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Impact of IAA, Brassinolide, Potassium nitrate and Kinetin on the Chlorophyll Contents of *Asparagus racemosus* Willd

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Abstract

In this investigation, the seeds of *A. racemosus* were studied for their chlorophyll contents which were pretreated with IAA, Brassinolide, Potassium nitrate and Kinetin before germination during which the highest chlorophyll contents (both a and b) were found to be 4.91 mg-g FW^{-1} in 100 ppm IAA treated seeds followed by 4.89 mg-g FW^{-1} under 50 ppm brassinolide, 4.79 mg-g FW^{-1} under 50 ppm potassium nitrate and 4.5 mg-g FW^{-1} under 50 ppm kinetin compared to untreated seeds which exhibited only 4.26 mg-g FW^{-1}. The mentioned results concluded that the primary productivity of this chosen plant increases with higher dozes of IAA as compared to controlled seedlings as well as other used factors.

It is commonly known as *Satavar, Shatavari or Shatamul* and is also commonly found in Sri Lanka, India and the Himalayas. It grows one to two metres tall at 1,300-1,400 metres elevation. *A. racemosus* is recommended in Ayurvedic texts for the prevention and treatment of gastric ulcers, dyspepsia and as a galactogogue. It has also been used successfully by some Ayurvedic practitioners for nervous disorders. It has small pin-needle-like phylloclades or photosynthetic branches that are uniform and shiny green. It produces minute, white flowers on short, spiky stems in July and in September, it fruits producing blackish purple, globular berries. It is an important medicinal plant of tropical and subtropical India. Its medicinal usage has been reported in the Indian and British Pharmacopoeias and in traditional systems of medicine such as Ayurveda, Unani and Siddha. Besides use in the treatment of diarrhoea and dysentery, the plant also has antioxidant immunostimulant, anti-dyspepsia and antitussive effects. The seeds of *A. racemosus* are black in color and hard with brittle testa.

In the present investigation, the seeds of *A. racemosus* were subjected to various treatments which are mentioned above to enhance its germination and also to check the impact of these treatments on its primary productivity. Studies on germination, dormancy and the primary productivity have been carried out by various workers which include absorption

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of light by chlorophyll solutions by Mackinney[9]. Wolken *et al.*,[14] have worked on environmental factors affecting growth and chlorophyll synthesis in euglena I. physical and chemical II. the effectiveness of the spectrum for chlorophyll synthesis. Effect of water stress on photochemical activity of chloroplast from wheat has been investigated by Zhou[15]. Singsaas *et al.*,[11] have elevated CO_2 effects on mesophyll conductance and its consequences for interpreting photosynthetic physiology. Identification of a *vinyl reductase* gene for chlorophyll synthesis in *Arabidopsis thaliana* and implications for the evolution of *Prochlorococcus* species have been carried out by Nagata *et al.*,[10]. Baker[1] has worked on chlorophyll fluorescence: A probe of photosynthesis *in vivo*. Taxonomic identity, phylogeny, climate and soil fertility as drivers of leaf traits across Chinese grassland biomes have been investigated by He *et al.*,[6]. Han *et al.*,[4] have studied biogeography and variability of eleven mineral elements in plant leaves across gradients of climate, soil and plant functional type in China. Similarly, relative effects of phylogeny, biological characters and environments on leaf traits in shrub biomes across central Inner Mongolia, China have been reported by Liu *et al.*,[7]. Croft *et al.*,[2] have investigated modelling leaf chlorophyll content in broadleaf and needle leaf canopies from ground, CASI, Landsat TM 5 and MERIS reflectance data. Large-scale estimation and uncertainty analysis of gross primary production in Tibetan alpine grasslands has been reported by He *et al.*,[5]. Croft *et al.*[3] have reported leaf chlorophyll content as a proxy for leaf photosynthetic capacity. Similarly during the same year, leaf morphological and anatomical traits from tropical to temperate coniferous forests: mechanisms and influencing factors have been studied by Tian *et al.*,[12]. Li *et al.*,[8] have investigated variation in leaf chlorophyll concentration from tropical to cold-temperate forests: association with gross primary productivity. Moreover the effect of high CO_2 treatment and MA packaging on sensory quality and physiological-biochemical characteristics of green *Asparagus* (*Asparagus officinalis* L.) during postharvest storage has been reported by Wang *et al.*,[13].

Healthy seeds of *A. racemosus* were collected. The seeds were washed with running tap water three to four times and once surface sterilized with 0.1% H_gCL_2 solution for 5 minutes to remove the surface adhering microbes. After surface sterilization, the seeds were again washed with double distilled water. Uniform sized seeds were then transferred to sterilized Petri Plates provided with filter paper pads. Three replicates of treated and control seeds were kept for germination studies. The filter paper pads were moistened as and when needed. The emergence of radical was taken as germination.

The leaves of the treated as well as untreated plants were subjected to the chlorophyll estimation at regular intervals preferably fortnightly by the method given by Arnon (1949). For the estimation of chlorophyll a, chlorophyll b, and total chlorophyll contents weighed amount of the leaves was taken and a paste was made in acetone in a clean mortor. It was finely ground with the help of pestle and filtered through a Buchner funnel under suction. The process was repeated till the residue became colourless and devoid of chloroplast pigments. The volume of the filterate was adjusted to 100 ml by adding sufficient quantity of 80% acetone. The filterate was subjected to spectrophotometric calculation of optical densities. The optical density was measured at 645 nm, 652 nm & 663 nm. The calculation of chlorophyll amount was made on the basis of per gram of leaf tissue and expressed in milligrams.

Table 1: Effect of various factors on the chlorophyll contents of *A. racemosus*.

Treat-ments	Chloro-phyll a	Chloro-phyll b	Total Chlorophyll
	------ (mg/g FW^{-1}) -------		
Control	2.41	1.85	4.26
IAA 10 ppm	2.53	1.97	4.5
IAA 50 ppm	2.61	2.05	4.66
IAA 100 ppm	2.76	2.15	4.91
Brassinolide 10 ppm	2.6	1.99	4.59
Brassinolide 50 ppm	2.75	2.14	4.89
Brassinolide 100 ppm	2.34	1.69	4.03
Potassium nitrate 10 ppm	2.39	2.1	4.49
Potassium nitrate 50 ppm	2.56	2.23	4.79
Potassium nitrate 100 ppm	2.14	2.04	4.18
Kinetin 10 ppm	2.45	1.85	4.3
Kinetin 50 ppm	2.75	1.75	4.5
Kinetin 100 ppm	2.1	1.44	3.54

The seeds of *A. racemosus* were studied for their chlorophyll contents which were pretreated with IAA, Brassinolide, Potassium nitrate and Kinetin before germination during which the highest chlorophyll contents (both a and b) were found to be 4.91 mg-g FW^{-1} in 100 ppm IAA treated seeds followed by 4.89 mg-g FW^{-1} under 50 ppm brassinolide, 4.79 mg-g FW^{-1} under 50 ppm potassium nitrate and 4.5 mg-g FW^{-1} under 50 ppm kinetin compared to untreated seeds which exhibited only 4.26 mg-g FW^{-1} (table-1).

The above observed results concluded that in case of kinetin, the moderate doses increase the primary productivity of *A. racemosus* while the lower and higher doses decrease the primary productivity of this medicinally important plant by decreasing its chlorophyll contents. In case of potassium nitrate, also moderate doses enhance its primary productivity while lower and higher doses also decrease its primary productivity. Similarly, in case of brassinolide, the moderate doses results in the increment of its primary productivity while its lower and higher doses result in the decline of the primary productivity of this plant and finally in case of IAA, higher doses increase the primary productivity while its lower and moderate doses exhibit decreased amount of chlorophyll contents comparatively but this is the only factor which exhibited highest amount of chlorophyll contents among all the factors hence increased primary productivity.

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