

BLACK-MOULD OF ONION BULBS GROWN IN RAJASTHAN

ARVIND K.DWIVEDI, TRIBHUWAN SINGH and DALBIR SINGH

Department of Botany, University of Rajasthan, Jaipur 302 004, India.

Out of 131 bulb samples of onion from different districts of Rajasthan, 54 carried black discolouration of *Aspergillus niger* (5-55%) on basal disc and outer scale. In incubation 44-94%, 48-90% and 38-90% infection of *A. niger* was recovered from red, purple and white skinned onions respectively. The growth and sporulation was pronounced on stemplate and in between the outer scale and I foliage leaf. The heavy colonization resulted in wet-rot of the bulb.

Keywords : *Aspergillus niger*; Bulb; Host-parasite relationship; Onion.

Introduction

Onion (*Allium cepa* L.) is a major vegetable crop used throughout India and plays an important role in the economy of the country. The crop suffers from a number of fungal diseases¹⁻³. *Aspergillus niger*, a common saprophyte, was reported from Canada⁴ causing severe bulb rot in storage. In India the bulb damage caused by *A. niger* has been reported earlier by many workers⁵⁻⁸. The present study deals with the incidence, extent of penetration and damage caused by *A. niger* in the different bulb parts.

Materials and Methods

One hundred and thirty one bulb samples of red(57), purple(57) and white(17) skinned were collected from 12 districts of Rajasthan (harvest years 1990-93) and stored under cool and dry conditions in perforated paper envelopes. Bulbs were examined with naked eyes for disease symptoms.

For isolation of *A. niger*, bulbs were cut longitudinally and one-half of each bulb was dissected to separate different parts viz. outer dry scale, foliage leaves, bladeless leaf, stemplate and roots. The different

components of untreated as well as after pretreatment with 0.5% sodium hypochlorite for 3 min were plated on moistened blotters and on PDA. Plates were incubated for 7 days under alternating light from Philips fluorescent tube-lights and dark periods of 12 hr each and examined under steriobinocular microscope.

Invasion of pathogen in bulb tissues was determined in asymptomatic and symptomatic bulbs of 3 samples of red skinned type using cleared wholemount preparations of different parts. For clearing components were separated, boiled separately in 2% aqueous solution of KOH for 5 min, washed in distilled water, stained in cotton blue and mounted in P.V.A. The slides were dried in oven at 60°C for 48 hrs.

Results and Discussion

Fifty four out of 131 bulb samples carried black discolouration caused by *Aspergillus niger* (5-55%). The infection mostly occurred on outer scale, followed by stemplate and neck region. Heavily infected bulbs were black and shrivelled and often showed internal black softrot (Fig.1). The fungus readily sporulated between the outer

scale and the first foliate leaf producing a high amount of inoculum. The incidence of bulb infection was more in red cv. i.e. 32 out of 57 samples as compared to purple (18 out of 57) and white (4 out of 17) samples (Table 1).

In incubation test 22 fungal species belonging to 15 genera were recorded. In all 7 species of *Aspergillus* were found in association with onion bulbs but *A. niger* dominated and occurred in symptomless as well as bulbs showing black-mould symptoms. Other species recorded were *A. candidus*, *A. flavus*, *A. fumigatus*, *A. ochraceous*, *A. sulphureus* and *A. wentii*. These species were mostly recorded in low percentages could not be correlated with black mould symptoms.

In symptomatic bulbs infection in stemplate, first foliate leaf and the outer scale always showed decreasing pattern. But symptomatic bulbs yielded *A. niger* mostly in stemplate, outer scale and 1st to 3rd foliage leaves. In heavily infected bulbs fungus was found to spread vertically, affected bases of inner foliage leaves and causing soft rot.

In cleared wholemount preparations hyaline to brown, septate, branched mycelium and conidiophores with conidia of *A. niger* were observed in roots (60%), stemplate (80%), outer scale (60%) and 1st foliage leaf (40%) in asymptomatic bulbs but in all the parts of symptomatic bulbs. The infection percentage and density of inoculum was maximum in roots (Fig.3), stemplate and outer scales followed by foliage (Fig.2) and bladeless leaves. The hyphae were mostly intercellular and rarely became intracellular. Mycelium was never

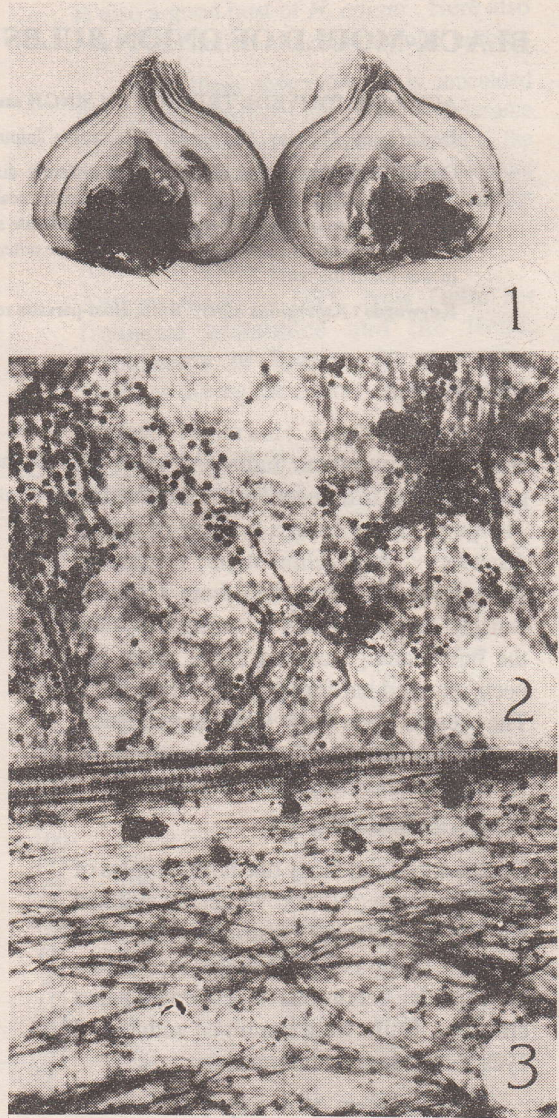


Fig. 1-3. Onion bulb infected with *A. niger* and cleared wholemount preparation.

1. Infected bulb; cut longitudinally to show infection in different parts.
- 2-3. Cleared preparation of infected bulb parts. Note mycelium and conidia in IVth foliage leaf and roots. X 300, X 150 respectively.

Table 1. District-wise number of samples, occurrence and incidence of black discolouration and percent range of *Aspergillus niger* in the three cultivars of onion bulbs in blotter test.

Districts	No. of samples			Black discolouration			%of <i>A.niger</i> in untreated (UT) and pretreated (PT) blotter test.					
	Red	Purple	White	Red	Purple	White	Red		Purple		White	
							UT	PT	UT	PT	UT	PT
AJMER	8	8	3	4(15-20)	2(10,15)	1(25)	48-90	32-58	44-90	22-70	62-84	46-72
ALWAR	2	3	2	2(15,30)	1(5)	-	50-80	28-50	60-76	36-50	72,86	32-38
BHILWARA	5	5	-	5(10-30)	4(15-25)	-	38-82	28-70	70-94	20-48	-	-
CHITTORGARH	6	8	-	6(15-50)	4(10-45)	-	34-94	34-48	80-96	22-76	-	-
JAIPUR	14	14	9	5(10-55)	3(10-20)	2(5,15)	58-92	24-76	58-94	28-88	68-90	38-76
JHALAWAR	2	2	2	1(15)	1(10)	1(5)	52-96	20-64	80-88	20-26	48,52	12-16
JHUNJHUNU	4	5	-	2(10,15)	-	-	68-88	24-30	60-68	22-30	-	-
KOTA	2	2	1	2(10,15)	1(5)	-	62,62	20,24	60-76	18-24	70	20
NAGAUR	2	-	-	1(10)	-	-	68,90	48-80	-	-	-	-
SAWAIMADHOPUR	3	2	-	1(20)	1(15)	-	82-90	18-22	78-86	18-20	-	-
TONK	11	4	-	2(10,25)	1(15)	-	68-84	12-24	72-94	14-40	-	-
UDAIPUR	2	-	-	1(15)	-	-	80-86	30-34	-	-	-	-

seen in vascular elements of any parts. Heavy fungal infection caused necrosis of cells of foliage leaves (Fig.2) and stemplate. Such bulbs when cut longitudinally revealed heavy growth and sporulation of the fungus which caused rotting of disc, foliage and bladeless leaf (Fig.1).

Black discolouration of onion bulb was reported earlier by Machacek⁴. Link and Walker⁹ reported that the outer scales of colour onions contains protocatechuic acid and catechol known to be disease resistant. Hatfield *et al*¹⁰ while studying the white, red, yellow and brown onion varieties with mild and strong pungent types found that coloured varieties showed higher incidence of black discolouration. In the present study, *Aspergillus* spp. also dominated with high incidence of *A. niger* in red onions. It may also be mentioned that in bulbs with intact outer dry scale, the amount of *A. niger* inoculum was more and often profuse between inner dry scale and the first foliage leaf and between the first and second foliage leaves. Other sites of infection are around the stemplate and neck. Very heavy infection in and around the stemplate caused wet rot of central scales of the bulbs. Ordinarily the invasion and spread of *A. niger* as well as its

sporulation and damage to host tissues showed gradual decrease from outside to inside. Handling of bulbs after harvest and storage conditions may prove vital in restricting losses caused by these fungi.

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