

Monitoring for fungicide resistance of major fungal diseases on ginseng in South Korea

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I . Abstract

Background : Pathogenic fungi isolates were obtained from ginseng that were infected by the pathogen causing leaf blight (*Alternaria* spp.), anthracnose (*Colletotrichum* spp.) and gray mold (*Botrytis cinerea*) disease.

Methods and Results : This study aimed to assess the incidence and distribution of pathogenic fungi in Korean ginseng. Pathogenic fungi were isolated from ginseng samples collected from 6 ginseng fields 2021~2022. A total of 391 fungal colonies were isolated based on morphology and identified using marker genes. About 41.4% of the fungal isolates were *Alternaria* spp. and others were *B. cinerea* (29.1%) and *Colletotrichum* spp. (24.9%). *Alternaria* isolates comprised mostly of *A. panax* (21.2%). *A. alternata* (18.7%), followed by *Alternaria* sp. (1.5%). The inhibitory effect of various fungicides (fludioxonil, fenhexamid, etc) on the mycelial growth of pathogenic fungi by using the agar dilution method was investigated to determine whether resistance to occurred.

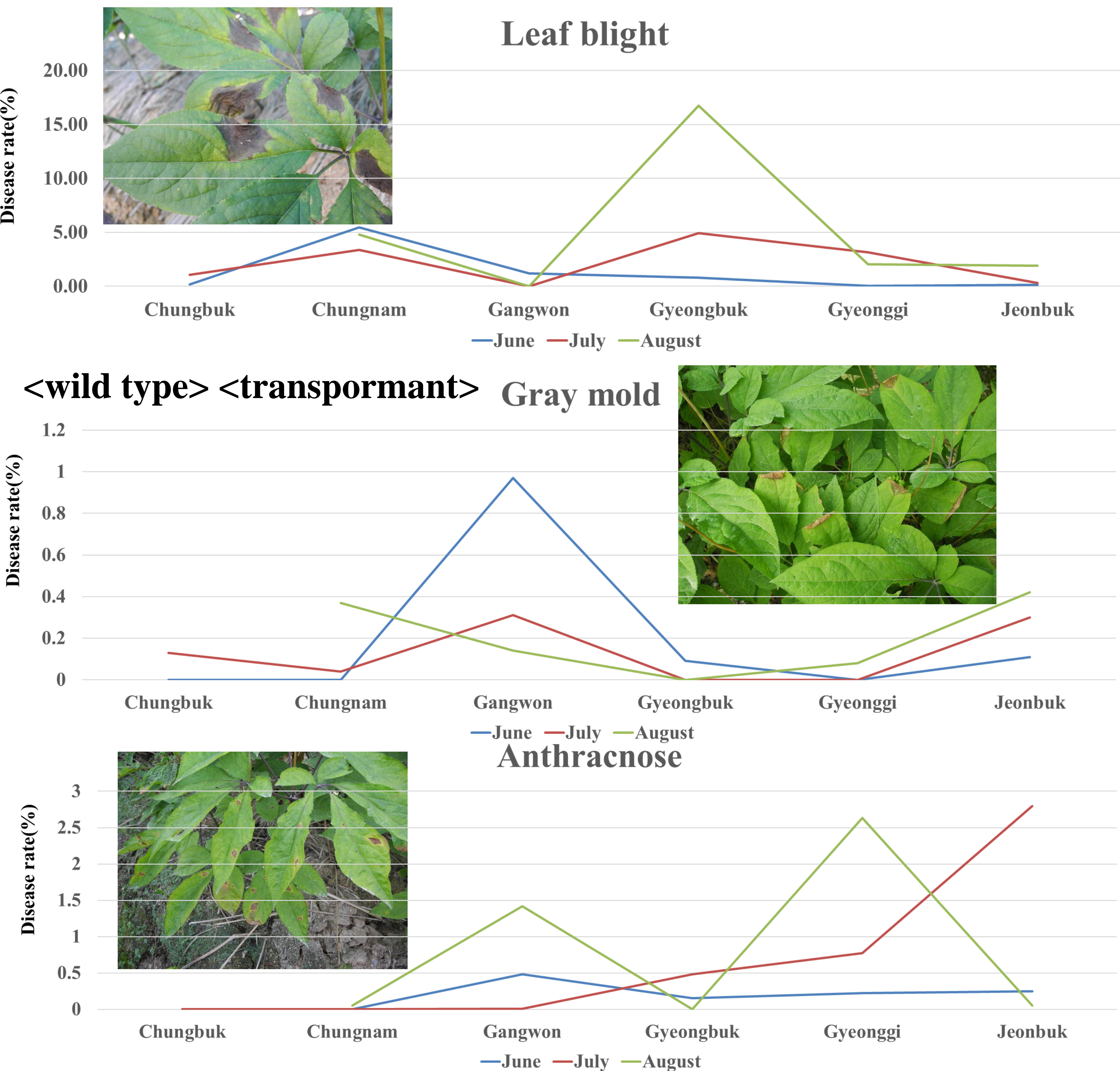
Conclusion :Of the 110 strains in 2022, 85 isolates of *B. cinerea* that showed resistance to boscalid or fenhexamid were detected. Most of *Colletotrichum* sp. showed azoxystrobin & iminoctadine tris (albesilate) were detected. In the case of *Alternaria* sp., most isolates showed azoxystrobin & fluazinam were detected. As seen from the above results, the isolation frequency of pathogenic fungi resistant to fungicide increases as the period of use increases, so careful management of field use of these fungicides is required.

II. Material & Method

- ❖ Survey of the aerial fungal disease rate from ginseng field in 2021~2022
 - *Alternaria* blight (*Alternaria* sp.), Gray mold (*Botrytis cinerea*), Anthracnose (*Colletotrichum* sp.)
- ❖ Isolation of pathogen
 - Analysis of fungicide resistance
- ❖ Screening of fungicide resistance related genes in *B. cinerea*
 - Restriction enzyme-mediated integration (REMI)
 - with pIGPAPA plasmid (Hyg^R:Amp^R:GFP)

III. Results

Monitoring of aerial fungal disease in ginseng



Fungal isolation

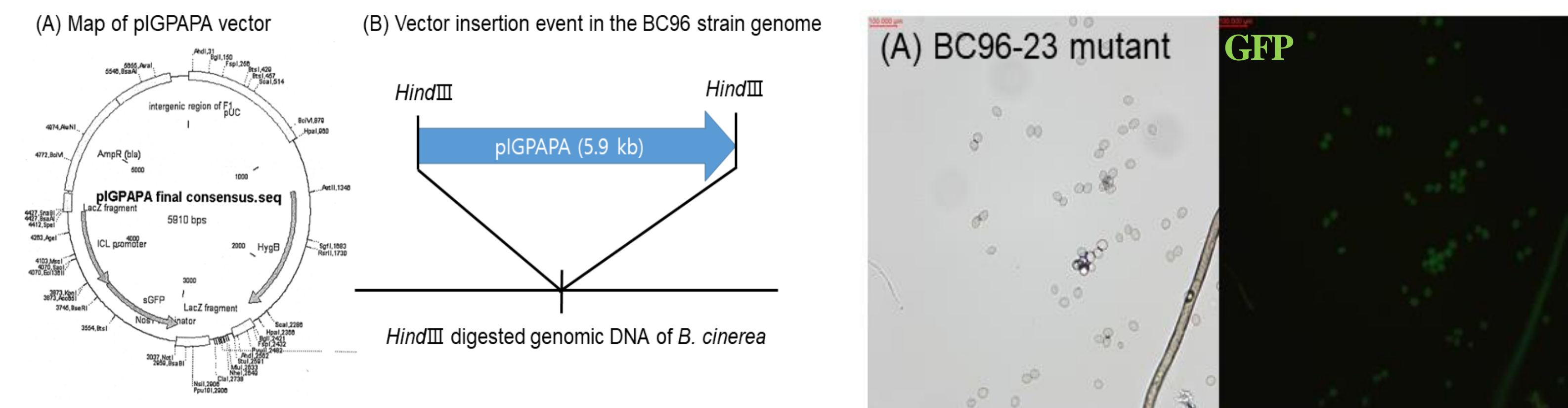
Alternaria spp. (162)			B. cinerea	Colletotrichum spp. (95)		etc	total
A. panax	A. alternata	Alternaria sp.		C. panacicola	C. truncatum		
83	73	6	114	93	2	20	391

Fungicide resistance

Fungi	Total	No. of isolates (%)			
Fungicide		Azoxystrobin	Iminoctadine tris (albesilate)	Fluazinam	Metconazole
Alternaria sp.	132	132 (100.0)	68 (51.5)	118 (89.4)	57 (43.2)
C. panacicola	91	91 (100.0)	90.0 (98.9)	11 (12.1)	0 (0.0)
Fungicide		Fludioxonil	Fenhexamid	Polyoxin B	Boscalid
B. cinerea	110	8 (7.3)	85 (77.3)	106 (96.4)	108 (98.2)

Random mutagenesis in B. cinerea

Random mutagenesis refers to a gene-editing technique that randomly inserts plasmids with functional transposable elements to establish a mutant library from the originals for effectively locating the function of targeted genes.



Fungicide (Fenhexamid) Resitance → Sensitivity



Sclerotia non-formation