NATURAL ROOT PROMOTING SUBSTANCES FOR ROOTING OF HORTICULTURE CROPS

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Abstract.

Natural plant extracts are a cost-effective and environmental friendly alternative to synthetic plant growth regulators and phytohormones. Some plant extracts also help in root development as they contain some component which supports the root development. Extract of Tulsi, Aloe vera and Cinnamon are used very much in this time. Some of the phytochemical constituentsof Tulsi are oleanolic acid, ursolic acid, rosmarinic acid, eugenol, carvacrol, linalool, and β-caryophyllene (about 8%). Tulsi essential oil consists mostly of eugenol (~70%) β-elemene (~11.0%), β-caryophyllene (~8%), and germacrene (~2%), with the balance being made up of various trace compounds, mostly terpenes. Also Aloe vera extract contains nutrient, vitamin, enzymes, amino acid , sugars as well as plants sterols, gibeerellins and salicyclic acid and are associated with improvement in vegetative growth particularly root. As Cinnamon used as a rooting agent is as useful as willow water or hormone rooting powder. A single application to the stem when plant the cutting will stimulate root growth in almost every plant variety occur. Pour a spoonful onto a paper towel and roll damp stem ends in the cinnamon. As it has a natural antibacterial, antimicrobial agent, that works as a fungicide. This allows the natural rooting auxins that are found in the green growth of your cuttings to thrive without competition.

Keyword: *Tulsi, Aloe vera, Cinnamon, Rooting agent, Phytochemical constituents*

INTRODUCTION

Plants have served human kind as sources of medicinal agents since its earliest beginnings. In fact natural product once served as the source of all drugs. Natural root promoting substances are a costless and safe to use as an alternative for rooting of horticulture crops. They are environmental friendly and can be used as a substitute for synthetic plant growth hormones like IBA (El-Sherif *et al.,* 2017). Natural rooting hormone like vermin wash, Coconut water, willow leaf water, honey, humic acid, Seaweed extract, Aloe Vera, cinnamon powder provide a cheap and economically sound mean for propagation and improving the quantity of rooting. This is due to combined effect of IAA and minerals present in different rooting substances. There is report that aloe vera gel has IAA and it could be used as an alternative hormone (El-Sherif, 2017). Aloe vera gel contains growth hormones like gibberellin and salicylic acid (Sahu *et al.*, 2013) which promotes growth of the plant. Rootex is a broad spectrum plant growth regulator used to stimulate rooting of cuttings of herbaceous and woody ornamentals. Rootex works with difficult softwood and semi-hardwood cuttings of deciduous plants and evergreens.

In horticulture, powder or powdered rooting hormone is a commercially available form of plant rooting hormones sold at specialty garden shops and many hydroponics supply shops. Rooting hormones help promote new root growth in young plants, and typically contain a class of plant hormones known as auxins. For examples like, aloe vera can be used as natural rooting hormone. Most commercial rooting hormones are auxin-based. The hormone auxin occurs naturally in plants in the form of indole acetic acid, or IAA. Synthetic auxins found in commercial rooting hormones include indole-butyric acid (IBA) and naptheleneacetic acid (NAA).Rooting Hormone is a powdered formula which enables to grow a new plant from a cutting. Indole-3-Butyric Acid is the active ingredient included in the powder, promoting root development as it stimulates the process which naturally occurs in plants. Nourishes rooting medium and induces a healthy rooting system (Muttagadur 2015)

Effect of Extract of Tulsi, cinnomon, and aloe vera gel extract in development of root of *Hibiscus* plant and its development is compared with root development in stem which is treated with rootex (a rooting hormone) and stem without any extract treatment. Root development in rootex is much faster than other 3 extract as it is the rooting chemical.

Tulsi extract, cinnomon and aloe-vera gel also shows root development, tulsi extract show frequent root development than other 2 extract then aloe vera gel extract plant shows rooting then cinnomon extract and then the plant which is planted simply without any extract treatment.

Tulsi

Ocimum tenuiflorum (synonym *Ocimum sanctum*), commonly known as holy basil or *Tulsi*, is an aromatic perennial plant in the family Lamiaceae. It is native to the Indian subcontinent and widespread as a cultivated plant throughout the Southeast Asian tropics.

Ocimum sanctum (Tulsi) herb has been known from as the vedic period. Its extract has numerous pharmacological activities like hypoglycaemic, immunomodulatory, analgestic, anti-stress, antipyretic, anti-ulcerogenic, anti-inflametory, anti-hypertensive and anti-bacterial. The active constituents of herb include volatile oil eugenal and B-caryophyllene, flavonoids ana a number of other components present in fixed oil (Shama B Lomate . and Khakre *et.al* 2019)

Tulsi is cultivated for religious and traditional medicine purposes, and also for its essential oil. It is widely used as herbal tea, commonly used in Ayurveda, and has a place within the Vaishnava tradition of Hinduism, in which devotees perform worship involving holy basil plants or leaves.

The predominant cause of global morbidity and mortality is lifestyle-related chronic diseases, many of which can be addressed through Ayurveda with its focus on healthy lifestyle practices and regular consumption of adaptogenic herbs. All the herbs used within Ayurveda, Tulsi is preeminent, and scientific research is now confirming its beneficial effects. There is mounting evidence that tulsi can address physical, chemical, metabolic and psychological stress through a unique combination of pharmacological actions (Cohen M. Marc, 2014).

The dried powder of Tulsi (50g) was placed in the thimble of Soxhlet apparatus and the experiment was done separately for methanol, ethanol and distilled water. The percentage yield was 8%w/w,7%w/w, and 5%w/w respectively. The study reveals that various secondary metabolites such as carbohydrate, tannin, flavonoids, saponins, glycoside, terpenoid, fatty acids and phenol are present in tulsi leaf extract. From the quantitative analysis it was found that high amount of phenols are present in Tulsi leaf ranging from 1.6 to 7.6 percentages. Consequently the amount of alkaloid and flavonoids ranged from 0.91 to 1.28 and 1.56 to 2.24 percentages respectively. From the GC-MS analysis of methanolic extract three compounds were identified as major constituents viz., Eugenol , Benzene, 1, 2-dimethoxy- 4- (2- propenyl), α - Farnesene and Cyclohexane, 1, 2, 4- triethenyl. Thesephyto-chemicals are known to possess antiseptic, analgesic, anti-inflammatory, antimicrobial, antistress, immunomodulatory, hypoglycemic, hypotensive and antioxidant properties. Hence it is more beneficial to use tulsi asan herbal medicine as compare to chemically synthesized drug (Borah R *et.al* 2018).

The main chemical constituents of Tulsi are: Oleanolic acid, Ursolic acid, Rosmarinic acid, Eugenol, Carvacrol, Linalool, and β-caryophyllene, (about 8%). have been used extensively for many years in food products, perfumery, and dental and oral products. *Tulsi* essential oil consists mostly of eugenol (~70%) β-elemene (~11.0%), β-caryophyllene (~8%), and germacrene (~2%), with the balance being made up of various trace compounds, mostly terpenes. Recent studies suggest that Tulsi may be a COX-2 inhibitor, like many modern painkillers, due to its high concentration of eugenol. Also to evaluate the qualitative estimation of phytochemicals and antimicrobial activity of aqueousand methanol extracts of root and leaves of *Ocimum sanctum* against pathogenic bacteria i.e. *Escherichia coli, Proteus mirabilis, Staphylococcus aures*. Study has been shown the presence of steroids, alkaloids and tannins. Significant antimicrobial activity of plant extract has been observed (Singh *et.al* 2013).

Ursolic acid (pentacyclic triterpene acid) and eugenol (phenolic compound), the major secondary metabolites of *Ocimum tenuiflorum L.,* exhibit many pharmacological activities. Due to low quantities of these metabolites in the plant, it was imperative to apply biotechnological approaches for enhancing accumulation of these compounds. Effects of three elicitors namely yeast extract, methyl jasmonate, and salicylic acid were studied on the hairy root cultures induced by infecting leaves of O. tenuiflorum with Agrobacterium rhizogenes strain. The transgenic nature of hairy roots was validated by PCR of rolB gene. The yield of ursolic acid and eugenol responded to the age of the culture, the concentration of the elicitor and the incubation time. The 17-day-old hairy root cultures when treated with yeast extract (50 mg/L) produced the highest amount of ursolic acid of 1.56 mg/g dry weight (5.6-fold higher than control culture) and eugenol content of 0.41 mg/g dry weight (~ 6.0-fold higher than the control) after 8 days of exposure. Methyl jasmonate at 60 mg/L concentration also enhanced the accumulation of ursolic acid up to 1.43 mg/g dry weight (5.0-fold higher than the control) and eugenol up to 0.1 mg/g dry weight (1.55-fold higher than the control) after 8 days of elicitor treatment. Increased elicitor concentration and extended exposure time as well as age of the culture resulted in reduced accumulation of ursolic acid and eugenol in hairy root cultures. Our results demonstrate the importance of age of the culture, different exposure time, and concentration of elicitors in the hairy root culture of *O. tenuiflorum* for increased production of pharmaceutically important metabolites (Biswas S 2018).

Tulsi has got the great medicinal value. Studies have also shown Tulsi to be effective for diabetes, by reducing blood glucose levels. The same study showed significant reduction in total cholesterol levels with Tulsi. Another study showed that Tulsi's beneficial effect on blood glucose levels is due to its antioxidant properties. The Rama Tulsi is the effective remedy for the severe acute Respiratory Syndrome. Juice of its leaves gives relief in cold, fever, bronchitis and cough. Tulsi oil is also used as the ear drop. Tulsi helps in curing malaria. It si very effective against indigestion, headache, hysteria, insomnia and cholera. The fresh leaves of Tulsi are taken by the millions of people every day. For over the centuries Tulsi (the queen of herbs) has been known for its remarkable healing properties. Modern scientific research offers impressive evidence that Tulsi reduces stress, enhances stamina, relieves inflammation, lowers cholesterol, eliminates toxins, protects against radiation, prevents gastric ulcers, lowers fevers, improves digestion and provides a rich supply of antioxidants and other nutrients. Tulsi is especially effective in supporting the heart, blood vessels, liver and lungs and also regulates blood pressure and blood sugar. Tulsi also shows some promise for protection from poisoning and cataracts. The oil extracted from the Karpoora Tulsi is mostly used in the herbal toiletry. Its oil is also used against the insects and bacteria. Tulsi can not only keep the dreaded Swine flu or H1N1 flu at bay but also help in fast recovery of an afflicted person, Ayurvedic practitioners claim. "The anti-flu property of Tulsi has been discovered by medical experts across the world quite recently. Tulsi improves the body's overall defence mechanism including its ability to fight viral disease (Kumar S. K.P. 2010).

Elicitor-mediated enhanced accumulation of ursolic acid and eugenol in hairy root cultures of *Ocimum tenuiflorum* L. is age, dose, and duration dependent (S. Sharanab *et.al* 2019)

Highlights

- ✓ Fast growing hairy root cultures of *O. tenuiflorum* L. were obtained.
- ✓ Elicitors enhanced accumulation of ursolic acid and eugenol in hairy root cultures.
- ✓ Yeast extract of 50 mg/L on 17-day-old culture was the most effective elicitor.
- ✓ Incubation time of 8-days was found most suitable for elicitation.

Aloe Vera

Natural plant extracts are a cost-effective and environmental friendly alternative to synthetic plant growth regulators and phytohormones. Aloe vera Leaf Extract as a Potential Growth Enhancer for Populus Trees Grown Under in vitro Conditions. Also Investigated the promotory activity of various concentrations (0, 10, 20 and 40 mL/L) of Aloe vera leaf extract (ALE) on the growth of hybrid aspen (*Populus tremula* L. × *Populus tremuloides* "Michx") clone T89 and aspen (*Populus tremula* L.) clone W52. The extract isolated from Aloe vera leaves increased the plant height and weight, number of shoots, leaves and roots, and the root length, as well as mineral concentrations of both Populus clones. The rooted plants were acclimatized in the greenhouse with 90% survival. ALE is an efficient alternative source to improve the growth of both Populus clones under study (Amar Surjushe, *et al* 2008)

Aloe vera is a cactus-like succulent plant – one of hundreds of different types of aloe plants. By far, aloe vera is the most common aloe type. It is often referred to as *"medicinal aloe vera"*. It is a stemless or short-stemmed plant,

growing up to 1 meter in height. Often times, aloe vera is grown purely for decoration and its exotic appearance. However, with some organic care, it is a wonderful medicinal plant. When it comes to using aloe vera as a rooting hormone, there is, in fact, ample scientific basis behind it**.** Research and experiments with control groups show that aloe vera often beats honey and cinnamon as an organic rooting hormone. In fact, many gardeners have found it to perform much better than your standard store-bought indole butric acid (an inorganic and chemical rooting hormone powder, often containing dubious ingredients with unknown health effects).The aloe vera plant, has a core which is filled with aloe vera gel, which consists of mostly salicylic acid. Salicylic acid is a natural, anti-inflammatory substance which is directly responsible for stimulation of roots in a cutting (Lee, 2013).

As a rooting hormone, it is well-known for its high success rate with propagation of cuttings, often reaching an almost 100% success rate. Aloe vera as a stimulant on just about any cutting of choice that wish to propagate. Aloe vera is best used in its fresh, organic form, by harvesting a leaf straight off of a plant. When using aloe vera gel as a rooting hormone, have two options, both yielding a high success rate with cuttings or can either choose to plant a piece of aloe vera with the cutting**, or** prepare a fresh aloe vera rooting hormone mixture**.**

Fresh Aloe Vera Rooting Hormone

1. Pick a fresh aloe vera leaf from plant. Peel off the green outer layer carefully with a sharp knife. Will find the magical rooting hormone gel inside – it will be transparent and quite gooey and sticky.
2. With a spoon, peel out the gel and transfer it to a container. Make it into a watery mixture, either by pressing it down with a spoon or by using a hand blender. Goal is to have the mixture be fairly smooth and devoid of bigger chunks of gel.
3. Choose plant cuttings carefully. As with any cutting propagation, follow the general golden rules of propagation (and any other that might be plant-specific). On A Prettier Petal, we quite often talk about roses and rose propagation, but mind that uses just about any plant that you want to propagate. Aloe vera will work the same magic on them all. Therefore, for best results, follow standard procedures. Choose healthy cuttings and prepare them accordingly to maximize your chances of successful propagation. Keep a 45-degree cutting angle; strip all the leaves off of the cutting and seal the top end with wax.
4. Choose a loose and well-draining medium. Soils containing coco-peat, sand or an organic component are ideal. Looser soils will help remove undue stress of root growth by making sure the plant doesn't over-exert itself.
5. Use a pencil to make coin-sized holes in the medium, keeping adequate distance to allow room for growth.
6. Dip the end of the cuttings into aloe vera mixture. You may keep them inside for about a minute. Wiggle them around to assure an even and thorough coating of aloe vera gel. However, for much better results, you can keep the cuttings immersed for up to about 6 hours.
7. Insert the cuttings into the medium and cover well, but not tightly.
8. Spray some water to keep the soil and the cuttings moist. In case you have some aloe vera gel mixture left over, mix it well into the water and water the soil. This will feed the medium and serve as an additional layer of protection for growing cuttings.

Using aloe vera leaf as rooting hormone

1. Prepare a leaf cut from an aloe vera plant.
2. Without removing the green outer layer, cut the leaf into equal parts, about 3 to 5 centimeters thick.
3. Take one aloe vera plant piece and pierce it with the end of your cutting. Have it be so that the end of the cutting is just barely visible through the aloe vera gel.
4. Plant the cutting in a medium of your choice. Spray the medium and the cutting copiously with water.
5. Re-water your cuttings as per the plant's needs and check back within 30 days for results.

Cinnamon

Cinnamon (*Cinnamomum zeylanicum*, and *Cinnamon cassia*), the eternal tree of tropical medicine, belongs to the Lauraceae family. Cinnamon is one of the most important spices used daily by people all over the world. Cinnamon primarily contains vital oils and other derivatives, such as cinnamaldehyde, cinnamic acid, and cinnamate (Rao V Pasupul et al 2014).

Cinnamon as a rooting agent is as useful as willow water or hormone rooting powder. A single application to the stem when you plant the cutting will stimulate **root** growth in almost every plant variety. Pour a spoonful onto a paper towel and roll damp stem ends in the cinnamon. The cinnamon doesn't actually act as the plant's auxin hormone (rooting hormone), rather, it's a natural antibacterial, antimicrobial agent that works as a fungicide. This allows the natural rooting auxins that are found in the green growth of your cuttings to thrive without competition. Cinnamon, real or fake, does not contain rooting hormones. It does have some antimicrobial properties and may help keep fungal growth down, but it does not cause roots to form (Jayaprakasha and Rao 2011).

The effects of organic powder of *Cinnamomum zeylanicum* on the development of *Botrytis cinerea* and its influence on tomato plants were studies. The cinnamon bark powder and its water suspensions and filtrates were used at 0.5 and 1% rates. After 6 days of the start of an in vitro experiment the mycelium growth was inhibited by both 0.5 and 1% cinnamon water filtrates - to a greater degree in the case of the higher concentration, by 54.4 and 81.4%, respectively.

Spraying with cinnamon water filtrates positively influenced the growth of plants both in the greenhouse and the field. Antifungal activity of cinnamon was proved in the greenhouse tests - the disease symptoms of grey mould on infected tomato plants decreased. The fresh weight of non-inoculated tomato plants treated with cinnamon filtrates was significantly higher than control plants (17.17 g compared to 12.83 g) showing a stimulating effect of cinnamon filtrates. In the case of inoculated plants due to treatment, their weight increased from 7.83 to 10.50 g. In the field experiment, tomato plants sprayed six times with cinnamon were better developed than the control plants. The most significant effect was observed for Hamlet variety - the mean number of leaves was higher by 27.3% and the mean number of branches by 19.7% compared to the untreated control plants. Thus it was proved that cinnamon powder has potential to inhibit *B. cinerea* growth and also has a stimulating effect for tomato plants (Kowalska. *et.al* 2020) .

Cinnamon is much cheaper than the chemical rooting hormone they sell in the big box store and just as effective! Just allow the cutting to dry slightly then apply cinnamon powder to the stem before you plant the cutting. Cinnamon does make a great anti-fungal but never heard of it being used as rooting hormone. Rooting hormone is actually a hormone - that's why you have to be careful with it. Maybe the cinnamon works for rooting cuttings simply because it helps prevent fungal infections that would kill or slow down the rooting process (Behbahani *et al* 2020)

The antioxidant activities of the methanolic extract of *Cinnamomum verum* barks (CBE) were evaluated with reference to antioxidant compounds like butylated hydroxyl anisole, trolox and ascorbic acid. By virtue of their hydrogen donating ability, all of the tested compounds and CBE exhibited reducing power. They were found to be potent in free radical scavenging activity especially against DPPH▪ radicals and ABTS radical cations. The hydroxyl (▪OH) and superoxide radicals (O2-) were also scavenged by the tested compounds. CBE also exhibited metal chelating activity. The peroxidation inhibiting activity of CBE recorded using a linoleic acid emulsion system, showed very good antioxidant activity (Mathew**. S** 2006).

Conclusion

Plants contain some and other components which help in many ways. As these 3 plant extract also contain some supportive component which helps in root development. Aloe vera extract contains nutrient, vitamin, enzymes,amino acid , sugars as well as plants sterols, gibeerellins and salicyclic acid and are associated with improvement in vegetative growth particularly root. Likewise in Tulsi it is seen eugenol is found which help in root development. In Cinnamon anti-bacterial and anti-fungicide property is found which support the root development of plant. Many other extract are also used which help in root formation. Plant hormone is being prepared which help to multiply plants variety easily e.g Rootex. Rootex is used which help stem cutting to develop root faster than other stem cutting.

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