G E N E R A L I N T R O D U C T I O N

Since the time immemorial people are fighting against insects for one reason or another either to prevent agricultural crops from being destroyed or to check the diseases caused by them. In doing so many insecticides of plant origin have been used either in crushed form or in the form of extracted solution (Crosby, 1971).

It is a common practice in the hill areas of North Bengal that people are using some plants in the form of dust to catch fishes in the streams and to control flies in animal sheds. The plants that are being used for these purposes have been noted to be various members under the family Leguminoseae and out of which Teprosia vogelii Hook and T. candida DC are very important.

From very early time, it has been the practice in several countries of the world to catch fishes by throwing into streams the crushed portion of the plants which have the effect of stupefying fish and thus bringing them insensate to the surface. The plants mostly used in the tropical countries include the species of Derris, Lonchocarpus, Millettia, Tephrosia and Mundulea (Rangaswami & Ramasastry, 1965; Subba Rao, 1965; Moore et al, 1956; Norton 1944; Kadylova et al, 1974). In addition to piscicidal property, these plants were also found to kill the insects which are parasites to animals. Later the roots of Derris and of certain species of Lonchocarpus began to be marketed as commercial insecticides, the former as 'Tuba' root and the latter as "Cube". Of recent interest

is "The Devil's shoestring" (Tephrosia virginiana) growing in the eastern and southern United States.

Among these plants, a number of species of Tephrosia and Derris have been noted to be studied thoroughly (Fukami and Nakajima, 1971). These and search of active principle in these plants. was pursued with vigour in several countries of the world. Rotenone, having high potency of fish poison and insecticide, was identified at the beginning of this century. By the subsequent years a large number of rotenoid compounds, tephrosin, degulin toxicanol etc. were isolated from related plants. They also exibits considerable fish toxicity and insecticidal activity though they are definitely inferior to rotenone.

The rotenoids have in common the four rings chromanochromanone system as the basic structural units They may be regarded as formarly isoflavanones which have been modified with an "extra" carbon atom. Such a view is noted to be consistent with the current knowledge of the biogenetic origin of these compounds (Wong 1975).

That these chemicals have the property to arrest the respiratory mechanism of insects was gradually realised (Fukami, 1951, Donglas et al. 1968, Red fearn, 1969, Fukami and Tomizawa 1951, Martin et al. 1943). In course of time these chemicals attracted the attention of biologists and being used for many years in a number of countries of the world because of their low toxicity to vertebrates, characteristic biological activity and rapid degradation to nontoxic substances (Fukami et al, 1971). But the discovery of high insecticidal activity of the synthetic substances, DDT during the world war placed at the disposal of a large

range of synthetic preparations. Since then a number of them are constantly being used in different fields of Agriculture, horticulture, forestry and public health campaigns. As a result the importance of these natural insecticides was lost to view. Rapid output of the synthetic insecticides, however, has resulted in a serious situation, since their residual toxicity has become dangerous and a number of insects have developed resistance to them. Recently some of them are noted to have carcinogenic activity and unselective toxicity to human being (Rangaswami, 1965; Fukami et al, 1971; Gablicks et al, 1979; Askari et al, 1979). DDT has now been considered as an important environmental pollutant (Taley et al, 1979; Franco et al, 1951; Olsen et al, 1980; Eidman et al, 1979). This has promted biologists to express grave concern over the use of synthetic insecticides. As a result USA and other countries banned the use of DDT in 1972 (Tyler et al, 1976). So an alternative to these synthetic insecticides preferably from natural source is being considered now-a-days by the scientists of the world. Although the synthetic insecticides have decreased the need for quantities of rotenone in the past few years, there is a considerable trade in rotenone containing plant parts. The annual importation of USA shows that this country has been using rotenone yielding plants and purified rotenone in increasing order (Gosalvez et al, 1978). During 1972, about 1,500,000 pounds of crude plant parts were imported against 5,000,000 pounds in 1954 (Tyler et al, 1976).

Rotenone has been tried to be synthesized from tubaic acid through a number of decarboxylation, condensation, oxidation and basification involving a chain of long process (Sasaki and Yamashita, 1979).

As the synthesis on commercial basis will consume huge expenses, the search of easily available plants yielding high content of rotenone and rotenoids and their utilization will be of much economic value for the country.

Tephrosia vogelii Hook and T. candida DC are growing as obnoxious species in North Bengal, India, upto an altitude of 1700 mtrs. These two species have been noted earlier to contain an appreciable quantity of rotenone and rotenoids (Irvine et al, 1959; Krishna and Ghose, 1938). According to Irvine and Freyne, 1959) Tephrosia vogelii Hook has the potentiality to be utilized commercially for the production of rotenoid compounds. Similarly the commercial use of T. candida DC has been recommended by Krishna and Ghose (1938). It is the purpose for this part of work to study the plants from physiological, biochemical, and phytochemical point of view so that these species may be utilized as commercial crop for this region.

Tephrosia vogelii Hook and T. candida DC are found to be very much similar in morphology, attempt has been made to distinguish these two species from morphological and chemical point of view.

Dormancy of seed of these species is a common problem and needs investigation for raising a large number of seedlings. Therefore the germination of seed has been studied with a view to understanding stimulation of it in different treatments and conditions.

The seeds of these two plants have been noted to be the storehouse of various flavonoids and phenolic compounds (Pradhan and Basu,

Unpub). For a long time flavonoids as with other secondary plant products have been regarded as metabolically inactive end products stored as waste material in various plant tissues (Schwarge, 1958; Reznik, 1960). Recently it has been noted in this laboratory that some flavonoids have role on the growth of seedlings of T. vogelii Hook (Pradhan and Basu, 1980, 1981, 1982). Thus a study on physiological biochemical aspects have been attempted to know the role of various phenolic compounds isolated from these plants on seed germination and seedling growth of these plants. The percentage of rotenone and retenoids has been noted to vary in different parts of the plant, as well as in different treatments and conditions (Irvine and Freyne, 1959). Variation in the content of the active constituent has also been recorded (wealth of India, 1976). Attempts have also been made to find optimum condition for the production of the active constituents in the plants. In this respect a precise as well as quick method for systematic quantitative analysis of rotenone has been attempted on the basis of certain principle of chemical reaction noted earlier. This work will ultimately be helpful for quantitative determination of the active principle from a large number of samples.

Though the seed of Tephrosia vogelii Hook and T. candida DC has been studied earlier in connection with various active constituents (Rangaswamy and Ramasastry, 1953) of viable seeds but no attempt has so far been made on the nonviable seeds of these species. While working on the isolation of various chemical components in the seeds of T. vogelii Hook a chemical constituent which is supposed to be a

new record has been isolated. An attempt has been made to ascertain the structural formula on the basis of some chemical and physical data. But detailed chemistry is not possible due to paucity of material. These plants also yield rotenoid and non-rotenoid substances the details of which are discussed in the thesis.

Thus in short an attempt has been made in this work to raise the economic status of two species of Tephrosia stydying the botanical and chemical aspects with special interest on ~~the optimum~~ understanding optimum conditions for the maximum yield of their rotenoid content.