

Allelopathic effect of *s. macrophylla* on the growth of *v. radiata* seedlings



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However, based on studies, it is shown that the mahogany tree has inhibitory effects that affect adjacent growing plants. This is made possible chemically and is referred to generally as allelopathy. This study aimed to determine if *S. macrophylla* had any adverse effects on the growth of plants in close proximity to it. The researchers selected three mahogany trees and planted six plots of differing distances with each plot containing ten munggo seedlings. The results obtained indicate that there is no significant difference between the growth of munggo seedlings growing near the mahogany tree to that of a munggo seedling growing near the control tree based on the analysis done on the seedlings' height, weight, and survival rate. Results also indicate that distance of the seedlings from the *S. macrophylla* has no effect on the intensity of inhibition of the growth of the *V. radiata*.

The results obtained can be attributed to factors that include the texture of the soil, fine-textured soil having been proven to have a greater retention capacity of allelochemicals than coarse-textured soils. Also, allelopathic interactions include both promotory and inhibitory activities of phenolic allelochemicals and thus using seed germination as a bioassay parameter may be of little value. It is currently used in the Philippines as a lumber tree and utilized in many reforestation projects. However, studies have shown that however beneficial *S. macrophylla* may be to the Philippine economy and to its environment, it also displays adverse effects to the Philippine wildlife. As a recently introduced species, the said tree has been unable to produce a natural web of life around it; there are no natural consumers of mahogany in the country, and as such, the area around the tree will not be populated by native fauna immediately. It is also suspected that mahogany

leaves contain allelopathic compounds. In a study conducted by P. Thinley in 2002, it was shown that *S. macrophylla* leaves inhibited the growth of *Pterocarpus indicus*. Allelopathic compounds inhibit the growth and development of other plants when introduced to them. Allelopathy is the production of a certain plant of such compounds and should not to be confused with competition, which may or may not involve allelopathy. Allelopathy is common in the plant kingdom, spread out in random fashion across borders. Some plants are deemed invasive due to their allelopathic nature and mahogany trees are not exempt.

STATEMENT OF THE PROBLEM

The study aimed to determine if *S. macrophylla* can adversely affect the growth of plants in close proximity to it and specifically sought to answer the following questions:

1. Does mahogany affect the growth of newly planted seedlings based on the seedlings' height and weight?
2. Is there a significant difference between the growth of seedlings within the proximity of the mahogany tree to that of seedlings within the proximity of a different tree?
3. Is there a significant difference between the survival rate of the seedlings within the proximity of the mahogany to that of seedlings within the proximity of a different tree?

HYPOTHESIS

The mahogany tree has no effect on the growth of newly planted seedlings.

SCOPE AND LIMITATIONS OF THE STUDY

The study aimed to determine the effect of the mahogany tree on the growth of monggo seedlings based solely on the seedlings' weight and height after a specified amount of time. Other possible factors that might affect the growth of the seedlings like availability of sunlight, presence of possible predators and competition with other plants in the vicinity were not included and were not accounted for in the analysis of the data obtained.

MATERIALS & METHODS

The researchers used monggo (*Vigna radiata*) as the subject plant. A frequent model plant for laboratory work in Philippine schools, *V. radiata* is known to be easily grown, requires little maintenance, and is fast-growing, which makes it ideal for an experiment limited to a few weeks. Monggo seeds were allowed to germinate by soaking the seeds overnight. Three mahogany trees located along Beta Way in the University of the Philippines Diliman Campus were chosen based on their proximity to other trees. Since competition with other flora could affect the results, it was made sure that the mahogany trees were at least three meters away from the other trees. They were marked as T1, T2, and T3. An acacia tree, *Samanea saman*, with similar conditions to the experimental trees, particularly to its proximity to other trees, was chosen as the control tree and was marked as T0.

To standardize the direction of planting on each tree, angles of 200 east of north and 200 west of south were used to mark radii of 3m each on the north and south side of the tree, respectively. The plots were cleaned and cleared of grass and other flora. Each radius was divided equally into three segments

on each segment 10 monggo seeds were planted with a 10cm-interval per seed. Seeds planted on the north side were labeled as N1, N2, and N3 for segments positioned 1m, 2m, and 3m away from the tree respectively. The labeling system was used for the south segments. The seeds were uprooted on the 9th day. Seedlings from the same segment were grouped together. The heights of the seedlings were measured using a ruler from the apex of its leaves to the tip of the roots. To standardize the measurement of the height of the seedlings, the roots were cut off at the point where the taproot has become soft and fibrous. The seedlings were then weighed using a top-loading balance. The averages of the height and weight of each segment were then determined.

RESULTS AND DISCUSSION

Swietenia macrophylla is known to have inhibitory effects that affect adjacent growing plants. This is made possible chemically and is referred to generally as allelopathy. " The term allelopathy was coined by Molisch in 1937 to refer to biochemical interactions between all types of plants, including microorganisms traditionally placed in the plant kingdom"(Waller 1987). It is defined by Rice (1984) as any direct or indirect beneficial or harmful effect of one plant, including microorganisms, on the other through the release of chemicals to the environment. Phenolics, terpenoids, alkaloids, polyacetylenes, fatty acids, steroids, and many other different secondary metabolites can act as allelochemicals. " However, the mere presence of these chemicals does not establish allelopathy, to demonstrate their involvement in allelopathy, it is important to establish 1)their direct release or indirect origin from plant-derived materials in the environment and that

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the chemicals are present in sufficient quantities and persist for a sufficient time in soil to affect plant species or microbes.

Allelopathy is different from competition; the latter defined as the removal or reduction of factors from the environment which are vital to survivability, by some other plant or microorganism sharing the same habitat. Allelopathic chemicals, or allelochemicals, are released by higher plants through several mechanisms. These are volatilization, exudation from roots, leaching from leaves or stem by rain, dew or fog, and from the decomposition of residues that contain the allelochemicals. Low molecular weight allelochemicals such as those belonging to terpenes are dispersed by volatilization. Nonvolatile allelochemicals such as alkaloids accumulate on plant surfaces and find their way to the soil by being leached by rainwater. Allelochemicals secreted through root exudation are of several classes. Some are alkaloids, coumarins, flavonoids, and many other types. Allelochemicals not directly secreted by the plant, in which some pigments are an example, but reach the soil by being released through the decomposition of the plant part that contains them). In the *S. macrophylla*, allelochemicals are released by the decomposition of leaf litter. *S. macrophylla* leaves are a source of tannins, which is evident in the reddish-brown color of the dry leaves. Tannins are phenolic compounds that also function as an allelochemical. In February, mature *S. macrophylla* trees shed their leaves, which will start to decompose on the ground and consequently release tannins from the cells. Aqueous extracts from the leaves of the *S. macrophylla* has been shown to retard the growth of *Pterocarpus discolor* seedlings.

Several hydrolyzable and condensed tannins were identified as growth and germination inhibitors in dry fruit, growth retarders of nitrogen-fixing bacteria in several plants, and as reducers of seedling growth in several plants". According to the data and the statistical analyses, the *Swietenia macrophylla* has no significant effect on the height, weight, and survival rate of the *Vigna radiata* seedlings compared to height, weight, and survival rate of the seedlings planted near the *Samanea saman*. The inhibitory effects exhibited by the *S. macrophylla* may have been too little or inconsistent to cause a significant change in the growth of the seedlings throughout the duration of the experiment. The texture of soil has been proved to affect the effectiveness of allelochemicals, favoring fine-textured than coarse-textured soil, and evidence indicates that the greater retention capacity of fine-textured soils for at least some allelochemicals may be important in the accumulation of physiologically active concentrations of these chemicals. This may have been the factor that reduced the effects of the allelochemicals involved in our experiment, owing to the beta way's coarser soil composition. It is also proven that allelochemicals are decomposed in the soil, either abiotically or by microorganisms.

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