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GENETIC VARIABILITY IN CROSSES OF AROMATIC AND NON-AROMATIC RICE (*ORYZA SATIVA* L.) FOR MORPHOPHYSICOCHEMICAL, QUALITY, AND YIELD TRAIT IMPROVEMENT

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ABSTRACT

The research was carried out among seven parental lines, viz., Malaysian rice varieties (MRQ50, MRQ74, MRQ76, MR219, Mahsuri Mutant, Mahsuri Mutant 98), and Indian traditional rice (Basmati 370), including eleven F_1 hybrids. The main objective was to develop superior rice breeding lines with enhanced morphophysicochemical, quality, and yield traits. Eleven rice hybrids were developed through the hybridization technique, and the seeds harvested were then planted on a field plot to assess their performance and heterosis value. The selected cross was then advanced until the F_4 generation by the single seed descent technique to speed up the breeding cycle. The F_5 and F_6 plants were then spaced and planted in the field plot for the selection of desired traits. The data comprised mean performances, genetic parameters, heterosis, and genetic analysis. The findings revealed that a hybrid developed from a cross between the Basmati 370 and MR 219 rice varieties has demonstrated high performances in most of the yield-contributing traits, such as length of panicle, number of fertile panicles, number of tillers, length of flag leaf, and thousand-grain weight. The hybrid also has a long grain (> 6.0 mm) and demonstrated the longest grain length of cooked rice, about 12.45 mm, as compared to other crosses. The value of the phenotypic coefficient of variation was also higher than the genotypic coefficient of variation, but with a low magnitude, which indicated the influence of environmental factors on the traits. About 196 rice genotypes, including parents and five check varieties, were raised in the field plot. Data was recorded and analysed, and the rice genotypes were divided into five main clusters by various traits. The finding showed that Clusters 1 and III comprised 91 and 42 genotypes, respectively, and were categorised as tall plants. Basmati 370 was classified under Cluster III, which has long flag leaves and the highest thousand-grain weight, while MR219 was classified under Cluster IV. Cluster IV, which comprised 36 genotypes, was suitable for the selection of genotypes with intermediate height and moderate panicle length and grain length. The results indicated that inbred lines that showed widely divergent clusters could be used in hybrid breeding programs. The knowledge and information gathered from this study can serve as a basis for future rice quality improvement programmes.

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"In the name of Allah, Most Gracious, Most Merciful"

All sincere praise and thanks are due to Allah SWT for His limitless blessings on us. May Allah bestow his peace and blessings upon His Prophet Muhammad S.A.W. and his family.

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INTRODUCTION

1.1　Background of Study

Asia is the world's biggest rice producer, accounting for more than 90% of the world's rice production (Khazanah Research Institute, 2019). It is estimated that about 852 million metric tonnes (MT) of rice will be needed to meet the demand of the world population by 2035 (Brar et al., 2017). The Department of Statistics Malaysia (2022) estimated that the population would increase by more than 40 million by 2040. Currently, rice production in Malaysia is still low, and the data showed that recent production is only able to meet about 60% to 70% of the self-sufficiency level (SSL), and the remaining 30% to 40% relies on imported rice to meet demand and preferences for specialty rice with characteristics such as pleasant aroma, elongation of cooked rice and low glycaemic index (Khazanah Research Institute, 2019). Malaysia aims to enhance its self-sufficiency level (SSL) and reduce its reliance on food imports, which now total more than RM60 billion per year (Nor Ain and Qistina, 2023). Vietnam, Thailand, India, and Singapore are among the major rice exporters in Malaysia. Therefore, an increase in rice production is needed to meet the demand of a growing population.

Presently, the trend in rice production and consumption in Malaysia has changed. The demand for specialty and premium rice increased due to the higher living standards and health concerns (Rosnani et al., 2018; Rajendran et al., 2021). Among the preferred imported rice varieties are the Basmati and Jasmine varieties, which originated in India and Thailand, respectively (Engku Elini et al., 2019).

Since the 1970s, MARDI has been one of the main organisations that have pioneered breeding work in Malaysia. Up to now, more than 50 rice varieties have been released by MARDI, including traditional and modern rice varieties comprised of non-aromatic and aromatic rice. MARDI rice varieties with specific features include MR Q50, MRQ 74, MRQ 76, MRQ 88, and MRQ 104. These varieties have different features and were developed with the aim of increasing the yield of fragrant rice and reducing the country's reliance on imported rice (Engku Elini et al., 2019). As compared to other nations such as India, the Philippines and Thaila).nd, the number of new