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Sucrose and gibber relic acid in maintaining leaf freshness of cut twigs of Som plant (*Perseabombycina*Kost)

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ABSTRACT

Cut twigs with fresh leaf of Som plant (PerseabombycinaKost) are used in indoor rearing of Muga Silkworm (Antheraeaassamensis) as food. Through the consumption of leaf the silkworm get required water content and nutrients for their normal metabolic activities for growth and development. A number of chemicals in single and combination were tested as water solutions keeping the twigs lower cut ends dip in solution inside bottles. Sucrose and gibber relic acid solutions are found to keep the leaf fresh for considerable period. Sucrose at a concentration of 40 g per liter of distilled water keep leafs fresh up to 96 hours. This concentration of the solution has a pH value of 3.25. Gibber relic acid solution at the concentration of 0.01 g per liter of distilled water with pH measuring 4.00 keeps leafs fresh for 36 hours. The best concentrations of these two chemicals were also worked out to be 4% for sucrose and 0.015% for gibber relic acid that give a pH value of 4.2 in distilled water. This concentration of gibber relic acid keeps Som plan leafs fresh for 48 hours.

Introduction

Leaf of a plant is the most important organ that supports very vital metabolic activities of plant life system. Leaf anatomy and physio-chemical mechanisms are supportive to vital plant life activities like photosynthesis, transpiration, respiration, chlorophyll synthesis, stomata movement, senescence etc. To make active of all these physio-chemical processes the leaf require standard level of water content 65% to 80% continuously throughout its life period. Depending upon structural and anatomical architecture of the plant as found in different ecological types, the standard level of water content in leaf shows variation. Further in the same plant itself the leaf water content vary subjecting to availability of absorbable soil water in root zone and atmospheric RH that change diurnally and seasonally. Since water is continuously used in the metabolic processes occurring in leaf, uninterrupted supply of water to leaf is very important to maintain standard level of water. Plant with the help of rhizoids in root system absorbs available root zone water in soil and transport to leaf through the xylem tissue. Any damage or blockage in this tissue system interrupt water supply to the leaf. As a result of insufficient water supply the metabolic activities in leafs are greatly hampered and started to wilt. Similarly in the cut twigs leafs start wilting immediately after their detachment from mother plant due to transpiration and non availability of continuous supply of water through xylem vessels. If the physiological activities including transpiration process are retarded or stopped, leaf of the cut twigs will remain fresh for considerable period. Otherwise continuous supply of water through xylem vessels to leaf has to be maintained in order to keep leafs in fresh condition. Thus by preventing transpiration to reduce water loss by leafs it was possible to keep leaves for several days without significant changes in either their total water potential or their osmotic relations as determined by the pressure-volume technique. Thus, maintenance of leaf moisture content to keep leaf fresh is an unsolved problem in different fields of its application. In this present context of study experiments were conducted with some possible chemical substances in water solution to keep Som's (*P. bombycinaKost*) leafy twigs fresh supposing the chemical substance or substances might have certain role in retarding metabolic activities including transpiration in leaf and there by minimizing use of leaf moisture and increasing leaf freshness period.

Methodology:

Required quantity of chemical was measured in electronic balance to prepare solution in measured amount of distilled water. In one liter of distilled water, quantity of chemical to be diluted to get individual solution were 30 g sodium chloride, 40 g sucrose, 0.5 g citric acid and 0.1 g gibber relic acid. These chemicals were also tested in combination to test possible effect of gibber reline (0.01%) at the rate of 3% sodium chloride per liter distilled water, 4% sucrose per liter distilled water and, 0.5% citric acid per liter distilled water. One liter of pure distilled water was treated as control against these chemical solutions. The pH of each of the solutions were measured separately by pH meter and recorded. Solutions were kept separately in bottles of convenient size and arranged along with the control.

In the field, Som plant twigs with 10 nos. of leaves measuring about 1½' long were cut with sharpener and immediately immersed the cut end in water in a bucket that was carried to the laboratory. These twigs were inserted each in a bottle including control so that lower cut end of the twig remained embedded in the solution. Now all these leafy twigs as such were allowed to stay undisturbed in ambient laboratory conditions. Leaf freshness of all these experimented twigs were observed and recorded periodically. After screening the chemical solution's effectiveness for maintaining leaf fresh for considerable period, different pH values of the chemical were tested. Different solutions of varied concentrations of the

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screened chemicals were prepared and experimented with cut twigs of Som plant keeping in bottles like previous experiment.

Results:

As per the methodology solutions of different chemicals were prepared and kept in bottles of convenient size. The pH of these solutions were measured by a pH meter and recorded as shown in table – 1. Healthy leafy twigs of the same Som (*P.bombycinaKost)* plant were collected in water bucket. The lower leafs of each twig were removed leaving 10 nos. of leaf in the twigs. Single twig was inserted in each bottle so that the lower cut end of the twig remained embedded in solution. Another twig was also inserted in distilled water in a bottle in same manner as control. The periods of leaf freshness of each treatment including control were recorded as shown in table- 1.

It has been found that the entire chemical tested in single or in combination with gibber relic acid showed effective to certain extent over the control. Sodium chloride kept 2 hours fresher than distilled water, citric acid had 4 hours more extended effect over control. But both sodium chloride and citric acid in combination with gibber relic acid exhibited more extended effect than their single counterparts, i.e. 16 and 18 hours respectively. But all these above chemical substances single or in combination did not show significant increase over distilled water. Moreover, pH values of sodium chloride and citric acid were 7.00 and 6.58 respectively that are alkaline. Sucrose at 4% has a pH value of 3.25. At this concentration and pH this chemical solution kept Som leafs fresh up to 72 hours which is significant over control. Another effective chemical is gibber reline which at 0.01% concentration and pH value of 4.00 significantly recorded 36 hours leaf freshness. In both the cases the pH value of the solutions was acidic. However, these two chemicals in combination at 4% sucrose and 0.01% gibber relic acid did not kept leafs fresh significantly for considerable period except for 24 hours only, although they recorded an acidic pH i.e. 3.39. Thus low pH values of effective chemical solution are significantly related to leaf freshness.

In the second phage of the experiment different pH values of sucrose and gibber relic acid were experimented for most effective pH that keeps the leaf fresh for longest period. By changing the concentration of the chemical in the solution different pH values were achieved. The results are tabulated and represented by statistical graphs in table- 2 and figure- 2 respectively. In the table-2, it is recorded that sucrose solution at 4.0% concentration with a pH value of 3.25 kept leafs fresh for longest period up to 96 hours than other concentrations and pH. Similarly in case of gibber relic acid, Som leafs of detached twig remained fresh for longest period of 94 hours at 0.015% concentration with pH value of 4.20.

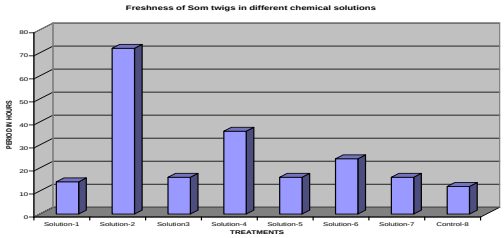

Fig.1.Diagrammatic representation of Som leaf freshness in different chemical solutions; sol-1(Sodium chloride), sol-2(Sucrose), sol-3(Citric acid), sol-4(Gibber relic acid), sol-5(Sodium chloride + Gibber relic acid), sol-6(Sucrose + Gibber relic acid), sol-7(Citric acid + Gibber relic acid) and sol-8(Distilled water).

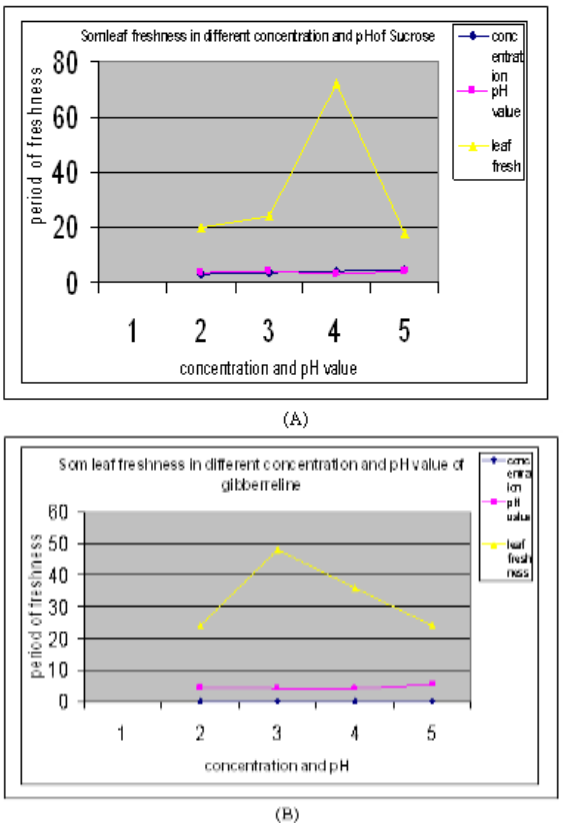

Fig. 2. Graphical representation of influence of concentration and pH of sucrose (A) and gibber reline solution (B) on Som leaf freshness.

Discussion:

In general two approaches have been practiced by different scientist time to time to retain leaf moisture content for freshness of cut twigs. The first one is physiological principle of vapor pressure atmospheric humidity (RH). This principle is governed by the fact that if the surrounding vapor pressure of relative humidity is equilibrium or high, the moisture due to transpiration will not be move from leafs as a result leafs remain fresh as long as this condition of surrounding equilibrium or high vapor pressure exist. HeidrunKarliet al., 1979; successes to store gymnosperm with application of simple procedure like keeping between wet foam-rubber mats or even immersion in water. In case of deciduous leaves the best method they found by storing leaves in completely airtight bags made from aluminum foil; for sclerophyllous evergreen leaves they stored by alternatively covering with a layer of Vaseline and stored in polythene bags between wet foam-rubber sheets. Thus by preventing transpiration they were able to keep leaves for several days without significant changes in either their total water potential or their osmotic relations as determined by the pressure-volume technique. Similarly Katep, C. Innes et al., 1995; kept twigs of *Melicytusramiflorus* and *Alectryonexcelsus* cool in airtight plastic bags, did not change significantly after storage for up to 27 and 49 hours respectively. In mulberry sericulture practice also mulberry leafs are harvested in the early hours of the day as leaf moisture content is more during morning hours. Such leaves are preserved carefully in wet gunny cloth or leaf chamber made up of wood and frequently water should be sprinkled on the leaf to keep leaf fresh

On the other approaches it is found that certain chemical agents retard leaf metabolic activities including leaf transpiration, thereby lingering lifespan of leafs in cut twigs. L. A. Boodle, 1917; was able to keep leafs fresh up to a period of

eleven days by treating the twigs in a water solution of hydroscopic agent like calcium chloride. Leal Matos Joao Carlos DC,1995; preserved fresh plant parts in their natural and original properties by means of sudden freezing operation by immersion with liquid nitrogen at a temperature around minus 200 degree centigrade and crystallization of the intercellular water in very small crystals keeping the cellular walls integrity.

FIG.3: Different experimental pictures at different time periods, solutions, and concentrations. After 24 hrs.- (1) seven different chemicals against water as control, (1-A) solution- 5, (1-B) solution- 2; after 48 hrs.- (2) all the solutions and water, (2-A) solution-2 and (2-B) solution 2 after 72 hrs.; after 72 hrs.- (3) four different concentration of solution-2 and solution-5, (3-A) four concentration of solution-2, (3-B) four concentration of solution-5; after 96 hrs.- (4) same of (3), (4-A) same of (3-A) and (4-B) same of (3-B).

Thus, detached twigs of Som plant can be preserved with solution of sucrose and gibber relic acid separately allowing the twigs to absorb the solution through xylem tissue at cut end of the twigs. It is also found that the specific concentration of these two chemical substances can preserve Som plant detached twigs for longer period than other concentrations. These specific concentrations of these chemicals also have specific pH value which is found acidic. Since only the specific concentration and pH exhibited prolong preservative effect on Som plant twigs over other concentrations and pH, the same concentration and pH will not be equally effective for other plants. Therefore, the concentration and pH of these two chemical substances will be different for different plant to act their preservative action in fullest extent. Thus, in this present context of study it is inferred from the above results and discussion that Som plant (*P. bombycina*Kost) twigs can be preserved fresh by keeping lower cut ends dip in water solution of sucrose at a concentration of 4% and pH value of 3.5. Similarly 0.015% gibber reline in water solution having 4.20 pH values also preserve Som plant cut twigs fresh for considerable period.

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Table-1: Percentage of chemical solutions, pH of the solution and period of leaf freshness of Som plant detached twigs in the solutions.

l. No.	Chemical Solution	ercentage of solution	H of solution	eriod of leaf freshness (in hours.)
1.	Sodium chloride	3%	7.00	14
2.	Sucrose	4%	3.25	72
3.	Citric acid	0.05%	6.58	16
4.	Gibber relic acid	0.01%	4.00	36
5.	odium chloride + Gibber relic acid	3% + 0.01%	4.55	16
6.	Sucrose + Gibber relic acid	4% + 0.01%	3.39	24
7.	Citric acid + Gibber relic acid	0.05% + 0.01%	3.38	18
8.	Distilled water	Control	6.96	12

Table- 2:Different percentage of concentrations, pH values and period of leaf freshness of cut twigs of Som in sucrose and gibber relic acid solutions.

l. No	SUCROSE			GIBBERRELIC ACID		
	% of concentration	H value	eaf freshness (hr.)	% of concentration	H value	eaf freshness (hr.)
1.	3.0%	3.85	20	0.02%	4.32	24
2.	3.5%	4.25	24	0.015%	4.20	48
3.	4.0%	3.25	72	0.01%	4.00	36
4.	4.5%	4.08	18	0.005%	5.28	24