

## IDENTIFICATION OF THE RACES OF THE SUNFLOWER BROOM RAPE IN THE PRINCIPAL SUNFLOWER PRODUCTION AREA OF JILIN PROVINCE

Dong Baichun, Sha Honglin, Liu Xuejing,  
Leng Tingrui, Yu Haiyan and Wang Xinghuan

Jilin Province Research Institute of Sunflower 17 Sanhe Road,  
Baicheng City, Jilin Province, PR,China Zip Code: 137000

### Abstract

In order to identify the races of the sunflower broomrape, *Orobanche cumana* Wallr, a study was carried out by inoculating the five sunflower differentials with the seeds of the parasite populations collected from several locations in the principal sunflower production area of Jilin Province in 1994. The results showed that all of the populations of the parasite from the different locations made the same response to the differentials or that the races of the parasite in the area were the same one. In line with the response of the differentials to known broomrape race populations, the races in the area were identified as race A. It was the first report on the races of the sunflower broomrape in China.

Key-words: Sunflower, Sunflower Broomrape, *Orobanche cumana*, Differential, Race

### Introduction

Since the sunflower broomrape, *Orobanche cumana* Wallr, was found in the sunflower fields in Changling County, a very important county in sunflower production in the western part of Jilin Province, in 1979 (1), it has been found in the sunflower fields in Taonan City and Qian'an county of the province. For most of the farmers in the area have planted the open-pollinated variety "Hungary 4" which is susceptible to the parasite for years, the parasite has been causing more serious losses of the seed yields. Great attention has been paid by the research institutions and extension services. The resistance of sunflower to the broomrape is controlled by the single dominant genes so that the breeding for the resistance to the parasite is the most effective and economic control measure(2).

Many races exist in the sunflower broomrape populations. Skoric(1988) reported that the estimated number of the races of the broomrape would be about 25-32 and five of them had been identified(3). Identification of the races is the most basic work for the breeding for the resistance to the parasite. However, there has not been work to be done in China. The objective of the study was to identify the races existing in the sunflower broomrape populations in the principal sunflower production area of Jilin Province.

### Materials and methods

The trials were conducted in the phytopathological lab and greenhouse of Jilin Province Research Institute of Sunflower, at Baicheng City, Jilin Province, in the May-October of 1994. The five differentials, S-59(Or0), Kruglic A-41(Or1), Jdanov 8281(Or2), Record(Or3) and S-A(Or4) which were used in the study, were obtained from CIDA, at Cordoba, Spain and their reactions to the known sunflower broomrape races are shown in Table 1.

Table 1. Reactions of the sunflower differentials to the known sunflower broomrape races

Differentials	Broomrape races					Resistance reactions	Resistance genes
	A	B	C	D	E		
S - 59	S	S	S	S	S	R0	-
Kruglic A - 41	R	S	S	S	S	R1	Or1
Jdanov 8281	R	R	S	S	S	R2	Or2
Record	R	R	R	S	S	R3	Or3
S - A	R	R	R	R	R	R4	Or4

R = Resistant

S = Susceptible

The seeds of the three broomrape populations, Taonan, Qian'an and Changling, which were used in the study, were collected in the sunflower fields in Najin Township of Taonan City, Yanzhi Township of Qian'an County and Daxing Township of Changling County, respectively. The three city/counties make up the principal sunflower production area of Jilin Province. At the beginning of the September last year, the whole broomrape plants were collected from the fields

and then identified as *Orobanche cumana*. After drying, the seeds were picked out with the tweezers and put in the aluminium boxes for uses.

The seeds of the sunflower differentials were sterilized in the 2% bleaching powder solution for three minutes and washed with tap water. Such treated seeds were placed in the Petri dishes and then in the plant growth chamber with the temperature of 24 C for germination. While the buds were as long as 1 - 2 mm, the seeds were taken out and placed in the sterilized dishes in the refrigerator with the temperature of 5 - 10 C for uses.

For inoculation, two germinated seeds of a sunflower differential were planted in a small pot (6.5 x 6.5 x 6.5 cm) containing 250 g prepared soil (silt : sand = 1 : 1) pre-mixed with 250 mg seeds (more than 5000 seeds) of a broomrape population on the thirtieth of May. Such treated pots were placed in the plant growth chamber with the temperature of 20 - 26 C and relative humidity of 80% for growing. The light with intensity of 10000 lux was supplied from 07:00 am to 09:00 pm each day.

While the seedlings were two true leaves old, the weak plant was cut off and the strong one kept. When reaching the three leaf age, the plants were with the broomrape - seed - mixed soil transplanted into the big pots (30 x 30 x 30 cm) with the prepared soil (peat : sand : silt = 2 : 2 : 1). The pots with the plants were placed in the greenhouse and the plants grew in the natural conditions. In the study, the five sunflower differentials were inoculated with the true sunflower broomrape populations, respectively. Inoculating one differential with one population (one pot) was one treatment. Each inoculation was replicated for ten times and a completely randomized design was used in the trials. When reaching 18 - 21 leaf age, the sunflower plants were recorded for the parasitic percentage by the broomrape. After a week, they were checked again.

## Results and discussion

The reactions of the sunflower differentials to the Taonan sunflower broomrape population are shown in Table 2. The differential S -59 did not contain the resistant genes so that the frequency of the attack of it by the population was 80% and that of the other four differentials was 0 because of containing the resistant

genes Or1, Or2, Or3 and Or4, respectively. In line with the responses of the sunflower differentials to the known sunflower broomrape races, the Taonan population was identified as the race A.

The inoculation of the differentials with the Qian'an population showed that the population only had the parasitism on S - 59 and no parasitism on the others (Table 2). It suggested that the broomrape population was also the race A. The frequency of the attack of S - 59 by the population lower than by the Taonan population was because the collecting time was earlier and some broomrape plants were not mature.

Table 2. Reactions of the sunflower differentials to the three sunflower broomrape populations

Populations	Differentials	No. of plants examined	No. of plants Attacked	Frequency of the attack (%)	Resistance reaction
Taonan	S - 59	10	8	80	S
	KruglicA-41	10	0	0	R
	Jdanov 8281	10	0	0	R
	Record	10	0	0	R
	S - A	10	0	0	R
Qian'an	S - 59	10	6	60	S
	KruglicA-41	10	0	0	R
	Jdanov 8281	10	0	0	R
	Record	10	0	0	R
	S - A	10	0	0	R
Changling	S - 59	10	8	80	S
	KruglicA-41	10	0	0	R
	Jdanov 8281	10	0	0	R
	Record	10	0	0	R
	S - A	10	0	0	R

R = Resistance

S = Susceptible

As shown in Table 2, the reactions of the differentials to the Changling population were the same as those to the Taonan and Qian'an populations so that the population was the race A.

Since the sunflower broomrape populations used in the study were collected from the sunflower fields in the three city/counties which make up the principal

sunflower production area of Jilin Province, the races of the populations of the parasite in the area were identified as race A. This situation is mainly caused by growing the susceptible variety "Hungary 4" by the farmers for years. In the future, with the new sunflower varieties and hybrids used, some new races will appear on the basis of "gene for gene" theory. Therefore, the breeders should make out the breeding program in line with the present and future situations. First, Or1 gene resistant to the rac A should be transferred into the breeding lines to develop new varieties and hybrids. On the other hand, other resistant genes, particularly the gene Or5 resistant to more races, should be considered to be transferred in to the breeding lines for preventing new races.

#### Acknowledgments

We wish to thank Dr. J. Melero and Dr.S. D. Mercedes for technical assistance.

#### Literatures cited

1. Zhou Zhonghuang , Zhang Zhicheng and Li Yu. 1980. Finding of the Sunflower Broomrape in Jilin Prpvince. Jilin Agriculture University Journal. 2.
2. Jack F. Carster. 1978. Sunflower Science and Technology. Agronomy .
3. Skoric D.. 1988. Sunflower Breeding. ULJARSTVO 25.