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EFFECTIVENESS OF VESICULAR ARBUSCULAR MYCORRHIZA ON ROOT DEVELOPMENT OF SAGO PALM PLANTLETS

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ABSTRACT

The state of Sarawak in Malaysia started the world's first plantation of sago palm (*Metroxylon sagu* Rottboll) in Mukah Division in the 1990s to cope with the growing demands of sago flour. Sago palm planting material using tissue culture propagation has been hindered by the slow nursery growth of the plantlets. Earlier studies have shown that the introduction of indigenous mycorrhiza belonging to the Glomus species isolated from wild sago palm have accelerated growth of tissue cultured plantlets in the nursery stage. *Arum* type with intercellular hyphae of arbuscles was discovered in the study. The successful isolation and bulking of the vesicular arbuscular mycorrhiza (VAM) inoculum using the alternate host, *Allium* sp. enabled study on the growth response of sago plantlets to VAM which indicated that the symbiosis relationship overcoming transplanting shock and accelerating nursery establishment. The introduction of VAM to *in-vitro* sago palm plantlet has not been investigated. Therefore, the main objective is to study the effectiveness of VAM on root development of sago palm plantlets. Inoculums obtained from the wild sago palms, confirmed as VAM were produced in a cultured media. A range of pH 3.8 to pH 6 was prepared to observe the highest number of spore production. The infectivity of cultured spores was determined by the colonization of VAM on alternate host and confirmed by the presence of VAM characteristic. The cultured spore was inoculated to the plantlets aged from stage three aged from zero to eight month. The result showed the highest production of spores occurred at pH 4.2 after 21 days of inoculation to the host plant of *Allium* sp. The cultured spores colonized the roots of the *Allium* sp. indicating its infectivity and therefore were used as a source of inoculum to infect the tissue plantlets of sago palm. An experiment based on complete randomized block design (CRDB) technique was carried out in the biotechnology laboratory of CRAUN Research Sdn. Bhd. to determine the plantlet infections after being surface sterilized with Teepol detergent. The spore number that resulted in the most successful infection of sago palm plantlets was 15 spores with 10.6% infection on plantlets aging between zero to two months old. The beneficial effect of VAM spores inoculated micropropagated plantlets at the *in-vitro* stage was reflected by the early initiation of lateral root growth. Thus, with accelerated root establishment in the *in-vitro* stage will overcome the problem of using micropropagated plantlets as planting materials.

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF THE STUDY

In Sarawak, sago palm (*Metroxylon sagu* Rottboll) commonly grows wild especially in the coastal area mainly in the Mukah division. The genus name *Metroxylon* is derived from Greek and means heartwood, while the species name 'sagu' is from a local name for the food. Sarawak has a long history of sago starch production, ranking highly among the agricultural export commodities within the state. Sago palms continually produce suckers maturing over a period of 10 to 15 years; thus, a sago holding virtually produces palms in perpetuity with no necessity for replanting. This eliminates the need for recurring expensive establishment costs after every harvest of mature palm. Sago starch is very versatile with multiple product usage. Locally, it is a source of carbohydrate consumed directly as food. The starch is also widely used as a binder in the noodle industries in Malaysia. Extensive uses of sago starch in other parts of the world also include the monosodium glutamate industry, the soft drink industry for making various syrups, and the glue industry involved in the plywood manufacturing. New biotechnologies have diversified the uses of sago in the manufacturing of degradable plastics, alcohol and citric acid. Cultivation of the crop is in semi-wild status with an average size of 5.03 ha averaging and ranging from 14 palms/ha to 41 palms/ha (Chew, 1998).

The future expansion is tremendous with about 1.69 million ha of peat soil that can be cultivated with this palm. Sarawak has embarked into the plantation industry of sago palm in the Mukah division developed by the Land Custody Development Authority (LCDA) as the world's first large scale commercial plantation.

1.2 PROBLEM STATEMENT

Extensive work has been conducted to increase the quality and quantity of planting materials of sago palm through tissue culture propagation in order to convert the present semi wild sago palm status to modern clones with high yield.

CHAPTER TWO
LITERATURE REVIEW

The true sago palm (*Metroxylon sagu* Rottboll) has been described as mankind's oldest food plant consumed as a staple food in Southeast Asia. The word 'Sago' is initially taken from the Javanese language which means starch containing palm pith. The scientific name is derived from 'metra', meaning pith or parenchyma and 'xylon', meaning xylem. It has been well considered as the 'starch crop of the 21st century' by many scientists (Jong, 1995). The word sago has become a common name for all sources of starch, especially in the regions where Malay language is spoken, and is generally meant as the starch of any palm (Schuiling and Jong, 1996).

2.1 BOTANICAL CHARACTERISTICS

According to Abdul Aziz (2002), sago palm will switch its stored nutrients into starch filling in the trunk during the vegetative stage just before flowering and reaching a maximum height of 25 m with trunk diameter of 40 cm which is notable by the full-bodied size of the inflorescence twigs. Sago produces both pollinated seeded fruit and non-pollinated fruits known as parthenocarpic. The seeded fruit contains a hard rough white endosperm and brown testa while parthenocarpic fruit is smaller and contain spongy mesocarp. The botanical characteristic of sago palm was shown in Figure 1.

2.1.1 Characteristics of Sago Palm

Flach and Schuilling (1997) described sago palm as being an extremely hardy plant, thriving in swampy acidic peat soils, submerged in saline soils, where few other crops can survive. Compared to sago palm, other crops also grow more slowly in peat soil than in mineral soil. These palms can increase water uptake, and at the same time, tolerant to drought conditions (Parke et al., 1983; Shrestha et al., 1996). They have the ability to reduce stress caused by high salt and heavy metal concentrations and toxicities (Bisen et al., 1996).