

## Occurrence of *Alternaria dianthi* on Carnation in Korea

Seung-Hun Yu, Hi-Wan Kang, Hyang-Burm Lee and Hong-Gi Kim

Department of Agricultural Biology, College of Agriculture, Chugnam National University,  
Taejon 305-764, Korea

### 한국에서 카네이션에 발생하는 *Alternaria dianthi*

유승현·강희완·이항범·김흥기

충남대학교 농과대학 농생물학과

**ABSTRACT:** A blight disease of carnation (*Dianthus caryophyllus* L.) caused by *Alternaria dianthi* was found in greenhouses and vinylhouses in southern Korea. In severely affected beds, many carnation plants were blighted and died. The growth of the fungus *in vitro* was optimum between 24 and 28°C. In controlled inoculations, *A. dianthi* caused lesions on leaves and stems of carnation plants.

**KEYWORDS:** *Alternaria dianthi*, Blight, Carnation

During our studies of alternaria diseases of flowers and ornamental plants in 1987 and 1988, we frequently encountered a blight disease of carnation in greenhouses and vinylhouses in southern Korea. A species of *Alternaria* was repeatedly isolated from diseased tissues. It fitted the description of *Alternaria dianthi* Stevens & Hall (Ellis, 1976; Neergaard, 1945; Stevens & Hall, 1909). Although the pathogen has been recorded (Anonymous, 1986), this is the first detailed report on the occurrence of *A. dianthi* in Korea. This pathogen has been reported on carnation from many parts of the world (Bickerton, 1943; Ellis, 1976; Neergaard, 1945; Rao, 1969).

The objectives of this study were to describe the disease symptoms on carnation and the characteristics of the pathogen.

#### Symptoms

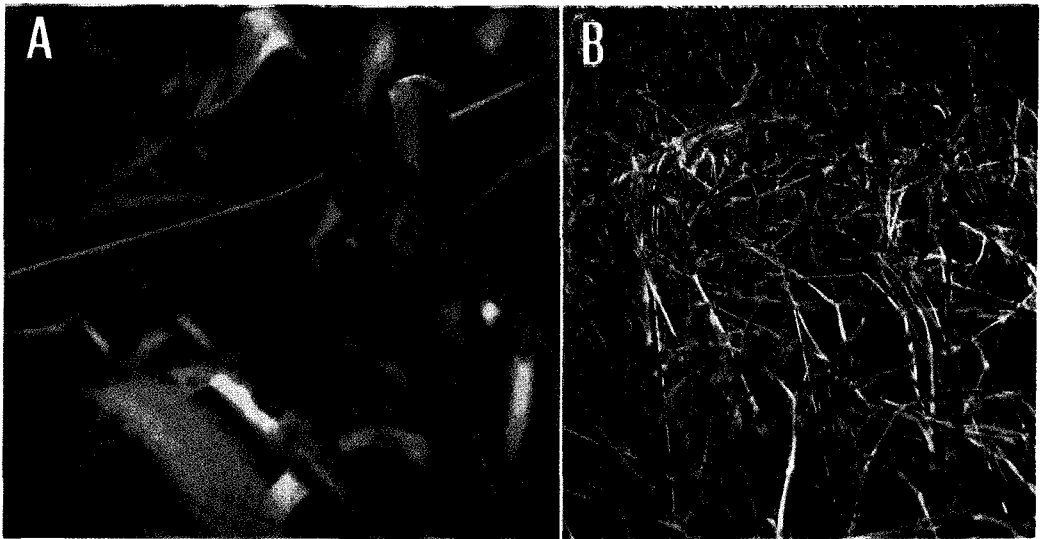
The initial symptoms on carnation leaves appeared in the form of leaf spots which were circular or slightly oval, running parallel with the longitudinal axis of the leaf. The spots were purple to reddish-brown in the center and soon

developed a broad yellowish green border. As the spots expanded, the center became light brown or grey and adjacent spots tended to coalesce. Healthy tissue between the spots often turned yellow or yellowish brown (Fig. 1A). Sometimes the infection took place at the stem joints; in this case the attack usually involved both the leaves and the intermediate stems, resulting in blighting of the more distant parts of the plant, and eventually killing the whole plants (Fig. 1B).

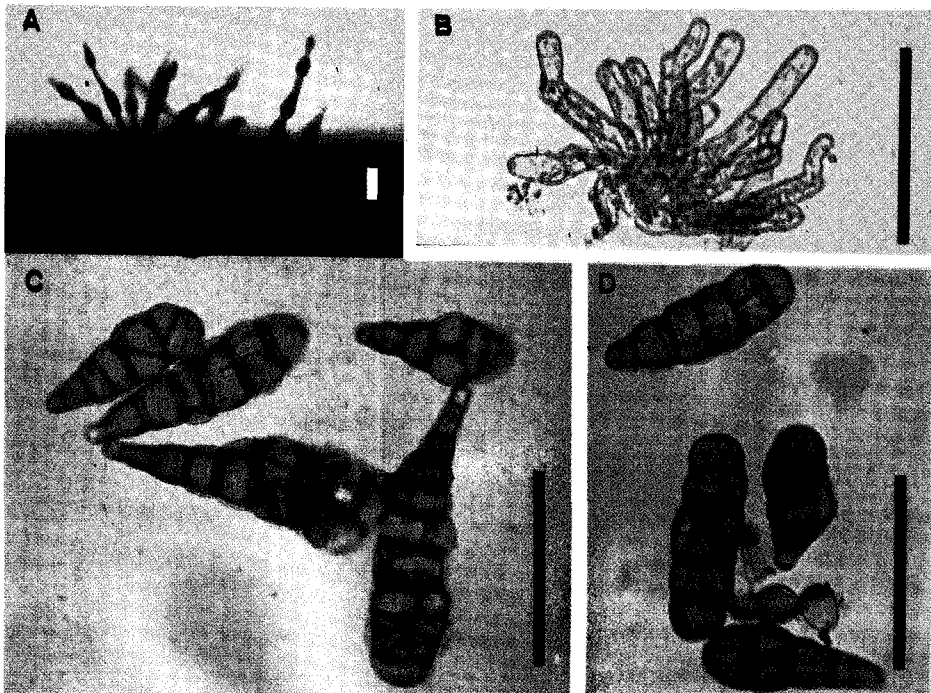
#### Pathogen characteristics

Several isolates were obtained from blight lesions on leaves of carnation collected in Chinju, Gyeongnam district. Those isolates were preserved on potato dextrose agar (PDA) slants at 5°C until use. The fungus was cultured on PDA and V-8 juice agar under 12-hr diurnal cycle of near ultraviolet light at 25°C. Samples were taken from lesions on the host and from the surface of 10-day-old culture and the morphology of conidia and conidiophores was examined under a microscope.

Several conidia of *Alternaria* in a leaf spot



**Fig. 1.** A). Naturally infected carnation leaves showing spots and blighting incited by *Alternaria dianthi*. B). Severely infected carnation plants in the greenhouse showing extensive blighting of the whole plants.



**Fig. 2.** A) Sporulation of *Alternaria dianthi* on a leaf lesion in damp chamber. Conidia are mostly formed in chains of 2-4. B) Conidiophores of *Alternaria dianthi* from diseased leaf. C-D). Conidia of *Alternaria dianthi* formed on V-8 juice agar under a 12-hr photoperiod (C) and in constant darkness (D). Each bar represents 50  $\mu\text{m}$ .

**Table I.** Dimensions of conidia of *Alternaria dianthi* from host and cultures compared with dimensions reported in the literature

Source of spores and data	Length of		Width of spore ( $\mu\text{m}$ )	Total length of spore ( $\mu\text{m}$ )
	Spore body ( $\mu\text{m}$ )	Beak ( $\mu\text{m}$ )		
Korean isolates <sup>a</sup>				
Carnation leaf <sup>b</sup>	17-70 av. (50.3)	2-32 av. (20.7)	10-28 av. (17.5)	23- 95 av. (65.4)
PDA <sup>c</sup>	20-76 av. (57.0)	2-48 av. (15.5)	12-30 av. (20.7)	25-115 av. (70.7)
V-8 juice agar <sup>c</sup>	20-74 av. (55.9)	2-40 av. (14.7)	12-33 av. (18.9)	25-110 av. (68.5)
Literature				
Steven & Hall (1909)			10-20	26-123
Neergaard (1945)	14-66	2-69	8-26	17-116
Ellis (1971)			10-25 av. (16)	30-120 av. (64)

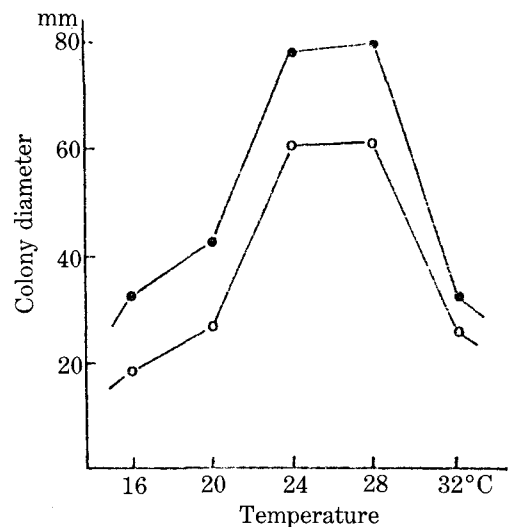
<sup>a</sup> Based on measurement of 100 randomly selected spores mounted in lactophenol

<sup>b</sup> Spores were taken from leaf lesions after 2-3 days incubation in a damp chamber.

<sup>c</sup> Spores were taken from the cultures grown at 25°C for 1 wk. under 12-hr diurnal cycle of NUV light.

on the surface of a leaf of a naturally infected plant are shown in Fig. 2A. The conidia are formed in chains, which most often are made up 2-4. Conidiophores are cylindrical, sometimes solitary but more commonly in fascicles, pale grey to pale brown, simple, straight or flexuous, geniculate, 1-4 septate, most often 20-50  $\times$  4-5  $\mu\text{m}$ , often becoming gradually broader towards the distal end (Fig. 2B). Conidia are smooth, conical to broad obclavate, pale brown to nearly olive brown in color, septate, with 1 to 9 transverse and usually several longitudinal or oblique septa, slightly constricted at septa (Fig. 2C, 2D). Measurements of conidia from leaf spots on naturally infected carnation plants and *in vitro* cultures and measurements of conidia reported in the literature are given in Table I. The range in size of conidia of Korean isolates was quite similar to the size ranges reported by others (Ellis, 1976; Neergaard, 1945; Steven & Hall, 1909). The slight differences in conidial size may be the results of measurements taken from conidia produced on different substrates.

The effect of light on conidial dimension of *A. dianthi* was examined further by culturing the fungus in constant darkness or alternating light (NUV) and darkness (12 hr each) on V-8 juice agar. The size of the conidia produced in cultures grown under light was larger than that



**Fig. 3.** The effect of temperature on mycelial growth of *Alternaria dianthi*. 12-day-old cultures on PDA (○-○) and V-8 juice agar (●-●).

in darkness (Fig. 2C, 2D): Conidial size under light was 25-115 (av. 69.0)  $\times$  12-33 (av. 18.9)  $\mu\text{m}$ , while that in darkness was 20-83 (av. 51.4)  $\times$  10-31 (av. 17.0)  $\mu\text{m}$ .

#### Growth in culture

The influence of temperature on mycelial growth of the fungus was examined in PDA and V-8 juice agar cultures at 16, 20, 24, 28 and 32°C. Five plates, each of the treatment, were

seeded with 5-mm fungal disks obtained from the edge of advancing fungal colonies and placed in completely random design in darkness at each temperature. Colony diameters were measured after 12 days of growth (Fig. 3). The growth of *A. dianthi* *in vitro* cultures was optimum between 24 and 28°C. The result corroborates that of Strider (1978), who found that *A. dianthi* grew faster at 24°C on PDA.

#### Pathogenicity test

For determining the pathogenicity of *A. dianthi*, 12-day old monospore culture grown on V-8 juice agar under a 12-hr photoperiod was used. Conidia were obtained by flooding the culture with 1-2 ml of sterile water and rubbing the fungal colony with sterile brush to dislodge the conidia. Plants of carnation (cv. Scania, White Sim), 7 weeks after transplanting, were sprayed with conidial suspension (5000 conidia/ml). The sprayed plants were placed in a moist chamber for 24 or 48 hr, and then transferred to the greenhouse and observed for symptoms.

Initial symptoms were noticed on all inoculated plants 3-4 days after inoculation as spots on leaf and stem then later enlarged, coalesced and resulted in extensive necrosis. Reisolation from all the infected tissue repeatedly yielded *A. dianthi*. Control plants did not show any lesion.

#### 摘 要

*Alternaria dianthi* 에 의한 카네이션의 검은무늬병이 1987년과 1988년 남부지방의 온실과 비닐

하우스단지에서 큰 피해를 주고 있음이 관찰되었다. 심하게 감염된 栽培床에서는 많은 카네이션 식물체가 枯死되었다. 培地上에서의 이 균의 생육 적온은 24-28°C였다. 접종실험에서 *A. dianthi* 는 카네이션의 잎과 줄기에 병반을 형성하였다.

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