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Inventory of Pathogenic Fungi by Red Chili Seeds (*Capsicum annuum L.*) from Deli Serdang Regency, North Sumatra

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Abstract

Red chilies known as Capsicum annuum L., hold significant importance as horticulture crops in Indonesia. The production of red chilies begins with the planting of seeds, making seed health a crucial factor in the process. Seeds contaminated with pathogens can serve as a reservoir for the transmission of diseases in the field, leading to the demise of seedlings and hindering their growth into fully mature plants, ultimately resulting in crop failure. This study used the blotter test technique to ascertain the morphology of a seed-borne pathogenic fungus. The research findings indicated that the blotter test technique detected four isolates of seed-borne pathogenic fungus, specifically TMIA with an infection rate of 0.5%, TMIB with an infection rate of 0.5%, TMIC with an infection rate of 2.5%, and TMIE with an infection rate of 3%. A single isolate of a seed-borne pathogenic fungus, named SRIA, was obtained from Sidodadi Ramunia village. The infection rate of this fungus was determined to be 0.5%. The chili seeds recovered were found to carry pathogenic fungal isolates belonging to Aspergillus sp., Penicillium sp., Verticillium sp., and Curvularia sp. based on morphological identification

Keywords: *Blotter test; Red chili pepper; Pathogenic fungi; Inventory; Carried by seed.*

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INTRODUCTION

Red chilies hold significant importance in the agricultural sector of Indonesia because of their widespread usage in Indonesian cuisine as a spice and as a fundamental component in the sauce manufacturing business. In 2021, chili output in Indonesia amounted to 1.36 million tons, marking a 7.62% rise of 96.38 thousand tons compared to 2020. The consumption of red chili in Indonesia mostly came from households, and in 2021, it had a significant increase of 8.49% compared to 2020 (BPS, 2021). Chili cultivation is hindered by pest and disease infestations. Fungi are the primary pathogens

that commonly infect red chili plants. The fungi responsible for causing disease in chili plants include *Fusarium oxysporum*, *Collectrotichum gloeospoiroides*, and *Cercospora sp.* (BPTP, 2014).

Disease-causing fungi often target seeds, plants, and fruit. Utilizing seeds contaminated with fungus can serve as a mechanism for disseminating illness in the field, thereby emphasizing the significance of seed health in the cultivation of red chili plants. Plant seeds must possess high viability and be devoid of plant pest organisms (OPT) (Rahayu, 2016). Healthy seeds are seeds that are devoid of pathogenic microorganisms such as fungus, bacteria, viruses, nematodes, and insects (ISTA, 2023). According to Ramdan & Kalsum (2017), The results of an inventory of fungi carried by chili seeds showed that chili seeds were infected with the fungi *Aspergillus sp.*, *Fusarium sp.*, *Colletroticum sp.*, and *Rhizopus sp.* Sukapiring & Nurliana (2020) also reported Red chili seeds from Berastagi district were infected with the fungi *Aspergillus fumigatus*, *A. niger*, *F. solani*, *A. flavus*, *Penicillium sp.*, *Curvularia sp.*

Seed health testing must be carried out to avoid the spread of disease in the field, and to avoid plant death from the seedling phase until the plants fail to grow to maturity. ISTA (2023) stated that there are 4 important reasons for seed health testing to be carried out, namely: (1) seed-borne inoculum can become a disease that attacks plants in the field and can reduce crop production; (2) imported seeds can spread disease to other areas, so testing needs to be carried out to meet quarantine requirements; (3) seed health testing can be the basis for seed germination testing to evaluate the causes of low germination percentage or low seed growth in the field; (4) the results of this test are also to determine whether or not seed treatment is necessary to inhibit seed-borne pathogens and to reduce risk of disease transmission. The importance of knowing the pathogenic fungi that infect chili seeds is as initial information in determining methods of controlling various red chili seed-borne diseases, so it is necessary to carry out research on the inventory of red chili seed-borne pathogenic fungi (*Capsicum annuum L.*) from Deli Serdang Regency, North Sumatra. This study aims to (1) determine the level of pathogenic fungus infection carried by chili seeds, (2) determine the group of pathogenic fungi that infect chili seeds from Tanjung Morawa B village, Deli Serdang Regency.

METHOD

Research Place and Implementation

This research was conducted in the basic laboratory of Nahdlatul Ulama University, North Sumatra. The chili seeds (the main research material) used in this research were local chili seeds from Tanjung Morawa B village, Deli Serdang district, North Sumatra.

Instruments and materials

The tools used in this research were petri dishes, tweezers, n-UV lamp, Bunsen, handspray, Erlenmeyer, objects and cover glass. The materials used are chili seeds, distilled water, 70% alcohol, NaOCl, PDA media, plastic warp, aluminum foil, and filter paper.

Research Procedure

Isolation and Percentage of Pathogenic Fungal Infections Carried by Chili Seeds Using the Blotter Test Method

The Blotter test method refers to the ISTA (International Seed Testing Association) standard seed health testing method. Chili seeds were soaked in a 3% NaOCl solution to sterilize the surface of the chili seeds from microbes for 3 minutes and rinsed three times with sterile distilled water. Then prepare 3 pieces of sterilized filter paper the size of a petri dish, soak the filter paper in sterile distilled water, drain, and then put into the petri dish. A total of 15–25 chili seeds were placed in a petri dish containing filter paper for a total of 200 chili seeds. Then the petri dish containing the seeds was incubated for 12 hours under n-UV light and 12 hours without light at room temperature (25 °C). On day 2, the seeds were incubated at -20 °C for 24 hours. Then the seeds were incubated again at room temperature (25 °C) for 14 days.

Observations were made on seed germination and the percentage of seeds infected with pathogenic fungi. Pure isolates were made of each pathogenic fungus by isolating it in a petri dish containing PDA (Potato Dextrose Agar) media. Calculation of the percentage of seed-borne pathogenic fungal infections from the blotter test results is carried out using the formula:

$$Percentage\ of\ infections = \frac{\text{total of infected seeds}}{\text{total of seeds incubated}}\ x\ 100\%$$

Morphology Identification of Pathogenic Fungi

Pathogenic fungi that infect seeds are detected by examining their micro- and macroscopic features under a microscope. This is done by placing a tiny colony of the fungus onto a glass slide that has been moistened with sterile distilled water and then covering it with a cover glass. Pathogens' features detected by microscopy are determined by employing an identification key book.

RESULTS AND DISCUSSION

Isolation and Percentage of Pathogenic Fungal Infections Carried by Chili Seeds Using the Blotter Test Method

Based on the results of the Blotter Test carried out, seed-borne pathogenic fungus isolates were obtained with the percentage of infection in table 1. Based on table 1, the highest percentage of seed-borne pathogenic fungus infections from Tanjung Morawa B village, Deliserdang district, North Sumatra was 3% and the lowest percentage of infection was 0.5%. Adiwena (2021) also reported The highest percentage of pathogenic fungi carried by rice seeds was 6% and the lowest was 3%. In addition, Afutu et al. (2014) demonstrated the highest percentage of chili seed mycoflora infection in Ghana without treatment was 20.47% and the lowest was 0.03%.

Table 1. Percentage of Pathogenic Fungal Infection Rates Carried by Chili Seeds in the Blotter Test Method

No	Isolate Name	Infection Rate (%)
1.	TMIA (*Penicillium* sp.)	0,5 %
2.	TMIB (*Rhizopus* sp.)	0,5 %
3.	TMIC (*Verticillium* sp.)	2,5 %
4.	TMIE (*Curvularia* sp.)	3 %

The identification results of the pathogenic fungus isolates obtained can be seen in the figure 1 below:

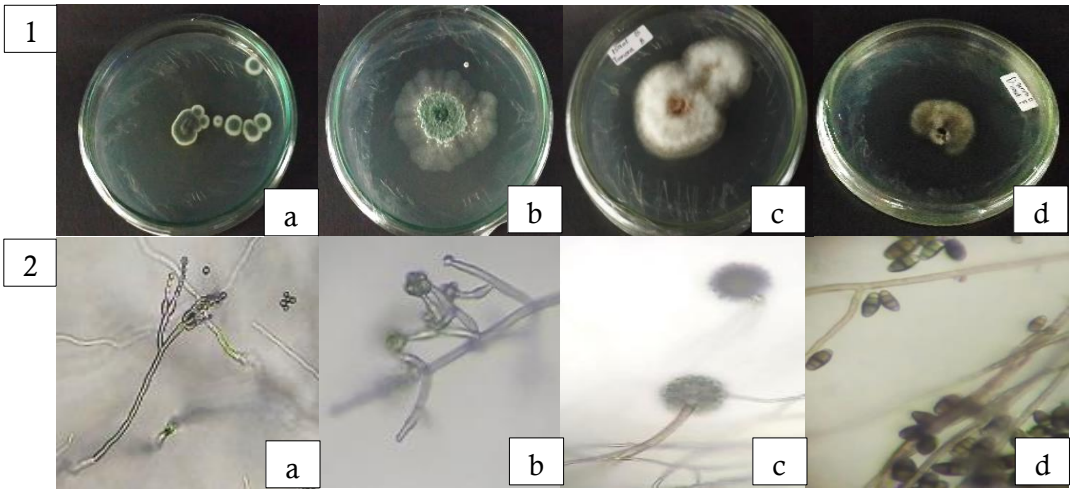

Figure 1. Seed-borne pathogenic fungus isolate on PDA media, (a) TMIA isolate, (b) TMIB isolate, (c) TMIC isolate, (d) TMIE isolate, 2. Seed-borne pathogenic fungus isolate under a 40x microscope (a) TMIA isolate, (b) TMIB isolate, (c) TMIC isolate, (d) TMIE isolate (Personal Documentation).

It is also known that the isolates of pathogenic fungi carried by chili seeds in the village of Tanjung Morawa B were identified as belonging to the fungus group of *Penicillium sp.*, *Rhizopus sp.*, *Verticillium sp.* and *Curvularia sp.* (Figure 1). Sukapiring & Nurliana (2020) stated that pathogenic fungi carried by red chili seeds from the Berastagi area, Karo Regency, Medan, North Sumatra are Aspergillus, Fusarium, Penicillium and Curvularia. Singh & Singh (2020) also conducted a study about identification of the microflora that infects *Capsicum annuum L.* chili seeds is *Alterneria spp.*, *Curvularia spp.*, *Penicilium spp.*, *Fusarium spp.*, *Colletotrichum spp.*).

The group of fungi obtained in this study has been widely reported to be seed-borne pathogenic fungi. Apart from chili seeds, these fungi are also reported to be pathogenic fungi carried by corn seeds as reported by Hanif & Susanti (2019), Corn seeds from the deliserdang area are infected with seed-borne pathogenic fungi from the *Aspergillus sp.*, *Penicillium sp.* and *Rhizopus sp.* groups. Ramdan & Kalsum (2017) also reported isolates of *Penicillium*, *Aspergillus* and *Curvularia* fungi infect soybean seeds. Nur Hidayati et al. (2020) conducted results of isolation and identification of *sengon*, *gmelina*,

mahogany and *tissuek* seeds infected with the *Fusarium sp.*, *Rhizopus sp.*, *Cladosporium sp.* fungi.

The discovery of fungi on chili seeds from Tanjung Morawa B Village, Deliserdang Regency, indicates that the chili seed samples tested contained seed-borne pathogenic fungi. Testing seeds using the blotter test method is one method of testing seed health. Seed health testing has an important role in improving seed quality, seed trade, and plant protection (Rahayu, 2016). Several reasons for seed health testing are carried out according to ISTA (2023) that seed health testing can be the basis for a seed germination test to evaluate the causes of low germination percentage or low seed growth in the field and the results of this test are also to determine whether or not seed treatment is necessary to inhibit seed-borne pathogens and to reduce the risk of disease transmission.

The definition of inventory according to KBBI (2023) is recording or collecting data about an activity, so this research, namely an inventory of pathogenic fungi carried by red chili seeds (*Capsicum annuum L.*) from Deli Serdang Regency, North Sumatra, was carried out to collect and record pathogenic fungi carried by chili seeds. obtained from research activities. The results of this research can be used as a basis for further testing such as controlling seed-borne pathogenic fungi to reduce sources of disease inoculum in chili cultivation areas in the future. Control of seed-borne pathogenic fungi can be done using endophytic fungal metabolites which have been carried out by Sukapiring et al. (2022). Control of seed-borne pathogenic fungi can also be done using plant extracts such as aloe vera peel extract which has been carried out by Waliha et al. (2022). Control can also be done by coating seeds to prevent seed-borne diseases carried out by Tefa et al. (2019).

CONCLUSION

According to the conducted research, it can be inferred that four strains of seed-borne pathogenic fungi were discovered in Tanjung Morawa B village. These strains are TMIA with an infection rate of 0.5%, TMIB with an infection rate of 0.5%, TMIC with an infection rate of 2.5%, and TMIE with an infection rate of 3%. The pathogenic fungus isolates found in the chili seeds were identified as belonging to the *Penicillium sp.*, *Rhizopus sp.*, *Verticillium sp.*, and *Curvularia sp.* groups by morphological analysis.

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