International Proceeding
Universitas Tulungagung
2025

RESISTANCE OF NEW CORN HYBRIDS TO CORN RUST (*Puccinia polysora*)

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Abstract

Corn is one of the most dominant food crops after rice. Breeding programmes should include development of resistance to both biotic and abiotic stress resistance besides yield increase. The objective of this study was to identify the resistance level of new high yielding hybrids to corn rust disease. Disease resistance testing for corn rust (*Puccinia polysora*) was conducted using a randomised block design with three replicates. The genetic material used was the same as the adaptation test material, consisting of 8 test hybrids, namely BPN--2301, BPN--2302, BPN-2303, BPN-2304, BPN-2305, BPN-2306, BPN-2307, BPN-2308, and 2 comparison varieties, namely NK6172 and BISI 18. The testing was carried out from 25 May to 15 September 2024 in Bajeng, Gowa, South Sulawesi. The testing was carried out on rice fields with regosol soil type and pump well irrigation. The trial site was located at an altitude of 100 metres above sea level. The disease-resistant variety used for the corn rust disease test was Pertiwi 6, while the susceptible variety used was Glutinous URI 1. The results of the study concluded that the disease resistance test results for the 8 test hybrid corn varieties, namely BPN-2301, BPN-2302, BPN-2303, BPN-2304, BPN-2305, BPN-2306, BPN-2307, BPN-2308, and 2 comparison varieties, namely NK6172 and BISI 18, as well as the Pertiwi 6 variety for corn rust resistance testing and the Glutinous URI 1 variety for susceptibility testing, produced data showing that corn rust was classified as moderately resistant, except for BPN-2303, which was classified as susceptible. Additionally, the susceptibility test results for corn rust disease also fall into the highly susceptible category.

Keywords: *Resistance Test, hybrid corn, corn rust*

INTRODUCTION

Among Indonesian farmers, corn is one of the food crop commodities that dominates in general after rice. This reflects the important role of corn as food, biofuel and other industrial materials. According to data from the Central Statistics Agency (2024), national corn demand in 2024 is estimated to reach 14.37 million tons. Along with the increasing demand for domestic corn, both for direct consumption and as industrial raw materials, increasing corn production is the government's main target to realize corn food self-sufficiency by 2025. In 2025 in the January-March period, the potential harvest area of dried pipilan corn is estimated to reach 0.85

million ha with a potential production of dry shelled corn with a moisture content of 14% as much as 4.81 million tons. This shows that corn production has reached a surplus and is able to exceed the target of domestic demand and has the potential to reduce dependence on imported corn-based food and feed raw materials. (Nedeljkovic, Krstic, & Maksimovic, 2019)(Arvan & Aqil, 2020)(Biradar, et al., 2024)

One of the strategic steps that must be taken to maintain the sustainability of the increase in stable corn production and distribution in Indonesia is to provide superior varieties that are high-yielding, resistant to biotic and abiotic stresses, and have extensive adaptations in various ecosystems. This needs to be done to ensure the availability of corn supply to maintain prices at the farmer and consumer levels as well as to face the challenges of climate change, land conversion and fluctuations in industrial demand. (Wahditiya, et al., 2024)(Prasetyo, Sari, & Lestari, 2024)

Breeding for superior corn varieties, resistant to biotic and abiotic environmental stresses and has high yield potential can be achieved through breeding programs. As science and technology advances, the breeding for superior hybrid varieties that not only have high productivity, but are also adaptive to specific challenges, such as resistance to corn rust disease. This effort aims to provide solutions for farmers in improving efficiency and yield through superior quality seeds designed according to their needs. (Amzeri, 2017). The hybrid corn breeding results conducted by PT. Benih Putra Nusantara (BPN-), a national private research company, produced eight candidate hybrid varieties for testing: BPN-2301, BPN-2302, BPN-2303, BPN-2304, BPN-2305, BPN-2306, BPN-2307, and BPN-2308, which need to be tested for their response to one of the most important corn diseases, namely corn rust. These varieties are specifically designed to adapt to certain areas that have great potential but still have limited availability of superior varieties. Through a series of yield trials in various locations, these varieties have demonstrated exceptional performance in increasing productivity and providing optimal benefits for farmers. Through a combination of innovation, intensive research, and a farmer-needs-based approach, BPN- is committed to continuing as a key partner in realising more advanced and sustainable agriculture. The objective of this study was to identify the level of resistance of selected high yielding hybrids to corn rust disease. The results of this research are expected to provide supporting data for the release of these tested hybrids.

MATERIAL AND METHOD

Resistance testing for corn rust disease (*Puccinia polysora*) was carried out with a randomized block design with 3 replications. The testing was carried out from 25 May to 15 September 2024 in Bajeng, Gowa, South Sulawesi. The testing was carried out on rice fields with regosol soil type and pump well irrigation. The trial site was located at an altitude of 100 metres above sea level. The genetic material used are 8 test hybrids, namely BPN-2301, BPN-2302, BPN-2303, BPN-2304, BPN-2305, BPN-2306, BPN-2307, BPN-2308, and 2 comparative varieties, namely NK6172 and BISI 18. The corn rust-resistant check variety uses the Pertiwi 6 variety, while the susceptible check uses the Glutinous Corn URI 1 variety. The inoculum source of the susceptible varieties of Glutinous Corn Glutinous URI 1 for corn rust testing was grown as a pathogen-spreading row plant, each with three rows around and between repetitions of the test plot. The planting is carried out four weeks before planting the material

to be tested. When the spreader row plants are three weeks old after planting, they are inoculated with the conidia suspension *Puccinia polysora (P. polysora).* Inoculation was carried out in the afternoon with humid conditions with a spore density of about 6x104 conidia/ml. Preparation of Conidia *B. maydis* Suspension as an inoculum material sourced from sick plants in the field and then isolated on *potato dextrose agarose* (PDA) media. The results of mushroom isolation are propagated in a petri dish using Oatmeal Agar media. Incubated for two weeks until the entire surface of the Oatmeal Agar media is full of mushrooms. Spore suspension is applied to the plant using a sprayer.

Four weeks after planting the pathogen-spreading row, test hybrids and comparator varieties are planted. Each genotype is planted in 4 rows with a row length of 5 m, planting spacing 70 x 20 cm. Each genotype is planted 1-2 seeds/planting holes. Thinning is carried out when the plants are 10 DAP old so that there is only one plant per clump. The first fertilization is given at the age of 10 days after planting (DAP) using Urea and NPK of 150 kg/ha and 400 kg/ha, respectively. The second fertilization is carried out at the age of 30 DAP by giving Urea 150 kg/ha.

Observations of the intensity of corn rust disease were carried out at the age of 45, 60 and 75 DAP. Observations are made by providing a scale based on the symptoms of the disease in the plant. The scale values for corn rust disease are based on Sharma's (1983) modifications, namely:

1 : There are one or two lesions scattered on the lower leaves;
2 : Moderate lesion count on leaves with a percentage of less than 25%;;
3 : Lession is abundant on the lower leaves, slightly on other parts with a percentage of 26-50%;
4 : Lession is abundant on the lower and middle leaves, extending to the upper leaves with a percentage of 51-75%;
5 : Lession is abundant on almost all leaves, premature drying plants, infection percentage 76-100%;

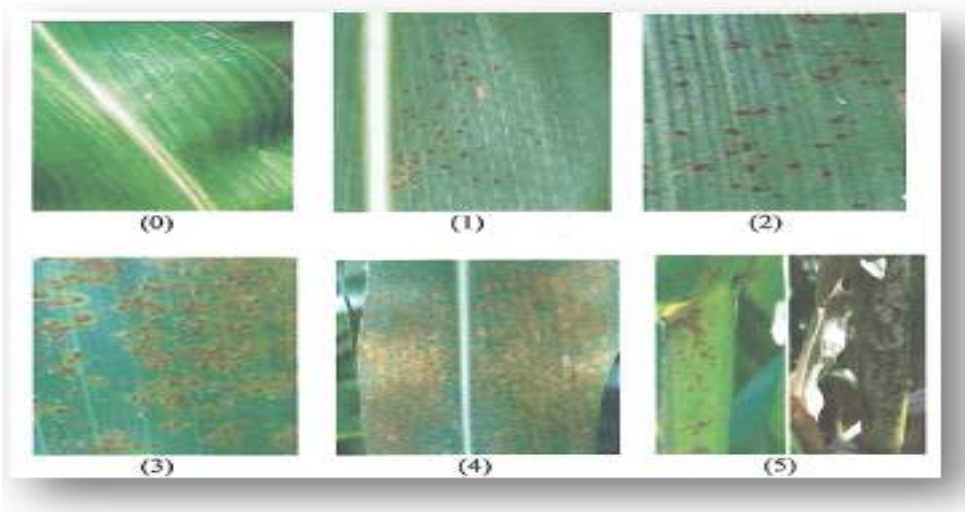

Figure 1. Scale of corn rust pustules based on the area of the infected area

Table 1. Criteria for resistance of candidate varieties to infection of the main disease of corn

Incidence of Disease	Durability Criteria
0 - 5%	Highly Resistant (HR)
>5 - 20%	Resistant (R)
>20 - 40%	Somewhat Resistant (SR)
>40 - 60%	Susceptible (S)
>60%	Highly Susceptible (HS)

RESULTS AND DISCUSSION

The results of the test hybrid resistance test against corn rust disease caused by the pathogen *Puccinia polysora* (*P. polysora*) are presented in Table 11. Symptoms of corn rust infection have been found in the age of 45 DAP plants with a very low intensity, namely with an infection range between 1.33% – 12.67%.

Table 4. Intensity of corn rust disease in the genotype of candidate hybrid corn varieties in South Sulawesi

Genotypes	**Infection Intensity *of P. polysora* (%)**			**Durability**
	45 DAP	60 DAP	75 DAP	**Criteria**
BPN-2301	1.33 cd	21.33 cd	28.00 cd	SR
BPN-2302	5.33 cd	23.33 cd	30.00 cd	SR
BPN-2303	3.33 cd	31.33 d	42.67 d	S
BPN-2304	2.67 cd	24.67 cd	32.67 cd	SR
BPN-2305	2.67 cd	23.33 cd	35.33 cd	SR
BPN-2306	4.00 cd	20.67 cd	28.00 cd	SR
BPN-2307	3.33 cd	16.67 cd	23.33 cd	SR
BPN-2308	3.33 cd	18.00 cd	25.33 cd	SR
Pertiwi 6 (a)	4.67	12.67	20.67	SR
NK6172 (b)	4.00	16.00	26.00	SR
BISI 18 (c)	12.00	34.00	42.00	S
Glutinous corn (d)	12.67	45.33	66.67	HS
Average	4.94	23.94	33.39	

Remarks: SR= Somewhat resistant; S = Susceptible; HS= Higly susceptible.

The infection rate illustrates that the severity of rust disease in all genotypes is still less than 20%. The severity of corn rust disease was significantly increased at the time of observation of age 60 DAP. This can be seen from the severity of corn rust disease in susceptible check varieties reaching 45.33% with the criterion of being susceptible, while the eight test hybrids still reacted resistant and somewhat resistant with disease severity less than 20%.

The severity of leaf blight at the time the plant was 75 DAP years old showed that there were seven of the eight test hybrids that reacted somewhat resistant to corn rust disease with disease severity ranging from 23.33% - 35.33%. The resistance level of the seven test hybrids is the same as the Pertiwi 6 and NK6172 resistant check varieties, which are somewhat resistant

to react. The susceptible check varieties BISI 18 and Glutinous URI showed a susceptible and highly susceptible reaction with disease severity of 42.00% and 66.67%, respectively.

CONCLUSION

The results of the research obtained can conclude that the results of the resistance test of 8 test hybrid corn, BPN-2301, BPN-2302, BPN-2303, BPN-2304, BPN-2305, BPN-2306, BPN-2307, BPN-2308, and 2 comparative varieties, namely NK6172 and Pertiwi 6 variety, are classified as somewhat resistant or tolerance to corn rust diseases. Genotypes of BPN-2303 and BISI 18 are classifed as susceptible hybrids. While Glutinous Corn variety, URI 1, as the susceptible check is classified as highly susceptible. Therefore all new hybrids except BPN-2303 can be considered for variety release

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