

Evaluation of Fusarium Wilt Race 2 Resistance and Development Inbred Lines in Watermelon (*Citrullus* spp.)

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Introduction

In summer, watermelon is often suffered from the plant wilting due to high temperature with deficient water uptake through the root. Fusarium wilt is a global plant disease, which is caused by soil-borne pathogen, *Fusarium oxysporum* f. sp. *niveum*. The pathogen invades through the root and blocks the vessel, leading to severe damage before harvest. Grafting technique is used to prevent the invasion of the pathogen which is watermelon-specified. However, new pathogen, *F. oxysporum* f. sp. *lagenaria*, has been recently reported which penetrates guard root and pumpkin rootstock affects adversely the fruit quality. In addition, although there are several breeding lines and cultivars resistant to Fusarium wilt race 0 and 1, it is not to race 2 which is more virulent. Therefore, the purpose of this study is to develop breeding lines resistant to Fusarium wilt race 2, together with high fruit quality.



Fig. 1. Classification of disease resistance depends on the severity of symptom.

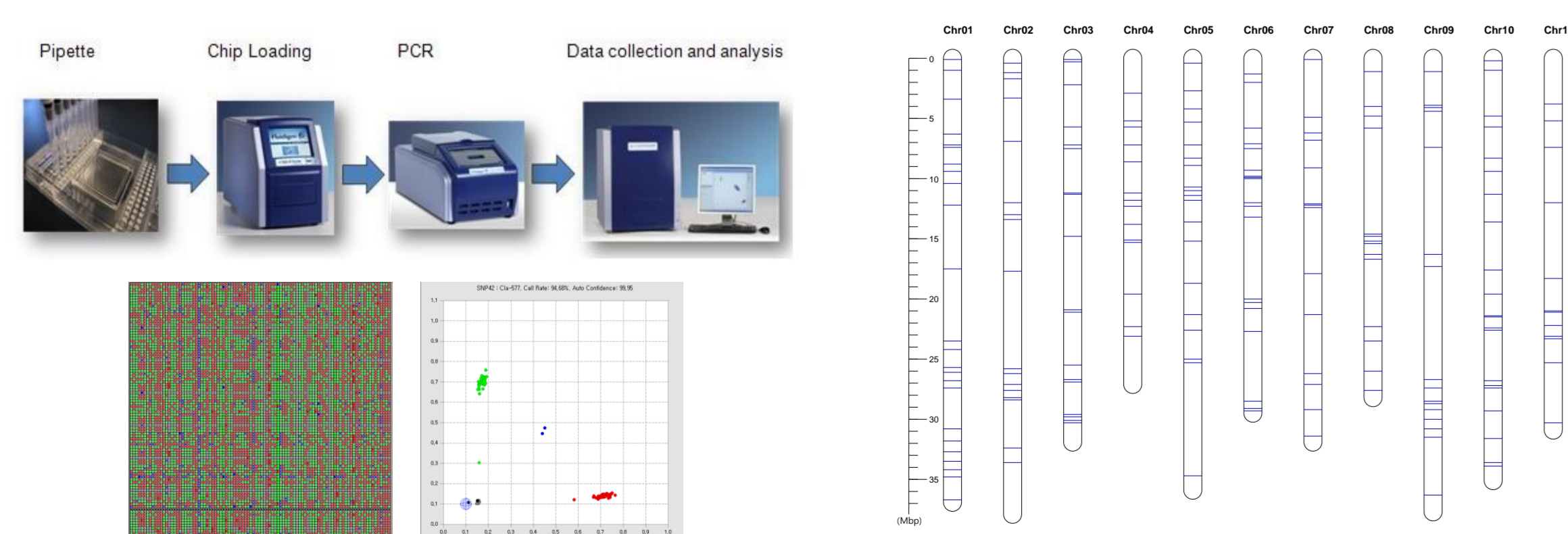


Fig. 2. Fluidigm® SNP genotyping system and physical map of 196 SNP markers

Materials and Methods

Plant Materials

- 183 watermelon accessions reported as resistant to moderate resistant on the journal article, research report, etc
- 111 *Citrullus lanatus*, 57 *C. amarus*, 14 *C. mucospermus*, 1 *C. colocynthis* are included
- 158 accessions were collected from the US Germplasm Collection of USDA-ARS(United States Department of Agriculture-Agricultural Research Service) and National Agrobiodiversity Center in South Korea

Pathogen Inoculation

- Plant stage : seedlings with one true leaf(10-day old)
- Pathogen: *F. oxysporum* f. sp. *niveum*(KACC 40905, race 2)
- Inoculation : Root dipping method
Cleaned the root and dipped into the conidia suspension for 30 min(5.0×10^5 conidia/mL). Transplanted the seedlings to the plug tray

Disease Assessment

- Severity of disease was assessed every 10 days after inoculation during 30 days
- Rated on a scale of 1 to 5 as follows: 1, no symptom; 2, slightly wilted on the lower leaves; 3, slightly wilted on the upper leaves; 4, severely wilted; 5, withered

Homozygosity Evaluation

- 196 markers designed as Fluidigm® SNP genotyping system was used to genotype disease resistant accession
- Homozygosity was evaluated by the ratio of SNPs genotyped as homozygous except missing sites

Results

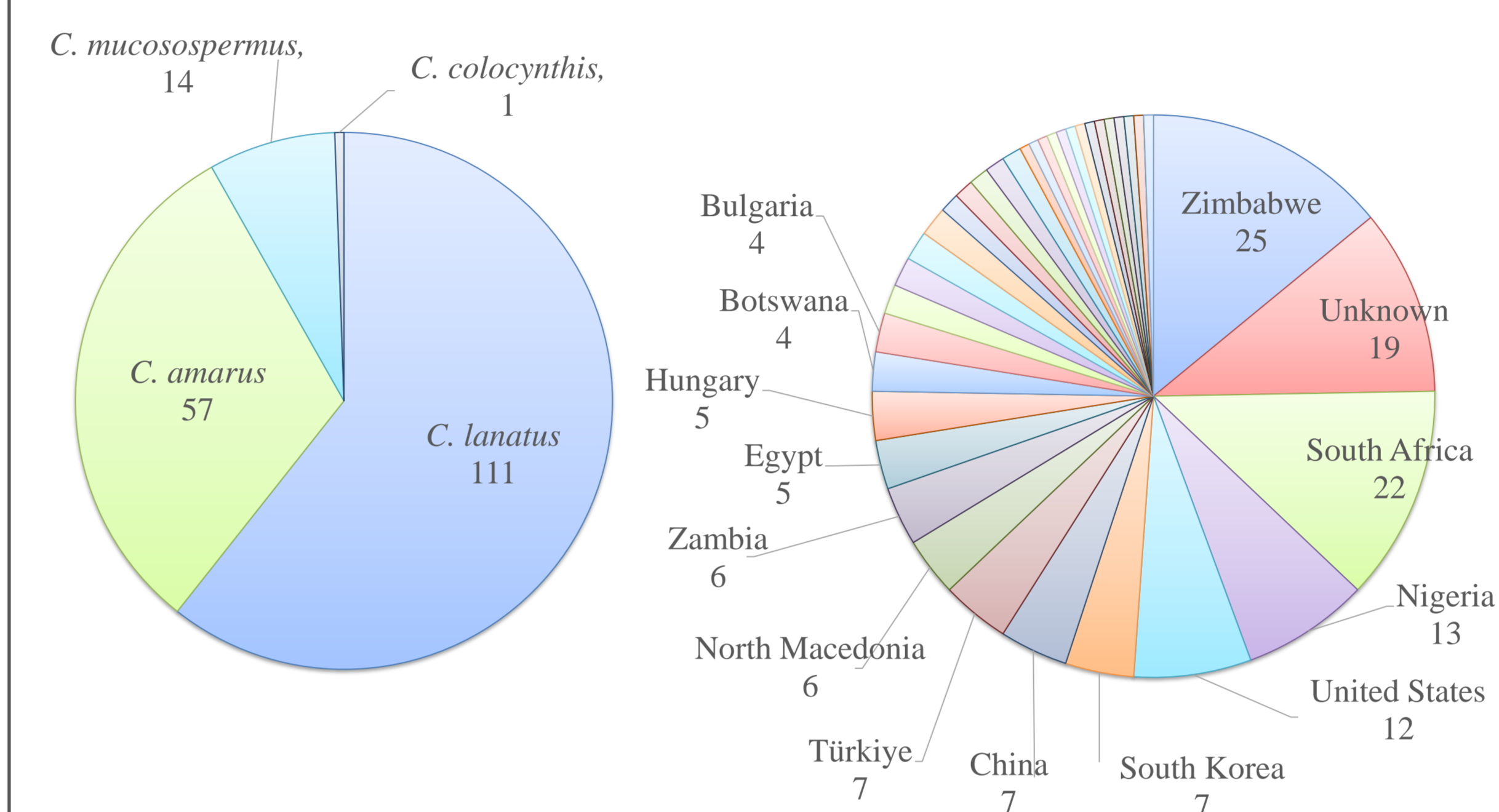


Fig. 3. Distribution of species and origin of watermelon accessions.

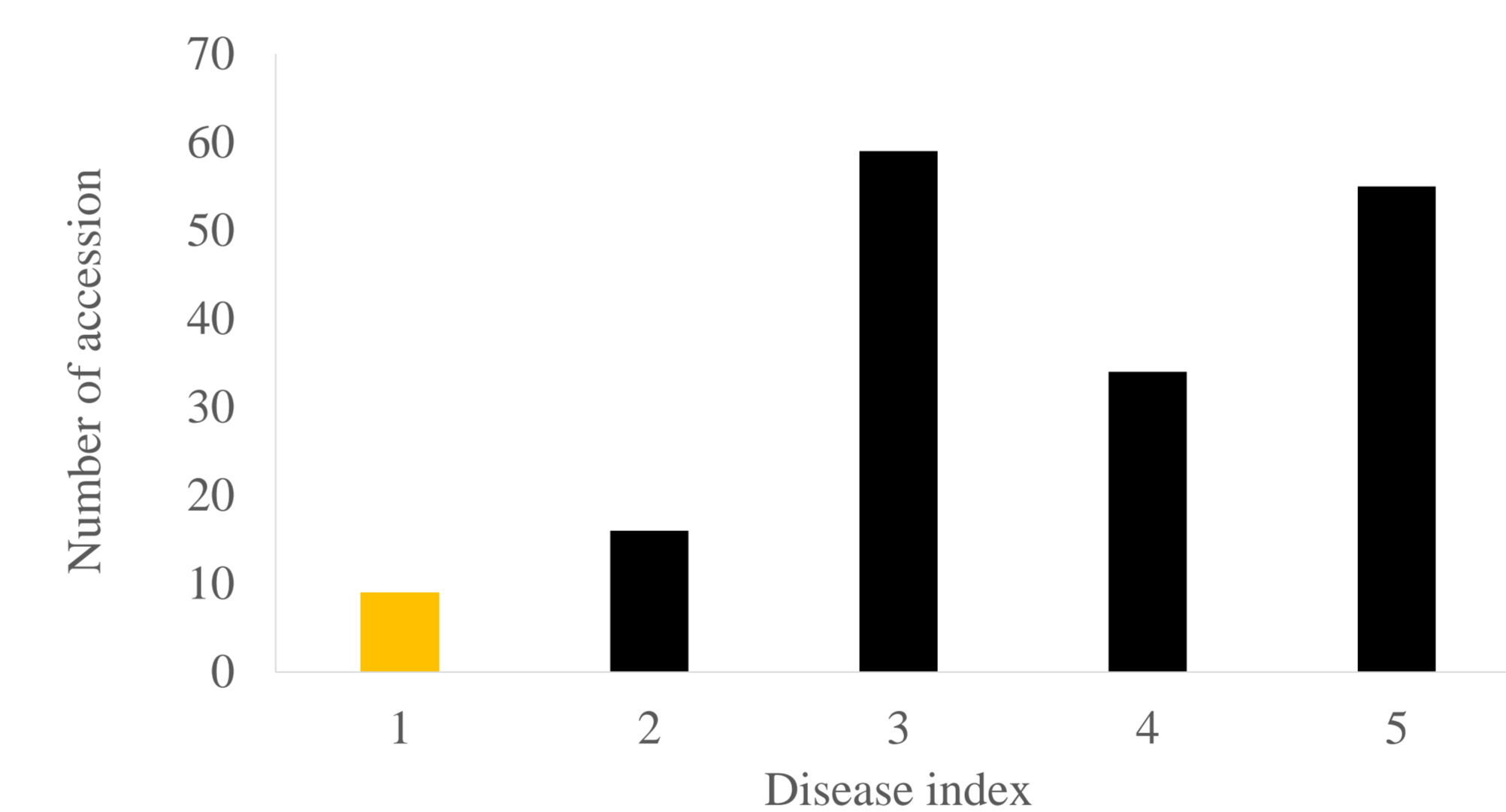


Fig. 4. Distribution of resistance to Fusarium wilt race 2.

Table 1. Disease index and homozygosity level of resistant accessions.

Accession	Species	Origin	Disease index	Homozygosity (%)	Missing rate(%)
IT 271075	<i>C. lanatus</i>	United States	1.0±0.0	96.6	1.1
IT 274119	<i>C. lanatus</i>	Hungary	1.0±0.0	95.0	0.6
PI 270563	<i>C. amarus</i>	South Africa	1.8±1.8	82.2	3.9
PI 270563	<i>C. amarus</i>	South Africa	1.8±1.7	93.7	3.9
PI 296335	<i>C. amarus</i>	South Africa	1.0±0.0	95.9	6.1
PI 326515	<i>C. lanatus</i>	Ghana	1.0±0.0	93.7	6.3
PI 500308	<i>C. amarus</i>	Zambia	1.6±1.5	96.4	6.6
PI 518611	<i>C. lanatus</i>	Soviet Union	1.8±1.7	95.6	0.6
WM 3052	Unknown	Unknown	1.8±1.8	90.7	9.3



Fig. 5. Fruits of watermelon inbred lines resistant to Fusarium wilt race 2.

Conclusion

- A total of 183 watermelon accessions were evaluated for Fusarium wilt race 2 resistance by root dipping method
- Nine accessions showed less than 2.0 of disease index, more resistant than the others
- Five accessions had more than 95% of homozygosity level which can be introduced to breeding program per se
- Three accessions were red fleshed watermelon, the others were wild type watermelon
- Homozygous accessions will be utilized for developing new cultivars resistant to Fusarium wilt and molecular markers to select resistant individuals
- Seedlings which showed no symptom were individually selected from all of the accessions
- 139 seedlings of the other accessions were selected and 117 fruits were harvested through self-fertilization
- Evaluation of Fusarium wilt resistance will be conducted with harvested fruits to develop new homozygous breeding lines

Acknowledgement

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