EVALUATION OF PEANUT GENOTYPES RESISTANCE TO LEAF SPOT (Cercospora personatum) AND RUST DISEASE (Puccinia arachidis)

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Abstract

The study was conducted in the greenhouse of Malang Research Institute for Legumes and Tuber Crops, July - October 2013. Twenty peanut genotypes were tested, each genotype were planted in five plastic pots (Φ = 30cm), 2 peanut seeds/pot. Inoculation of rust spore suspension (density of 20,000 spores / ml) at 3 weeks after planting by spraying it to the leaves of peanut. Rust disease observation was done by given a value to the leaves that covered leaf spot or rust disease and refers to Subramamyam (1995). Out of 17 peanut genotypes tested, one genotype was resistant (R) , 8 genotypes were moderately resistant (MR), 8 genotypes were moderately susceptible (MS) against leaf spot disease. Moreover three genotypes were resistant (R), three genotypes were moderately resistant (MR) , 10 genotypes were moderately susceptible (MS) , and one genotype was susceptible (S) against rust diseases.

Keywords: peanut, leaf spot and rust disease, resistance.

1. Introductions

Peanut or groundnut is one of important food crop, as a source of protein and botanical oil, it can be made snack, seasoning, fried oil, and the other food, the waste of peanut crop for cattle food, therefore peanut production should be increased. Leaf spot and rust disease are one of the constrain in peanut production, caused of it widely spread and yield losses. Leaf spot and rust disease were widely spread in the centre of peanut production area in Jawa, Sumatera, Kalimantan, Sulawesi, Bali, and Lombok islands. Yield losses of local varieties can be reach up to 50% [3], besides it can be reach 12 – 22% in national varieties [2]. One of the control measured was planting resistant varieties, this measured was friendly to the environment.

Rust disease is second important disease in peanuts after leaf spot, caused by the fungus *Puccinia arachidis*, belong to the order Uredinales, class Basidiomycetes. Symptoms generally found on the lower leaf surface in the form of brown pustules like iron rust. If there are a number of pustules ruptured uredospora that resembles flour comes out. Factors that influence the rust diseases are: temperature, humidity, wind speed, and precipitation.

Group life cycle of fungi causing rust disease (*Puccinia*) can take two kinds of asexual and sexual. As asexually uredospora will germinate and form uredospora again, while the uredium sexually turned into telium, then form the basidium, basidium form spermogonium (gametes +) and hyphae recesif (gametes -), from the cross formed aesium, aesium will turn into uredium.

Peanut leaf spot caused by *Cercospora arachidis* and *Cercosporidium personatum* were the major disease. It was widesprayed in the peanut production countries, included Indonesia. Yieldloss was arround 50% in local varieties and 12 – 22% in improved varieties. Spot symthoms was occured in the leaves, small spot in the beginning, brown, and it's developed wider. The spot of *C. arachidis* was brownish, surrounded by yellow arroud the spot and the spot of *C. personatum* was dark brown almost black.

Leaf spot disease of peanut well developed when 95% relative humidity and temperature was range 12 – 33 ° C. The control measured of leaf spot can be achived by several ways, and the simple way is planted resistant varieties, such as Panter atau Domba

Planting resistant variety was the best way to control leaf spot and rust disease, this methods was cheaper, easy to apply, and was not make a pollution than chemical one. Planting the resistant variety means decrease the amount of early inoculums source [9]. The aim of the research was founding the resistant genotypes to leaf spot and rust diseases.

2. Material and Methods

Experiment was conducted at the green house of Indonesian Legumes and Tuber Crops (ILETRI), in July – September 2013. Number of genotypes to be tested were 17 genotypes, with 3 check varieties. Peanut seeds were grown in plastic pots that was already contained 5 kg of soil approximately, two seeds per pot, and 5 pots per genotypes. Artificial inoculation of rust disease was done by spraying spore suspension (10^4 spores/ml) to the leaves, when the plant were 3 weeks after planting. Three drops of Tween 20 were added to spores suspension by mean suspension homogenous. Besides leaf spot was naturally inoculation. Observation of rust disease and leaf spot intensity were refered to Subramamyam[7] method as followed:

No	Leaf spot or rust disease intensity (%)	Resistance categories
1.	1 - 10	R
2.	11-20	MR
3.	21 – 40	MS
4.	>40	S

Table 1 Leaf spot intensity and their description

No	Leaf spot intensity (%)	Description
1.	0	No disease
2.	1 – 5	Lesion present largely on lower leaves, no defoliation
3.	6 – 10	Lesion present largely on lower leaves, no defoliation, defoliation of some leaflets evident on lower leaves
4.	11 – 20	Lesion on lower and middle leaves but severe on lower leaves, defoliation of some leaflets evident on lower leaves
5.	21 – 30	Lesion present on all lower leaves and middle leaves, over 50% defoliation of lower leaves
6.	31 – 40	Severe lesion on lower middle leaves, lesions present but less severe on top leaves, extensive defoliation of lower leaves, defoliation of some leaflets evident on middle leaves.
7.	41 – 60	Lesion on all leaves but less severe on top leaves, defoliation of all lower and some middle leaves
8.	61 – 80	Defoliation of all lower and some middle leaves, severe lesion on top leaves, some defoliation of top leaves evident
9.	81 – 100	Almost all leaves defoliated, leaving bare stems, some leaflets may remain, but show severe leaf spots

Table 2. Rust disease intensity and their description

No	Rust disease intensity (%)	Description
1.	0	No disease
2.	1 – 5	Pustules sparsely distributed, largely on lower leaves
3.	6 – 10	Many pustules on lower leaves, necrosis evident; very few pustules on middle leaves
4.	11 – 20	Numerous pustules on lower and middle leaves; severe necrosis on lower leaves
5.	21 – 30	Severe necrosis of lower and middle leaves; pustules may be present on top leaves , but less severe
6.	31 – 40	Extensive damage to lower leaves; middle leaves necrotic, with dense distribution of pustules; pustules on top leaves
7.	41 – 60	Severe damage to lower and middle leaves; pustules densely distributed on top leaves
8.	61 – 80	100% damage to lower and middle leaves; pustules on top leaves, which are severely necrotic
9.	81 – 100	Almost all leaves withered; bare stems seen

Table 3. Leaf spot intensity and resistant categories

No	Name of Genotype	Leaf Spot Disease Intensity at			Resistance Categories
		8 wap	9 wap	10 wap	
1.	Mhs/91278-99-c-180-13-5	4.00	11.67	15.00	MR
2.	**G/92088/92088-02-B-2-9**	**5.00**	**5.00**	**10.00**	**R**
3.	G/92088/92088-02-B-2-8-1	10.00	15.00	18.33	MR
4.	G/92088/92088-02-B-2-8-2	16.67	16.67	20.00	MR
5.	J/J 11-99-D-6210	15.00	23.33	25.00	MS
6.	P 9801-25-2	13.33	16.67	16.67	MR
7.	G/92088/92088-02-B-8	20.00	23.33	23.33	MS
8.	Mhs/91278-99-c-180-13-5	15.00	23.33	25.00	MS
9.	J 91283-99-C-192-17	13.33	20.00	30.00	MS
10.	Mhs/91278-99-c-180-13-5	21.67	31.67	31.67	MS
11.	M/92088-02-B-1-2	21.67	23.33	23.33	MS
12.	MLG 7720	11.67	16.67	21.67	MS
13.	MLG7638	10.00	11.67	13.33	MR
14.	GH 02/G-2000-B-653-54-28	11.67	18.33	26.67	MS
15.	IC87123/86680-93-B-75-55-1	3.00	6.67	11.67	MR
16.	IC87123/86680-93-B-75-55-2	6.67	8.33	11.67	MR
17.	MLGA 0306	6.67	8.33	13.33	MR
18	Jerapah (check-1)	11.67	13.33	16.67	MR
19.	Unila 2 (check-2)	11.67	11.67	20.00	MR
20.	Talam-1 (check-3)	10.00	15.00	23.33	MS

Wap = week after planting, R = resistance, MR= Moderate resistance, MS = Moderate susceptible, S = susceptible

3. Result and Discussion

The performance of disease can be expressed by disease intensity. Leaf spot intensity among genotypes were vary 4 - 22%, 5 - 23%, and 10 – 32% in 8, 9, and 10 week after planting respectively (Table 3), besides rust disease intensity were 0 – 30%, 0 – 37%, and 0 – 50% in 8, 9, and 10 week after planting respectively (Table 4)

According to description book that published by ILETRI, said that Panter and Domba varities were resistance to leaf spots and rust. Bison, Jerapah, Kelinci, and Badak moderately resistance to leaf spots, and Pelanduk only was susceptible to leaf spots disease [1]

In 2012, at the greenhouse of ILETRI, screening of the germplasm collection to rust disease have been found that out of 115 genotypes tested, 16 genotype was resistant, 13 genotypes were moderately resistant, 29 genotypes were moderately susceptible, and 57 genotypes were susceptible to rust disease. Besides, in 2013 at Jambegede research station there were 120 genotypes tested, and that found one genotype was resistant, namely: A MLG 0099, there was not any moderately resistant, 59 genotypes were moderately susceptible, and 60 genotypes were susceptible to rust disease [4]. Plant resistance to disease can occur in structural,or biochemical, or both. Susceptible varieties have stomata density more than

Table 4. Rust disease intensity and resistance categories

No	Name of Genotype	Rust disease intensity at			Resistance categories
		8 wap	9 wap	10 wap	
1.	Mhs/91278-99-c-180-13-5	26.67	31.67	35.00	MS
2.	**G/92088/92088-02-B-2-9**	**0.00**	**0.00**	**0.00**	**R**
3.	**G/92088/92088-02-B-2-8-1**	**0.00**	**0.00**	**0.00**	**R**
4.	**G/92088/92088-02-B-2-8-2**	**0.00**	**0.00**	**1.67**	**R**
5.	J/J 11-99-D-6210	26.67	30.00	33.33	MS
6.	P 9801-25-2	5.00	8.33	13.33	MR
7.	G/92088/92088-02-B-8	18.33	23.33	35.00	MS
8.	Mhs/91278-99-c-180-13-5	9.00	14.00	16.67	MR
9.	J 91283-99-C-192-17	5.67	11.67	20.00	MR
10.	Mhs/91278-99-c-180-13-5	18.33	25.00	30.00	MS
11	M/92088-02-B-1-2	18.33	20.00	26.67	MS
12.	MLG 7720	18.33	21.67	25.00	MS
13.	MLG7638	23.33	23.33	25.00	MS
14.	GH 02/G-2000-B-653-54-28	30.00	36.67	50.00	S
15.	IC87123/86680-93-B-75-55-1	10.00	20.00	30.00	MS
16.	IC87123/86680-93-B-75-55-2	13.33	16.67	25.00	MS
17.	MLGA 0306	5.67	8.33	21.67	MS
18.	Jerapah (check-1)	7.33	11.67	15.00	MR
19.	Unila 2 (check-2)	13.33	21.67	31.67	MS
20.	Talam-1 (check-3)	21.67	25.00	31.67	MS

Wap = week after planting, R = resistance, MR= Moderate resistance,
MS = Moderate susceptible, S = susceptible

1330 piece/mm^2, according to Yulianti [8], at 11 weeks after sowing peanut has stomatal density about 1280-1330 pieces / mm2 whereas the tolerant were 1550-1670 pieces / mm2. Sommartya and Patcharee [6] says that the leaves of the susceptible peanut (Tainan 9) has a number of stomata (open wider) more resistant than peanut leaves. In addition, the resistant varieties has the number of trichoma lower than in susceptible one. Peanut plant resistance to rust disease is complementary, as described genetically inheritance encoded pattern with 9 : 7, which is controlled by a recessive gene copies [5].

4. Conclusions

Out of 17 peanuts genotypes tested, one genotype was resistant (R) , 8 genotypes were moderately resistant (MR), 8 genotypes were moderately susceptible (MS) against leaf spot disease. Moreover three genotypes were resistant (R), three genotypes were moderately resistant (MR) , 10 genotypes were moderately susceptible (MS), and one genotype was susceptible (S) against rust diseases.

Acknowledgements

Author would like to say thank a lot to Mrs. Ir. Trustinah MSc., that had already given me some seeds of peanut for conducted research

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