INDIAN BRASSICA MATERIAL TESTED IN SWEDEN FOR COLD TOLERANCE

Ingvar Ohlsson, Department of Plant Husbandry
Swedish University of Agricultural Sciences, Uppsala, Sweden

INTRODUCTION

Frost damage often causes severe losses to Brassica oil crops in India when grown at the northern extent of the growth area. Within the scope of the Indo-Swedish Collaborative Research Programme, cold tolerance was investigated in Sweden in 1980 of a comprehensive Indian material. The results obtained demonstrated differences in cold tolerance both between species and between varieties.

In 1981 the investigations were continued at the Department of Plant Husbandry, Swedish University of Agricultural Sciences, Uppsala (50° 49' N and 17° 40' E).

MATERIAL AND METHODS

The investigation included:

Indian material		
Brassica campestris	var. toria	53 lines
	var. brown sarson	15 lines
Brassica juncea		56 lines
Swedish material		
Brassica napus		1 line
Canadian material		
Brassica campestris		1 line

The experiment was sown on 18 August at a seed rate of 10 kg/ha. Each line was sown without replicates on an area of 0.3 m^2. The soil type of the experimental field was a clay sand with low organic content. Minimum temperatures at the soil surface and precipitation levels were recorded during September-November.

RESULTS AND DISCUSSIONS

Plant development

On 25 August the material emerged with slight differences between lines. Start of flowering was determined and dates are reported in Table 1. Lines of Brassica juncea did not reach flowering stage, with the exception of line RV-175 where a few flowers developed in November. Brassica campestris var. toria started flowering in the interval 12-30 October. Var. brown sarson flowered some days later, in the interval 15 October - 6 November, apart from the two lines DBS-1 and DBS-2.

Temperature at soil surface

The meteorological data obtained from the Ultuna station are given in Diagrammes 1-3. In the middle of September the min. soil surface temperature decreased freezing point and reached -4 °C on September 14 and -3 °C on September 19. During the later part of the same month and up to mid-October high temperatures were predominant. Low soil surface temperatures of -8 to -10 °C were recorded on the following dates: October 16, 19 and 25, November 4, 9 and 10. On November 16 the low temperature of -11 °C at the soil surface was registered in the morning.

Precipitation was extremely low in September but increased during the rest of the investigation period. In October and November double the normal average precipitation was obtained.

It was only in the month of November, 7-12 and 15-16, that snow covered the soil surface.

Frost damage

The first symptom of visible frost damage in the plant material was observed on October 30, a date about two weeks after the low soil min. temperature of -8 to -10 °C. Observations of the type of injury on the plants showed that stems and leaves dried and turned brown. It was only in Indian Brassica campestris that the first frost damage symptoms were observed. No visible effects of frost damage could be found in other lines tested.

One week later on November 6 frost symptoms were noted again. Up to this date the soil min. temperature again reached -8 °C. Examination of the plant material at this time showed that all lines of Indian Brassica campestris, with a few exceptions, had symptoms of frost damage.

On November 12 and 17 the frost damage on plant material was graded on a 0-10 scale, where 0 indicated no damage and 10 frost killed plants (Table 1). The data listed showed severe frost damage of Indian Brassica campestris compared to Brassica juncea and Brassica napus and Brassica campestris from Canada. The results obtained also indicated a distinct difference in cold tolerance between var. toria and var. brown sarson. Out of the var. brown sarson lines, 50-90 % of the plants were found damaged by frost, with best tolerance shown by lines DBS-1, DBS-2 and BSIK-1. Within the lines of var. toria 10-80 % were damaged by frost. Good tolerance was demonstrated by lines TIK-2, TIK-781, GSPC-1 and GSPC-5.

The remaining part of the total test material showed very good frost tolerance, with a maximum of 10 % damage to the plants. Very few lines were found to have any symptoms of frost injury at all. About 10 % frost damage was observed in the following lines of Brassica juncea RLM-234, RH-30, RH-7513, RK-1, TK-4, Pusa Bold and in the Canadian line Span of Brassica campestris.

A corresponding investigation was carried out at Weibullsholm Plant Breeding Institute in southern Sweden.

SUMMARY

Frost damage often causes severe losses to Brassica oil crops in India when grown at the northern extent of the growth area.

Cold tolerance, mainly at the flowering stage of the plant, has been studied in Sweden of 124 Indian lines of Brassica juncea and Brassica campestris. The standard lines included comprised of one line of Brassica napus from Sweden and one of Brassica campestris from Canada.

The investigations have revealed important and large differences in the material between different species as well as between different lines.

The results obtained demonstrated that Brassica juncea has a greater cold tolerance than Brassica campestris. In Brassica campestris the plant material was damaged considerably, with more severe frost damage to var. brown sarson lines than to var. toria lines.

ACKNOWLEDGEMENT

The investigation was supported by a grant from SAREC through the Indo-Swedish Collaborative Research Programme on Rapeseed/Mustard Improvement and Oil and Protein Utilization.

Table 1. Results of cold tolerance investigations in 1981

No.	Variety/line	Start of flowering	Frost damage: Symptoms observed = *		Graded effect 0-10 (0 = no damage, 10 = dead plant)	
		October	Oct 30	Nov 6	Nov 12	Nov 17
	Brassica campestris var. toria					
1	TIK-1	15	*		2	2
2	TIK-2	15		*	1	1
3	TIK-781	19		*	1	1
4	TIK-782	15		*	1	4
5	TH-2	23	*		2	2
6	TH-4	19		*	2	3
7	TH-5	19		*	1	2
8	TH-8	12		*	3	4
9	TH-11	23	*		1	4
10	TH-12	23		*	1	4
11	TH-17	28		*	1	4
12	TH-37	19			1	5
13	TH-42	15			1	4
14	TH-44	23		*	1	4
15	D-1	12		*	5	5
16	M-27	15	*		4	6
17	RAUTK-1	12	*		3	6
18	RAUTK-2	15	*		6	7
19	RAUTK-3	15		*	7	8
20	TWC-1	15		*	3	7
21	TW-2/8	12		*	2	2
22	TW-1/16	12			2	2
23	TW-4/10	12			3	3
24	TW-8/12	12		*	3	3
25	GSPC-1	19			1	1
26	GSPC-5	23			1	1
27	PT-1	23		*	1	1
28	PT-8	23			2	3
29	PT-9	15			1	2
30	PT-30	19			1	3

Table 1. Continued

No.	Variety/line	Start of flowering	Frost damage: Symptoms observed = *		Graded effect 0-10 (0 = no damage, 10 = dead plant)	
		October	Oct 30	Nov 6	Nov 12	Nov 17
61	BSIK-1	Nov 6		*	3	6
62	BSIK-2	19	*		3	7
63	BSIK-3	26	*		6	8
64	DSH-1	19	*		8	8
65	UUBS-1	15		*	6	7
66	MSB	15	*		8	9
67	BSH x DS-2	15	*		9	9
68	BSK-1	26		*	7	7
	Brassica juncea					
69	RLM-29				0	0
70	RLM-29/25				0	0
71	RLM-45				0	0
72	RLM-82				0	0
73	RLM-84				0	0
74	RLM-105				0	0
75	RLM-137				0	0
76	RLM-171				0	0
77	RLM-185				0	0
78	RLM-198				0	0
79	RLM-234				0	0
80	RLM-240				0	1
					no germinated seeds	
81	RLM-514				0	0
82	RLM-528				0	0
83	RLM-603				0	0
84	RH-30				0	1
85	RH-765				0	0
86	RH-761				0	0
87	RH-763				0	0
88	RH-771				0	0
89	RH-7326				0	0
90	RH-7361				0	0

Table 1. Continued

No.	Variety/line	Start of flowering	Frost damage: Symptoms observed = *		Graded effect 0-10 (0 = no damage, 10 = dead plant)	
		October	Oct 30	Nov 6	Nov 12	Nov 17
91	RH-7513				0	1
92	RH-7514				0	0
93	RH-7515				0	0
94	RH-7710				0	0
95	RH-7711				0	0
96	RIK-2				0	0
97	RIK-3				0	0
98	RIK-4				0	0
99	RIK-5				0	0
100	RK-1				0	1
101	RK-2				0	0
102	RK-8				0	0
103	RK-9				0	0
104	RK-10				0	0
105	RK-11				0	0
106	RK-12				0	0
107	RK-14				0	0
108	RW-85-59				0	0
109	RW-175				0	0
110	R-75-2				0	0
111	TM-2-11				0	0
112	TM-4				0	1
113	T-46-1				0	0
114	PR-6				0	0
115	PR-10				0	0
116	PR-15				0	0
117	P-11/7-1				0	0
118	P-26/21				0	0
119	BR-13				0	0
120	PUSA BOLD				0	1

Table 1. Continued

No.	Variety/line	Start of flowering	Frost damage: Symptoms observed = *		Graded effect 0-10 0 = no damage 10 = dead plant	
		October	Oct 30	Nov 6	Nov 12	Nov 17
121	PRAKASH				0	0
122	DURGAMANI				0	0
123	VARUNA				0	0
124	RL-18				0	0
	Brassica napus					
125	WW OLGA				0	0
	Brassica campestris					
126	SPAN				0	1

Diagram 1. Min. temperature of the soil surface and precipitation. September 1981.

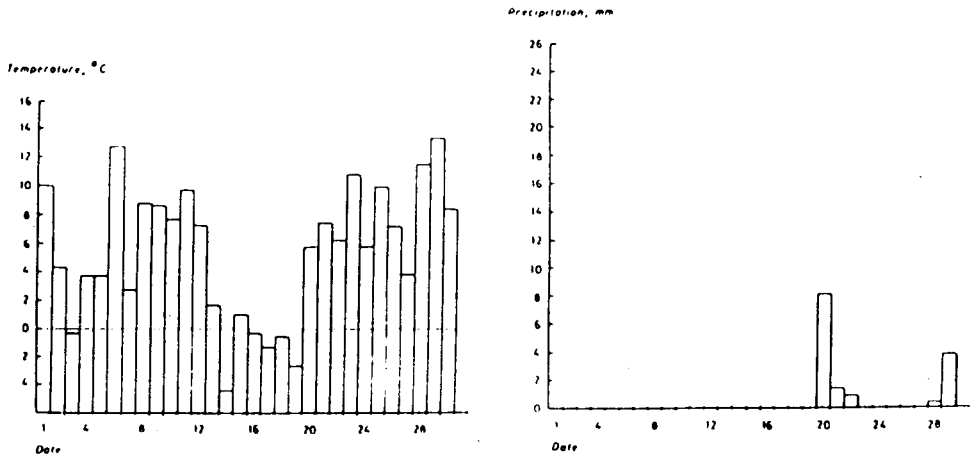

Diagram 2. Min. temperature of the soil surface and precipitation. October 1981.

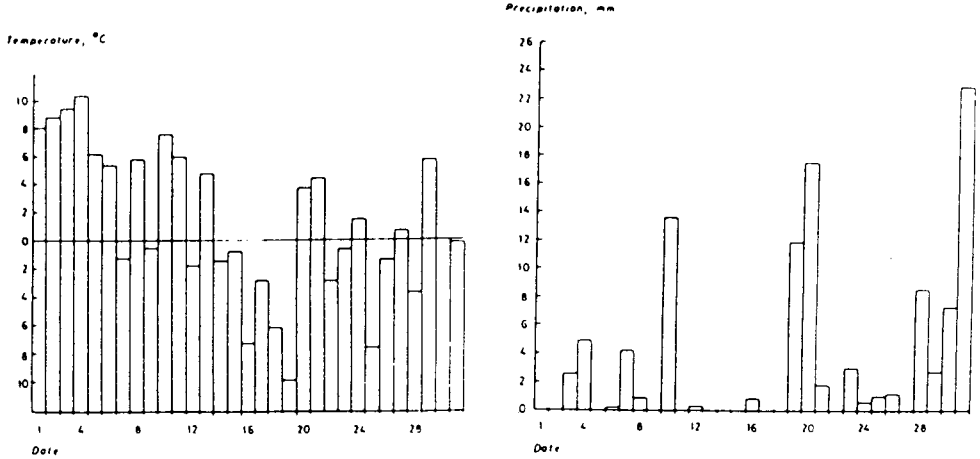

Diagram 3. Min. temperature of the soil surface and precipitation. November 1981.