CHICKPEA BLIGHT IN IRAN

MYCOSPHAERELLA RABIEI Kovacevski = *ASCOCHYTA RABIEI* [Pass.] Labrousse

by

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The chickpea blight caused by *Ascochyta rabiei* is restricted to *chickpeas (Cicer arietinum* L.) only. It was observed for the first time in 1957 in Iran in Ghazvin area. Now it is prevalent in most provinces of the country wherever chickpeas are grown. A summary outline on this disease was already given by ***Zalpoor*** in 1963 (12).

DAMAGE

Chickpeas are cultivated on about 40000 hectars of land in the country. The losses due to blight are particulary severe in the north and the north-western parts of Iran, i. e. Caspian sea areas and some parts of Azarbayejan (see fig. 1, distribution map). When climatical conditions are favourable for blight development, the whole crop is destroyed at times. The damage averages annually at least 15% of the total chickpea crop in Iran, and amounts to $ 1.2 Mill. loss.

SYMPTOMS

A. rabiei attacks all above ground parts of the plant. The roots are not affected. Dark brown necrotic spots are produced on the affected organs. On the stem the spots are elongated if the fungus infects in early stage of the growth of the plant. In this case the lesions are about 2–3 cm long and generally encircle the stem, especially when they occur near to the ground. The parts of the stem above the lesions in such cases usually collapse and ultimately dry up (fig. 2 e). If environmental conditions are favourable numerous lesions will be produced along the main stem and branches (fig. 2 a). On the leaflets and pods the spots are circular and are about 5–6 mm in diametre (fig. 2 b, c, d). Numerous black pycnidia of *A. rabiei* are formed on the spots.

HISTORY

Investigations on gram blight first were undertaken in 1929 in India and Pakistan. Besides ***Jones*** (1927) in the USA and ***Mohindra*** (1931) ***Butler***, ***Sydow***, ***Trotter***, ***Sprague*** and ***Labrousse*** gave some contributions for the systematic and nomenclature of the causal fungus (cited by ***Kausar***, 5). Investigations about the control of gram blight in Punjab were published by ***Luthra***, ***Sattar*** & ***Bedi*** (7,8). From this literature it appears that in Pakistan, where

blight is the most important disease of chickpeas, the growing of resistant varieties would be the most effective control method.

SOME INVESTIGATIONS ON THE BIOLOGY OF *A. RABIEI*

1. ***Cultural media***: A comparative trial was conducted to find the best media for culturing *A. rabiei*. Eight media were used: malt agar, Czapek solution agar, P. D. A., oatmeal agar (Difco), carrot agar, sterilized pieces of carrot and potatoes.

Among those media tested oatmeal agar and carrot pieces were found to be the best. On oatmeal agar *A. rabiei* grows well and forms many pycnidia. Pycnidia on carrot pieces are very conspicuous.

2. ***Macroscopic characters of A. rabiei on P. D. A.***: Colonies at first are white and gradually they become dark grey. The margin of the colony is defined and the hyphae in this part are compact and velvety. At 20 – 25° C pycnidia are formed at the centre of the colony in concentric circles in about 5-7 days.

3. ***Pycnospores***: Pycnospores from P. D. A. are hyalin, ovoid to oblong, 5.5 – 6.4 × 9.0 – 15.0 μ (average 5.7 × 10.8 μ). Some show a constriction in the middle. Only a few of the spores are septate and two celled. In each preparation from natural specimens we usually have not observed more than 1 or 2 of such septate spores.

4. ***Germination of pycnospores on different media***: The germination of pycnospores on different media was tested by the hanging drop method at 25° C. The results are given in table 1.

Table 1. Germination of pycnospores on different media at 25° C

Media	% of germination after 45 hours	average speed of germination (hours)
Malt-agar (Difco)	100	9.5
Chickpea juice (1:2 diluted)	100	5.1
Czapek agar (Difco)	100	23.3
Distilled water	77	25.0

Pycnospores of *A. rabiei* usually germinate from one end. Only septate spores germinate from both ends. Among the tested media malt agar and diluted chickpea juice gave the highest and the most accelerated germination. In distilled water percentage and speed of germination was decreased.

5. ***Isolation of A. rabiei from infected chickpea seed:*** Five pods, each bearing 1–2 spots were selected and their seed taken out. After surface sterilization (mercury chloride 0.1 %, 1 minute) the seeds were carefully washed and put on malt agar. After 5–7 days *A. rabiei* appeared and later pycnidia were also formed.

6. ***Perpetuation and occurence of the disease:*** According to *Luthra, Sattar & Bedi* (7) the disease is carried over from year to year by: a) sowing infected seeds, and b) debris of diseased chickpea plants which remain on the soil of

infested fields or on threshing floors.

As we have observed infected lands with debris of infected plants are the most important source for the starting and perpetuation of chickpea blight. High humidity (irrigation water, rain) are also important for the occurence of the disease.

7. Incubation period: Chickpea plants were inoculated in the greenhouse at 20° C (range 10-30°) and 50 % relative humidity (range 35-80 %) with suspensions of pycnospores. According to the age of the plants the first symptoms broke out:

on 13 days old plants after 5 days
on 80 days old plants after 8 days

CONTROL MEASURE EXPERIMENTS

1. Effect of seed dressings on the germination of chickpea seed: Chickpea seed was treated with the following fungicides and concentrations:

Ceresan dry (1g, 2g, and 3g per kg seed)
Ceresan wet (0. 1 %, 0. 2 %, 0. 3 %; in 1/2 hour)
Arasan (4g, 5g, 6g per kg seed)
Orthocide 75 % w.p. (2g, 3g, 4g per kg seed)
Rhizoctol-Combi (3g, 4g, 5g per kg seed)

The treated seed was sown in wooden boxes filled with soil from the field and put in the greenhouse. Germination was counted every 5 days up to 25 days (for results, see table 2 in persian text).

Compared with the untreated (check) none of the tested fungicides, even in the highest concentration, had any significant effect to the percentage or speed of germinaton. As it was observed, mercury compounds brought some deformations in the chickpea seedlings, such as nanism and thickening of the stem. For this reason they are not recommended as seed dressings on chickpea. The other fungicides were free of such phytotoxic secondary effects.

2. Fungicide spray trials in greenhouse: Chickpea plants in pots were sprayed with different fungicides (3 replications). After 20 hours each pot was inoculated by putting 40 droplets of a pycnospore suspension on the stems and branches at the angles of the petioles of leaves (fig. 3). The plants were then held in a greenhouse. After 24 days the lesions on the plants were counted. The results are shown in table 3.

Table 3. Effect of fungicides on *A. rabiei* in greenhouse trial

Fungicides	% of inoculation droplets which produced lesions (average from 3 replications)
Check	92.5 % (= 37 lesions)
Copper-Lonacol 0. 3 %	17.3
Lonacol (Zineb) 0. 3 %	15.6
Orthocide 50 0. 3 %	14.5
Copper-A-Compound 0. 3 %	9.1
Elosal (Sulfur) 0. 3 %	6.0

L.S.D. = 15.5

The difference between check and treatment is significant at 0,01 % level. Differences between the fungicides are not significant.

Some preliminary trials with Copper–A–Compound and Copper–Lonacol showed that these two products have a high phytotoxicity to chickpea plants if they are used with higher concentrations than 0.3 %.

Fungicide spray trials were also carried on in the field, but there was no any clear result up to this time.

SEARCH FOR RESISTANT VARIETIES

1. Local types: 17 collections of chickpea from different provinces of Iran were grown in a greenhouse in Teheran–Evin. Plants were inoculated by a spore suspension. All the local types used were found to be susceptible and severely damaged by the disease, except two black gram types which showed some resistance.

2. Foreign types: In 1963 we got 13 types of chickpea from foreign countries (India, Pakistan, and F.A.O.) and their resistance to *A. rabiei* was tested in a greenhouse by artificial inoculation. Among them, eight types showed marked resistance. Attention was concentrated on these types which were indicated as 13.679, C.612, C.727, F.8, C.84, C.235, C.12/34, and 5/1 A. In 1964 these eight types were also tested for resistance in the field at Gorgan. Experiments were conducted in a highly infected field, using randomized blocks and 5 replications, each block being 35 m². Gorgan type (G) which was highly susceptible to *A. rabiei* was used as a check. No artificial inoculations were made. Forty days after sowing, the disease appeared for the first time. Ten days later the diseased and dead plants were counted. 20 days after this first recording, the lesions on each chickpea type were counted.

The results of the first and second counting are given in table 4.

Table 4. Resistance of chickpea types to *A. rabiei* in a field trial

Types of chickpeas	infection means of 5 replications		average grain yield of 5 replications (g)
	(% of diseased plants) 1st record	(lesions) 2nd record	
13.679	1.6	31.2	1195
F.8	1.9	18.6	857
C.235	4.4	54.5	1244
5/1A	4.7	52.6	1114
C.84	7.7	*	*
C.12/34	8.4	37.2	979
C.727	9.1	59.8	1001
C.612	13.5	109.1	695
G = Check	57.7	372.9	845

L.S.D. 1st record = 14.0
2nd record = 84.3

* Because of some unknown factor the plants of the C.84 type were gradually dying. For this reason it was eliminated from the second record as well as from further trials.

Statistical analysis:

a) The differences between foreign types and Gorgan (check) are significant at 0.01 level.

b) The type F.8 is more resistant than C. 612.

c) The type C.612 is less resistant than all other types.

During the years 1965 and 1966 experiments were repeated in the same infested field in Gorgan, using only the following six types:

13.678, C. 12/34, C. 727, C. 235, F.8, 5/1 A. Results were similar to that of 1964.

CONCLUSION

1. Up to this time, 13.679 type which was similar in qualities to Iranian local chickpeas was considered most suitable for propagation as a resistant variety to the blight and for a substitution for the local seed (fig. 4, lower).

2. Type F. 8 is highly resistant to *A. rabiei*, but is not similar to Iranian local types. Its colour is light brown and its size is smaller than that of local Iranian seeds.

CHARACTERISTIC OF RESISTANT TYPES

13.679: Plant tall, foliage dark green, flower white, grains cream of large size and with smooth surface. Highly resistant to blight.

F. 8 : Foliage green, leaflets smaller than those of 13.679, flower pink, grains light brown with rough surface. Highly resistant to blight, but susceptible to wilt (5).

C. 235: Foliage green, grains brown with rough surface. Highly resistant to blight.

5/1 A: Grains brown, larger than C. 235, flower pink. Highly resistant to blight.

C.12/34: Foliage dark green, flower pink, grain of small size, brownish yellow. Resistant to blight.

C. 727: Foliage dark green in colour, grains brownish cream, and of medium size. Resistance to blight medium and less than that of the first three types. (fig. 4, lower).

LITERATURE CITED

1. ANONYM : Anthracnose of the chickpea. Rev. Path. Vég. et Ent. Agric. *XVII*
2. CMI : Distribution maps of plant diseases. No. 151, 1948
3. *Abdol-Aziz, Ch. M.* (Cereal Botanist, Lyallpur) : Personal letter.
4. *Hafiz, A.* (Regional Cons. F. A. O., Near east wheat and barley improv. project): Personal letter 16.8. 1964.
5. *Kausar, A. G.* : Fifty years of investigations on plant diseases at agric. college and research inst. Lyallpur. Departm. Agric., West Pakistan, 1960
6. *Kovacevski, I. C.* : (The blight of chickpea, *Mycosphaerella rabiei* n. sp.). Issued by Min. Agric. Nat. Domains, Sofia, 80 pp. 1935.

7. ***Luthra, I.C., Sattar, A. & Bedi K. S.*** : Life history of gram blight (***Ascochyta rabiei*** [Pass.] Lab. = ***Phyllosticta rabiei*** [Pass] Trot.) on gram (***Cicer arietinum*** L.) and its control in Punjab. Agric. live-Stk India, V (5), pp. 489–498, 1935.

8. ***Luthra, I. C., Sattar, A. & Bedi, K.S.*** : Further studies on control of gram blight. Indian farming IV. 1943.

9. ***Sattar, A.*** : On the occurence, perpetuation and control of gram ***(Cicer arietinum)*** blight caused by ***Ascochyta rabiei*** (Pass.), with special reference to Indian conditions. Ann. appl. biol. XX (4), 612–632, 1933.

10. ***Sattar, A.*** : A comparative study of the fungi associated with diseases of certain cultivated leguminous plants. Trans. Brit. Mycol. Soc. XVIII (4), 276-301, 1934.

11. ***Sprague, R.*** : Notes on ***Phyllosticta rabiei*** on chickpea. Issued by Departm. of Bot. and Plant Path., Oregon State Agric. Coll, Cornvallis, Oregon.

12. ***Zalpoor, N.*** : ***Mycosphaerella rabiei*** Kovacevski=***Ascochyta rabiei*** (Pass.) Lab. Ent. Phytopath. appl., Teheran, No. 21, p. 4, 1963.