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Gloriosa Superba Tissue Cultured Plant: Effect Of Abiotic Stresses On The Adaptation Of Metabolites Like Total Phenols, Flavonoids, And Alkaloids

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ABSTRACT:

Cultured G. superba plants on Murashige-Skoog (MS) medium were subjected to abiotic stress created artificially by applying different light periods (12, 14 and 16 hrs), different pH (6, 7 and 8.5), and different temperatures (25, 30 and 35°c) in order to study the effect of stresses on secondary metabolite adaptation. To ascertain the impact of abiotic stress on the quantity of phenol, flavonoids, and alkaloids, G. superba extract, extracted with 95% methanol, was utilised. The amount of phenolics ranged from 0.4440.004 to 1.3920.02 mg TA/g extract, and there were no appreciable differences between the plants grown under various physical conditions.

The highest TPC values were reported to be 1.1760.007, 1.3010.02 mg TA/g extract, and 1.3920.02 mg TA/g extract in plants that were cultivated at various temperatures. and 35 degrees Celsius, respectively. Plant extracts contained flavonoids at levels ranging from 0.0320.03 to 0.2680.002 mg QE/g extract. The extracts of G. Superba cultivated under temperature stress at 25, 30, and 35oC contained the largest amounts of flavonoids, 0.241, 0.268, and 0.247 mg QE/g extract, respectively. Plants cultivated at a temperature of 25oC had a high alkaloids content (11.3080.41mg Col/g extract), but alkaloids accumulated less slowly at higher temperatures (30 and 35oC). In contrast to pH and photoperiods, the present study found that temperature was significantly more important for the optimal adaptation of secondary metabolites in G. superba.

Keywords:
Gloriosa superba, Abiotic stress, Alkaloids, Flavonoids, Phenols;

INTRODUCTION :

Stress is a physiologically changed condition brought on by things that tend to upset the balance. Any physical or chemical change brought on by a stress is referred to as strain [1]. The term "stress" has several diverse definitions, including the physiological definition and the suitable term as a response to certain circumstances. One of the most successful methods for increasing the output of bioactive secondary metabolites is the use of elicitors of plant defence systems, or elicitation [2]. In order to speed up the production of high product concentrations, secondary metabolite creation is stimulated in plant cell cultures using biotic and abiotic stressors that are categorised according to their source. Numerous environmental stressors, including extreme heat and cold, drought, alkalinity, salinity, UV radiation, and pathogen infection, have the potential to be hazardous.the vegetation. Elicitation has frequently been used to boost production of secondary metabolites or to cause their denovo synthesis.

Plant cell cultures grown in vitro [3]. Several scientists have used a variety of conditions to increase the synthesis of secondary metabolites in cultures of plant cell, tissue, and organ. Phenylpropanoids are frequently accumulated more as a result of environmental challenges such pathogen invasion, UV radiation, lighting, wounding, nutrition deficiency, temperature, and herbicide application. A plant that is more resistant might be produced by secondary metabolite concentrations that are higher. They are believed to be expensive to produce and hinder plant growth and reproduction [4].

Different plants create secondary metabolites, a type of bioactive molecules that include numerous groups of organic compounds such alkaloids, terpenoids, phenols, flavonoids, tannins, saponins, etc. These chemical compounds in plants that have distinct physiological effects on the human body are what give them their therapeutic worth.[5] Phytochemical study of traditional medicines Because of its importance for finding new sources of bioactive chemicals and medicinal agents, research on secondary metabolites is a crucial area of basic science [6]. G. superba L., a perennial tuberous climbing herb that belongs to the Liliaceae family, is found across India's tropical and subtropical regions. One of today's most significant medicinal plants, G. superba L., is under danger of local extinction owing to climate change. The plant's various parts have a wide range of uses, particularly in Indian traditional medicine that dates back thousands of years. G. superba L. tubers and seeds are a pricey export product. This plant was harvested from the wild and utilised as medicine because of its medical potential.

95% of the medicinal plants used as raw materials for large-scale pharmaceutical businesses were out to be endangered species that were included to the Red Data Book due to over-exploitation [7]. This is why the current study is intended to look at how stresses affect the adaptability of secondary metabolites including phenol, flavonoid, and alkaloids in the G. superba tissue culture plant.

The Existing Ranking Methods:

In order to accomplish this, cultivated plants in Murashige-Skoog (MS) medium were subjected to abiotic stress that was induced artificially by applying varied light periods (12, 14 and 16 hrs), different pH (6, 7 and 8.5), and different temperatures (25, 30 and 35°c). Cultured plants were examined on the medium for a month while stressful conditions persisted. All plants were taken after one month in order to examine how abiotic stress affected the levels of secondary metabolites.

Extraction and Phytochemical Analysis:

At room temperature (39 °C), the cultured entire plants were dried and ground into powder. G. superba dry powder that was extracted using a soxhlet device and 95% methanol (Merck). To get crude for phytochemical analysis, the extract was then evaporated in a water bath at 50°C [8].

Determination of Total Phenolic Content:

The method of Singleton and Rossi [9] was slightly modified in order to measure the total phenolic content (TPC) of the crude extracts of the G. superba plant. The total phenol was determined using the Folin Ciocalteau reagent in this technique (1:10 v/v diluted with distilled water). Following incubation, the blue color's development was seen. Then, using a spectrophotometer, the absorbance of blue colour in several samples was determined at 725 nm. On the basis of a standard curve for tannic acid, the phenolic content was estimated as Tannic acid equivalents (TA)/g extract. Tannic acid equivalents (TA/g) of the plant extract were used to express the findings.

CONCLUSION:

The current study came to the conclusion that abiotic stress factors affect the plant's ability to produce secondary metabolites. The impacts are obvious. In actuality, the altered stress element affects productivity. For instance, the effects of temperature, pH, and photoperiod, among other factors, also affect plant productivity and adaptation.

There have been significant advancements in the generation of medicines and secondary metabolites using in vitro plant cell culture. The fundamental knowledge for the generation of secondary metabolites for commercial application will be provided through the utilisation of abiotic stress and changing environmental circumstances. Large-scale plant cell culture technology is now again gaining popularity because of the rising use of natural goods for medical purposes, low product yields, and supply issues associated with plant harvest. variables that are biotic and abiotic that affect secondary The potential to overproduce beneficial phytochemicals for a variety of uses is enhanced by metabolite synthesis. In this study, temperature exhibits the highest adaptability of secondary metabolites in G. superba plant as compared to pH and photoperiods. According to our study, G. superba's culture conditions were improved in order to produce bioactive secondary metabolite compounds.

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