CHAPTER I

INTRODUCTION

1. Definition of lectins

Lectins are protiens found in plants and animals, which have multiple combining sites, bind specifically to the saccharides on cell surfaces. They interconnect large number of cell together, causing them to agglutinate (1). Due to their specific sugar binding, these proteins provide an important tool for determinations of exposed saccharide receptor on the cell surface. They have also been used as ligands in affinity chromatography for the purification of many biologically important materials that contain carbohydrates.

2. Distribution of lectins

Lectins have been demonstrated to be widely distributed in plants and animals such as legumes (2-4), wheat (5-7) and electric eel (8) etc. In particular those of the legumes, contain relatively large concentrations of lectins. For example, Concanavalin A (ConA) comprises about 2-3% of the total protein of the jack bean (9), and soybean agglutinin (SBA) 1-1.5% of the soybean protein (9). To date at least 50 lectins have been purified and chemically characterized.

3. Physical and chemical properties of purified lectins

Physical and chemical properties of purified lectins are diverse, examination of the amino acid composition, molecular size and other molecular properties of many lectins show that they have little in

common except that they are all proteins. For example, SBA is a glycoprotein that has no sulfur-to-sulfur bonds in its molecule; its molecular weight is 120,000, it consists of 4 subunits and it has two binding sites (1). Wheat germ agglutinin (WGA) is not a glycoprotein and is rich in sulfur-to-sulfur bonds; its molecular weight is 36,000, it is made up of 2 identical subunits and has 4 binding site for sugars (1).

4. Binding sites, agglutination and inhibition on lectins

Binding sites on lectins are thought to be clefts or grooves into which particular sugars fit, with certain side groups of the sugar of oligosaccharides chains protuding from the cell surface contact with small combining regions on the lectins. The result of cross-linking of cell by lectins cause them to agglutinate. Agglutination is inhibited if the monosaccharide that is responsible for the binding is added to the cell suspension, because the monosaccharide occupies combining sites on the lectins.

5. Lectins' hemagglutination

Lectins agglutinate erythrocytes, in certain cause with very high specificity, and some of them are used in the typing of human blood and in the study of the chemical structure of blood group substances. For example, the specific agglutination of type A red cells by the lima bean lectin is best inhibited by the sugar N-acetyl-D -galactosamine, and thus pinpointed that sugar as a determinant of type A specifically (4).

6. Role of lectin in the association of soil bacteria and plant roots.

Bacteria of the genus Rhizobium fix atmospheric nitrogen in symbiotic association with legumes. The establishment of this symbiotic association involves an infection of the host plant by the bacteria and the subsequent formation of root nodules. Infection and nodule formation are hostspecific phenomena: legume species which are nodulated by some Rhizobium isolated are not nodulated by other Rhizobium isolates. It has recently been suggested that the host specificity of legume-Rhizobium symbiosis may be determined by the binding of host plant lectins to characteristic carbohydrate receptors on the Rhizobium cell surface (10). Bohlool and Schmidt (11) prepared a fluorescent derivative of soybean lectin and found that it bound to 22 of the 25 strains of Rhizobium japonicum that nodulate soybean plants. In contrast, 23 other strains of Rhizobium that do not nodulate soybeans did not bind the fluorescent lectin.

Albersheim and Wolpert (12) used a some what different approach; they isolated lectins from the seeds of four legumes (soybean, pea, red kindney bean and jack bean) and lipopolysaccharides from the four corresponding Rhizobial species. In all cases, the bacterial lipopolysaccharide interacted only with the lectin from the legume which the bacterium forms a symbiotic relationship.

In addition, support for the role of lectins in specific root-bacterial symbiosis comes from a studies with the clover-Rhizobium trifolii system (13). The purified lectin from clover seeds and clover root have agglutinated Rhizobial trifolii and is inhibited

specifically by 2- deoxy glucose.

The aim of this research is to 1) study the properties of lectin purified from rice bran locally obtained in our country comparing to Tsuda's rice bran lectin. 2) study the agglutination activity of our rice bran lectin with some strains of nitrogen-fixing bacteria isolated from the rice rhizosphere.

It is hoped that the nitrogen fixer with the highest potential to associate with the rice plants can be obtained, in order to promote the biological nitrogen-fixation in Thailand.