

ABSTRACT

A B S T R A C T

Tephrosia candida DC., a native leguminous plant has been noted to grow in Balason-Catchment area of North Bengal in endangered condition. It is the purpose to study the plant from chemical and plant physiological point of view, so that it can be utilised for the development of economy and ecology of the region. During the isolation and characterisation of chemical constituents of various parts of T. candida DC., it has been noted that the plant is characterised by the presence of various phytosterols, rotenoid compounds, phenolic acids and flavonoids. Petroleum ether fraction showed the presence of β -sitosterol and stigmasterol. Ether soluble fraction of methanolic extract has been examined to contain five phenolic acids (3,4-dihydroxy benzoic acid, *o*-coumaric acid, gallic acid, 4-hydroxycinnamic acid and 4-hydroxy, 3-methoxy cinnamic acid) from leaf, two (gallic acid and 4-hydroxy, 3-methoxy cinnamic acid) from root as well as fresh seed (*o*-coumaric acid and 4-hydroxy, 3-methoxy cinnamic acid). Rotenone and tephrosin, the naturally occurring insecticides have been detected in petroleum ether and neutral fractions. Rotenone is noted to be present in all parts of T. candida DC. Rutin (Quercetin 3-rutinoside) has been isolated from ether insoluble alcoholic fraction of leaf. Neutral fraction of 6 years old non-viable seed has been shown to contain dehydrotetenone-like compound. An attempt has been made to identify the chemical nature of the compound with the help of melting point determination, chromatographic behaviour, microanalysis of carbon, hydrogen and oxygen and analysis of spectrum of UV, IR, Mass and PMR.

In connection with the quantitative estimation of rotenone, a new and easy colorimetric method has been proposed and which is based on the chemical reaction proposed earlier by Haussler (1946, 1947). The content of total rotenoid and rotenone have been estimated from different parts of T. candida DC. Green leaf, seed and young root are found to contain appreciable amount of rotenone (0.74, 0.83 and 1.00% respectively on dry weight basis). A significant decrease in total rotenoid and rotenone content has been observed in decomposed leaf (0.30%) and non-viable seed (0.35%).

The soil collected from different places in Balason catchment area has been noted to be very poor in low contents of N,P,K and other micronutrients having acidic pH in most of the cases (pH 4.8-5.7). Culture experiment of T. candida DC. in different edaphic conditions shows a remarkable increase in N,P,K contents of the soil in all the cases. Organic carbon shows very high values (1.0 - 1.2%) compared to that of control (0.23%). C-N ratio in the soil has been noted to increase remarkably (3.36 to 7.50) over control (1.60). Available micronutrients (Cu, Fe, Mn and Zn) has also been increased in soil under T. candida during culture. Change in soil pH from acid to neutral or alkaline (6.2 to 7.8), congenial for growth of other plants has been noted during cultivation of the plant. T. candida culture growing in high and moderately high lands shows rapid growth rates compared to low lands. Moderately high land has been found to be congenial for showing the best growth

performance of T. candida. As regards biomass production, yield of 18,000 kg of wood/ha/yr indicates its efficiency to be utilised as energy plantation. Average biomass production of leaf, wood, root and nodules has been observed to be remarkably high at the end of third year. Deciduous leaf, perennial habits, production of large number of viable seeds with an easy and explosive dispersal mechanism and having a great role on the improvement of soil, the plant may be considered as an important species to be utilised for large scale plantation for upliftment of ecology and economy of the region.

During the estimation of different bio-chemical parameters of T. candida, green leaf has been found to be very rich in nitrogen (2.6%), Protein (11-17.5%) amino acid (3.3%) and phenol contents (4.5 to 7.5%). The high content of total nitrogen in green leaves may help in nitrogen supply to the soil. The amount of all the chemicals, mentioned have been noted to decline gradually during senescence and decomposition. Total phenol content has been found to decrease remarkably (0.9%) in decomposed leaf both from quantitative and qualitative point of view. Root shows lower amount of all bio-chemical contents as compared to leaf. Increased value of nitrogen, protein and amino acids have been noted in soils under T. candida vegetation over control. Cultures growing in moderately high land shows higher values in all respects. A remarkable increase of free amino acid content under T. candida cultivation has been noted.

During the study on the germination of seed, T. candida seeds were noted to be in a state of dormancy at the time of their dispersal due to the presence of hard seed coat. Treatment with conc. H_2SO_4 was noted to overcome the state of dormancy of seed. During photoperiodic treatment, seed shows higher rate of germination in dark than in light. The seed has a wide range of tolerance to dark, sunlight and other quality of lights. $30^{\circ}C$ has been found to be the optimum for showing maximum seed germination (98%). T. candida seeds has been noted to prefer the lower range of pH (3.0 to 5.8) during germination in presence of 6 different buffer solutions of Na and K. Stimulation of seed germination in all the cases has been noticed in presence of K^+ as compared to Na^+ .

In connection with the effect of various growth hormones and phenolic compounds on the germination behaviour of T. candida seed, highest stimulatory activity has been recorded at the lower concentration in the order of GA, Kinetin followed by ethylene and IAA.

While ABA has been observed to be inhibitory in its activity at higher concentrations (2-12% germination at 10^3 ppm) lower concentrations show acceleration in germination over control both in presence of light and in dark. Among the phenolic acids, gallic, benzoic, caffeic and ferulic acids show inhibitory activity during germination at higher concentration but acceleration has been noticed at lower concentrations of the chemicals both in light and in dark. Among the flavonoids, highest stimulatory activity has

been recorded in presence of rutin and quercetin followed by Morin. T. candida seed shows much low germination percentage in phosphorus deficient solution in comparison to that of complete nutrient solution. 100% seed germination has been observed in solution deficient in nitrogen and potassium. Much less of the plant growth is observed in culture lacking phosphorus. Potassium has no influence on growth of the plant upto 6th months. Progressively greater germination percentage has been observed when different phosphate salts were applied to seeds indicating the necessity of adequate supply of phosphorus for better establishment of the plant in the soil.

On the basis of seed germination behaviour and colour test with tetrazolium chloride, T. candida seeds were noted to lose their viability at the end of 6th year (0% germination). As much leachates have been noted to come out from the seeds during storage, change in the membrane structure of T. candida seed may be the factor responsible for the occurrence of non-viability of seed.

During storage condition, a distinct chemical changes including decrease in nitrogen, protein and carbohydrate content has been noted in T. candida seed as compared to fresh seed (2.00, 30.10; 1.69; 2.83% in 6 yrs. old non-viable seed and 4.50, 39.75; 2.93; 6.92% in fresh seed). However, a marked increase in total phenol content has been observed in non-viable seed (3.50%) in comparison to fresh seed (2.20%).

Green leaf extracts of T. candida DC. shows distinct inhibition of germination and shoot-root lengths of different test seeds.

Bicarbonate fraction of methanolic extract shows much more inhibition than water soluble extract over control. In this respect the inhibitory effect has been observed to have direct correlation with the concentration of extract. Inhibition has been overcome completely as leaf grows older and decomposes in soil. Shoot and root lengths of the test seedlings show increased values in presence of decomposed leave of T. candida over control suggesting the importance of the plant in connection with the ecorestoration of the region.

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