

## Determination of Mimosine in *Mimosa invisa* Mart. and Effect of Ensiling

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### ABSTRACT

*Mimosa invisa* Mart. (F-Mimosaceae) an alien invasive weed, which was first reported from Kerala in 1964, has emerged as a problem invasive weed adversely affecting the biodiversity and causing toxicity problems to animals. The toxic amino acid, mimosine, present in the plant is an anti nutritional factor contributing to clinical cases of toxicity in livestock. The mimosine content in *M. invisa* was the highest (9.2%) at active vegetative stage. Among plant parts, content was highest (10.4%) in the immature leaves. Ensiling the *M. invisa* admixed with fodder grass in different proportions ranging from 10 to 90% for 60 days lowered the mimosine content by 32 to 46%.

### INTRODUCTION

*Mimosa invisa* Mart. (family-Mimosaceae), an alien spiny weed, mostly annual and rarely perennial under moist conditions, is spreading rapidly all over Kerala. The earliest reference of *M. invisa* in India is the report of its introduction to some coffee plantations in South India as cover crop (Coffee Board, 1955). It is now a troublesome invasive weed in the tea estates of Assam, and in the natural forests, forest plantations and agricultural systems in North-Eastern States of India (Hazarika and Barua, 2003). The plant has even become a threat to the single horned rhinoceros in the world famous Kaziranga National Park in Assam. Here the pasture of the mega herbivore is infested with *M. invisa*, threatening the food availability to the animal (Vattakkavan *et al.*, 2004). The first report of *M. invisa* in Kerala is from Perunna, near Changanacherry (Nair, 1964).

Mimosine, which is chemically ( $\beta$  N-3 hydroxy 4-pyridine)- $\alpha$  amino propionic acid, is reported to be an anti nutritional factor (Jones, 1979; Paterson, 1993). The mimosine content of subabul (*Leucaena leucocephala*), a tree fodder and a member of Mimosaceae, is causing toxicity problems in livestock. The mimosine toxicity problems due to overgrazing on subabul were already reported in buffaloes, camels and sheep from different parts of

the world. Clinical cases of mimosine poisoning in calves and heifers due to ingestion of *M. invisa* were reported in Kerala (Rajan *et al.*, 1986; Alex *et al.*, 1991). However, *M. pudica* (touch-me-not), a common member of the family, is observed to be non-toxic to livestock. Studies on the practices to lower mimosine toxicity have proved the efficiency of ensiling for 60 days to lower the mimosine content in subabul (James and Gangadevi, 1990).

Keeping these points in view, a study was conducted to estimate the mimosine content at different growth stages and in different parts of *M. invisa*, compared to other common mimosaceous plants. Also the effect of ensiling in reducing the mimosine content in the fodder grass admixed with *M. invisa* in different proportions was studied. This helped to understand the tolerable level of admixture of *M. invisa* with fodder grass, which can be made safe by ensiling the mixture.

### MATERIALS AND METHODS

#### Mimosine Content

A study was conducted at Kerala Agricultural University, Vellanikkara, Thrissur to estimate the content of mimosine in *M. invisa* (giant sensitive plant), in comparison with *M. pudica* (touch-me-not) and *Leucaena leucocephala*

(subabul), the common mimosaceous plants of the area, using colorimetric method described by Brewbaker and Kaye (1981) and the absorbance was determined at 535 nm in a Spectronic-20 Spectro photometer.

The mimosine content of *M. invisa* was analysed at 5, 15, 30 and 45 days (seedling stage), 100 days (active vegetative stage) and 120 days (flowering stage) after germination. The immature leaves, mature leaves, stem apex, stem basal and flower buds of *M. invisa* at flower bud initiation stage and its seeds at maturity were analysed separately for the mimosine content. Also *M. pudica* and *L. leucocephala* were compared with *M. invisa* for the mimosine content in immature leaves, stem, flowers and seeds.

#### **Effect of Ensiling on Mimosine Content**

The study on the effect of ensiling on the degradation of toxic amino acid mimosine in *M. invisa* was conducted at the University Livestock Farm and Fodder Research Station, Mannuthy. The safe level of admixture of *M. invisa* allowable in pasture grass was determined by cutting and ensiling it with *M. invisa* in different proportions. The fodder grass Hybrid Napier (variety Co-6) and *M. invisa* were chopped and mixed in different proportions viz., 90% Hybrid Napier+10% *M. invisa*, 75% Hybrid Napier+25% *M. invisa*, 50% Hybrid Napier+50% *M. invisa*, 25% Hybrid Napier+75% *M. invisa* and 10% Hybrid Napier+90% *M. invisa*.

Thirty plastic buckets with lid of three litre capacity (enough to hold four kilograms green matter), were used for ensiling. A drainage hole was provided at the bottom of each bucket. Hybrid Napier and *M. invisa* were cut and chopped separately, mixed in the required proportion, allowed to wilt in shade for one day and packed compactly in a polyethylene bag (with a hole at the bottom) kept in the bucket. Molasses (50 ml) was mixed with the green matter and packed in the polyethylene bag kept inside the bucket without trapping air and tied airtight. The space in the bucket above the polyethylene bag was mud plastered and covered

with the lid so as to provide the anaerobic condition required for ensiling. The buckets were kept for 60 days to complete the ensiling. After 60 days, the buckets were opened and samples were drawn for analysis of mimosine. Mimosine content of sun-dried and powdered *M. invisa* and extract of green plants were also analysed for comparison.

The data obtained were subjected to statistical analysis suggested by Panse and Sukhatme (1985) and significance tested at 95% probability level.

## **RESULTS AND DISCUSSION**

### **Mimosine Content**

The mimosine content was highest (9.22%) at 90 days after germination (active vegetative stage) of *M. invisa*. This was very high compared to 3.05% mimosine content in subabul as reported by Prabakaran (1995). The mimosine content of the plant gradually increased from early seedling stage to active vegetative stage and dropped at flowering stage (Fig. 1). The highest mimosine content (10.4%) was in the immature leaves of the plant at active vegetative stage (Fig. 2).

The *M. pudica* plants contained 2.85% (Fig. 3), which is in contrast to the earlier reports of Brewbaker and Hylin (1965) that mimosine is absent in *M. pudica*. Since *M. pudica* is usually eaten by goats without developing any toxicity symptom, it may be assumed that mimosine content in *M. pudica* is below the toxic level. Immature leaves and seeds of subabul are found to contain 10 to 12% mimosine which is toxic to cattle, as reported earlier by Jones (1979).

### **Effect of Ensiling on the Mimosine Content**

Ensiling for 60 days caused more than 32% reduction in mimosine (from 0.92% mimosine in fresh mixture to 0.62% in ensiled mixture) when the proportion of *M. invisa* in the fodder was only 10% (Table 1). There was an increase in the rate of reduction in mimosine content (32 to 46%) with

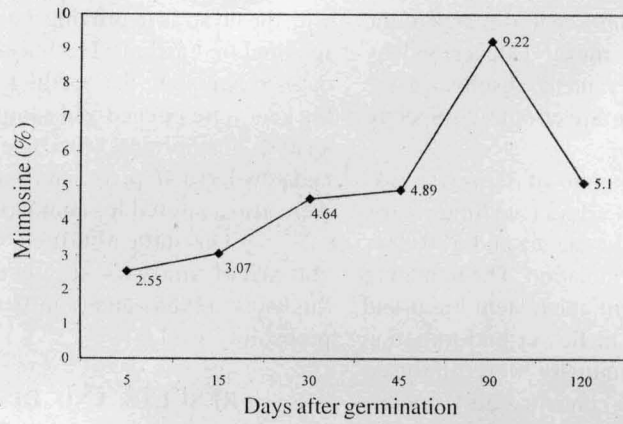


Fig. 1. Mimosine content of *Mimosa invisa* at different growth stages.

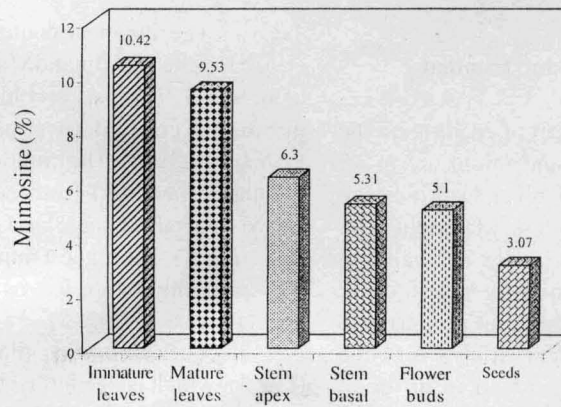


Fig. 2. Mimosine content in *Mimosa invisa* in different plant parts.

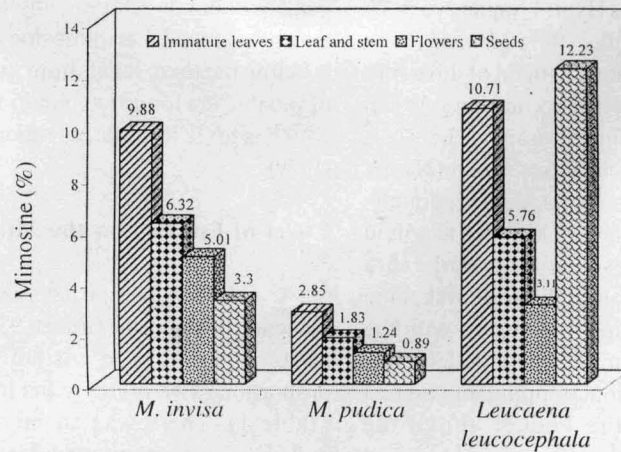


Fig. 3. Mimosine content in common mimosaceous plants.

Table 1. Mimosine content in fresh and ensiled *Mimosa invisa*

<i>M. invisa</i> : Fodder	Quantity of mimosine (%)		Reduction in mimosine (%)
	Fresh mixture	Ensiled mixture	
10 : 90	0.92	0.62	32.51
25 : 75	2.30	1.49	35.43
50 : 50	4.61	2.76	40.11
75 : 25	6.91	3.75	45.76
90 : 10	8.30	4.47	46.13
LSD (P=0.05)	0.479		-

increase in the proportion of *M. invisa* in the mixture from 10 to 90%. When 90% *M. invisa* was present in the mixture, the mimosine content dropped from 8.3% in the fresh mixture to 4.47% in the ensiled mixture, giving the highest reduction in mimosine (46%). Thus, ensiling *M. invisa* infested pasture/fodder grass is an effective method to reduce the mimosine content of the mixture before feeding to livestock.

During the early stages of *M. invisa* infestation, even though grazing cannot be allowed, the admixed fodder can be ensiled and used for feeding. However, suitable control measures should be adopted to contain the infestation, since a higher proportion of admixture of *M. invisa* may render the fodder unsuitable, even after ensiling.

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