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WATER USE EFFICIENCY OF THREE INDIGENOUS MEDICINAL PLANTS WITH SPECIAL REFERENCE TO CONSERVATION

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An experiment was conducted during the monsoon season (March to July) to investigate the water use efficiency(WUE) of *Duranta repens* Linn., *Holmskioldia sanguinia* Retz. and *Lantana camara* Linn. by observing their leaf characters viz: number of stomata (SN), size of the stomata(SS), stomatal index (SI), stomatal frequency (SF), water content (WC), relative water content (RWC) and leaf water deficit (LWD) etc. Highest SN was observed in *Lantana* (31.66) and least in *Holmskioldia* (17). Maximum RWC (92.39%) and minimum LWD (7.65%) were found in *Duranta*. Minimum RWC (75.36%)and maximum LWD (24.65%) were observed in *Lantana*. Water use efficiency was highest in case of *Duranta* and lowest case of *Lantana*, which is an important factor for proper maintenance and conservation measures of the indigenous medicinal plants.

Keywords : Medicinal plants; Water use efficiency.

Water use efficiency (WUE) is an important phenomenon in plants and often arises in leaf's stomata to maintain plant water status[1,2]. In the present investigation, it is planned to study the effect of WUE on three medicinal plants, *Duranta repens* Linn., *Holmskioldia sanguinia* Retz. and *Lantana camara* Linn.

Duranta is poisonous, leaves contain a saponin and the fruits contain an alkaloid analogous to narcotine. Diluted fruit juice is lethal to mosquito larvae[3,4]. The leaf extract of *Holmskioldia* is prescribed in headache and dizziness probably due to high blood pressure. Leaves and inflorescences are used as an ingredient for the preparation of indigenous hair lotion by the women of Manipur[3]. *Lantana* is vulnerary, diaphoretic and antispasmodic, used in fistulae, pustules and tumors, decoction is given in tetanus, rheumatism and malaria also for ataxy of abdominal viscera [3,4].

If WUE is known for these three medicinal plants, they can be properly maintained in the prevailing environmental conditions.

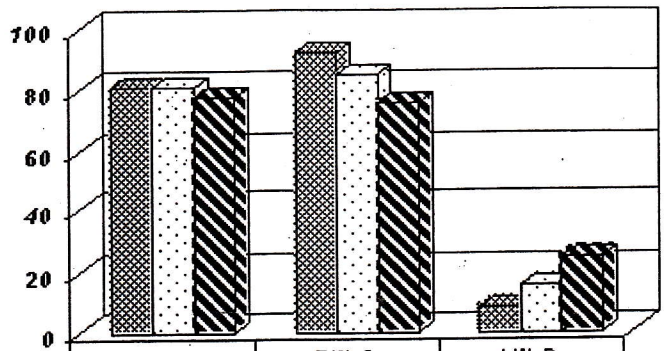
Young leaves (YL), mature leaves (ML) and Fully mature leaves (FML) were collected from the plants *Duranta, Holmskioldia* and *Lantana*. Two different types of experiments were set up to study WUE. The size of the stomata (SS) under 10x X 40x, number of stomata (SN) per microscopic field of vision, stomatal index (SI) and stomatal frequency (SF) were measured [5,6]. Water content (WC), relative water content (RWC) and leaf water deficit (LWD) were measured in all leaf samples [7].

The variation in SS, SN, SI, SF, WC, RWC and LWD were observed from these three different plants. The value of SS was maximum (0.3 μm X 0.25 μm) in case of *Holmskioldia* and minimum (0.17 μm X 0.12 μm) in *Duranta* (Table1). The maximum (31.66) and minimum (17) SN were found in *Lantana* and *Holmskioldia* respectively (Table1). *Lantana* leaf recorded the highest SI (19.82) and *Duranta*, the lowest (13.12) SI (Table1).The SF was maximum (2.65) in case of *Lantana* and minimum (1.42) in case of *Holmskioldia* (Table1). The value of WC was highest (81%) in *Duranta* and lowest (77.34%) in *Lantana* (Fig.1). Maximum RWC (92.39%) and minimum LWD (7.65%) were found in *Duranta* (Fig.1). Minimum RWC (75.36%) and maximum LWD (24.65%) were found in *Lantana*. In all the parameters, average SN was highest in case of fully mature leaves and lowest in young leaves. Among these three medicinal plants, *Duranta* recorded maximum WC and RWC, however LWD was minimum.

From the above findings, it is observed that WUE can be maintained favourably in *Duranta* plant, because it has got maximum WC and RWC. *Duranta* is also suited for

Table 1. Stomatal number (SN), Stomatal index (SI) and Stomatal frequency (SF) of *Duranta, Holmskioldia* and *Lantana leaves.*

Species name	SL(μm)	SB(μm)	SN/ microscopic field	SF	SI
Duranta repens	0.17	0.12	27	2.12	13.12
Holmskioldia sanguinia	0.3	0.25	17	1.42	16.19
Lantana camara	0.25	0.15	31.66	2.65	19.82



	WC	RWC	LWD
Duranta	81	92.39	7.65
Holmskioldia	80.67	84.73	15.28
Lantana	77.34	75.36	24.65

Fig.1. WC (Water content), RWC (Relative water content) and LWD (Leaf water deficit) of *Duranta, Holmskioldia* and *Lantana* leaves.

WUE due to lesser values of LWD and SI. Comparatively in case of *Lantana,* it has got maximum LWD, SN and SI. This plant has lesser values of WC and RWC.

In order to know WUE in medicinal plants, the present investigation will pave a line for conservation of these valuable indigenous medicinal plants in biological diversity. WUE is often cited in physiological studies. The highest WUE reflects their capacity to maintain high rates of photosynthesis while effectively conserving water.

Under ideal conditions of these three medicinal plants which are in C_3 category are more efficient than C_4 plants. Because CO_2 supply limits photosynthesis in C_3 plants[8]. These three medicinal plants are used as a source of indigenous medicine. Even though their distribution is restricted, conservation is necessary by studying their water use efficiencies.

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References

1. Terashima I 1992, Anatomy of non-uniform leaf photosynthesis. *Photosynth.* Res. 31: 195-212.
2. Siebke K and Weis E 1995, Assimilation images of leaves of *Glechoma hederacea*: Analysis of non-synchronous stomata related oscillations. Planta. 196: 155-165.
3. Sinha S C 1996, Medicinal plants in Manipur. Sinha and Mass Publications, Imphal.
4. Chopra R N, Nagar S L and Chopra I C 1999, *Glossary of Indian medicinal plants.* NISC, CSIR, New Delhi, India
5. Kumar N C 1993, *An introduction to medical botany and pharmacognosy.* Emkay Publications, New Delhi, India
6. Mitra D, Guha J and Chowdhuri S K 1995, *Studies in Botany* Vol.2. Moulik library 18- B, Shyamacharan De Street, Calcutta- 700073.
7. Lal R K, Ram P C and Chaturvedi G S 1997, *Plant Physiology laboratory manual.* Centre of advanced studies, Department of Crop Physiology, NDU of Agri & Tech, Kumarganj, Farizabad, U.P.
8. Hopkins W G 1995, *Introduction to Plant Physiology.* John Wiley and sons, INC, New York.