

## Effects of Temperature and Relative Humidity on Ethephon Induced Gum Exudation in *Acacia nilotica*

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**Abstract:** The gum tapping was done by chemical method in January to June 2014. The ethephon (2-chloroethylphosphonic acid) 39% was used in various dilution. In *Acacia nilotica* it was used in two trade names i.e., E-Super and ethrel @ 39% diluted 100 times 0.39% @ 4ml and 2ml in to south direction, commencement of treatments in different trees were done since January to June and observed that 4ml E-Super (0.39% ethephon) was significantly effective to produce high quantity of gum in the month of May in *Acacia nilotica* (33.32 g/plant). The gum yield was positively correlated with tapping intensity, rainfall, and minimum and maximum temperatures at tapping time, and negatively correlated with tapping time, and minimum and maximum temperatures at gum collection.

**Key words:** *Acacia nilotica*, temperature, relative humidity, gummosis.

### Introduction

Gum is a one of the important non-timber forest produce (NTFP) and viable income sources for thousands of forest dwellers, especially tribals in India (Pal et al. 2013). Gum trees are economically important and found in tropical moist and dry deciduous forests, produce a significant quantity of gum, which are widely used as industrial, food and medicinal purposes in India. The major commercially important gums in good quantity are sourced from the central Indian forests, consisting of states like Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Orissa, Jharkhand and Bihar and to some extent Gujarat and Rajasthan. Chhattisgarh State is rich in forest and has vast variety of minor forest products to favourable agro climatic conditions resulting in good forest area i.e. 43.6 % of total (Bhattacharya, 2012).

*Acacia nilotica* is a medium sized, almost evergreen thorny tree, sometimes attaining a height of 15m and comes under family Mimosaceae. It is considered as a very important economic plant since early times as a source of tannins, gums, timber, fuel, fodder and medicine. (Ali et al. 2012). *Acacia nilotica* gum is known as 'Indian gum Arabic'. It exudes from the wounds in bark. It generally exudes during March-May. It occurs in the form of rounded or ovoid tears and size up to 1cm and color varies from pale-yellow to brown or almost black. The gum contains galactose, L-arabinose, L-rhamnose, and four aldobiouronic acids. The gum production is up to maximum of 1 kg/tree/year, but the average is only few grams (Sao, 2012). Trees are tapped to increase gum yield by making incisions in the bark or treating with stress hormone ethylene or ethylene-releasing compounds such as Ethephon (2-chloroethylphosphonic acid). The gum yield

increase with increase in concentration of Ethephon. Treatment of trees with Ethephon exceeding the optimum amount may cause die back and death. Ethephon concentration above 960 mg/4ml in *Acacia senegal* induces shoot desiccation and dieback. Gum tapping using scientific methods of gum exudation not only increase the life span of the tree but also yields good quality gum of high international value (Gupta et al. 2012). This may go a long way in raising the socio-economic status of tribal belt of Chhattisgarh state.

The temperature and relative humidity played a significant role for the process of gummosis and gum exudation. The temperature was increase gradually from the month of January to June and relative humidity decreased in concomitantly. As per Ballal et al. (2005) the gum yield was positively correlated with tapping intensity, rainfall, and minimum and maximum temperatures at tapping time, and negatively correlated with tapping time, and minimum and maximum temperatures at gum collection. Late tapping reduced the production of gum. Harmand et al. (2012) observed the best time to gum tapping the trees was at the beginning of the dry season, when the relative humidity dropped, depending on the location along the climatic gradient.

### Materials and methods:

The experiment carried out at Phunder village near the 2 k.m from the University campus in the University premises Indira Gandhi Agricultural University, Raipur (Chhattisgarh) during 2013-2014 with *Acacia nilotica* trees. Raipur is situated in plains of Chhattisgarh at 21°16' N latitude and 81°36' E longitude with an altitude of 289.60 meter above mean sea level (MSL). Raipur comes under sub humid region, receiving an average rainfall of 1200-1400 mm out

of which about 85 per cent is received during the rainy season ( June to September) and the rest 15 per cent during winter season (October to February). The place experiences a short mild winter, January being the coolest and dry hot summer, May being the hottest month. Soil surface temperature of this region crosses 60°C, air temperature touches to 48°C and humidity drops up to 3 to 4% during summer season and mercury level drops to as low as 60°C during December and January.

At these places variance combination of ethephon we will use for gum exadution i.e. combination of ethephon and distil water (2ml ethephon + 200ml distil water). For the purpose of gum tapping we have used two different trades named chemical Ethephon (E-Super) and Ethephon (Ethrel) having 39% and compared with different temperature and relative humidity of gum exudation. The diluted concentration of ethephon (100 times diluted) 0.39% was used in different doses 2ml and 4ml treatment. The commencement of treatment was done from January and continued upto May 2014. Each combination was applied on 4 trees of *A. nilotica* has given in the following (table 1)

**Table 1. Dose of ethephon in babul as per number of holes and girth.**

S.No	No. of holes /tree	Girth of tree (cm)	Dose of Ethephon
1.	2	90	2 ml
2.	2	100	2 ml
3.	4	96	4ml
4.	4	125	4ml

**Table 2 Effect of temperature and Relative humidity on gum yield of *Acacia nilotica*.**

S.No	Month	Mean temperature in °C	Relative humidity in %	Gum yield in Ethephon (Ethrel) in gm		Gum yield in Ethephon (E-Super) in g	
				2ml	4ml	2ml	4ml
1.	January	21	64.1	-	-	-	-
2.	February	22.3	64.8	-	-	-	-
3.	March	26.7	55.6	0.80	1.89	4.27	10.54
4.	April	31.5	40.4	2.13	3.53	6	24.69
5.	May	34.1	39.1	2.8	4.23	13.78	33.32
6.	June	33.1	54.5	0.73	6.09	2.38	32.34

#### Correlation analysis :

Correlation coefficient is a statistical measure used to know the degree and direction of relationship between two or more variables. The degree of association also affects an effectiveness of the selection process. Thus, correlation indicates the degree of relationship existing among various attributing characters.

#### Correlation between temperature and relative humidity with gum exudation:

The sampling was done at varies temperature and relative humidity on Jan to June 2014 to compare the impact of temperature and relative humidity on gum exudation in various temperature and relative humidity.

#### Result and Discussion

##### Effect of temperature and relative humidity on gum exudation

Six tapping dates were compared for gum exudation at different relative humidity and temperature from January to June 2014 was present in Table 2. The gum yield obtained in each month at different tapping dates. It was observed that the gum exudation was started since March last week (19<sup>th</sup>) when the average temperature increased up to 26.7°C and relative humidity was 55.6% and the treatment 2 ml ethephon (E-super) induced gum 4.27g/plant while the 4 ml ethephon (E-super) induced gum 10.54g/plant. However, the impact of Ethrel was quite low as compared to E-super for gum exudation i.e. 0.80g/plant and 1.89 g/plant by 2 ml and 4 ml Ethrel respectively in this month.

The maximum gum production was noticed in month of May 2014 by Ethephon (E-super) 4 ml i.e. @ 33.32 g/plant while it was only 13.78 g/plant by 2ml (E-super). However, the Ethrel was not found to be superior for gum production and the gum production was quite lower i.e. 2.80 g/plant and 4.23 g/plant by 2 ml and 4 ml of Ethrel. Gum yield was higher when tapping was carried out during the sharp decrease of the relative humidity and increase the temperature.

The results of correlation analysis of some of the characters are presented in Table 3 and it was found that the gum yield in 4 ml ethephon exhibited positive and highly significant with the mean temperature (0.989\*\*).

Gum yield in 2 ml ethephon showed negative and significant with the relative humidity (-0.908\*) as similar finding as per Ballal et al. (2005)

**Table 3 correlation between temperature and relative humidity with *Acacia nilotica* gum exudation.**

	<i>MT</i>	<i>RH</i>	<i>GY 2ml</i>	<i>GY 4ml</i>
<i>MT</i>	1	-0.857*	0.765	0.989**
<i>RH</i>		1	-0.908*	-0.805
<i>GY 2ml</i>			1	0.712
<i>GY 4ml</i>				1

**Note: \* Significant at (5%) level and \*\* Significant at (1%) level.**

### Conclusion

From above investigation it was observed that the gum production was also depending upon the girth of tree, relative humidity and temperature. Gum production was positively correlated with tree girth, tapping intensity, rainfall, and minimum and maximum temperatures at tapping time, and negatively correlated with low temperatures and high relative humidity. The temperature was increase gradually from the month of January to June and relative humidity decreased in concomitantly. The maximum gum yield observed in month of May in respectively of treatment.

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