BIOCHEMICAL STUDIES ON PLANTAGO SPECIES

By

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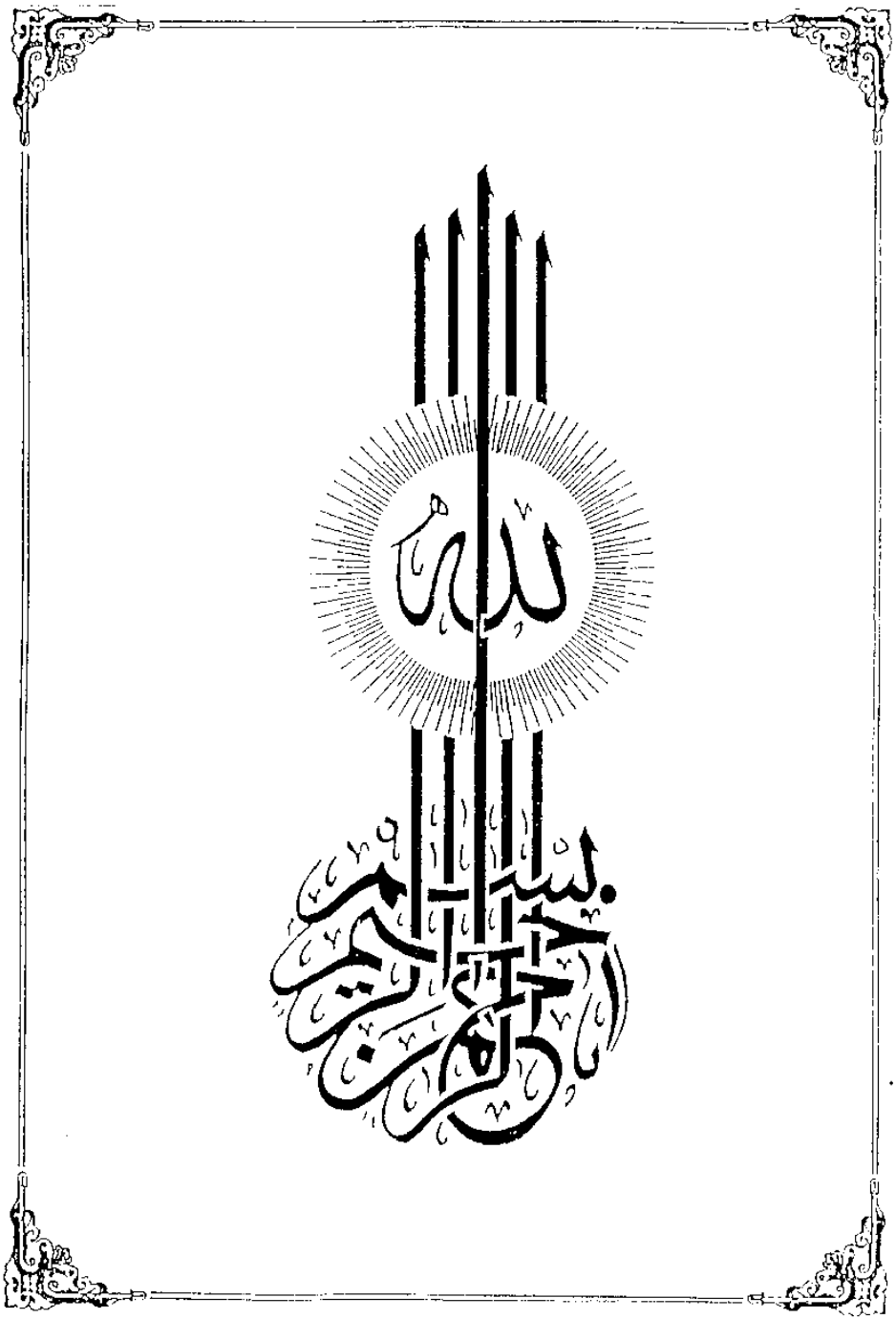

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CONTENTS

Recently, certain species of plantago have been extensively grown in the western coastal region as a pasture plant. The seeds of plantain family are well known to be a good source of mucilages.

Mucilages and gums constitute an important group of compounds from the pharmaceutical as well as the therapeutic view of point.

Plantain seed is, the cleaned dried ripe seed of plantago psyllium or of P.indica, known in commerce as spanish of French psyllium seed, or of P. Ovata. Forskal, known in commerce as Blond psyllium or Indian plantago seed. In Europe the seed have been used as a domestic remedy since the 16th century, but only since 1930 have they been extensively used in America as a popular remedy for constipation (gather coal and wirth, 1947).

In 1937, Over 3.600.000 pounds of psyllium seed were imported into the United States, the biggest consumer of this article, commercially, the most important plantago product is the husk of the seed of plantago ovata. It is produced in north western India and further purified and processed in the U.S.A. (claus 1961).

According to the B.P.C (1963) psyllium (seed of P. Psyllium and P. arenaria) has the property of absorbing

and retaining water and has therefore been used as a bulk providing medium in the treatment of chronic constipation.

Preparation of psyllium was also used to assist the production of a smoth solid foecal mass after colostomy. Psyllium, on account of its content of mucilage, has been used as a demulcent.

The glycoside aucubin, reported to be the active principle of plantago spp.

Egyptian plantains are represented in Egypt by 21 species, some of them are very rare, while others are common abandance. Some of these P. Ovata grow with a high degree of abandance and dominance in the Western Mediterranean Coastal region of Egypt.

Non of the Egyptian Plantago species was studied chemically and, therefore, it was of interest to study the available Egyptian plantags species and to report on their constituents. This study was carried out.

Dealing primarily with chemical investigation of the seeds of plantago psyllium and plantago Ovata with special emphasis to the determination of constents and comparison between the values of these species, and to study some of the important biochemical constituents of

the seeds of *Plantago* sp. and to give a picture of the evolution of the local seeds hoping to open further investigations for medical and pharmaceutical use in our country.

...lted at 180 - 184°C and contained 5.51 % water, the dry substance had $(\alpha)_D$ 174-189°.

Emanuel and papavasilion (1920) stated that the seeds of P. Coronopus yielded 44.2% mucus and 4.6% of a water-soluble gum which showed the reaction of pentoses and was converted by nitric acid into mucic acid. The entire plant exclusive of the seeds yielded plantagenic acid $C_9H_{12}O_2$, m.p. 210°C; soluble resin and coronopic acid $C_{54}H_6O_2$, m.p. 281-282°C.

Horissey (1933) stated that P. maritima contained the glycoside aucuboside.

The same auther (1935) reported the presence of stachyose and aucuboside in the roots of P. maritimum and P. Carinata.

Anderson and Firenan (1935) reported that the seed coats of P. Psyllium are composed of about 98% of a mucilage which can be extracted with cold water, either from the whole seed or the separated seed coat.

The mucilage is contained entirely in the seed coat and is composed of L. arabinose, D-xylose and D-galacturonic acid.

Mullan and percival (1940) stated that extraction

of ribgrass (P. lanceolata) seeds with water at room temperature gave a viscous solution from which a polysaccharide contained 15.2% uronic acid 72% Pentosan and 11% methyl Pentosan.

Anderson et al (1941) stated that the seed of (P. fastigata) contained 19% of a mucilage which is a mixture of acids varing from 8-17 pentosan molecules combined with 1mole of D-galacturonic acid. The mucilage was very similar in composition and properties to that isolated from P. psyllium.

Nelson and percival (1942) studied that mucilage of P. aronatia and found that it was composed of 80% pentosans and 7.2% uronic acid. A detailed study of its chemical structure was also given.

Wattiez and Hans (1943) extracted a holoside from the seeds of P. major and P. OVata forsk (P. isphaghulata Roxb). The holoside was soluble in water slightly soluble in absolute ethanol; insoluble in ether and carbon totrachloride. It melted at 123-124°C and had $(\alpha)_D$ + 125.62° (in ethanol). The holoside was a trisaccharide consisting of glactose, glucose and fructose, distinguishable from stachyose and raffinose and the name plantose was recommended for it. It

contained two molecule of water of crystallization.

Hirst, Jones and Raymond (1947) carried out a general investigation of P. psyllium seeds and in particular the carbohydrates. They stated that the seed coat contained sucrose, reducing sugars and carbohydrates other than sugars.

Ruiz and Munoz (1947) stated that the seeds of P. psyllium contained glycosides, Free glycide, diholosides, dextrins, lignin, Cellulose, tannin and pentosans in addition to the mineral salts.

Greenberg (1948) described the seeds of four varities of plantago (P. arenaria, P. ovata, P. wrightiana and P. rhodosperma) , which yielded mucilages similar to P. psyllium. He reported a new easily made hand press which was used in 3 methods of quantitatively expressing the mucilage from the seeds. The amounts, description and viscosities of the mucilages obtained were discussed.

Percival (1949) found that hydrolysis of the polysaccharide obtained from seeds of P. lanceolata with 3% oxalic acid gave D-xylose, a small amount of D-galactose and a degarded acid which contained D-galacturonic acid, L-arabinose, D-xylose and D-galactose.

Laidlaw and Percival (1949, 1950) examined the polysaccharide extracted from the seeds of P.Ovata Forsk and found that the mucilage extracted by cold water had a higher uronic acid content 20% and a lower pentosan content (52%) than the polysaccharide isolated by extracting the residue with water at 90-95°C. The latter Polysaccharide contained approximately 3% uronic acid and 90% pentosan. The sugar constittuents of the mucilage were D-xylose, L-arabinose, L-rhamnose and D-galacturonic acid.

Hostettler and Devel (1951) studied the mucilage obtained from the seeds of P. arenaria and stated that on hydrolysis with 3% oxalic acid it yielded D-xylose (60%), L. arabinose (17%) D-galactose (6%), 2-O-(-D-galactopyranosyluronic acid) L-rhamnose (13%) and an insoluble residue which appeared to be a mixture of cellulose and lignin. This aldobiuronic acid was formerly isolated by them.

Guseva (1952) found that both the seeds of P. Lanceolata and P. media Contained aucubin P. major contained aucubin, but only in its leaves.

Wild and French (1952) showed by paper chromatography

that roots of P. rugellii and P. major contained sucrose, raffinose, plantcose, stachyose and higher molecular weight homologous oligosaccharide.

The latter after hydrolysis, gave fructose, glucose, galactose, melibrose, plantcobiose and mannitriose.

French et al (1953) studied the constitution of plantcose isolated from the seeds of P. major and P. ovata and showed that it is 6-(α -D-galactopyronosyl) β-D-fructo-furanosyl- -D-glucopyranoside.

Hirst et al (1954) reported that the mucilage from dark "psyllium" (P.arenaria) seeds could be extracted with cold water and no further material was obtained by extraction of the seeds with hot water. The acidic polysaccharide was obtained by precipitation from the viscous aqueous extract with acidified ethanol.

Swintosky et al (1955) prepared the powderd polysaccharide acids from plantago by ion exchange of the gum solution with a sulfonic acid exchanger followed by spray drying. They found that the polysaccharide acids of plantago retarded tablet disintegration while those of carbony methyl cellulose promoted it.

Jones and Albers (1955) found that the mucilage

content of inflexa, P.rhodosperma and P.helleri was slightly less than that of P. ovata studies of viscosity values indicated that heating has a definite effect.

Erskine and Jones (1956) fractionated the mucilage of P. ovata and P. arenaria by stepwise addition of Cu $(OAc)_2$ and ethanol. Determination of the optical rotation, equivalent weight and constituent sugars showed that they gave at least two polysaccharides.

Herissey (1957) described a technique for preparing planteose from plantago psyllium

Lewis and Smith (1957) proved by electrophoresis that the mucilage of P. lanceolata was formed of two components.

Bandyo (1960, 1961) carried out potentiometric titration and conductivity measurements at several degrees of neucralization of polysaccharide from P. ovata of equivalent weight 550 molecular weight 20.000. The former indicated that H bonds persisted up to 20% nutralization; the latter indicated fixation of genenion on the polyion as a result of high charge d on the polyion at higher values of .

Dusinsky and Tyllova (1960) described a spectro-