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Bio-physical characterization of different aloe vera (*Aloe barbadensis* L.) germplasm

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ABSTRACT

Aloe vera has a long history as a medicinal plant with diverse therapeutic applications. Germplsm of *Aloe vera* used in study were procured from experimental farm of medicinal and aromatic plant of NDUAT, Kumarganj, Faizabad. This study was conducted to determine morphological and biochemical character of *Aloe vera* leaves and leaves gel. Physical and biochemical characteristics of germplasm revealed that the line IC-112517 showed maximum per cent of leaf weight (168 g) gel content (97.00 per cent) and number of leaves per plant (14 leaves). The germplasm IC-283655 showed maximum leaf length (48.77 cm) leaf thickness (6.97 cm) and leaf width (9.97 cm). *Aloe vera* line IC-112527 showed maximum per cent of carbohydrate (64.20%), total mineral (11.10%) and total sugar content (30.07%). Thus, on the basis of physical and biochemical analysis of germplasm, the lines IC-112517, IC-283655 and IC-112527 were selected as promising germplasm among all the germplasm under investigation. Overall this investigation has provided a succinct resume of information regarding the morphological character and gel content of *Aloe vera* leaves. It would be worthwhile embarking on an intensive scientific experimentation and investigation on this valuable medicinal plant and to promote its large scale utilization.

Key Words: *Aloe vera, Leaf weight Morphological analysis*

INTRODUCTION

The plant of *Aloe vera* and its usage as drug dates back to 6000 years B.C. The plate's blonging to sumer period during 2200 years BC, indicate use of this plant as a drug. In those plates, it is written about origin of this plant as Africa that has 240 species and is ever green. Cleopatra said that her beauty is due to use of *Aloe vera* plant. One prescription that belongs to 1550 BC shows *Aloe vera* plant used for different illness. It was known to people in Egypt and also Greece for example Aristoteles explains special characteristics of *Aloe vera.* Jelatin that is extracted from this plant is continuously used to treat burns, cuts and inflamed scars since many years. It is also used in cosmetics sector, medical sector and beverage sectors. *Aloe vera* is a hardy, perennial, tropical, drought resistant, succulent plant belonging to the Liliaceae family which, historically has been used for a variety of medicinal purposes. There are over 250 species of *Aloe vera* grown around the world. Only two species are grown commercially, *Aloe barbadensis* Miller and *Aloe aborescens.* The *Aloe vera* plant is grown in warm tropical areas and cannot survive freezing temperatures. The original use of the *Aloe* plant was in the production of *Aloin*, a yellow sap used for many years as a laxative ingredient by the pharmaceutical industry. Physical description of *Aloe vera* is succulent, almost sessile perennial herb, leaves 30-50 cm long and 10 cm broad at the base, colour pea green (when young spotted with white), bright yellow tubular flowers 25-35 cm in length arranged in a slender loose spike, stamens frequently project beyond the perianth tube. The plant *Aloe Vera* has a history dating back to biblical time. *Aloe vera* leaves are formed by a thick epidermis (skin) covered

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with cuticle surrounding the mesophyll, which can be differentiated in to chlorenchyma cells and thinner walled cells forming the parenchyma (fillet). The parenchyma cells contain a transparent mucilaginous jelly which is referred to as *Aloe vera* gel (Ramachandra CT and Rao PS 2008). The *Aloe vera* plant has been known and used for centuries for its health, beauty, medicinal and skin care properties (Rai *et al* 2011). The parenchyma cells contain a transparent mucilaginous jelly which is referred to as *Aloe vera* gel (Ramachandra and Rao 2008). In India it is used as tonic for anemia, poor digestive function and liver disorders. *Aloe vera* is being used as an ingredient for functional food, mainly in the development of health drinks and beverages like tea, *etc.* (Singh *et al* 2009). *Aloe vera* is the most commercialized aloe vera species and processing of the leaf pulp has become a large worldwide industry. In the food industry it has been used as a source of functional foods and as an ingredient in other food products for the production of gel containing health drinks and beverages. In the cosmetic and toiletry industry, it has been used as base material for the production of powders, capsule, creams, lotions, soaps, shampoos, facial cleansers, oils and other products for both external and internal uses for a wide variety of indications (Hamman 2008, Haque *et al* 2012).

MATERIALS AND METHODS

Aloe barbadensis plants were obtained from the experimental farm of medicinal and aromatic plant of NDUAT. Kumarganj, Faizabad. Sample collection was conducted during the months of March and April 2012. The collected *Aloe vera* leaves were cleaned and dried. It was then dried in an oven for 16 hours. The physical properties of the *Aloe vera* leaves were analysed and the results are summarized. Moisture was estimated by drying the known amount (10g) of sample in an oven maintained at $55\pm2^{0}2$ till it attained a constant weight. Moisture content was calculated by subtracting the dried weight from the fresh weight and expressed as percentage of fresh weight (Ranganna 1986). Three leaves were harvested and each leaf was measured with measuring tape from the basal point of midrib to its apex. The three measurements were averaged out and the leaf length was recorded in cm. Three leaves were harvested and each leaf was measured with measuring tape one end to another center of the leaf. The three measurements were averaged out and the leaf width was recorded in cm. Three harvested leaves were measured for thickness with the help of vernier's calliper and their average thicknesses were taken to find out leaf length. Five plants were randomly selected. The leaves in each plant were counted separately. The number of leaves counted for each plant were averaged out and recorded as number of leaves / plant. The three leaves of *Aloe vera* plant were harvested and the peels from each leaf were removed and the total gel content was collected separately in each petridish. The gel % was calculated on the basis of following.

$$\text{Gel content} = \frac{\text{Weight of gel}}{\text{weight of leaf}} \times 100$$

Three leaves of *Aloe vera* were harvested from the field. Each leaf was weighted on physical balance. Total carbohydrate content analysed by Yemm and Willis (1954) by using anthron reagent. Total sugar content analysed by Dubois *et al* (1950) by using phenol reagent. Total mineral content was estimated by the method as described by Hart and Fisher (1971).

$$\text{Total mineral content (\%)} = \frac{\text{weight of ash}}{\text{weight of sample}} \times 100$$

RESULTS AND DISCUSSION

The results on identity, strength and assay of *Aloe vera* leaves and morphological data are shown in Table 1 and 2, respectively. The moisture content is affected by the environmental factor such as temperature humidity, etc. Maximum moisture content was recorded 97.03 per cent in IC-112517 which was statistically significant and higher over all the germplasm. The results have a close agreement

with the reports of Ganesh and Alagukannang (2009). The leaf weight in germplasm of *Aloe vera* ranged in grams from 158.33- 168.00. Maximum leaf weight was found to be 168.00 g in IC-112517. The variation among the germplasm was found statistically significant. Leaf weight is corresponded by its genetic potential. Hence, germplasm differed significantly with each other in respect of leaf weight. Variation in leaf weight is closely related with finding of Abhila *et al* (2010), Rodriguez *et al* (2007). The leaf length in germplasm varied from 40.07-48.77 cm. Maximum leaf length was found 48.77 cm in IC-283655 which was found statistically significant higher over the rest germplasm. Leaf length of germplasm is corresponded by its genetic potential. Hence, germplasm differed significantly with each other in respect of leaf length. The results are closely favours with Abhila *et al* (2010), Anez and Vasqes (2005), Channabasappa and Madiwalar (2007).

1. Leaf weight, leaf length and leaf thickness of *Aloe vera* germplasms (One year plant).

Germplasm	Moisture content (%)	Leaf weight(g)	Leaf length (Cm)
IC-112532	96.50	158.33	40.07
IC-112517	97.03	168.00	42.50
IC-112527	96.37	161.67	46.93
IC-283655	96.90	167.67	48.77
IC-285626	96.33	163.33	44.47
CD at 5%	**1.219**	**5.707**	**5.237**

The number of leaves per plant varied from 12.67-13.00 in various germplasm of *Aloe vera.* Maximum value was recorded number of leaves per plant to be as 13 in IC-285626 and IC-283655 respectively which was statistically significant higher over the other germplasm. This result was supported by Abhila *et al* (2010), Anez and Vasqes (2005), Channabasappa *et al* (2007). The gel content *in Aloe vera* germplasm *ranged* from 96.33-97.00 g. Maximum gel content was found 97.00 g in IC-283655 and IC-112517. Variation among the germplasm was found statistically non-significant. It may be caused due to environmental factors. Variation in gel content is closely related with O'Brien *et al* (2011), Ganesh *et al* (2009), Roy *et al* (2007). The leaf width in germplasm varied from 5.57-9.97 cm. Maximum leaf width was found 9.97 cm in IC-283655 which was statistically significant higher over the rest germplasm. Leaf length of germplasm is corresponded by its genetic potential. Hence, germplasm differed significantly with each other in respect of leaf width. The results are closely favours with Abhila *et al* (2010), Anez B (2005), Akinyele *et al* (2007), Hazrati *et al* (2012).

2. Number of leaves/ plant, Gel content and leaf width of *Aloe vera* germplasms.

Germplasm	No. of leaves/ plant	Gel content (%)	Leaf width(Cm)
IC-112532	12.67	96.33	5.97
IC-112517	14.00	97.00	6.00
IC-112527	12.67	96.33	5.57
IC-283655	13.00	97.00	9.97
IC-285626	13.00	96.67	5.87
CD at 5%	**0.800**	**2.253**	**0.278**

Carbohydrate in the form of glycoprotein and glycolipid participate in the structure of cell membrane and cellular functions. The carbohydrate content varied from 60.87-64.20 per cent in various germplasm of *Aloe vera*. Maximum carbohydrate content was found 64.20 per cent in IC-112527 which was significantly superior over the rest of germplasm. These results are closely correlated with Moghaddasi and Verma (2011). Total sugar is a measurement of sucrose and reducing sugars. Total sugar content ranged from 29.10-30.07 per cent in various germplasm of *Aloe vera*. Maximum total sugar content was observed 30.07 per cent in IC-112527 which was found statistically significant higher over the rest germplasm. These results are in close agreement to Varindra e*t al* (2011). Minerals are inorganic (does not contain carbon) elements found in small amounts in body. The mineral content varied from 10.29-11.20 per cent in various germplasm of *Aloe vera*. Maximum mineral content was reported 11.20 per cer cent in IC-112527 which was statistically significant superior among all the germplasm.

Table 3 Carbohydrate, total sugar and total minerals of *Aloe vera* germplasm.

Germplasm	Total carbohydrate content (%)	Total sugar content (%)	Total mineral content (%)
IC-112532	60.87	29.53	10.80
IC-112517	62.30	29.10	10.29
IC-112527	64.20	30.07	11.20
IC-283655	63.20	29.37	10.60
IC-285626	62.43	29.47	10.80
CD at 5%	1.842	0.426	0.552

Aloe vera has a long history as a medicinal plant with diverse therapeutic applications. The paper has concentrated on the physical and biochemical characteristics with consumer preferences of *Aloe vera* germplasm. Among the varieties studied the gel content, number of leaves per plant and leaf weight recorded highest in IC-112517, the germplasm IC-283655 showed maximum leaf length, leaf thickness and leaf width and IC-112517 showed maximum carbohydrate, total sugar and total minerals. Morphological and biochemical analysis always helps the consumers to select better *Aloe vera* germplasm for their consumption and use. The present study revealed that some of the strongly gel content, leaf length and number Of leaves per plant of *Aloe vera* plant have potential for consumer's preferences and it could be used for breeding programmes and biotechnological research for the improvement of valuable *Aloe gel* quality traits. *Aloe gel* has been very well known for its use in cosmetics as well as in the other areas of medicine such as its property to heal cancer and treat AIDS. In traditional medicine use of plants shows presence of their therapeutic compounds. In such perspective, testing the biological activity of *Aloe vera* and related plants demands a special approach.

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