然科學教育學系，臺北市 106 和平東路 2 段 134 號，台灣，中華民國。

2. 市立成淵高中，臺北市大同區承德路 2 段 235 號。

3. 通信作者。