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Scientific Notes

A Fusarium Wilt of Garland Chrysanthemum

Ching-Shing Lee and Shou-Kung Sun

Department of Plant Pathology, National Chung Hsing University Taichung, Taiwan, R.O.C.
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A wilt disease of Garlang Chysanthemum (*Chrysanthemum coronarium* L. var. *spatiosum* Bailey) was found in 1976 in Tali county near Taichung city. Diseased plants showed wilting and stunting, the wilting leaves became soft but not rot (Fig. 1), still green in color. Eventually, brown necrotic, dry lesions appeared on wilting leaves. Some roots became browning and necrotic with conspicuous internal brownish vascular discoloration in the basal portions of the stems (Fig. 2). A species of *Fusarium* was consistently isolated on pentachloronitrobenzene (PCNB) medium (4) as well as on water agar. Greenhouse inoculations were made by dipping sterilized germinating garland chrysanthemum seeds (0.5% NaOCl, 3 min and germinating on filter paper) in spore suspension of the tested fungal conidium cultures and then planting the seeds in sandy soils. Alternate method was made by planting sterilized Garland chrysanthemum seeds in soil that had been inoculated with conidia suspension of the tested fungus. Typical wilting symptoms appeared in about 3 wk. Koch's postulates was completed which indicated that the tested fungus was the causal agent (Fig. 3). Microscopic examinations of the tested fungus indicated it belonged to a species of *Fusarium* in the section Elegans (3).

Fig. 1. Wilting symptoms of Garland chrysanthemum. (Arrow, wilt plant)
Fig. 2. Vascular discoloration of diseased plant.
Fig. 3. Pathogenicity test of the causal fungus, *Fusarium oxysporum*. Inoculated pot (left) Check pot (right)

Garland chrysanthemum, a kind of vegetable belongs to family Composite. has been cultivated only in China and Japan. No Fusarium wilt disease has been reported previously. Literatures revealed that Fusarium wilt of China aster caused by *F. oxysporum* Schl. f. sp. *callistephi* (Beach) Snyd. & Hans and Fusarium wilt of Chrysanthemum caused by *F. oxysporum* Schl. f. sp. *chrysanthemi* Litl., Armst. & Armst. were reported (1,2). In 1977, the authors found Fusarium wilt of China aster in Changhwa prefecture and *F. oxysporum* f. sp. *callistephi* was isolated. Comparative study of *Fusarium* sp. from Garland chrysanthemum with *F. oxysporum* f. sp. *callistephi*, the wilt pathogen of China aster, was reported in this paper in order to confirm whether the Garland chrysanthemum Fusarium was pathogenic to China aster and chrysanthemum.

Morphlological characteristics of *F. oxysporum* from Garland chrysanthemum and China aster

Both fungi formed microconidia abundantly from short conidiophores on potato dextrose agar (PDA). Thry are one-celled or tow-celled, hyaline, elliptic, long elliptic or ovoid. Macroconidia formed also on PDA, though not as much as microconidia. Macrocohidia are hyaline, sickle-shaped, slightly curved, foot cells generally obscure, 1-4 septated. Average size of spores of the two *Fusarium* spp. are listed in Table 1.

According to Booth (3), Snyder and Hansen (5) and Toussoun *et al.* (6), the *Fusarium* sp. from Garland chrysanthemum should belong to *F. oxysporum.*

Cross-inoculation test

Seeds (sterilized in 0.5% NaOCl, 3 min) or cuttings (Chrysanthemum) were used for pathogenicity test by planting them in soil that had been inoculated with the tested fungi to a propagule density 2.34×10^3 propagules/g soil. Results were as Table 2 and Table 3.

Wilt incidence of Garland chrysanthemum and China aster in the field

Garland chrysanthemum—a plot of 637 Garland chrysanthemum was surveyed, wilt incidence was 2.1%, propagule dnesity in soil was 8.77×10^2 propagules/g soil.

China aster—Wilt incidence was surveyed at Puli county and Tien-Wei county indicating that high wilt incidence was in the plot with high propagule density in soil (Table 4).

Seed contamination by *F. oxysporum*

Seeds of Garland chrysanthemum that collected from diseased plot, farmers and market were plated on PCNB medium to see whether seeds were carrier of *F. oxysporum.* Result showed that all seeds of Garland chrysanthemum were contaminated by *F. oxysporum* (Table 5).

From the above preliminary study, it was concluded that the *F. oxysporum* isolated from Garland chrysanthemum was not *F. oxysporum* f. sp. *chrysanthemi,* because it did not infect the seven cultivars of chrysanthemum tested. The *F. oxysporum* from Garland chrysanthemum was, we think, rather a new race of *F. oxysporum* f. sp. *callistephi* than a new formae speciales of *F. oxysporum* which attacked Garland chrysanthemum. Wilt disease of Garland chrysanthemum was subsquently found in Taipei by 1977.

Key words: Garland Chrysanthemum, *Fusarium oxysporum* f. sp. *callistephi,* new race.

TABLE 1. Average size of conidia and chlamydospores of *Fusarium* sp. from garland chrysanthemum and *F. oxysporum* f. sp. *callistephi*

Spore	*Fusarium* sp. from Garland chrysanthemum (μm)	*F. oxysporum* f. sp. *callistephi* (μm)
1-celled microconidia	7.2–14.4 × 2.4–4.8 (10.6 × 4.1)[1]	7.2–12 × 2.4–3.6 (8.6 × 2.6)
2-celled microconidia	7.2–14.4 × 3.6–4.8 (9.6 × 4.6)	7.2–9.6 × 2.4–3.6 (8.4 × 3.1)
3-celled macroconidia	36–45.6 × 3.6–4.8 (39.4 × 4.8)	31–43.2 × 3.6–4.8 (36 × 4.6)
4-celled macroconidia	45.6 × 4.8 (45.6 × 4.8)	40.8–50.4 × 4.8 (40.8 × 4.8)
Chlamydospore (diam.)	6–9.6 (7.7)	4.8–9.6 (7.9)

1. Numbers in parentheses are average.

TABLE 2. Host range of *Fusarium oxysporum* f. sp. *callistephi,* the wilt pathogen of China aster

Plant inoculated (Composite)	No. of plants inoculated	% wilting
China aster (*Callistephus chinensis* Nees) (雲南菊) (田尾，花紅色)	15	87
China aster (*C. chinensis Nees.*) (翠菊) (自中興大學，花多色)	14	64
Lactuca sp. (鵝仔菜)	15	20
Garland chrysanthemum (*Chrysanthemum coronarium* L. var. *saptiosum* Bailey) (茼蒿)	14	0

TABLE 3. Host range of *Fusarium oxysproum* from Garland chrysanthemum

Plant inoculated (Composite)	No. of plants inoculated	% wilting
Garland chrysanthemum (*Chrysanthemum coronarium* L. var. *spatiosum* Bailey) (茼蒿)	20	100
China aster (*Callistephus chinensis* Nees.) (翠菊)	7	100
China aster (*C. chinensis* Nees.) (雲南菊，又名翠菊)	10	0
Centaurea cyanus L. (矢車菊)	8	50
Chrysanthemum carinatum L. (花環菊)	9	56
Lactuca sp. (鵝仔菜)	9	40
Kidney bean (*Phaseolus vulgaris* L.) (四季豆)	8	25
Cockscomb (*Celosia cristata* L.) (雞冠花)	16	13.5
Pe-tasi (*Brassica sinensis* var. *pe-tasi* Pault.) (白菜)	20	2.0
Asparagus bena (*Vigna sesquipedalis* Wight) (豇豆)	20	50
Soy bean (*Glycine max* (L.) Merr.) (大豆)	13	0
Stevia sp. (甜菊)	6	0
African marigold (*Taqetes erecta* L.) (萬壽菊)	6	0
common cosmos (*Cosmos bipinnatus* Cav.) (大波斯菊)	10	0
yellow cosmos (*C. bipinnatus* Cav.) (黃波斯菊)	8	0
French marigold (*Tagetes potula* L.) (孔雀菊)	18	0
Florists chrysanthemum (*C. morifolium* (Ramat.) Hemsl.) (頂字菊)	5	0
Chrysanthemum morifolium (Ramat.) Hemsl. (香港紅)	3	0
C. morifolium (Ramat.) Hemsl. (紅球菊)	5	0
C. morifolium (Ramat.) Hemsl. (冬玉)	6	0
C. morifolium (Ramat.) Hemsl. (月之友)	4	0
C. morifolium (Ramat.) Hemsl. (新力仁)	5	0
C. morifolium (Ramat.) Hemsl. (精英之華)	5	0

TABLE 4. Wilt incidence of China aster caused by *Fusarium oxysporum* f. sp. *callistephi* in the field

Location	No. of Plants surveyed	Wilt (%)	propagule/g soil
Puli	2784	0.57	8.16×10^2
Tien-Wei A	5435	9.14	6.52×10^3
Tien-Wei B	1312	3.13	not counted

TABLE 5. Contamination of seeds of garland chrysanthemum by *Fusarium oxysporum*

Source	Garland chrysanthemum	
	No. of seeds tested	Contamination (%)
Diseased plot at Tali county	50	16
Market	100	3
Farmer	100	12

LITERATURE CITED

1. Armstrong, G. M., Armtrong, J. K., and Littrell, R. H. 1970. wilt of Chrysannthemum by *Fusarium oxysporum* f. sp. *chrysanthemi*, forma specialis nov. Phytopathology 60:496-498.
2. Armstrong, G. M., and Armstrong, J. K. 1971. Races of the aster wilt-*Fusarium*. Phytopathology 61:820-824.
3. Booth, C. 1971. The Genus *Fusarium*. Commonwealth Mycological Institute, Kew, Surrey, England. 237 p.
4. Nash, S. M., and Snyder, W. C. 1962. Quantitative estimation by plate counts of propagules of the bean root rot *Fusarium* in field soils. Phytopathology 52:567-572.
5. Snyder, W. C., and Hansen, H. N. 1940. The species concept in *Fusarium*. Amer. Bot. 27:64-67.
6. Toussoun, T. A., and Nelson, P. E. 1968. A Pictorial Guide to the Identification of *Fusarium* species According to Taxomic System of Snyder and Hansen. The Pennsylvania State University Press, University Park and London. 51 p.

摘　　要

李俊興、孫守恭. 1992. **茼蒿萎凋病.** 植病會刊 1:45-48. (台中市　國立中興大學植物病理學系)

1976年12月，在台中縣大里鄉發現茼蒿(*Chrysanthemum coronarium* L. var. *spatiosum*)萎凋病。罹病株萎凋矮化，萎凋之葉變軟但無腐爛，仍爲綠色，後期罹病葉上出現褐色壞疽斑塊。病株之根部分褐化死亡，莖基部維管束褐化。以組織分離於PCNB培養基上或水瓊脂上，均出現鐮胞菌(*Fusarium* spp.)，溫室接種顯示此*Fusarium* sp.引起茼蒿萎凋病，經完成克柯氏法則，證明此*Fusarium* sp.爲茼蒿萎凋病之病原菌。茼蒿屬菊科蔬菜，僅我國及日本栽培，過去無萎凋病之記錄。文獻記載菊科之翠菊有萎凋病，其病原爲*Fusarium oxysporum* f. sp. *callistephi*，菊花有萎凋病，其病原菌是*F. oxysporum* f. sp. *chrysanthemi*。作者於彰化田尾發現翠菊萎凋病並分離到其病原菌。由翠菊*F. oxysporum*及茼蒿*Fusarium* sp.之胞子大小及形態比較顯示，茼蒿*Fusarium* sp.應屬於Booth之Elegans群的Fusarium，即*F. oxysporum*。經交互接種試驗顯示，茼蒿之*F. oxysporum*可侵害一些翠菊，但不侵害菊花，由此觀之，茼蒿*F. oxysporum*似屬*F. oxysporum* f. sp. *callistephi*之新菌之系爲害茼蒿及翠菊的某些品系不像是*F. oxysporum*的新分化型。

關鍵字：茼蒿萎凋病、*Fusarium oxysporum* f. sp. *callistephi*、新菌系。