Euphytica 27 (1978) 861–864

GUMMY STEM BLIGHT RESISTANCE OF CUCUMBERS (*CUCUMIS SATIVUS* L.)

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Received 22 September 1977

INDEX WORDS

Cucumis sativus, cucumber, *Didymella bryoniae*, gummy stem blight, resistance.

SUMMARY

A start was made with breeding for resistance to gummy stem blight in cucumber. A method has been developed for screening plants in a young stage. Using this method a distinct level of resistance was found in plants of Leningradsky, Wjarnikovsky, a P.I. entry from Birma, Rheinische Vorgebirge and a P.I. entry from Turkey. Lines developed from this material show a higher level of resistance than Dutch slicing and pickling cucumber varieties.

INTRODUCTION

The involved fungus was recently reclassified as *Didymella bryoniae* (AUERSW.) REHM by BOEREMA & VAN KESTEREN (1972) (synonyms: *Mycosphaerella citrullina* (C.O. SM.) GROSS, and *M. melonis* (PASS.) CHIU and WALKER). The conidial stage should be called *Phoma cucurbitacearum* (FR.) SACC. (Synonyms: *Ascochyta cucumis* FAUTR. and ROUM., *A.* citrullina C.O. SM. and *Phyllosticta cucurbitacearum* SACC.). Other names for gummy stem blight are black stem rot and, in the USSR, Ascochytosis.

The disease occurs in water-melon (*Citrullus vulgaris* SCHRAD.), musk-melon (*Cucumis melo* L.), cucumber (*Cucumis sativus* L.) and some other cucurbits. It is very likely that all these crops are susceptible to the same strain of *Didymella bryoniae*. No specialisation has been mentioned in literature up to now.

In the Netherlands gummy stem blight is a severe disease in greenhouse cucumbers but it does not affect outdoor crops. The fungus survives on plant debris and is spread by ascospores and conidia. Symptoms can appear on the stems, leaves, growing points and on fruits (VEENMAN, 1972). The most effective control method is ventilation so as to prevent condensation of water on the plants. Since complete control is not possible, resistant varieties will be most welcome.

In water-melon and musk-melon resistance was found by SOWELL et al. (1962, 1966). SOWELL assumes that, in general, cucumbers are less susceptible than water-melon and musk-melon (personal communication). Gummy stem blight resistance in cucumber was mentioned by several Russian research workers (BELOVA, 1970; BOOS & BELOVA, 1975; NEKLYUDOVA, 1973; PROKHOROVA, 1975). Probably most of their screening work was done under practical growing conditions.

In the present article a description is given of our research work on resistance to gummy blight in cucumber.

THE SCREENING METHOD

At our Institute in 1969 a start was made with the development of a screening method.

Initially the symptoms on cotyledons after hand inoculation, were used as a criterion. This criterion proved to be unreliable, as sometimes the cotyledons of the control plants died off as well, probably because of the very high humidity needed for incubation.

Subsequently the symptoms on the growing point and of the first two true leaves were considered. At first, however, this did not appear a reliable basis either, since too often the inoculation failed.

We were able to improve the screening method considerably in cooperation with Van Steekelenburg, research worker of the Institute for Phytopathological Research (IPO) at Naaldwijk. The following method gives quite satisfactory results:

The fungus is grown on malt extract agar (Oxoid) in petri dishes at a temperature of 20°C. In order to get a good spore production the plates are exposed at the same time to near UV light during 12 hours a day. Care must be taken to work with virulent isolates.

Plants are grown (in pots) in a greenhouse till they have a first true leaf of about 5 cm diameter. At this stage the plants are covered with transparent plastic at about 16.00 h. Inoculation (spraying) takes place 24 hours later with a spore suspension of 10^7 spores per ml. Subsequently the plants are covered again with transparent plastic and on top of that with a layer of black plastic. During incubation the temperature is kept at about

Fig. 1. Cucumber plants 6 days after inoculation. Left: susceptible. Right: resistant.

26°C and the relative humidity as near to 100% as possible. Two days after inoculation the black plastic is removed at 08.00 h.

Symptoms, which are a browning and dying of parts of the true leaves and, sometimes, of the growing point (Fig. 1) appear within a week after incubation. When plants are tested in the winter period additional light is given daily from 07.00–19.00 hrs. HPI/T-400 Watt (Philips) lamps, are situated 1,0 m above the plants at a density of one per m^2.

SCREENING FOR RESISTANCE

From 1974 till 1976 about 650 entries were screened. Several hundreds of them were P.I. accessions of the P.I. Station in Ames, Iowa, USA. Per entry seven plants were tested.

Some plants showed a good level of resistance. These plants were selfed and intercrossed. Subsequently the F_1's were selfed. In this way we obtained lines with a relatively high level of resistance (Fig. 1).

Plants which yielded relatively resistant lines were found in: Leningradsky from the USSR, P.I. 200818 originating from Birma, Wjarnikovsky from the USSR, Rheinische Vorgebirge from Western Germany and P.I. 339241 originating from Turkey.

Differences in resistance are given in Table 1.

Table 1. Number of plants resistant to gummy stem blight in the Dutch commercial cultivar Toska, and in a number of lines selected for resistance. Per population seven plants were tested. a = number of plants with leaves affected; b = number of plants with growing points affected.

Cultivar/line	a	b
Toska (7 samples)		
sample 1	7	7
samples 2, 3 and 4	7	3
samples 5, 6 and 7	7	2
(Birma × Len.)		
line 1	2	0
lines 2, 3, 4, 5, 6, 7, 8 and 9	0	0
(Birma × Len.) × Turk.		
line 1	1	0
lines 2 and 3	0	0
(Birma × Len.) × Wjarn.		
lines 1, 3 and 4	1	0
line 2	0	0
Rhein. Vorgebirge		
lines 1 and 2	0	0
line 3	1	0

DISCUSSION

The resistance developed up to now, will be of value for practical breeding work. Obviously it can withstand very heavy infection pressures.

The next step should be to investigate the quality of resistance in a more fully grown stage of the plants and in the fruits. Hopefully, this investigation will give a consistent criterion for the value of the above mentioned resistance in practice. If so, a start can be made in studying the genetical background of the gummy stem blight resistance.

ACKNOWLEDGMENTS

We are grateful for the generous supply of many P.I. accessions from Ames, Iowa, by Dr R. Clark and for many V.I.R. accessions we received from the Vavilov Institute in Leningrad.

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