P 5: A descriptor list of *Silybum marianum* (L.) Gaertner – morphological and biological characters

Elena Dušková, Karel Dušek, Kateřina Smékalová

Department of Genetic Resources for Vegetables, Medicinal and Special Plants, Centre of the Region Haná for Biotechnological and Agricultural Research, Crop Research Institute, Šlechtitelů 29, Olomouc, 78371, Czech Republic, e-mail: Smekalova@genobanka.cz (corresponding author)

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Abstract

Silybum marianum (L.) Gaertn (Milk thistle) is an important medicinal plant which fruits are used for treatment of various liver diseases. In an effort to utilize the genetic potential of cultivated plants in the best way, the breeding of new high-performance cultivars is underway all over the world. Genetic improvement in *Silybum* can only be, as with all other plants, achieved through a clear understanding of the plant´s behaviour and the amount of variability presented in wild populations. Surprisingly no descriptor list has been compiled up to now, which would permit an objective and easily repeatable description an evaluation of the different *Silybum* genotypes. The first part of such a descriptor list, which is intended mainly for evaluation of genotypes perspective for fruit production, is presented here and it contains both the morphological and biological characters.

Keywords: Milk thistle, evaluation descriptors, production of fruits

Introduction

Silybum marianum (L.) Gaertn (Milk thistle) is an important medicinal plant of which pharmaceutical importance rises once again and it is grown commercially almost all over the world. Its fruits (i.e. achenes), often referred to as seeds, have been valued for their medicinal properties (Gažák et al., 2004) and currently the most important medicinal application of *Silybum* is its use as a hepatoprotectant and as supportive treatment of chronic inflammatory liver disease such as cirrhosis, hepatitis, and fatty infiltration due to alcohol and toxic chemicals. It has also been used in the treatment of liver damage by poisonous mushrooms (Kvasnička et al., 2003).

Despite the wide use and considerable volume of *Silybum* sales - 8,312,867 USD in 2005 (Blumenthal et al., 2006) – there is lack of research efforts on the domestication and improvement of this plant (Ram et al., 2005) but the breeding of new high-performance cultivars is underway all over the world. The first step in breeding of wild or native populations is collection and description of genetic variation of plant populations for desired characters (Shokrpour et al., 2011). Genetic improvement in *Silybum* can only be, as with all other plants, achieved through a clear understanding of the plant´s behaviour and the amount of variability presented in wild populations, including genotypes which may represent the maximum expression of adaptation capability to environmental conditions. The selection of an ideotype with desirable traits will facilitate agrotechnology and allows to maximal yield (Gresta et al., 2006).

An objective and easily repeatable evaluation of many important crops is made possible by using descriptor lists. Surprisingly no descriptor list for different *Silybum* genotypes has been drawn up up to now and therefore the first part of such a descriptor list is presented here. It is intended mainly for evaluation of genotypes perspective for fruit production and it contains both the morphological and biological characters.

Materials and Methods

Presented descriptor list of *Silybum marianum* was created based on the references for the development of crop descriptor lists (Bioversity International, 2007) and it comprises results and experiences of 5 years growing and evaluating of milk thistle genetic resources, which were collected in the Czech gene bank. Own measurements and evaluation, acquired in the period 2007-2009 in

locality Olomouc (CZE) and 2013-2014 in localities Olomouc and Znojmo (CZE), were confronted and supplemented by many literature references from scientific papers. The presented descriptor list is intended mainly for the evaluation of genotypes perspective for fruit production. In case of evaluation in order to other use (fodder plant, production of biomass, ornamental plant, weed etc.) some additional characters should be added.

Results

The first part of milk thistle descriptor list is presented in Tab. 1 and it contains both the morphological and biological characters. The economic characters, as the total silymarin and oil content and the content of its components, are processed.

Tab. 1 Descriptor list of Silybum marianum – Morphological and Biological characters

Descriptor	Scale	Values	Note
1. Morphological characters			
1.1 Plant			Average of 10 randomly selected plants.
1.1.1 Plant habit	1 erect		Recorded in terminal head full flowering stage.
	2 semi-erect		
1.1.2 Plant – height (cm)	3 low	< 110	Recorded in terminal head full flowering stage; from ground level to the top of terminal head.
	5 intermediate	110-140	
	7 high	> 140	
1.1.3 Plant – width (cm)	3 small	< 70	Recorded in terminal head full flowering stage.
	5 intermediate	70 - 90	
	7 great	> 90	
1.1.4 Plant - length of flowering stem (cm)	3 short	< 50	Length of stem from first branching point to the top of terminal head; recorded in terminal head full flowering stage.
	5 intermediate	50 - 70	
	7 long	> 70	
1.1.5 Plant - intensity of branching	3 low	< 10	Number of fertile branches per plant. Recorded at harvest time.
	5 intermediate	10 - 20	
	7 high	> 20	
1.2 Leaf		Average of 10 leaves, each leaf from different randomly selected plant.	
1.2.1 Rosette leaf – length (cm)	3 short	< 50	Fully developed leaves including petiole, in the beginning of stage of generative organ creation.
	5 intermediate	50 - 65	
	7 long	> 65	
1.2.2 Rosette leaf – width (cm)	3 narrow	< 25	Recorded in the widest point of fully developed leaves, in the beginning of stage of generative organ creation.
	5 intermediate	25 - 27	
	7 wide	> 27	
1.2.3 Rosette leaf - depth of incisions	3 pinnatilobed	< 1/3	Fig. 1; Deep of incisions of blade margin to the main vein.
	5 pinnatipart	1/3 - 1/2	
	7 pinnatifid	> 1/2	
1.2.4 Rosette leaf - degree of marbling	0 absent		Fig. 2
	3 low		
	5 medium		
	7 high		
1.3 Inflorescence			
1.3.2 Diameter of primary head (cm)	3 small	< 4,5	Average of 20 randomly selected plants. Recorded in terminal head full flowering stage.
	5 intermediate	4,5 - 5,5	
	7 great	> 5,5	
1.3.3 Inflorescence - number of heads per plant	3 small	< 6	Number of other flower heads per plant (except the primary head). Recorded in terminal head full flowering stage.
	5 intermediate	6 - 9	
	7 great	> 9	
1.3.4 Flower - colour	1 white		As present or using RHS colour chart.
	2 creamy		
	3 pinkish		
	4 light violet		
	5 dark violet		
	6 other		

Descriptor	Scale	Values	Note
1.4 Fruit			Recorded in full maturity stage.
1.4.1 Fruit – length (mm)	3 small	< 7	Average of 20 randomly selected fruits; achenes without crest.
	5 intermediate	7 - 8	
	7 great	> 8	
1.4.2 Fruit – width (mm)	3 small	< 3	Average of 20 randomly selected fruits; in the widest part of fruit.
	5 intermediate	3 - 4	
	7 great	> 4	
1.4.3 Fruit - colour	1 dark brown		The main colour of the seed is the colour with the largest area. As present or using RHS colour chart.
	2 brown black		
	3 other		
1.4.4 Number of fruits on primary flower head	3 low	< 80	Average of 10 random terminal flower heads.
	5 intermediate	80 - 120	
	7 high	> 120	
1.4.5 Fruit - Yield per plant (g)	3 low	< 15	Average of 10 random plants. Yield of all gradually harvested flower heads of plant. Example variety SILYB (CZE, 1988).
	5 intermediate	15 - 30	
	7 high	> 30	
1.4.6 Fruit - 1,000 fruits weight (g)	3 low	< 20	
	5 intermediate	20 - 25	
	7 high	> 25	
2. Biological characters			
2.1 Vegetation period			
2.1.1 Number of days from sowing to beginning of generative organs creating (days)	3 early	< 80	Beginning of generative organs creating = flower central head clearly visible between rosette leaves, vertical bract tips. Example variety SILYB (CZE, 1988).
	5 intermediate	80 - 90	
	7 late	> 90	
2.1.2 Number of days from sowing to beginning of terminal head flowering (days)	3 early	< 90	Beginning of terminal head flowering = the flower bud bends; first flower in blossom.
	5 intermediate	90 - 100	
	7 late	> 100	
2.1.3 Number of days from sowing to terminal head maturity (days)	3 early	< 100	Terminal head maturity = The bracts are dry. The head is opening and the pappus is visible and seed dispersal start.
	5 intermediate	100-115	
	7 late	> 115	
2.2 Biotic stress susceptibility			
In each case, it is important to state the origin of the infestation or infection, i.e. natural, field inoculation, laboratory. Record such information in descriptor 2.2 Notes. These are coded on a susceptibility scale from 1 to 9, viz.:			
	1 very low or no visible sign of susceptibility		
	3 low		
	5 intermediate		
	7 high		
	9 very high		
2.2.1 *Botrytis cinerea* - Botrytis head rot			
2.2.2 *Septoria silybi* - Septoria leaf spot			
2.2.3 *Alternaria silybi* - Alternaria leaf spot			
2.2.4 *Fusarium oxysporum* - Fusarium wilt			
2.2.5 *Golovinomyces cichoracearum* - Powdery mildew of milk thistle			
2.2. others			

Fig. 1 Depth of incisions of blade margin to the main vein (scale examples)

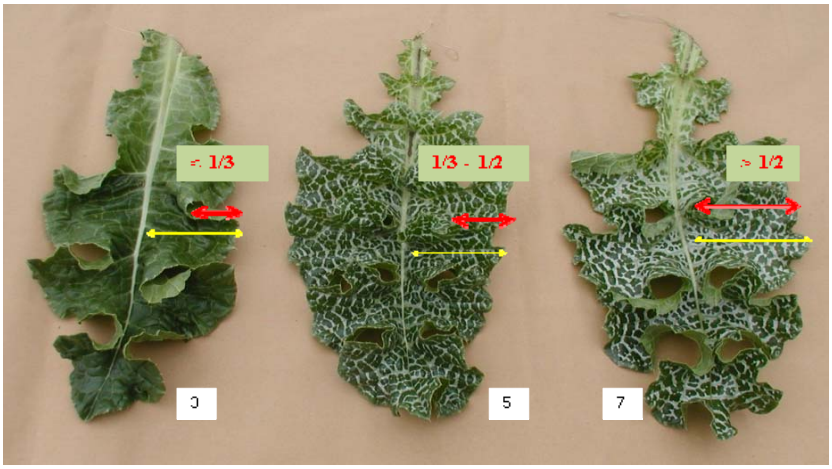

Fig. 2 Rosette leaf - degree of marbling (scale examples)

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