



Research Article

Copyright@ Youssif Mahmoud Ahmed

# Effect of Growth Regulators on Callus Formation and Alkaloids Production on Vinca Rosea Plant (Catharanthus Roseus L.)

**Youssif Mahmoud Ahmed\***

Department of Biotechnology, Faculty of Agriculture, Al-Azhar University, Egypt

\*Corresponding author: Youssif Mahmoud Ahmed, Department of Biotechnology, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt.

**To Cite This Article:** Youssif Mahmoud Ahmed. Effect of Growth Regulators on Callus Formation and Alkaloids Production on Vinca Rosea Plant (Catharanthus Roseus L.). Am J Biomed Sci & Res. 2022 17(3) AJBSR.MS.ID.002359, DOI: [10.34297/AJBSR.2022.17.002359](https://doi.org/10.34297/AJBSR.2022.17.002359)

**Received:** 📅 October 10, 2022; **Published:** 📅 November 21, 2022

## Abstract

Vinca alkaloids are a subset of drugs obtained from the periwinkle plant they are naturally extracted from the pink periwinkle plant (Catharanthus roseus), and they have been used to treat diabetes, high blood pressure and have been used as disinfectant. The vinca alkaloids are also important for being Cancer resistant there are four major vinca alkaloids in clinical use: Vinblastine (VBL), Vinorelbine (VRL), Vincristine (VCR) and Vindesine (VDS). Vinca alkaloids are the second most used class of cancer drugs and will stay among the original cancer therapies. Catharanthus roseus is still source used for the powerful antitumor drugs. Callus culture had been done on MS-medium containing Different Concentrations from BA-2,4-D-NAA-IAA. Where the different effects of growth regulators were studied when different parts of the plant have been cultured from leaves and stems this is to induce callus formation and encourage growth and the concentrations that were prepared: BA (0,1-0,3-1-2mg/l) - NAA (0,1-1mg/l)-IAA (0,1 mg/l)-2,4-D (0,75-1mg/l). And after culture the explants we transferred it to the growth room with a temperature ranging from 27 to 29°C relative humidity around 80% And in complete darkness. The results from HPLC analysis for the dry weight of callus were as follows ajmalicine (0.18 mg/g DW), catharanthine (0.07 mg/g DW), serpentine (0.37mg/g DW), vindoline (0.11 mg/g DW).

**Keywords:** Alkaloids, Catharanthus roseus, Growth regulators, High Performance Liquid Chromatography (HPLC), Fluorescence, UV

## Introduction

It was found that the Vinca rosea plant contains more than 50 alkaloids that have a rapid medicinal effect for the treatment of some serious diseases. The aqueous extracts of the Vinca rosea are used as a drink for dentin for gum infections, dental pain and decay, as well as for the dentin of gastrointestinal ulcers, and recently it was possible to know the vital effect of some alkaloid substances in Chronic constipation dentin, More than 40 years ago, other substances have been shown to have an effective effect in the dentin of many types of cancerous diseases, including: vincristine, vinblastine, Ajmalicine and Serpentine, in addition to the substance Hypertension, which plays a role in the dentin of hypertension. These compounds are important for the plant as

they are defensive materials against Pathogens, in addition to their use as pharmaceuticals, food flavors, dyes, perfumes, or pesticides, and plants are considered the continuous source in the work to produce important secondary metabolites, Plant tissue culture is the science of growing plant cells, tissues or organs isolated from mother plant on artificial media [1]. It includes techniques and methods appropriate to research into many botanical disciplines and several practical objectives. Both organized and unorganized growth is possible in vitro [2]. For most of the world's population, medicinal plants are the only source of life-saving medicines. They still serve as an important therapeutic aid in the treatment of human diseases. Catharanthus roseus produces more than 100 monoterpenoids Indole Alkaloids (TIA) in different organs. Leaves



and stems are sources of dark alkaloids, Vincristine and vinblastine are indispensable cancers medicines, while the roots have antihypertensive, ajmalicine and serpentine. [3]. *Catharanthus roseus* (L.) G. Don. (Habit Known as the family Periwinkle Apocynaceae) it has gained commercial importance due to its alkaline contents in various parts of the plant. Some are used in the pharmaceutical industry to treat childhood leukemia, Hodgkin's disease, testicular cancer, and carcinoid tumors [4]. Alkaloids are a class of organic compounds consisting of Carbon, hydrogen, nitrogen, and usually oxygen, which are often derived from plants such as *C. alkaloids* It has physiological effects that make the vinca plant of medicinal value.

## Materials and Methods

The experiments and Cultivation process and chemical analysis were carried out in the Laboratory of Biotechnology Department, Faculty of Agriculture, Al-Azhar University, Nasr City, Cairo, Egypt.

### Plant Material

The main plant part used in the cultivation process the parts that were used in cultivation were a stalk 2cm long [2] and a part of the leaf 1cm long and 0.5cm wide free of middle vein [5] was obtained for *Vinca Rosa* plant (one years-old produced by explant) cultivated in the farm of Faculty of Agriculture, Al-Azhar University,

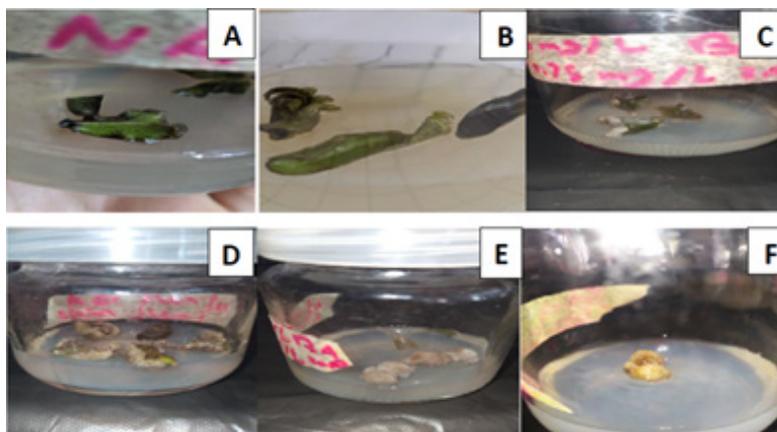
Nasr City, Cairo, Egypt.

### Explant Preparation

Surface sterilization of explants The branch of a plant has been collected from garden and it cut into small parts and Separate the leaves from the stem and it cut the stems the plant to small part it is 2cm long [2] and these parts were put in a big jar, and wash with industrial detergent and they were washed with running water 4 times [5], and It's surface was sterilized with ethanol at 97% concentration for 2 minutes , Then we washed 3: 5 times with sterile distilled water in a laminar flow hood [2], Now the parts are ready to be cultured [6].

### Effect of Growth Regulators on Callus Formation

Sterile uniform explants i.e. 1.0\*0.5cm for leaf blade is free of middle vein and placed in the outside of it and main stem are a 2centimeter long placed in italics in media were aseptically transferred to jars containing 30mL of Murashige and Skoog (MS) medium 2liters of media were prepared to contain ( 8.86g/2L MS + 60g/2L sucrose + 14g agar ) then we take 1.75liters from them and were individually transferred into 250ml jars and different combinations of 2,4-D (2,4-dichlorophenoxyacetic acid) - BA (Benzyl Adenine) - NAA (1-Naphthaleneacetic Acid) - IAA ( Indole Acetic Acid ) (Table 1, Figure 1,2).



**Figure 1:** Induction of callus. After 45 days from culture, it was observed callus induction with good grade by using: (BA 0.1mg/L+2.4-D 1mg/L), (BA 0.3mg/L + 2.4-D 0.75mg/L)



**Figure 2:** Light white to yellowish friable callus produced in vitro cultured leaf explants of *Catharanthus roseus* at MS medium with BA 0.3 mg/l and 2,4-D 0.75 mg/l hormonal combination.

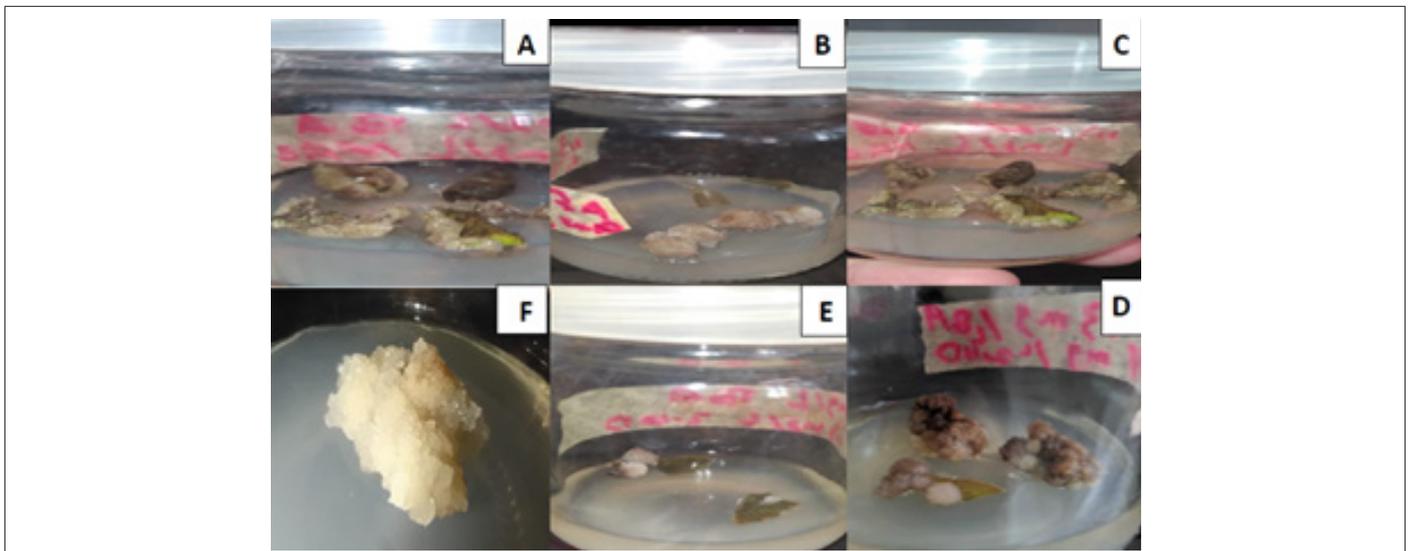
**Table 1:** Our concentration from hormones that used.

	Hormonal Transactions	Concentrations
1	BA+NAA	0.1mg/l+1mg/l
2	BA+NAA	1mg/l+0.1mg/l
3	BA+2,4-D	0.3mg/l+0.75mg/l
4	BA+2,4-D	0.1mg/l+1mg/l
5	BA+2,4-D	2mg/l+1mg/l
6	BA+2,4-D	2mg/l+0.5mg/l
7	BA+IAA	0.1mg/l+1mg/l

## Result and Discussion

These results show the variation and difference from the effect

of different concentrations of hormones on tissue formation, as well as the effect of subcultures on the size and purity of the callus (Figure 3, Table 2).



**Figure 3:** Difference of callus formation when used different concentration from hormones.

**Table 2:** Specific properties of *C. roseus*' TIAs and precursors for HPLC separation and detection, And the result from HPLC analysis was as follows: Ajmalicine (0.18mg/g DW), Catharanthine (0.07mg/g DW), Serpentine (0.37mg/g DW), Vindoline (0.11mg/g DW).

Alkaloid	Fluorescence (max Ex/Em in nm)	Absorption UV (nm)
Tryptophan	250/330	1,98,231
Ajmalicine	250/350	2,17,265
Serpentine	310/380	2,72,367
Vindoline	201/261	2,01,239
Strictosidine	216/289	2,11,236
Catharanthine	129/181	1,60,197

## Conclusion

The *Vinca rosea* plant contain indole alkaloids that have medical applications. High performance liquid chromatography was used with tandem mass spectrometry to determine Tryptophan, Ajmalicine, serpentine, vindoline, catharanthine, and Strictosidine. Overall, vinca alkaloids have the second most-used class of cancer

drugs and will stay among the original cancer therapies. Different research and studies for new vinca alkaloid applications will be carried out in this regard. So, we conclude from this research that the different concentrations of growth hormones affect the differentiation and formation of callus Where it was found that the use of hormonal BA and 2,4-D is what gives the highest efficiency and vitality of the resulting callus.

## References

1. George EF, Hall MA, Klerk GJ De (2008) The Components of Plant Tissue Culture Media I: Macro- and Micro-Nutrients. Plant Propagation by Tissue Culture 3<sup>rd</sup> Edn. pp.65-113.
2. Ghareeb Y, Soliman S, Ismail T, Hassan M (2016) Effect of Growth Regulators and Ecotypes of Egyptian Vinca Rosa (*Catharanthus roseus*) on Callus Induction and Alkaloids Production. Zagazig J Agr Res 43(1): 141-150.
3. Ibrahim M, Ahmed MF, Kazim SM, Ghori SS, Mehjabeen SS, et al. (2010) Antidiabetic Activity of Vinca rosea Extracts in Alloxan-Induced Diabetic Rats. Int J End pp.1-7.
4. Hoda E (2013) In Vitro Regeneration and Somaclonal Variation of *Catharanthus roseus* Don. Using Leaf and Internodal Explants. Alexandria Sci Exc J pp.452-459.
5. Swanberg A, Dai W (2008) Plant Regeneration of Periwinkle (*Catharanthus roseus*) via Organogenesis. Hort Sci 43(3): 832-836.
6. Ataei Azimi A, Delnavaz HB, Ebrahimzadeh H, Majd A (2008) High in vitro production of ant-canceric indole alkaloids from periwinkle (*Catharanthus roseus*) tissue culture. African J Bio 7(16): 2834-2839.