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Research Paper

BIOCHEMICAL CHARACTERIZATION AND ANTIBACTERIAL ACTIVITY OF PANCHAGAVYA

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ABSTRACT

In this study, the efficacy of an organic product-Panchagavya's biochemical properties were evaluated. The traditional Panchagavya was prepared as per the standard guidelines and its various chemical and biological properties were analyzed by standard methods. The results showed that Panchagavya had slightly acidic pH, increased EC, rich in macro, micro nutrients and organic carbon. Many effective microorganisms were isolated from Panchagavya viz., bacteria, fungi, actinomycetes particularly Pseudomonas, Lactic acid bacteria, Azospirillum, Azotobacter were predominant. Panchagavya did not have direct antimicrobial activity against microorganisms.

The metabolic products like IAA and GA3 were found. The organic nutrients present in the Panchagavya plays vital role in the growth and yield of crops. The beneficial microflora not only acts like a biocontrol agent but also as a probiotic. Thus, Panchagavya acts as both biofertilizer and biopesticide.

Keywords: Panchagavya, biochemical properties, antimicrobial activity, biofertilizer, biopesticide.

Introduction

Organic matter, nitrogen, phosphorus and potash are the chief constituents, which must be supplied to the soil for sustainable production. Nitrogen is one of the first important nutrients in crop production. The soil has a mechanism by which it absorbs nitrogen from the atmosphere and makes it available to plants. Indian soils, while deficient in nitrogen and phosphates are generally rich in potash. Panchagavya is a nutrition prepared by organic farmers of Tamil Nadu (one of the states in India) using indigenous materials and applied widely for agricultural and horticultural crops (Natarajan, 2002). Panchagavya refer to a combination of five products (dung, urine, milk, curd and ghee) obtained from the cow, fermented for 21 days overnight. When suitably mixed and used, they have positive influence on living organisms. The positive influence may be due to depression formed during the clockwise and anti clockwise stirring of Panchagavya stock solution, which might have facilitated cosmic ray link (Sundararaman et al., 2001 and Natarajan, 2002). This product from cow has the ability to bring the flow of cosmic energy. Cosmic energy, when made to pass through a living system, removes the imbalance in terms of physical, chemical, biological and physiological aspects then by harmonizes the basic elements that revitalize the growth process (Natarajan, 2002). Microorganisms present in Panchagavya not only enhance the microbes in the environment but also act as catalysts with a synergistic effect to promote all the useful microbes of the environment. These microorganisms secrete proteins, organic acids and antioxidants in the presence of organic matter and convert them into energy thus, the soil micro flora and fauna change a disease inducing soil to a disease suppressive soil, which has the capacity to develop the soil (Natarajan, 2002 and Somasundaram et al., 2004). As Panchagavya induces the synergistic effect with bio-fertilizers and soil microorganisms, it leads to improved water and nutrient-holding capacity. The soil begins to take on a spongy quality and is less prone to compaction (Natarajan, 1999). Panchagavya can act both as biofertilizer and biopesticide. Solaiappan (2002) found that in Panchagavya, proven bio fertilizers such as Azospirillum (1010), Azotobacter (109), Phosphobacteria (107) and Pseudomonas (106) were found besides Lactobacillus. Pseudomonas produces organic acids like IAA and GA3 (Mahalingam and Sheela, 2003). In the present study, Panchagavya was prepared and analyzed for its biochemical properties.

Materials and Methods:

Panchagavya solution was prepared by thorough mixing of fresh cow dung (7 Kg), cow ghee (butter oil, 1 Kg), fresh cow urine (10 l), cow milk (3 l), cow milk curd (2 l), jaggery (unrefined sugar from sugarcane juice, 3 Kg) and riped banana (2 Kg) in a open plastic container. On the first day, 7 Kg cow dung was mixed with 1 Kg cow ghee and kept for 72 hours followed by addition of 10 l cow urine and 10 l water. The mixture was stirred twice in a day and allowed to ferment for 15 days. On the 18th day, 3 Kg cow milk, 2 Kg cow curd, 3 Kg jaggery and 2 Kg banana were added in the mixture and allowed to ferment for further seven days while stirring twice a day. The Panchagavya was ready for use after a period of 25 days. When stirred twice daily, the Panchagavya solution can be kept for six months without any deterioration in its quality also in its macronutrients, micronutrients, microorganism, its growth hormones get increased and it makes Panchagavya a nutrient rich fertilizer/manure. Whenever the solution becomes thick due to evaporation of water over a long period, suitable quantity of water can be added to keep it in a liquid state. (Natarajan, 1999 and Somasundaram et al., 2004).

The quality of Panchagavya gets increased if it is kept for

longer time up to six months. Panchagavya prepared for the study was analyzed on the day of use i.e. 15th day after preparation for its biochemical properties and the mean values are presented in Table 1. 15th day was chosen as per the recommendations of the earlier workers (Natarajan, 1999 and Somasundaram et al., 2004)

Table.1. Biochemical Properties of Panchagavya

Properties	Methods and Author
Chemical properties	
pH	Jackson (1973).
EC (dS m^{-1})	Glass electrode – Jackson (1973).
Total Nitrogen (ppm)	Microkjeldhal- Humphries (1956).
Total Phosphorus (ppm)	Triple acid digestion colorimeter – Jackson (1973).
Total potassium (ppm)	Triple acid digestion (Flame photometry) – Jackson (1973).
Total Calcium (%)	Versenate method – Jackson (1973).
Total Mangnesium (%)	Versenate method – Jackson (1973).
Total Sodium (%)	Flame photometer – Jackson (1973).
Total Iron (ppm)	Aqua-regia digestion, Flame Atomic Absorption Spectrophotometer – USEPA (1979).
Total Manganese (ppm)	Aqua-regia digestion, Flame Atomic Absorption Spectrophotometer – USEPA (1979).
Total Zinc (ppm)	Aqua-regia digestion, Flame Atomic Absorption Spectrophotometer – USEPA (1979).
Total Copper (ppm)	Aqua-regia digestion, Flame Atomic Absorption Spectrophotometer – USEPA (1979).
Total organic carbon (%)	Chromic acid wet digestion – Walkey and Black (1934).
IAA (ppm)	(Mahalingam and Sheela, 2003).
GA_3 (ppm)	(Mahalingam and Sheela, 2003).
Biological properties	
Bacte ria (CFU/ml)	Nutrient agar medium – Collings and Lyne (1968).
Fungi (CFU/ml)	Martin's rose Bengal agar medium – Martin (1950).
Actinomycetes (CFU/ml)	Ken knight's medium – Ken knight and Muncie (1939).
Pseudomonas (CFU/ml)	Kings B medium– Walksman and Fred (1922).
Lactic acid bacteria (CFU/ml)	MRS Medium- DeMan Rogosa Sharp.
Azospirillum(CFU/ml)	Day & Dobereiner (1976).
Azotobacter (CFU/ml)	

Antimicrobial activity of Panchagavya

The Panchagavya solution was prepared and tested for its antimicrobial activity against various gram positive and gram negative pathogens.

Results and Discussion:

Biochemical properties of Panchagavya revealed that they possess almost all the macro nutrients, micro nutrients and growth harmones (IAA & GA) required for crop growth. The results were similar reported by Mathivanan et al, (2006). Predominance of fermentative microorganisms like yeast and Lactobacillus, organic acids production by the fermentative microbes might be due to the combined effect of low pH, milk products and addition of jaggery as substrate for their growth. Besides Lactic acid bacteria, Panchagavya also contain large amount of beneficial bacteria, fungi and actinomycetes (Table.2 & Fig.1). Hence it acts as a both biofertilizer and biopesticide which was similarly reported by Solaiappan (2002). The Panchagavya constituted by cow dung, cow urine, cow curd, cow milk and cow ghee contains all the nutrients required for growth of bacteria, fungi and actinomycetes. Cow dung also called as gomay is rich in bacteria, fungi and other microorganisms. The microbial consortium present in the Panchagavya on fermentation releases volatile substances and compounds formed in which them helps to improve crop growth, yield besides reduction of pest and diseases. Manital Chandle (1996) reported that cow curd was rich in microbes (Lactobacillus) that are responsible for fermentation and has got added curative components property to Panchagavya. Nene (1999) reported that fresh cow urine has antimicrobial activity. The analyzed results of the biochemical properties of Panchagavya were given in the following table. 2.

Table.2. Biochemical properties of Panchagavya

Properties	Values
Chemical properties	
pH	5.7
EC (dS m^{-1})	9.2
Total Nitrogen (ppm)	310
Total Phosphorus (ppm)	215
Total potassium (ppm)	325
Total Calcium (%)	0.37
Total Mangnesium (%)	0.22
Total Sodium (%)	0.45
Total Iron (ppm)	217
Total Manganese (ppm)	286
Total Zinc (ppm)	27
Total Copper (ppm)	41.60
Total organic carbon (%)	0.85
IAA (ppm)	8.5
GA_3 (ppm)	3.5
Biological properties	
Fungi (CFU /ml)	$4x10^5$
Actinomycetes (CFU /ml)	$3x10^4$
Pseudomonas (CFU/ ml)	$45x10^3$
Lactic acid bacteria (CFU/ ml)	$22x10^5$
Azospirillum (CFU /ml)	$1x10^2$
Azotobacter (CFU /ml)	$45x10^3$

Antimicrobial activity of Panchagavya

No antimicrobial activity was found when tested against Gram positive pathogens such as Streptococcus pyogens, Staphylococcus aureus, Bacillus cereus and gram negative pathogens such as Escherichia. coli, Klebsiella pneumoniae, Proteus vulgaris, Salmonella typhi and Pseudomonas aeruginosa.

Conclusion:

From the study, it was found out that Panchagavya contains growth hormones, macro and micro nutrients along with the effective microorganisms in the Panchagavya. Since it has all the nutrients it is widely used for the agriculture and horticulture crop as biofertilizer and biopesticide. As Panchagavya induces the synergistic effect with bio-fertilizers and soil microorganisms, it leads to soil fertility, improved water and nutrient-holding capacity. Therefore, it can be recommended as an alternate source of nutrients for organic cultivation of crops.

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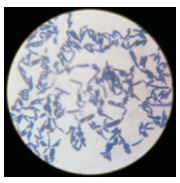
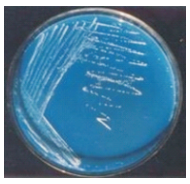
Fig.1. The following microorganism present in the Panchagavya

Lactobacillus



Azospirillum



Pseudomonas

Azotobacter

Actinomycetes

Aspergillus

Penicillium