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Short Communication: Peanut introduced germplasm response against *Ralstonia* bacterial wilt disease

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Abstract. *Nugrahaeni N, Rahayu M. 2017. Short Communication: Peanut introduced germplasm response against Ralstonia bacterial wilt disease. Nusantara Bioscience 9: 138-140.* Peanut germplasm introduction is a means to increase genetic variability within the germplasm collection. However, its utilization is frequently hampered by its susceptibility to bacterial wilt disease, the main disease in peanut cultivation in Indonesia. The aim of the present study was to assess peanut introduced germplasm response against *Ralstonia* bacterial wilt disease. One hundred and fifty peanuts introduced germplasm were planted on the bacterial wilt endemic area in Pati, Central Java, Indonesia. Pre-planted isolation revealed that the bacterial population in the soil was considered high, i.e. 2.6×10^6 cfu.g^{-1}. The trial was laid out in RCBD, replicated two times. Each accession was planted in two rows of 4-m length with 40 cm x 10 cm plant spacing. The crop received a basal dose of Phonska at 300 kg.ha^{-1} and SP36 at 100 kg. ha^{-1}. Observations were made on bacterial wilt disease incidence and agronomic traits. Research result showed that the introduced germplasm was highly variable in their responses to the wilt disease with wilt incidence ranging from 0% to 100%. Twenty-three accessions, out of 150, were resistant to the disease. Those resistant accessions showed good agronomic characters and gave dry pod yield in the range of 1.56-4.5 t.ha^{-1}. This results indicated that introduced germplasm could be used in increasing variability of bacterial wilt resistant gene source as well as in increasing yield potential in developing new peanut improved cultivars.

Keywords: *Arachis hypogaea* L, introduced, germplasm, bacterial wilt

INTRODUCTION

Availability of genetic resources as genes source or character variability is essential for plant breeding program. Therefore germplasm collection profile which describing diversity of morphological and agronomic characteristics and resistance to biotic and abiotic stresses is a valuable information for their utilization in the breeding program.

Indonesian Legumes and Tuber Crops Research Institute (Iletri) is currently conserved 554 accessions peanut germplasm. Peanut germplasm is also conserved at the Center for Biotechnology and Genetic Resources (BB-Biogen) with 1,194 accession numbers (Sumarno 2007). The peanut collection number is considered small compared to peanut collection maintain in China with 6,839 accessions (Jiang et al. 2012), as well as those that maintain at the International Crop Research Institute for Semi-Arid Tropic (ICRISAT). ICRISAT, an international agency for semi-arid crops including peanut, maintains 15,446 accessions (ICRISAT 2014). The collection consists of 14,968 cultivated varieties and 478 wild varieties from 92 countries.

The peanut germplasm collection contains of local cultivars, breeding lines, and introduced cultivars. All of the local accessions susceptible to leaf diseases (Trustinah 2009), small to medium seed size, Spanish type, low pod yield. On the other hand, peanut breeding goals need genetic sources for large seed size, resistant to leaf diseases, high pod yield, and Valencia pod characteristics which are mostly found within introduced accessions. However, utilization of those introduced accessions is frequently hampered by its susceptibility to bacterial wilt disease. *Ralstonia* wilt disease is an important biotic constraint on peanut production in Indonesia, and its resistance is a prerequisite for releasing new peanut varieties in Indonesia. Resistance to bacterial wilt is a key for peanut improved varieties adoption or planting since most of peanut growing area in Indonesia is already infected by the bacteria. The disease causes yield loss through a lower number of harvested plants and lower seed quality in case of the plant can survive until harvest. Yield losses due to bacterial wilt disease range between 15-35% on resistant varieties, and as high as 60-100% in susceptible varieties grown on high infestation fields (Machmud and Hayward 1992; Nugrahaeni et al. 1998). Besides, influenced by varieties planted, the yield loss level was also influenced by local climate, soil type, cultivation techniques, and *R. solanacearum* virulence (Elphinstones 2005). Tropical environment such as in Indonesia is an optimal environment for the bacterial wilt development (Hayward 1994). It means that the disease will remain to be the problem in growing peanut in Indonesia.

A total of 306 out of 554 ILETRI germplasm accessions came from the introduction, including from India, Nepal, Thailand, Philippines, Australia, and USA. Introduced cultivars play an important role in peanut breeding in

Indonesia, 30 of the 42 varieties released in Indonesia is the adaptation of introduced varieties or offspring of crosses using introduced varieties as one of the parents. Peanut breeding goals are changing and improving, both in increasing productivity and other characters. Introduced cultivars are frequently used as source genes for increasing yield potential, resistance to leaf diseases, *Aspergillus flavus*, drought, and seed quality improvement program, i.e. characters of peanuts breeding goals in Indonesia. Considering the important status of bacterial wilt disease on peanut cultivation in Indonesia, utilization of introduced cultivars in peanut breeding program needs to be accompanied by information for resistance to *Ralstonia* bacterial wilt disease. This study aimed to evaluate the resistance of 150 peanuts introduced accessions to bacterial wilt disease.

MATERIALS AND METHODS

Evaluation of peanut introduced germplasm against *Ralstonia* bacterial wilt was conducted in bacterial wilt endemic area in Pati regency, Central Java, during the dry season (DS) 2013. Soil samples were taken and then it was cultured on potato dextrose agar medium (PDA) contains *Triphenyltetrazolium Chloride* (TZC) to quantify bacterial population. A total of 150 peanuts introduced germplasm accessions, mainly from ICRISAT genebank, including resistant check cultivar Gajah (MLGA 0001) and a susceptible check MLGA 0336 were evaluated. The trial was laid out in RCBD, replicated two times. Each accession was planted in two rows of 4-m length with 40 cm x 10 cm plant spacing. The crop received a basal dose of Phonska at 300 kg. ha^{-1} and SP36 at 100 kg. ha^{-1}. Observations were made on bacterial wilt disease incidence and agronomic characters. Total plants of each plot were counted and recorded at the seedling stage and at harvest. Observation of plants showing bacterial wilt symptoms was recorded weekly, since one week through 10 days to harvest time. Wilt disease incidence was calculated as a percentage of healthy plants to total plants and was used in classifying resistance degree. Resistance classifications followed Machmud and Rais (1994), i.e. 0-15% wilted plants belong to resistant category, >15-25% wilted plants as moderately resistant, >25-35% as moderately susceptible, and >35% wilted plants belong to a susceptible category.

RESULTS AND DISCUSSION

Results

Pre-planting bacterial population measured on soil in the trial location (Tayu-Pati, Central Java) was 2.6×10^6 cfu/g. Under the condition, there was a diversity of resistance responses among the 150 accessions under study. Wilt incidence among those accessions was in the range of 0-100%. MLGA 0336, the susceptible check, is including in the accessions with 100% wilt incidence. The resistant check cultivars were belonged to moderately resistant (MLGA 001) with 16% disease incidence.

First bacterial wilt symptoms occurred in 10 days, and it was observed on 108 accessions. The wilt symptoms were continued until harvesting stage for susceptible accessions, otherwise, the symptoms were stopped at about flowering stage in resistant accessions. Under such conditions, most of the accessions (79 accessions) were belong to susceptible category, 24 accessions were classified to moderately susceptible, 24 accessions were moderately resistant, and 23 accessions were resistant. The 23 resistant accessions had wilt incidence ranged from 0 to 14.8% (Table 1).

Discussion

Conducting resistance field screening requires information on disease incidence history in the respective field. Data on the existence of the bacteria in the soil is useful for preventing misclassification due to plant escape phenomenon. Bacterial population in the test location, i.e. 2.6×10^6 $cfu.g^{-1}$, was considered high. The high bacterial wilt population in the test site and the differentiation accessions' responses strongly supports the field screening results.

The resistant level of the resistant accessions was higher than the resistant level of the check variety Gajah (MLGA 001) with wilt incidence 16% (Table 1). Gajah is an old peanut variety which was released in 1950 and is still grown by farmers due to its high resistance to the wilt disease. Highest resistance found in MLGA 0292 accessions

Table 1. Agronomics traits and *Ralstonia* wilt disease incidence of 23 resistant introduced germplasm accessions evaluated in endemic area of Pati, Central of Java

Accessions no.	Plant height (cm)	Branch no./plant	Full pods/plant	Dry pod yield ($t.ha^{-1}$)	Wilt incidence (%)
MLGA 0292	57.6	3	16	2.66	0.0
MLGA 0115	50.8	4	22	4.22	3.6
MLGA 0413	41.8	4	18	3.44	4.4
MLGA 0373	57.2	3	13	4.06	6.7
MLGA 0382	48.0	4	18	2.89	8.4
MLGA 0343	48.6	4	19	3.28	8.5
MLGA 0244	62.4	3	14	3.20	10.3
MLGA 0404	44.3	5	33	2.97	10.4
MLGA 0406	51.4	4	18	4.22	10.4
MLGA 0333	52.6	4	27	1.72	10.6
MLGA 0250	63.9	4	18	3.44	10.7
MLGA 0370	48.7	4	15	3.59	10.8
MLGA 0414	53.2	4	21	3.75	11.9
MLGA 0438	59.4	4	19	3.75	12.7
MLGA 0400	53.5	4	23	3.52	12.8
MLGA 0345	42.7	4	20	3.67	13.0
MLGA 0540	56.9	4	18	2.34	13.1
MLGA 0325	42.1	5	37	1.56	13.6
MLGA 0417	50.8	3	16	3.52	13.9
MLGA 0363	49.4	4	25	2.89	14.1
MLGA 0550	55.1	4	20	2.03	14.5
MLGA 0418	63.8	4	14	1.76	14.5
MLGA 0422	51.3	5	37	4.69	14.8

with no wilt symptom (Table 1). MLGA 0292 accession is an exceptional introduced peanut accession. It was the only introduced germplasm which was then released as Turangga, an improved cultivar resistant to rust as well as to bacterial wilt. The resistance in Turangga is governed by digenic nuclear genes (Nugrahaeni et al. 2007).

Result obtained from this evaluation is very important for improving peanut varieties in Indonesia. In general, introduced germplasm possesses leaf diseases resistance, high productivity and good seed characteristics, but are vulnerable to bacterial wilt disease. Leaf diseases are a main disease constraint peanut cultivation not only in Indonesia but also in peanut production in India, China, and other Asian countries. The advantages of the introduced varieties can be used to improve the resistance of local varieties in Indonesia. Local peanut germplasm accessions conserved in ILETRI are all susceptible to the leaf diseases (Trustinah 2009). Utilization of resistant accessions obtained in these evaluation trial will broaden genetic basis of the resistance characteristics of bacterial wilt disease in peanuts in Indonesia. The genetic basis of resistance to bacterial wilt disease in peanut in Indonesia is still very limited. During the period 1950-2014, the Indonesian government has released 42 peanut varieties, 29 of them were described as resistant to the wilt disease. Twenty-three of those 29 resistant varieties obtained their resistance characteristics from Schwarz 21, either directly or indirectly. Schwarz 21 was the first peanut cultivar resistant to bacterial wilt disease released in Indonesia in 1925 (Nigam 2014). Evaluation germplasm material for resistance to bacterial wilt disease is an effort to increase the diversity of sources of resistance to the disease. These results support previous researched that the resistance to bacterial wilt disease can be found in peanut genotypes derived from non-wilt endemic areas (Singh et al. 1997). Agronomic traits of those 23 resistant accessions were 41.8-63.9 cm plant height, 3-5 number of branches per plant, 13-37 pods per plant, dry pods equivalent to 1.56 to 4.69 t/ha. Those agronomics traits along with bacterial wilt resistant characteristics beneficial in broadening the genetic base of the bacterial wilt resistance as well as in improving agronomic traits in peanut breeding in Indonesia.

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