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Foreword

The International Sunflower Association (ISA) and the Argentine Sunflower Association (ASAGIR) are pleased to present this guide to the 18th International Sunflower Conference.

At the time the main objectives for the meeting were defined, organizers aimed to provide a forum for the international sunflower research community with interest in any aspect of science and technology relating to the crop (in its oil-seed and confectionery variants) that would allow all involved to:

- Update knowledge in all fields of sunflower research since the previous conference held at Córdoba, Spain, June 2008;
- Review recent technological advances in sunflower production and identify knowledge gaps that require attention;
- Analyze the status and expectations for current and prospective demands for sunflower products;
- Provide a venue for workshops and special-interest meetings focusing on unresolved research, market, and production issues;
- Provide new generations with an opportunity to interact with global leaders in sunflower research.

The local Program Committee, with the help of the International Steering Committee, has developed a program covering the whole spectrum of relevant topics from genes and genomics through to field agronomy, crop protection, and industry and market issues. The program comprises 14 plenary and 13 invited presentations, 14 short oral presentations, an exhibition of 160 posters that can be visited during each of the first three days of the meeting. In addition, there will be three associated workshops (Bird Damage, Breeding, International Sunflower Genome Initiative), a special-interest presentation of the Global Crop Diversity Trust, and facilities will be available on request for small groups who wish to discuss business or scientific topics.

On the last day of the meeting, the Conference Field Day will be held at the joint INTA-Universidad de Mar del Plata facility in Balcarce. This time the traditional Conference demonstration plots of hybrids from International Sunflower Association member countries and from the host country will be complemented by a broad range of demonstrations of production and management techniques, as well as demonstrations of research techniques in current use by Argentine sunflower research teams.

This Conference has been made possible by the work of many people, by the support of sponsors from both the public and the private sector (sponsors are recognized on the back covers of this guide) and last, but certainly by no means least, those responsible for the lectures, short oral presentations, posters, associated workshops and special interest meetings, and field and laboratory demonstrations that make up the rich and varied bill of fare for this Conference, as reflected in this guide. The Organizing Committee extends their heartfelt thanks to all these individuals and organizations.

ISA and ASAGIR trust that this guide will enable all attendees to have an interesting and fruitful 18th International Sunflower Conference.

Welcome

It has been 27 years since the 11th International Sunflower Conference was held in Mar del Plata, Argentina, March 10-13, 1985. Since then, very many things have changed in the world of sunflower science, technology, and crop production and management. As the global sunflower community reconvenes once again in the same city, its members will have the opportunity to review progress in the last four years, which has been substantial in many areas.

Mar del Plata, a vibrant city located by the sea, with a fishing port, good restaurants, an unusually good choice of golf courses, and kilometers of sandy beaches, together with Balcarce, provide excellent venues for the Conference lectures and Field Day, and will allow attendees to appreciate a unique combination of seas, hills and Pampas. It is a great pleasure for the Organizing Committee to be able to host attendees to this meeting, which we hope will be both enjoyable and fruitful.

Welcome to Argentina, to Mar del Plata and Balcarce, and to the 18th International Sunflower Conference.

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Screening perennial Helianthus species for powdery mildew

Boško Dedić, Sreten Terzić, Jovanka Atlagić, Dragana Miladinović, Jelena Mrđa, Sonja Tančić, Vladimir Miklič
Institute of Field and Vegetable Crops, Maksima Gorkog 30, 21000 Novi Sad, Serbia, bosko.dedic@ifvcns.ns.ac.rs

ABSTRACT

- Powdery mildew (*Erysiphe cichoracearum*) has been reported as a potential constraint for sunflower growing in regions with warm climate. Severity of disease varies depending on the sunflower genotype. Aim of this research was to determine response of wild Helianthus species grown in IFVC wild species collection to powdery mildew, as there are not many references on the reaction of wild sunflowers to this disease.
- Disease severity was recorded in naturally infected field during four year period. Total of 23 Helianthus spp. (333 accessions) were included in the survey.
- Reaction to powdery mildew varied among years and species with the highest occurrence of disease in 2011. There was significant difference in disease occurrence among accessions of the same species. During 4-year survey period, powdery mildew was not recorded in 6, 10 and 6 accessions of *H. decapetalus, H.divaricatus,* and *H. laevigatus*, respectively. Moreover, complete absence of disease was registered in another 10 species represented by one or two accessions. Accessions of other surveyed species differed in susceptibility and percentage of susceptible ones varied between 50% for *H. giganteus* and 89% for *H. tuberosus*.
- In conclusion, significant difference in reaction of tested perennial Helianthus species to powdery mildew was found. This difference was also observed among accessions of some of the tested species. However, in some species all tested accessions were resistant to powdery mildew.
- This research will contribute to the knowledge on reaction of wild perennial sunflower species to powdery mildew and their more extensive use in cultivated sunflower breeding for resistance to this disease.

Key words: Helianthus spp. - powdery mildew – resistance

INTRODUCTION

Powdery mildew is commonly found in majority of countries with sunflower crop production (Acimovic, 1998). Three fungal species are identified from diseased sunflower leaves and *Erisiphe cichoracearum* is most commonly found (Gulya et al., 1997). Strains of *E. cichoracearum* from various hosts differ in ability for cross infection (Yearwood, 1957; Kolte, 1985). Moreover, it was reported by Zeller and Levy (1995) that this fungal species is a complex of morphologically similar, but host-limited forms. Identification of pathogen is now easier using an effective technique based on ITS sequence analysis which have been developed for easy detection and differentiation of *E. cichoracearum* and *Sphaeroteca fuliginea* (Chen et al., 2008). Two other species *Leveillula compositarum* and *Sphaeroteca fuliginea* are creating similar symptoms as *E. cichoracearum* does, although they have somewhat limited geographical range (Gulya et al., 1997).

Damage due to disease is more likely to happen in tropical rather than in temperate regions. Development of disease is enhanced by dry and warm weather. Recently, severe occurrence of sunflower powdery mildew has been reported in India (Dinesh et al., 2010).

Wild sunflower species are used as a source of resistance genes for control of fungal diseases such as downey mildew or sunflower rust. Differences in susceptibility of accessions of wild sunflowers to biotic stress are extensively exploited in breeding programs. Differences in resistance to powdery mildew are also observed among species from the genus Helianthus. Resistance to *E. cichoracearum* has been found in 14 perennial and 2 annual species (Salman et al., 1982). Moreover, resistance to this pathogen was found in some accessions of *H. tuberosus, H. praecox, H. bolanderi* and *H. praecox* (Acimovic, 1998). Resistance found in annual *H. debilis* subsp. *debilis* was described as incompletely dominant and transferred into *H. annuus* (Jan and Chandler, 1985).

The objective of this study is to determine variability of perennial wild sunflower species in susceptibility to *E. cichoracearum*.

MATERIALS AND METHODS

Tested plant material included 23 perennial species from genus Helianthus with total of 333 accessions that are part of IFVCNS wild sunflower species collection (Table 1).

The plants of each accession were grown in small plots, 0.8 m width and 3.6 m in length, with nylon bedding to prevent uncontrolled spread via underground parts. Presence of powdery mildew on plants under natural infection was evaluated in four consecutive years, in period 2008-2011. Depending on the accession, 7 to 10 plants, were evaluated for disease severity using scale 0-3 (0 – no infection; 1 – a few colonies of *E. cichoracearum* (less than 10% of leaf area) on the bottom leaves; 2 – colonies covering 11-50% of the leaf area; 3 – colonies covering more than 50% of the leaf area)(Saliman et al., 1982). Disease index was calculated for each accession averaging disease severity ratings. The screening was done in physiological maturity or after flowering for late-flowering accessions. Based on disease index, which is calculated by averaging ratings of disease, accessions were grouped as resistant (R; index 0-1) or susceptible (S; index > 1).

RESULTS AND DISCUSSION

Extensive appearance of powdery mildew was not detected only in 2009. Therefore, data from that year were excluded. First appearance of the disease during other three years was noticed in the second half of vegetation period and disease incidence was high enough for making distinction in susceptibility among accessions.

Resistance was detected in 124 accessions which makes a third of all tested accessions. Each of 23 species had at least one resistant accession (Table 2). In all tested accessions of *H. decapetalus, H. divaricatus,* and *H. laevigatus* powdery mildew was not recorded. Furthermore, there was no occurrence of disease in accessions of *H. californicus, H. eggertii, H.glaucophyllus, H. laetiflorus, H. microcephalus, H. multiflorus, H. resinosus, H. salicifolius, H. silphioides* and *H. smithii*. Saliman et al. (1982) reported, in conditions of natural infection, the same results for species *H. californicus, H. decapetalus, H. microcephalus* and *H. smithii.* In contrast to our results, Saliman et al (1982) have found species of *H. glaucophyllus, H. salicifolius* and *H. egertii* highly susceprible In our work there was complete absence of powdery mildew symptoms on the plants of these three species.

Table 1. Resistance of perennial Helianthus species expressed by number of resistant accessions

Species	Number of tested accessions	Number of resistant accessions	Percentage of resistant accessions
H. californicus	1	1	100
H. decapetalus	6	6	100
H. divaricatus	10	10	100
H. eggertii	2	2	100
H. giganteus	16	8	50.0
H. glaucophyllus	1	1	100
H. grosseseratus	31	15	48.4
H. hirsutus	4	2	50.0
H. laetiflorus	1	1	100
H. laevigatus	6	6	100
H. maximilliani	35	18	51.4
H. microcephalus	2	2	100
H. mollis	8	3	37.5
H. multiflorus	1	1	100
H. nutalii	23	13	56.5
H. pauciflorus	5	3	60.0
H. resinosus	2	2	100
H. rigidus	9	3	33.3
H. salicifolius	2	2	100
H. silphioides	1	1	100
H. smithii	2	2	100
H. strumosus	21	6	28.6
H. tuberosus	144	16	11.1

Table 2. List of accessions which were resistant to powdery mildew based on three-year observation in field under natural infection

IFVCNS number	PI	Disease index	IFVCNS number	IP	Disease index	IFVCNS number	IP	Disease index
H. californicus			2081	547197	0	1962	531043	0
772	-	0	2094	547201	0	292	-	0
H. decapetalus			*H. hirsutus*			239	-	0.2
B	-	0	1536	468738	0	1514	468795	0
1882	503258	0	2092	547204	0	1989	531049	0
1922	503246	0	*H. laetiflorus*			*H. pauciflorus*		
1926	503248	0.1	655	435710	0	2228	-	0
1884	503240	0	*H. laevigatus*			2207	-	0
1887	503242	0	1618	468740	0	2099	586909	0
H. divaricatus			1871	503226	0	*H. resinosus*		
1948	503216	0	1874	503227	0	1597	-	0
1876	503210	0	1875	503228	0	1545	468879	0
1955	503217	0	1620	468742	0	*H. rigidus*		
1881	503211	0	1619	468741	0	1696	-	0
1885	503212	0	*H. maximiliani*			1911	503234	0
1873	503209	0	34	-	0	1	-	
830	435675	0	m	-	0	*H. salicifolius*		
2056	547171	0	33-001	-	0	X	-	0
2082	547173	0	41	-	0	241	435872	0
2085	547174	0	2031	-	0	*H. silphoides*		
H. eggertii			2049	-	0.4	1539	468886	0
1626	2029	0	2087	547208	0	*H. smithii*		
X	-	0	2219	586897	0	1603	468889	0
H. giganteus			2224	586900	0	hn 2 1600	-	0
1616	468718	0	2234	586904	0	*H. strumosus*		
1890	503221	0	2097	586891	0.3	1941	503253	0
1897	503223	0	2115	586894	0	2019	547212	0

2016	547178	0	2222	586899	0	1927	503249	0
2017	547179	0	2221	586898	0	*x-2*	-	0
2018	547180	0.3	2226	-	0	2095	547226	0
2020	547181	0	2230	586902	0	1953	503259	0
2029	547184	0	*H. microcephalus*			*2042*	547216	0
H. glaucophyllus			1827	503231	0	2068	547221	0
1604	468721	0	1585	468752	0	*H. tuberosus*		
H. grosseseratus			*H. mollis*			1698	-	0
2212	586890	0	1298	468759	0	1700	-	0.5
1690	-	0	361	435758	0	1699	-	0
1543	468726	0	x	-	0	15	-	0.2
1687	-	0	*H. multiflorus*			1959	503283	0
1685	-	0	MUL RU	-	0	8	-	0
2039	547193	0	*H. nutalii*			1704	-	0
2022	547185	0.2	2153	-	0	*1628*	468897	0
2025	547186	0	2133	597917	0	Ns 2	-	0.2
2026	547187	0	1986	531045	0	2066	547241	0.2
2027	547188	0.3	1987	531047	0.3	2067	547242	0
2043	547195	0	1996	531050	0	2080	547247	0.1
2032	547190	0	1997	531051	0.2	2024	547227	0
2028	547189	0	2000	531053	0			
2091	547200	0*	2001	531054	0			

* Results continues from the top of the next column

The species with the greatest number of susceptible accessions (128 or 88.9%) was *H. tuberosus*. Powdery mildew attack can be moderately severe in this species and there is a considerable genetic variation in resistance the gene pool (Kays and Nottingham, 2007). McCarter (1993) found three resistant *H. tuberosus* lines out of 36 tested which is in concordance to our results.

Resistance to powdery mildew is found in other Helianthus species with percentage of resistant accessions ranging from 28.6% for *H. strumosus* to 56.5% for *H. nutalii* (Table 1). Jan et al. (2008) reported differential reaction of *H. grosseseratus* and *H. maximilliani* similar to findings in our research. In addition to four previously mentioned species the ones with both resistant and susceptible accessions were *H. giganteus, H. hirsutus, H. mollis H. pauciflorus* and *H. rigidus*. However, other researchers found *H. nutalii* and *H. grosseseratus* to be highly susceptible to powdery mildew in both field and greenhouse while *H. rigidus* had the symptoms of powdery mildew only after inoculation in the greenhouse (Saliman et al, 1982).

Colonies of *E. cichoracearum* on leaves were not recorded for majority of resistant accessions although they were planted in proximity to susceptible ones. Only small number of *H. tuberosus. H. nutalii, H. maximilliani, H. grosseseratus, H. giganteus* and *H. decapetalus* accessions had plants with limited area with symptoms of powdery mildew which explains low values of disease index (Table 2).

Accessions of tested wild sunflower species clearly differed in reaction to *E. cichoracearum*. For some tested species all accessions were found resistant while others have a certain number of susceptible accessions. None of examined species was completely susceptible. Future research should be focused on testing of accessions that were resistant in field under natural infection, using artificial inoculation in field and greenhouse.

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