General Introduction

Trigonella foenum graecum L., commonly known as fenugreek, is an annual herbaceous plant belonging to the sub family Papilionaceae under the family Leguminosae . It is indigenous to the countries bordering on the eastern shores of Mediterranean and largely cultivated in India, Egypt, and Morocco from ancient days. The seeds are imported chiefly from Mogadore and Bombay.

It was well known to the ancients, who used the herb as cattle fodder and employed the seeds medicinally. In Egypt the seeds are roasted and eaten and in India the young shoots form a favourite vegetable. In ancient Italy it was grown for the spring forage and for medicinal purposes. In Greecethe seeds boiled or raw eaten with honey. The herb is also grown for improving the soil in the Mediteranean countries, India, California and other tropical countries for having nitrogen fixing ability.

In Arabic countries it is known as "helbeh", in India and Pakistan "Methi", in Ethiopia "abish", in America "Shambala", in Russia "Pazhithik" and so on.

Medical papyri from ancient Egyptian tombs reports that once it was used to reduce fever as a food. In religious rites it was one of the numerous components of the celeborated "Kuphi" (holy smoke), an Egyptian compound incense used in fumigation and emblaming (Sambamurty and Subrahmanyam, 1989).

Fenugreek is employed today in Indian and Ethiopian medicine as a carminative and tonic for gastric troubles. When soaked in water the seeds swell and produce mucilage which is said to aid in digestions. Fenugreek seed is used also by Indian women for its alleged power to promote lactiation. Ground fine and mixed with cotton seed it is fed to cows to increase the flow of milk so it is used as valuable fodder. In India fenugreek seed is of daily use as a spice and adds nutritive value to food as well as flavouring agent. In Egypt and Ethiopia it is a popular ingredient of bread known to the Arabs as "hulba". From ancient days seeds of this plant are being used as a remedy against skin disease and diabetes. Recently it has been verified with pharmocological study to become very much effective for its active constituents for the treatment of skin disease and diabeties (Khosla et al, 1995 ; Rastogi, 1994 ; Sadhukhan, 1994). Besides, seeds of T.foenum graecum L.

has been observed to be useful for the cure of cancerous swelling of the liver caused by malignant matters (Ahmad and Farooqi, 1991).

As the seed of T.foenum graecum L. is well known for a long time to serve as a food article, much emphasis was given earlier to examine and estimate different components of food. Such as, vitamins, carbohydrates and proteins (Reid and Meier, 1970) but information in connection with the isolation and identification is meagre. Diosgenin was isolated by several workers (Vershny and Sharma, 1966 ; Hardman and Fazil, 1972). Alkaloid, trigonelline was isolated by Fournier,(1958). Since the discovery of Marker et al, (1947) that diosgenin may be converted to a number of steroid hormones used for the preparation of oral contraceptives and cortisone synthesis, much attention was given to diosgenin and which becomes the most important source of raw material for the synthesis of steroid drugs (Applezweig 1962, 1969). Supplies of diosgenin are ultimately limited (Martin 1972). Diosgenin at present is obtained mainly from the tubers of Dioscorea (wild yam) species. The rise in demand for steroid drug that has occured in recent years and the lack of stability in the production and marketing diosgenin (Anon 1973 ; Applezweig 1974; -

Love 1976) from Dioscorea has accelerated the development of alternative source of raw material. According to Rule (1975) and Bradley et al, (1978) diosgenin from T.foenum-graecum L. requires further investigation as possible future alternative source. For commercial drug production, it is important to have Δ^5 linkage. Hence diosgenin in T.foenum graecum L. would be suitable whereas tigonenin and others would not (Mann 1978). Thus much importance has been given on the production of diosgenin specially in relation to the effect of various factors on growth and development of plant. Methodology so far used for the estimation of diosgenin from the plant are gravimetric (Selveraj, 1971) gas liquid chromatography (Tang et al,1978); Glyzine 1981), densitometric method using TLC scanner (Gunawan et al, 1994), but no attempt has so far been made to establish an easy and rapid colorimetric method for estimation of diosgenin on microscale. Thus attempt has been suitable for quantitative determination of diosgenin in large number of samples obtained during various treatments of the plant.

In India fenugreek is generally cultivated in cold season. As compared to South Bengal, cultivation of the plant is very much sporadic in North Bengal though the

climatic conditions prevailing in the region is expected to be very much congenial for good growth of the plant as per the suggestion of ecosystematic data on medicinal plants, worked out by Duke (1982). The lack of knowledge in connection with the growth and development of the plant in North Bengal may be considered as the main reason for giving any priority for the plant to be cultivated commercially by the local cultivators and for which no specific target and data on productivity of plant is available in North Bengal. Due to prevailing high humidity and precipitation in North Bengal throughout the year, much of the stored seeds for future use, enters into non-viability within a few years. But non-viable seed still contain considerable amount of diosgenin during its deteriorative condition. Thus attempt has been made for chemical analysis of non-viable seeds following conventional phytochemical method.

The study on seed germination behaviour of any economically important plant is very essential specially when raising of large number of seedling is necessary in connection with its commercial cultivation. This part of work is very essential when decline of seed vigor is observed

during storage of seed in laboratory condition. As the seed reaches non-viability due to storage, huge amount of seeds are becoming useless after a certain period of time in each year. Thus the study on seed invigoration by chemical treatment is very important for its purpose-ful utilisation. It has been the experience that some of the chemicals, like vitamins have the ability to stimulate germination of seed, having low germination capacity due to storage. Thus attempt has been made to screen out certain chemicals which may be helpful to stimulate germination of considerable amount of seed which are considered useless from commercial point of view.

The productivity of secondary metabolites such as diosgenin is very much dependent on growth and develop-ment of plant. It also depends on various environmental factors. From review it appears that a number of authors have attemped to study agrobotanical aspects with special emphasis on fertilizer trial (Patel, 1991) irrigation (Bhati 1993, grain yield (Sharma et al, 1990), effect of organic matter (Gupta and Mukherjee, 1992 ; Krishnan et al, 1995 ; Atallah and Lopez-Real 1991) and on some biochemical para-meters such as mineral content (Luhora et al, 1995 ; Singh

et al, 1991) enzyme activity (Zambou et al, 1993) carbohydrate accumulation (Bewley et al, 1993, Singh et al, 1994, Edward et al, 1993),DNA content (Kar and Sen,1992), agronomic factor (Martiniello and Elota, 1993), morphological and cytological investigations (Singh et al, 1991) and production of chlorophyll mutant (Janardhan and Nijam 1995) have also been conducted. But report in connection with the effect of various factors on the yield of diosgenin content in the plant is meagre excepting Mehra et al,(1995) who observed the effect of some chemicals such as N,P,NAA and H_2So_4 on the yield of the plant with special emphasis on its diosgenin content. All these experiments have been conducted under the environmental condition of different places other than North Bengal.

Thus investigation has been conducted on the effect of micronutrients of Zn, Mn and Cu in the form of chloride and nutrient solution containing various combinations of N,P and K on growth and development of T.foenum-graecum L. with special emphasis on diosgenin yield in climatic condition of North Bengal.

Heat treatment of seed of T.foenum graecum L. has been observed to cause accelerated ageing of the seed

and which also showed accumulation of higher amount of diosgenin as compared to that of seed untreated. On the basis of saponin content of both types of seed it appears that there might be the involvement of endogenous enzyme which perform hydrolysis of saponin to diosgenin. It requires isolation of enzyme to confirm the activity over saponin. This is very essential because with the help of this technology it will be possible to develope a procedure for enzymatic hydrolysis of saponin avoiding chemical hydrolysis which in turn initiate loss of considerable part of diosgenin to its diene form (Harborne, 1973) because diene form of diosgenin is generally considered unless in connection with the production of 16-DPA. Thus standardisation of methodology for the preparation of 16-DPA is very essential because of the fact that 16-DPA is very important from commercial point of view. It is generally utilised for the preparation of cortisone and contraseptive pills.

With this back ground the plant has been studied from chemical, biochemical and plant physiological point of view so that the information derived out of the work will be of much help during purposeful utilisation of the plant, specially for the development of steroid industry in our country.