

GENERAL INTRODUCTION

The contraceptive steroids and antiinflammatory agents such as Beta methasone, Dexamethasone and others derived from corticosteroids are two major groups of steroids that are being manufactured presently all over the world on an industrial scale (Weston, 1976). This was due to an announcement of the dramatic effect of cortisone for the treatment of rheumatoid arthritis followed by the discovery of suppression of ovulation by contraceptive steroids (Kendall and Hench, 1949, Banerji et al., 1981). This necessitated a greater supply of the naturally occurring steroid precursors from which these drugs can be prepared on large scale.

Out of various steroidal precursors, diosgenin has been noted to be the most important source of raw material for the synthesis of steroid drugs (Appelzweig, 1962;) for which different species of Dioscorea yielding diosgenin has so far been utilised for a considerable period of time (Coppen 1979).

The situation started changing after that period when rising prices and uncertainty of the availability of Dioscorea yams caused shortage of steroid drugs based on diosgenin (Appelzweig, 1969; Love, 1976). According to Chopra and Hunda (1963), Dioscorea exhibits very poor growth performances accompanied by reduction of tubers and its saponin contents when it is planted away from its natural habitat condition and its commercial cultivation becomes not encouraging due to stringent climatic conditions (Abrol and Kapoor, 1962).

But the rising demand for steroid drugs that has occurred in recent years and lack of stability in the production and marketing of diosgenin from tubers of Disocorea ultimately turned the attention to other alternative source.

Costus speciosus(Koenig) Sm. belonging to the family Zingiberaceae recently gained much more importance as an alternative source for the purpose. Das Gupta and Pandey (1970) were amongst the first to predict the occurrence of diosgenin 2.12% in the rhizome of the plant. Kapahi et al. (1978), Rathore and Khanna (1979) Gupta et al. (1981a) ; (1981b) in their techno-economic evaluations studied the cultivation of Costus speciosus as a commercial crop and indicated a comparable profit as against other conventional crops. The conventional method which they have introduced could be considered as plus point for making C.speciosus as an ideal raw material for steroid industry , and according to them pure form of diosgenin could be obtained from this plant as compared to other.(Chakrovarti et al., 1976).

Light influences a number of biochemical physiological and morphological characters of plant including steroid metabolism (Duperon, 1968 ; Bush et al., 1971). Lot of information is available in connection with the effect of quality of light on growth and development of the plant (Downs, 1956, Moore , 1980 , Walton et al., 1982 ; Rao et al., 1982) but no report has so far been made on growth and development of the C.speciosus as well as biosynthesis of sapogenin in it by the influence of quality of light. However bio synthesis of some steroidal

constituents from Mevalonic acid has been observed to be higher in presence of light (Bush and Grunwald 1973). Besides , Akahori et al. (1970) observed increase of different sapogenin by the application of light in Dioscorea tokoro. Similar observation was also noticed by various authors in different other species of Dioscorea (Karnick , 1972 ; Nandi and Chatterjee , 1978).

Thus it is very essential to study the effect of quality and quantity of light on C.speciosus with special emphasis on its diosgenin content.

During the last few decades an increasingly effective technology of chemical regulation of plant evolved (Leopold and Kridman. , 1975) one of the outstanding characteristics of secondary metabolism is its dependence on the developmental stages of plant. The effect of various growth regulators has been worked out in details on diosgenin yielding plants other than Costus speciosus , Khanna (1977), Marshall and Staba (1976) , Martin and Delphin (1969); Suthar et al., (1980).

Besides application of bacterial fertilizer is a modern technique for cultivation of medicinal plants and other crops. Chemical fertilizers sometimes affect the plants , reduce the fertility , change the characters of the soil and polutes the environment. Under such circumstances , application of bacterial fertilizer is only the possible way to have better yield.

Thus , attempt has made to study the effect of various chemicals and different commercially available bacterial fertilizers viz., 'Azotobactor' and 'Phosphobacterin' on growth and development of Costus speciosus (Koenig) Sm. with special emphasis on the yield of diosgenin and other biochemical parameters to understand the metabolism in the plant.

The microbes used were B. Polymixa , Pseudomanas Striata and Aspergillus awamorii. These organisms were known for their ability to solubilize phosphate from Rock phosphate and Tricalcium phosphate efficiently (Kundu and Gaur , 1981). According to them when all the three cultures were used together , the population was enhanced. From the observation it appears that the application of phosphobactrin also stimulated the growth of the plant accompanied by the increase of diosgenin synthesis.

Though 'Azotobactor' showed some effect on the plant 'Phosphobactirn' was observed to show better performance in the plant as compared to that of 'Azotobactor' and specially with reference to the increment of the diosgenin content.

Diosgenin has been noted to be incorporated into the component of cellulose in cell wall and this observation was supported by selvaraj and Subhash Chandra (1980) who detected some amount of diosgenin in the isolated cellulose part of hydrolized tuber Dioscorea floribunda.

Very recently it has been noted that diosgenin content in tuber of Dioscorea deltoidea and Dioscorea floribunda may be increased due to post harvest incubation of tuber in presence of various chemicals. Roy and Dutta (1978 b) observed the increase of diosgenin content upto 34.9% (in Dioscorea) which was due to water induced fermentation process prior to hydrolysis of rhizome. Increased content of diosgenin due to incubation of rhizome in presence of water and different growth regulators has also been reported (Shah et al 1978).

Thus there is a possibility to increase the diosgenin content in the rhizome of Costus speciosus due to incubation process and needs investigations.

It has been noted earlier that bio synthesis of diosgenin is very much related to carbohydrate metabolism and it arises via Mevalonic acid path way to produce squalene which , in turn , gives rise to diosgenin via cholesterol Croey et al., (1966) ; Haftman , (1970) ; Bennett and Haltman , (1965) , Tscheche et al., 1974. While working on the production of diosgenin in yam of Dioscorea under various treatments and conditions , it has been noted to vary in different samples accompanied by the frequency occurrence and their distribution of late accumulation of starch has been worked out in details from physiological and biochemical point of view (Bernadette et al , 1989 ; Gosta and Rydepetterson , 1989). Besides , the

relationship between size difference of starch to its chemical component has been worked out in details (Hasse and Kempf , 1989). The shape size of starch has been noted to be a very good indicator to identify its Botanic origin (Trease and Evans , 1978 ; Tyler et al , 1976).

Thus the study on Linear regression in connection with observation on size difference of starch grains and estimation of Diosgenin in the same material of yam is very necessary to have a better understanding of the principle with the help of which the quality of the sample material may be assessed.

Thus, in short, the present study deals with some investigations on Costus speciosus, very much acclimatized in ecological condition of Darjeeling District in North Bengal, with special interest on the improvements of its diosgenin content in its rhizome under various treatments and conditions. Moreover, attempt has also been made to study the relationship of starch grain in yam with that of its diosgenin content following the principle of 'Linear regression' analysis. It is expected that the knowledge derived out of the present investigation will be of much help in connection with utilization of both these plants as raw materials for the steroid industry in the region of North Bengal, India.