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# Plasma Nutfah

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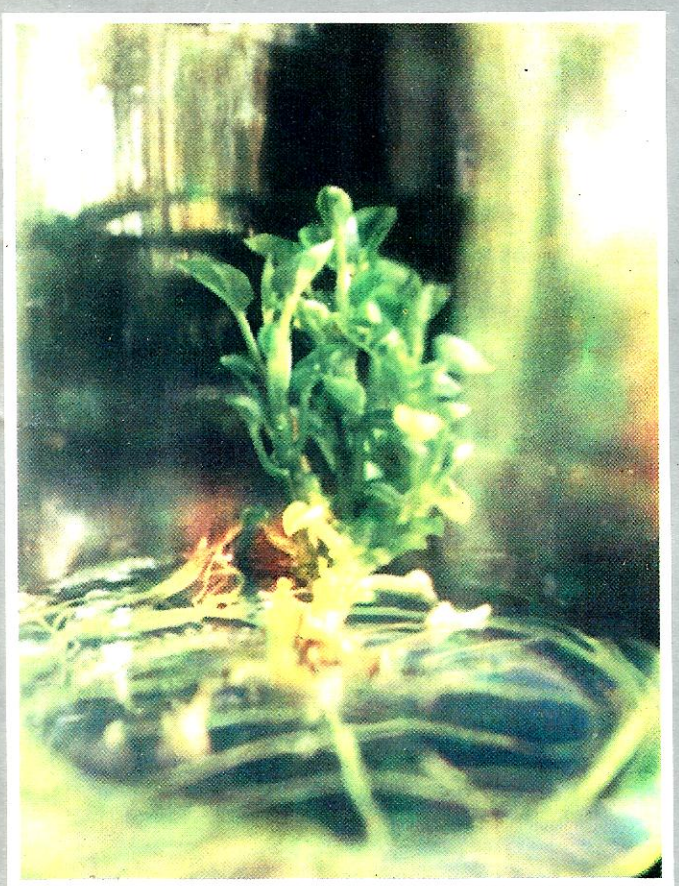

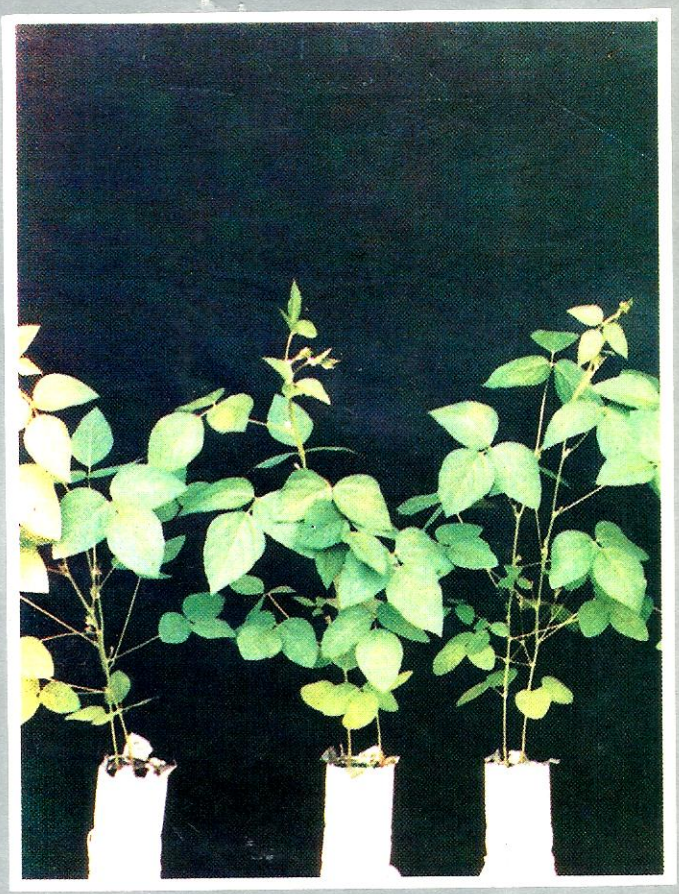

Komisi Nasional Plasma Nutfah
Badan Penelitian dan Pengembangan Pertanian

# Buletin Plasma Nutfah

Volume 5 Nomor 1 Tahun 1999





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# Buletin *Plasma Nutfah*

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## Pengantar

Buletin *Plasma Nutfah* mengalami perubahan keanggotaan redaksi sehubungan dengan restrukturisasi di tubuh Badan Litbang Pertanian. Meskipun demikian, hal ini tidak mempengaruhi frekuensi terbit Buletin. Perubahan tersebut tidak sekadar bergantinya personel, tetapi anggota redaksi yang baru diharapkan mampu lebih memperkuat keredaksian Buletin *Plasma Nutfah*.

Dalam nomor ini, Buletin *Plasma Nutfah* terbit dengan tujuh tulisan dengan topik yang beragam. Beberapa tulisan lainnya yang diterima redaksi sudah disetujui untuk diterbitkan dalam Buletin nomor berikutnya. Untuk mempertahankan kontinuitas media publikasi ini, redaksi senantiasa menunggu tulisan yang lain.

Redaksi

**Buletin *Plasma Nutfah* diterbitkan oleh Komisi Nasional Plasma Nutfah, Badan Penelitian dan Pengembangan Pertanian. Memuat hasil penelitian dan tinjauan ilmiah yang belum pernah diterbitkan tentang eksplorasi, karakterisasi, evaluasi, pemanfaatan, dan pelestarian plasma nutfah tumbuhan, hewan, dan mikroba, Buletin ini diterbitkan secara berkala, dua kali setahun.**

## Daftar Isi



**Komisi Nasional Plasma Nutfah**
**Badan Penelitian dan Pengembangan Pertanian**

# Screening on Soybean Resistant to Rust Disease*

**Yayuk Aneka Bety**

*Balai Penelitian Tanaman Kacang-kacangan dan Umbi-umbian, Malang*

## ABSTRACT

Rust disease was one of many constraints in soybean production in Indonesia. Therefore, the genes informing resistance to rust should be involved in the development of new improved varieties of soybean. The source of genes for rust resistance could be derived from lines, cultivars or varieties of germplasm collection. The experiment was aimed to get some soybean lines resistant to rust disease. As primary evaluation 150 early maturity and 150 late maturity genotypes taken from germplasm collection were evaluated in the field at Genteng, Banyuwangi and Jambegede, Malang Research Station in the late dry season of 1996. The genotypes selected from the primary evaluation were reevaluated in the screen house at Research Institute of Legumes and Tubers, Malang (RILET) in the rainy season of 1996/97. The field experiment was arranged in the randomized block design with two replications. Each genotype was planted in a 3 m row with planting distance of 50 cm between row and 10 cm within row, one plant/hole. The plant were fertilized with 50 kg/ha of urea, 90 kg/ha of TSP, and 90 kg/kg of KCl/ha as basal fertilization. The artificial inoculation of *Phakopsora pachyrhizi*, concentration of 2.104 spores/l, was applied on 21 days after planting. In the following evaluation conducted in the screen house, each genotype were planted in three pots, two plants/pot and treated as that in the field screening test. Result of the evaluation showed that from the final evaluation conducted in the screen house, it was selected four resistant early maturity genotypes, namely MLG 2643, MLG 3059, MLG 3525, and MSC-06-D-3 with the days to flowering of 30-41 days, days to maturity of 84-86 days and yield/plant 3.7-4.3 g/plant. For late maturity genotypes, it was selected three resistant genotypes, namely MLG 2550, MLG 2573, and MLG 3463 with the days to flowering varied from 35-43 days, days to maturity 95-96 days and yied/plant 4.7-6.3 g. It was suggested to reevaluate the seven selected lines in the bigger plot in many locations and seasons.

Key words: Screening, rust disease, soybean.

## ABSTRAK

Salah satu kendala dalam peningkatan hasil kedelai di Indonesia adalah tingginya penularan penyakit karat. Oleh karena itu, dalam pembentukan varietas unggul kedelai perlu dimasukkan sifat tahan karat. Sumber gen dari sifat tersebut dapat diperoleh melalui penyaringan galur, kultivar atau varietas kedelai dari koleksi plasma nutfah yang tersedia. Tujuan penelitian adalah mendapatkan genotipe-genotipe kedelai tahan penyakit karat. Penyaringan genotipe dilakukan terhadap 150 genotipe kedelai umur genjah dan 150 genotipe kedelai umur dalam yang berasal dari koleksi plasma nutfah, galur uji DHP dan DHL. Tiga ratus genotipe kedelai tersebut diuji di lapang, yaitu di Instalasi Penelitian (IP) Genteng, Banyuwangi dan IP Jambegede, Malang pada MK II, 1996. Genotipe yang tersaring pada percobaan lapang diuji kembali di rumah kasa Balitkabi, Malang pada MH 1996/97. Percobaan lapang ditata dalam rancangan acak kelompok, dua ulangan. Tiap genotipe ditanam dalam satu baris panjang 3 m, jarak tanam 50 x 10 cm, satu tanaman/lubang. Tanaman dipupuk dengan 50 kg urea, 90 kg TSP dan 90 kg KCl/ha. Inokulasi jamur karat dilakukan pada waktu tanaman berumur 21 HST dengan konsentrasi 2 x 104 spora/ml. Untuk percobaan di rumah kasa, tiap genotipe ditanam dalam tiga pot, dua tanaman/pot. Tanaman dipupuk dan diinokulasi seperti pada percobaan di lapang. Parameter yang diukur untuk percobaan lapang adalah intensitas penularan karat, umur berbunga, umur masak, jumlah tanaman dipanen/baris dan hasil biji kering/baris, sedangkan untuk percobaan rumah kasa adalah intensitas penularan karat, umur berbunga, umur masak, hasil biji kering/tanaman. Dari penyaringan bertahap di lapang dan dilanjutkan di rumah kasa teridentifikasi empat genotipe kedelai umur genjah yang tahan karat, yaitu MLG 2643, MLG 3059, MLG 3525, dan MSC 9206-D-3 dengan kisaran umur berbunga 30-41 hari, umur masak 84-86 hari dan hasil biji/tanaman 3,7-4,3 g. Dari kelompok umur dalam teridentifikasi tiga genotipe tahan karat, yaitu MLG 2550, MLG 2573 dan MLG 3463 dengan kisaran umur berbunga 35-43 hari, umur masak 95-96 hari dan hasil biji/tanaman 4,7-6,3 g. Tujuh genotipe yang tersaring perlu diuji kembali dalam petakan yang lebih luas pada beberapa lokasi dan musim.

Kata kunci: Penyaringan genotipe, penyakit karat, kedelai.

## INTRODUCTION

Resistant to rust was an important character involved in the development of new improved varieties of soybean as the disease has great effect on yield losses. Usually rust disease intensively attact during generative plant stages and able to decrease the yield for 0-100% depend on genotypes and environment (American Phyt. Soc., 1975). This statement was supported with another researcher reporting that the yield was highly correlated with disease intensity of rust in the field (Hardaningsih, 1986). In the development of new improved varieties resistant to rust involved genes for rust resistance derived from selected lines, cultivars or varieties of germplasm collection.

In Indonesia, new varieties completely resistant to rust were not available as resistance on some released

varieties was not a main character. They were mostly moderately resistant or tolerance to rust. For example, Orba variety was indicated tolerance to rust based on yield losses. Previous screening for rust resistance on some genotypes of soybean in four locations obtained eight genotypes of soybean which were moderately resistant to rust (Sumarno and Sudjadi, 1977). Another study upon several mutant lines of soybean found some moderately resistant lines (Ratna, 1984; Ratna, 1988). While, multilocated observation conducted by researcher of RILET in several location identified one line namely 653/Tidar-8-3 which was resistant to rust (Sugito, private communication).

Development of rust disease are influenced with (a) day lenght which affect plant ages, (b) air temperature and precipitation which influence disease severity and plant development, and (c) leaf wetness which affect disease infection (Tscanz *et al.*, 1983). Therefore, screening for parental stock purposes had to be done in several locations and seasons to create different environment as disease intensity of rust in the field varied with time and locations (Sudjadi, 1985). Sujadi *et al.* (1977) found that in multilocation and multiseason test, the genotypes tested represented their own specific reaction to rust. Grouping based on plant maturity, early and late maturity, was suggested in screening to rust resistance and each group was screened in the separate experiments. Plant grouping was necessary as disease severity and yield loss were affected with plant ages whereas disease incident during generative phase resulted in the greater yield losses (Hardaningsih, 1994). Screening to rust on soybean conducted both in Indonesia and abroad indicated that late maturity genotypes generally were more resistant to rust than the early one (Sumarno and Sudjadi, 1977; Tscanz and Tsai, 1982).

## MATERIALS AND METHODS

One hundreed and fifty early maturity genotypes and 150 late maturity genotypes consist of seed from germplasm collection and advanced selection lines were evaluated in the field at Genteng and Jambegede research station in the late dry season of 1996. The genotypes selected from the field experiment were reevaluated in the screen house at RILET, Malang in the rainy season of 1996/97. The field experiment was arranged in the randomized block design with two replications. Each genotype was planted in a 3 m row with planting distance of 50 cm between row and 10 cm within row, one plant/hole. The plant were fertilized with 50 kg/ha of urea, 90 kg/ha of TSP, and 90 kg/kg of KCl/ha as basal fertilization. The artificial inoculation of *Phakopsora pachyrhizi*, concentration of 2.104 spores/l, was applied on 21 days after planting. In the screen house, each genotype was planted in three pots, two plants/pot and treated as that in the field screening test. Irrigation was applied three times.

Observations:

1. Evaluation of resistance of the genotypes to rust conducted at 60-70 days after planting based on IWGSR (International Working Group of Soybean Rust) method.

   IWGSR scoring methods:

   a. First number determined leave position in the plants.
      1 = the observing leaves on the lowest part of the plants
      2 = the observing leaves on the middle part of the plants
      3 = the observing leaves on the highest part of the plants
   b. The second number determined pustule density on the leave surface.
      1 = no pustules
      2 = pustule density of 1-8 pustules/$cm^2$
      3 = pustule density of 9-16 pustules/$cm^2$
      4 = pustule density of 16 pustules/$cm^2$
   c. The third number determined respon of the plant to rust
      1 = no pustules
      2 = represent unsporulated pustules
      3 = represent sporulated pustules
2. Days to flowering
3. Days to maturity
4. Yield/plant.

## RESULT AND DISCUSSION

Disease intensity during experiment was sufficient to identify the degree of resistance among the genotypes

Table 1. Degree of resistance to rust, days to flowering, days to maturity, and yield/plant of the selected early maturity genotypes in Genteng and Jambegede research station in the dry season of 1996.

| Genotypes | Days to flow. (day) | Days to mat.(day) | Yield/plant (g) | Degree of resistance |
|---|---|---|---|---|
| MLG 2643 | 45 | 99 | 6,59 | R |
| MLG 2672 | 42 | 94 | 2,38 | MR |
| MLG 2676 | 43 | 96 | 4,45 | MR |
| MLG 2713 | 38 | 96 | 1,18 | MR |
| MLG 2738 | 44 | 96 | 5,53 | MR |
| MLG 2896 | 38 | 98 | 2,68 | MR |
| MLG 2992 | 39 | 92 | 1,07 | MR |
| MLG 2998 | 38 | 91 | 2,00 | MR |
| MLG 3059 | 43 | 96 | 5,40 | R |
| MLG 3107 | 42 | 102 | 0,86 | R |
| MLG 3260 | 39 | 100 | 3,37 | MR |
| MLG 3287 | 39 | 102 | 6,17 | MR |
| MLG 3425 | 38 | 96 | 1,60 | MR |
| MLG 3439 | 49 | 97 | 3,18 | R |
| MLG 3525 | 43 | 99 | 6,09 | R |
| MSC 9206-D-3 | 46 | 100 | 2,39 | MR |
| MSC 9208-D-1 | 43 | 99 | 3,55 | MR |
| MSC 9213-D-2 | 45 | 93 | 6,66 | MR |
| MSC 9214-D-4 | 43 | 99 | 8,74 | MR |
| MSC 9218-D-2 | 49 | 101 | 4,36 | MR |
| MSC 9009-C-10-2 | 40 | 98 | 3,24 | MR |
| MSC 9016-C-4-1 | 38 | 96 | 1,67 | MR |
| MSC 9053-C-1-1 | 39 | 95 | 2,20 | MR |
| MSC 8606-5-1M | 38 | 94 | 3,92 | MR |
| Malabar | 38 | 93 | 0,90 | MR |

R = resistant
MR = moderate resistant

Table 2. Degree of resistance to rust, days to flowering, days to maturity, and yield/plant of selected long maturity genotypesin Genteng and Jambegede research station in the dry season of 1996.

| Genotypes | Days to flow. (day) | Days to mat. (day) | Yield/plant (g) | Degree of resistance |
|---|---|---|---|---|
| MLG 2545 | 43 | 106 | - | R |
| MLG 2550 | 45 | 103 | 3,13 | R |
| MLG 2573 | 47 | 104 | 5,10 | R |
| MLG 2577 | 45 | 106 | 3,20 | R |
| MLG 2597 | 48 | 104 | 4,73 | R |
| MLG 2723 | 43 | 107 | 0,52 | R |
| MLG 2731 | 39 | 102 | 2,23 | R |
| MLG 2750 | 42 | 106 | 0,98 | R |
| MLG 2756 | 42 | 102 | 0,43 | R |
| MLG 3463 | 39 | 105 | 12,00 | R |
| MSC 8306-1-1M | 46 | 107 | 4,61 | R |
| 653/TIDAR-B-3 | 39 | 105 | 4,56 | R |
| MLG 2773 | 46 | 107 | 9,48 | R |
| MSC 9256-D-2 | 49 | 107 | 3,44 | MR |
| MSC 9257-D-1 | 48 | 108 | 1,03 | R |
| MSC 9161-D-6 | 42 | 105 | 3,21 | MR |
| MSC 9204-D-2 | 49 | 106 | 5,59 | MR |
| MSC 9223-D-1 | 48 | 107 | 5,91 | MR |
| MSC 9224-D-1 | 48 | 106 | 5,26 | MR |
| MSC 9228-D-1 | 49 | 107 | - | MR |
| MSC 9239-D-1 | 44 | 107 | 5,52 | MR |
| MSC 9172-D-3 | 43 | 104 | 5,88 | R |

(-) = the data not available
R = resistant
MR = moderate resistant

tested to rust, the susceptible genotypes could be detected from the present of the sporulated pustules on the leaves in the highest part of the plant, while in the moderate and resistant genotypes, the leaves in that position free from any pustules. In the early plant stages, the disease symptom was not clearly vissible, but became abundant along with plant age.

From two locations, they were selected 26 early maturity and 22 late maturity genotypes of which categorized as resistant and moderately resistant genotypes based on IWGSR scoring method (Table 1 and 2). The observations were carried out at 60 to 70 days old and only the genotypes resistant to rust in both two locations were selected. The unstable genotypes which resistant in one location but turned out to be susceptible in the other locations were not suitable as source of genes for resistance to develop universal resistant varieties.

Based on the number of the genotypes resistant to rust, it was indicated that the late maturity genotypes were more resistant than the early maturity. This result was met with the previous result got by Shanmugasundaram and Toung (1982) which explained that time to flowering and time to maturity were correlated with the level of resistance to rust. More over, they suggested that time to flowering and time to maturity were two important characters in determining whether any genotypes suitable as source of genes for resistance. Other researcher explained that time to flowering and time to maturity have correlation with degree of resistance due to those two characters determined the pattern of plant growth (Tscanz and Tsai, 1982).

The symptom of rust appeared in all of the genotypes tested, on which the pustules were present on the leaves in the middle and lowest leaves or on the whole leaves. For the resistant genotypes, the highest leaves were free from pustules, the middle leaves had a few number of unsporulated or sporulated lesions, and the lowest leaves represented some sporulated pustules.

Twenty five early maturity and 22 late maturity genotypes of soybean which were categorized as resistant and moderate resistant to rust were reevaluated. This evaluation was conducted to confirm the degree of resistance of the genotypes selected from the former evaluation. The evaluation was conducted in the screen house to get more precise observation and to get more stable genotypes in the more restrained environment. In this evaluation, the disease incident was severe, the selection pressure on plant was high and genotypes carrying greater resistance likely to be present. For susceptible genotypes, the leaves in the highest position showed 1-8 sporulated pustules/cm$^2$.

Result of the evaluation showed that four early maturity genotypes and three late maturity genotypes were categorized as resistant genotypes to rust (Table 3 and 4). The resistant varieties in the early maturity group were the genotypes having scores of 133, 233 and 311 meaning that the lowest leaves having 9-16 sporulated pustule/cm$^2$, the middle leaves had 1-8 sporulated pustules/cm$^2$, and the highest leaves had no pustules. For late maturity groups, the selected genotypes had score of 133, 222 and 311 meaning that the lowest leaves had 9-16 sporulated spots/cm$^2$, the middle leaves had 1-8 unsporulated spots/cm2 and the highest leaves free from any pustules.

Table 3. The selected early maturity genotypes of soybean resistant to rust in the advance selection carried out in the screen house in the rainy season of 1996/97.

| Genotypes | Days to flow. (day) | Days to mat. (day) | Yield/plant (g) |
|---|---|---|---|
| MLG 2643 | 39 | 84 | 4,34 |
| MLG 3059 | 43 | 85 | 4,24 |
| MLG 3525 | 42 | 84 | 3,71 |
| MSC 9206-D-3 | 41 | 86 | 4,32 |

Table 4. The selected late maturity genotypes of soybean resistant to rust in the advance selection carried out in the screen house in the rainy season of 1996/97

| Genotypes | Days to flow. (day) | Days to mat. (day) | Yield/plant (g) |
|---|---|---|---|
| MLG 2550 | 35 | 96 | 6,30 |
| MLG 2573 | 43 | 95 | 5,22 |
| MLG 3463 | 39 | 95 | 4,70 |

Note : R =resistant

## CONCLUSSION

1. In the field evaluation, it was selected 25 resistant and moderately resistant genotypes to rust of early maturity groups, and 22 resistant and moderately resistant genotypes of late maturity groups.
2. In the screen house evaluation, it was selected four resistant genotypes and three resistant genotypes from early and late maturity groups, respectively.

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