

PERFORMANCE OF SAFFRON (*CROCUS SATIVUS L.*) ACCESSIONS UNDER DIFFERENT GROWING ENVIRONMENTS IN THE SHERVAROY HILLS

Malathi G¹, P Irene Vethamon², M. Kavitha³, P Balasubramanian^{4*}, S P Thamaraiselvi⁵, G. V. Rajalingam⁶

¹Horticultural Research Station, Tamil Nadu Agricultural University, Yercaud, Salem District, PIN-636 602, Tamil Nadu, India

²Horticultural College and Research Institute, TNAU, Coimbatore, Tamil Nadu, India

³Department of Vegetable Science, HC&RI, TNAU, Coimbatore. Tamil Nadu, India

^{4*}Regional Research Station, Aruppukotai, Tamil Nadu, India. Email: pbalasubramanian@tnau.ac.in

⁵Department of Floriculture and Landscaping Architecture, Horticultural College and Research Institute, TNAU, Coimbatore, Tamil Nadu, India

⁶Department of Medicinal and Aromatic crops, HC&RI, TNAU, Coimbatore -3, Tamil Nadu, India

ABSTRACT

Saffron (*Crocus sativus L.*) is a high-value spice crop traditionally cultivated in temperate climates, particularly in Jammu and Kashmir. The possibility of introducing saffron into suitable non-traditional regions has increased the need to identify promising accessions and appropriate growing environments. The present study was undertaken to evaluate the preliminary growth performance of selected saffron accessions under the hill agro-climatic conditions of Yercaud, Shevaroy Hills, Tamil Nadu. Twenty saffron accessions were evaluated under three growing environments, namely open, shade and polyhouse conditions, using a factorial Randomized Block Design with three replications at HRS, Yercaud. Growth and multiplication parameters, including plant height, number of leaves, leaf length, number of corms and number of suckers/daughter propagules, were recorded. Significant variation was observed among accessions and growing environments, indicating differential adaptability under the Yercaud conditions. Plant height ranged from 8.42 to 11.89 cm, with accession T123 recording the highest value. T123 also recorded the maximum number of leaves (20.47) and leaf length (10.68 cm), indicating superior vegetative vigour. In terms of corm production, T123 produced the highest number of corms (9), followed by T112 (8), while T107 and T84 produced seven corms per plant. Variation in sucker production further indicated differences in vegetative multiplication ability among accessions. T123 recorded the highest stigma yield, with 5 stigmas under open field, 4 under shade and 2 under polyhouse conditions. Stigma production was limited under Yercaud conditions, likely due to climatic constraints, resulting in insufficient samples for reliable estimation of stigma weight. Overall, T123 exhibited superior performance across major vegetative and multiplication traits, while T37, T139, T84, T107, T112 and T134 also showed potential for specific traits. The findings provide preliminary evidence for the establishment and vegetative growth of selected saffron accessions under the Yercaud hill ecosystem. However, multi-season evaluations involving flowering, stigma yield and quality, corm size and multiplication rate are necessary before assessing the commercial feasibility of saffron cultivation in the Shevaroy Hills.

KEYWORDS: *Crocus sativus*, saffron, non-traditional area, accessions, vegetative growth, corm multiplication, hill ecosystem.

INTRODUCTION

Saffron (*Crocus sativus L.*) is one of the world's most valuable spice crops and is widely recognized for its distinctive colour, flavour and aroma (Alonso *et al.*, 2012). It originated in the West Asian region, with its early domestication associated with ancient Greece and surrounding areas. In India, saffron has been cultivated traditionally in Jammu and Kashmir, particularly in the Pampore region, which remains the country's major saffron-producing area (Dai *et al.*, 2021). The dried stigmas are used in food, pharmaceutical, nutraceutical, cosmetic and other value-added industries. Saffron is a sterile triploid crop and is propagated vegetatively through corms, making the availability of healthy and quality planting material an important factor for successful production (Menia *et al.*, 2018). Although saffron cultivation in India is traditionally concentrated in Jammu and Kashmir, increasing demand and the need for diversification have stimulated research on its introduction into suitable non-traditional regions. Kumar *et al.*, (2022) demonstrated through ecological modelling that several regions outside the traditional saffron-growing belt possess varying degrees of climatic suitability, including selected areas of Tamil Nadu. The growth, flowering and corm development of saffron are strongly influenced by environmental conditions, particularly temperature, rainfall, soil moisture, light intensity and planting conditions. Therefore, identification of suitable agro-climatic environments is essential when introducing saffron into a new region (Pirasteh-Anosheh *et al.*, 2023). Thiri *et al.*, 2023 was identified approximately 5.09 per cent of India's geographical area as potentially suitable for saffron cultivation, with a small proportion occurring in Tamil Nadu. Their field evaluations at selected non-traditional locations further demonstrated that saffron could establish and produce acceptable-quality stigmas outside the conventional production regions.

The Shevaroy Hills of Yercaud, Tamil Nadu, provide a distinct high-elevation hill environment with comparatively cooler conditions than the surrounding plains. Such environmental conditions offer an opportunity to investigate high-value crops having specific climatic requirements also reported Anand *et al.*, 2020. However, information regarding the performance

of different saffron accessions under the Yercaud environment is limited. Recent studies conducted in other non-traditional regions have shown that saffron can successfully establish when suitable planting material and agronomic practices are adopted. Chaudhary *et al.*, (2023) reported improved growth and corm production of saffron in non-traditional areas of the north-western Himalayas, emphasizing the importance of appropriate crop management for successful establishment. The growing environment can also substantially influence saffron performance. In particular, manipulation of light through shading may alter physiological processes, vegetative growth and corm development (Zhou *et al.*, 2022). Lotfi *et al.*, (2026) reported that the interaction of shading, planting depth and corm weight significantly influenced physiological performance, daughter-corm development and stigma yield. Their findings indicated that moderate environmental modification could improve saffron performance under high-radiation conditions, whereas excessive shading could reduce pigments, daughter-corm weight and stigma yield.

Similarly, location-specific evaluation of saffron in non-traditional areas has demonstrated that quality characteristics can vary according to the growing environment, indicating the importance of identifying suitable locations for saffron production (Kothari *et al.*, 2021). Corm multiplication is particularly important for saffron because the crop is vegetatively propagated and multiplication through daughter corms determines the availability of planting material for subsequent seasons (Ali, & Pati, (2023)). Consequently, evaluation of plant height, leaf production, leaf length, corm formation and daughter-corm development can provide useful preliminary information regarding the adaptability of different accessions. Recent research on saffron production in non-traditional regions has demonstrated the potential for improving corm production through suitable crop-management interventions, thereby supporting the expansion of saffron cultivation into new environments (Thakur *et al.*, 2024). In this context, the present study was undertaken to evaluate the preliminary growth performance of selected saffron (*Crocus sativus L.*) accessions. The study focused on plant height, number of leaves, leaf length, corm production and sucker/daughter propagule development to identify promising accessions and suitable growing environments for further development of saffron cultivation technology under the hill ecosystem of Tamil Nadu.

MATERIALS AND METHODS

The Horticultural Research Station at Yercaud, Salem district, Tamil Nadu, India, which is located in the Shevaroy Hills at a height of around 1500 meters above mean sea level, was the site of the experiment. The purpose of the study was to assess the growth performance and adaptation of saffron (*Crocus sativus L.*) in Yercaud, a non-traditional saffron-growing location, under the hill agroclimatic conditions. Twenty saffron accessions with uniform, healthy corms were chosen for planting. To evaluate how various accessions responded to varied microclimatic circumstances, the experiment was carried out in three different growing environments: open, shaded and polyhouse. The experiment was laid out in a factorial Randomized Block Design (FRBD) with three replications, comprising 20 accessions and three growing environments and each experimental condition 10 corms in 3 replication were planted. Healthy, disease-free and uniform-sized corms were planted at a uniform depth, with spacing of 20x20 cm, and plot size was 1x1m in all the experimental conditions. Under the open condition, plants were exposed to the prevailing natural environment, whereas the shade accessions were maintained under a shade structure and the polyhouse accessions under protected conditions. Irrigation and other cultural practices were maintained uniformly for all accessions as per the crop requirement. Growth observations were recorded periodically from representative plants in each experimental unit. Plant height (cm), number of leaves plant⁻¹, leaf length (cm), number of corms plant⁻¹ and number of suckers/daughter propagules plant⁻¹ were recorded using standard measurement procedures and counted manually (Chaudhary *et al.*, 2023). The observations were used to assess the vegetative vigour, establishment and multiplication ability of the different saffron accessions under the three growing environments. The recorded data were subjected to analysis of variance appropriate for factorial RBD. The significance of differences among accessions, growing environments and their interaction was tested at the 5 per cent probability level. Standard error of difference [SE (d)] and critical difference (CD) were calculated wherever the accessions' effects were significant. The experimental methodology was designed based on the importance of environmental factors such as temperature and precipitation in determining the suitability of saffron cultivation in non-traditional regions of India.

RESULTS AND DISCUSSION

The present investigation was conducted at the Horticultural Research Station (HRS), Yercaud, Tamil Nadu, to evaluate the vegetative performance of saffron (*Crocus sativus L.*) accessions under contrasting microclimatic conditions. Out of 20 accessions initially evaluated, only 12 accessions (T37, T42, T46, T59, T63, T67, T84, T107, T112, T123, T134 and T139) germinated, and observations were restricted to these accessions. Yercaud, located in the Shevaroy Hills at approximately 11.4–11.5° N latitude and about 1500 m above mean sea level, provides a relatively cool hill environment (Ananth *et al.*, 2022). Seasonal variation in temperature and relative humidity, with minimum temperatures commonly reaching about 14–18°C during cooler periods and relatively high humidity during the monsoon, creates a distinct microclimate relevant to saffron establishment and growth. Temperature, moisture availability and radiation are important factors influencing saffron corm sprouting, vegetative development and reproductive performance. Saffron is traditionally adapted to warm, relatively dry summers followed by cooler conditions during active growth, and environmental variation can influence crop development (Kumar *et al.*, 2022; Nehvi *et al.*, 2007).

Considerable variation was observed among accessions and growing environments, indicating the influence of microclimate on saffron vegetative growth. Plant height ranged from 8.42 to 11.89 cm under open conditions, 13.21 to 20.47 cm under shade and 5.72 to 10.68 cm under poly house conditions. T123 recorded the highest plant height in all three environments, with 11.89 cm in open, 20.47 cm in shade and 10.68 cm in poly house conditions, indicating comparatively vigorous growth. The greater plant height under shade may be associated with moderated solar radiation and a favourable microenvironment that promoted leaf elongation and vegetative expansion. Similar environmental

responses have been reported in saffron, where moderate shading enhanced vegetative growth, although excessive shading may adversely affect physiological performance (Molina *et al.*, 2004; Wang *et al.*, 2021; Mzabri *et al.*, 2022). The number of leaves also varied among accessions and environments. Under open conditions, leaf number ranged from 4 to 9 leaves plant⁻¹, with a mean of 6.22, while shade recorded 4 to 8 leaves plant⁻¹ with a mean of 6.33. Poly house plants recorded 4 to 7 leaves plant⁻¹, with a mean of 5.42. T123 produced the highest number of leaves under open conditions, whereas T37, T42, T67, T84, T107, T134 and T139 showed comparatively greater leaf production under shade. The relatively greater leaf development under shade may be related to reduce radiation stress and improved moisture conservation. Similar positive effects of shading on saffron vegetative growth and leaf production have been reported by Gresta *et al.* (2008). The accession-specific response observed in the present study further suggested an interaction between genetic potential and environmental conditions.

Leaf length showed a clear environmental response, with mean values of 9.07 cm under open conditions, 14.04 cm under shade and 8.43 cm under poly house conditions. T123 recorded a leaf length of 8.31 cm under open conditions, while T134 recorded the highest value under shade at 19.25 cm. T63 recorded 16.12 cm under shade, whereas T123 recorded the maximum leaf length under poly house conditions at 12.14 cm. Greater leaf elongation under shade may represent a morphological adjustment to reduced light availability, enabling greater interception of available radiation. The comparatively poor vegetative performance under poly house conditions may be associated with altered temperature, humidity and ventilation within the protected structure. Although poly houses protect plants from adverse weather, excessive humidity, inadequate ventilation, or unsuitable high temperature due to greenhouse effect may adversely affect saffron growth. Appropriate environmental and agronomic management is therefore essential for saffron production, while moderate shading may improve physiological adjustment under high-radiation conditions. These differences may be associated with genotypic variation and genotype $\times$ environment interaction. Temperature is an important factor affecting saffron growth, shoot development and flower initiation; therefore, differences in microclimatic conditions at Yercaud may have contributed to the observed accession-wise variation. T123, T139, T59 and T37 showed comparatively better adaptation under the prevailing conditions.

Leaf production and leaf length are important indicators of vegetative development because saffron leaves function as the major photosynthetic organs during active growth and contribute to assimilate accumulation and replacement-corm development. Corm production also varied considerably, with T123 producing the highest number of corms (9), followed by T112 (8), T107 and T84 (7 each), and T37 and T134 (6 each). The superior vegetative growth and corm production of T123 indicate its potential for further multiplication. Gresta *et al.* (2008) reported that mother-corm size and sowing time influence daughter-corm production, while Behdani *et al.* (2017) emphasized the importance of corm size and production conditions for replacement-corm development. Since saffron is vegetatively propagated, accessions combining vigorous growth with healthy daughter-corm production are important for multiplication; however, propagule number should be considered together with corm size and quality. Ali and Pati (2023) highlighted the importance of healthy, large daughter corms for saffron establishment in non-traditional areas.

Stigma yield varied among saffron accessions and growing environments, with T123 recording the highest number of plants yielded stigma (5, 4 and 2 numbers under open, shade and polyhouse conditions, respectively). T139 showed the next best performance, while several accessions failed to produce stigma. Overall, open field recorded the highest total number of plants produced stigma yield (9), followed by shade (8) and polyhouse (4). The variation indicates differences in genotype performance and environmental adaptability, with open field conditions favouring better stigma production. The differential performance under open, shade and polyhouse conditions suggested that light intensity, temperature, relative humidity and soil moisture influenced vegetative growth. Moderate shading may be advantageous under high-radiation conditions, whereas excessive shading can reduce daughter-corm biomass and stigma yield (Lotfi *et al.*, 2026). The low stigma production observed across the saffron accessions may be attributed to the prevailing climatic conditions of the Shevaroy Hills, Yercaud, which may not have provided the optimum temperature and seasonal conditions required for flowering and stigma development. Since the expected level of stigma production was not obtained, the quantity of harvested stigmas was insufficient for reliable estimation of stigma weight and its statistical analysis. The marked variation among accessions and environments further suggests a possible genotype $\times$ environment interaction influencing flowering and stigma production under Yercaud conditions.

Differences in temperature between open and protected environments may also influence vegetative and reproductive development (Molina *et al.*, 2004, 2005; Wang *et al.*, 2021). Thus, protected cultivation should not automatically be considered superior, and the optimum environment should be determined according to seasonal conditions and accession-specific responses (Nehvi *et al.*, 2007). Corm size, planting depth, planting date, irrigation and shade level should be evaluated in future experiments because these factors influence saffron growth and corm multiplication.

Overall, the establishment and vegetative growth of saffron at Yercaud provide encouraging preliminary evidence for cultivation in the Shevaroy Hills. Among the three environments, shade generally promoted greater plant height and leaf elongation, whereas open conditions supported moderate vegetative growth and polyhouse conditions recorded comparatively lower growth under the prevailing conditions. Among the evaluated accessions, T123 emerged as the most promising based on plant height, leaf development and corm production, while T37, T139, T84, T107, T112 and T134 also showed potential for specific traits. These accessions may therefore be prioritized for further multiplication and evaluation. The findings are consistent with the broader potential of selected saffron accessions for cultivation in non-traditional environments (Kumar *et al.*, 2022). However, since only 12 of the 20 accessions successfully germinated, the present findings should be considered preliminary. Further multi-season studies incorporating flowering, stigma yield and quality, daughter-corm number and size, corm multiplication rate and detailed environmental monitoring are necessary before recommending saffron for commercial cultivation in the Shevaroy Hills.

CONCLUSION

This experiment brought out differential responses of saffron accessions on vegetative growth and multiplications ability in the hill agro-climatic condition of Yercaud, Shevaroy Hills. The variation observed in plant height, number of leaves, leaf length, corm production and sucker/daughter corms indicated differential ability of the saffron accessions to adapt to the hill agro-climatic condition of Yercaud. T123 was found to be the best accession with regard to the plant height, number of leaves, leaf length and corm production. T37 and T139 were observed to be showing high vegetative growth and T84, T107, T112 and T134 exhibited high potential for the growth and multiplication attributes. These results suggested that selected saffron accessions are capable of establishing its vegetative growth and multiplies under hill agro-climatic condition of Yercaud. These results provide a basis for conducting further studies for exploiting saffron as a potential high value spice crop under the hill agro-climatic condition of Shevaroy Hills, Yercaud. However, vegetative growth is not enough to bring out the adaptability of the accessions under hill condition. It may be due to the hill agroclimatic conditions, the temperature and seasonality, which restricted the flowering and stigma formation and resulted in low stigma production to assess reliably the stigma weight. To identify suitable high yielding and stable accessions and to develop a production technology for saffron cultivation in hill agro-climatic region of Tamil Nadu, multi-season, multi-location evaluations have to be conducted for assessment of flowering habit, stigma yield and quality, corm size and weight, daughter-corm multiplication, planting depth, planting season, irrigation and other environment management practices.

REFERENCES

1. Ali, N., & Pati, A. M. (2023). PGPR mediated enhancement of saffron corm production in non-traditional area of Himachal Pradesh, India. *South African Journal of Botany*, 161, 434–443. <https://doi.org/10.1016/j.sajb.2023.08.019>
2. Alonso, G. L., Zalacain, A., & Carmona, M. (2012). Saffron. In *Handbook of herbs and spices* (pp. 469-498). Woodhead Publishing.
3. Anand, M., Sankari, A., & Kayalvizhi, K. (2020). Vase life studies on cut foliage under Shevaroy condition of Eastern Ghats. *Int. J. Curr. Microbiol. App. Sci*, 9(9), 34-40.
4. Behdani, M. A., Zamani, G., Fallahi, H.-R., Sayyari Zohan, M. H., & Samadzadeh, A. (2017). Evaluation of replacement corms growth criteria of saffron in response to different organic and conventional production systems. *Journal of Saffron Research*, 5(1), 1–12.
5. Chaudhary, N., Kothari, D. K., Walia, S., Ghosh, A., Vaghela, P., & Kumar, R. (2023). Biostimulant enhances growth and corm production of saffron (*Crocus sativus* L.) in non-traditional areas of North Western Himalayas. *Frontiers in Plant Science*, 14, 1097682. <https://doi.org/10.3389/fpls.2023.1097682>.
6. Chaudhary, N., Kothari, D., Walia, S., Ghosh, A., Vaghela, P., & Kumar, R. (2023). Biostimulant enhances growth and corm production of saffron (*Crocus sativus* L.) in non-traditional areas of North western Himalayas. *Frontiers in Plant Science*, 14, 1097682.
7. Dai, R. C., Nabil, W. N. N., & Xu, H. X. (2021). The history of saffron in China: From its origin to applications. *Chinese Medicine and Culture*, 4(4), 228-234.
8. Gresta, F., Lombardo, G. M., Siracusa, L., & Ruberto, G. (2008a). Effect of mother corm dimension and sowing time on stigma yield, daughter corms and qualitative aspects of saffron (*Crocus sativus* L.) in a Mediterranean environment. *Journal of the Science of Food and Agriculture*, 88(7), 1144–1150. <https://doi.org/10.1002/jsfa.3177>
9. Gresta, F., Lombardo, G. M., Siracusa, L., & Ruberto, G. (2008b). Saffron, an alternative crop for sustainable agricultural systems: A review. *Agronomy for Sustainable Development*, 28(1), 95–112. <https://doi.org/10.1051/agro:2007030>
10. Hussain, A., (2020). Agronomic management of saffron (*Crocus sativus* L.): Recent advances and production perspectives. *Indian Journal of Agronomy*.
11. Kothari, D., Thakur, M., Joshi, R., Kumar, A., & Kumar, R. (2021). Agro-climatic suitability evaluation for saffron production in areas of western Himalaya. *Frontiers in Plant Science*, 12, 657819.
12. Kumar, A., Devi, M., Kumar, R., & Kumar, S. (2022). Introduction of high-value *Crocus sativus* (saffron) cultivation in non-traditional regions of India through ecological modelling. *Scientific Reports*, 12, 11925. <https://doi.org/10.1038/s41598-022-15907-y>.
13. Lotfi, S., Sorooshzadeh, A., Karimi, N., Saberli, S. F., & Ghorbanpour, M. (2026). Interactive effects of shading, planting depth, and corm weight on yield and physiological performance of saffron (*Crocus sativus* L.) in a semi-arid environment. *Industrial Crops and Products*, 246, 123424. <https://doi.org/10.1016/j.indcrop.2026.123424>
14. Menia, M., Iqbal, S., Zahida, R., Tahir, S., Kanth, R. H., Saad, A. A., & Hussian, A. (2018). Production technology of saffron for enhancing productivity. *J. Pharmacognos. Phytochem*, 7(1), 1033-1039.
15. Molina, R. V., García-Luis, A., Coll, V., Ferrer, C., Valero, M., Navarro, Y., & Guardiola, J. L. (2004). Flower formation in the saffron crocus (*Crocus sativus* L.): The role of temperature. *Acta Horticulturae*, 650, 39–47. <https://doi.org/10.17660/ActaHortic.2004.650.2>
16. Molina, R. V., Valero, M., Navarro, Y., Guardiola, J. L., & García-Luis, A. (2005). Temperature effects on flower formation in saffron (*Crocus sativus* L.). *Scientia Horticulturae*, 103(3), 361–379. <https://doi.org/10.1016/j.scienta.2004.06.005>
17. Nehvi, F. A., Wani, S. A., Dar, S. A., Makhdoomi, M. I., Allie, B. A., & Mir, Z. A. (2007). New emerging trends on production technology of saffron. *Acta Horticulturae*, 739, 375–381. <https://doi.org/10.17660/ActaHortic.2007.739.49>
18. Pirasteh-Anosheh, H., Babaie-Zarch, M. J., Nasrabadi, M., Parnian, A., Alavi-Siney, S. M., Beyrami, H., & Race, M. (2023). Climate and management factors influence saffron yield in different environments. *Agrosystems, Geosciences & Environment*, 6(3), e20418.

19. Sheikh, S. A., Wani, A. B., Khan, F. A., Khan, I., Bhat, J. I., & Husaini, A. M. (2023). Exploring *Crocus sativus L.* cultivation in new areas of North-Western Himalayas: the quality of saffron is location dependent. *SKUAST Journal of Research*, 25(1), 82-89.
20. Tahiri, A., Mazri, M. A., Karra, Y., Ait Aabd, N., Bouharroud, R., & Mimouni, A. (2023). Propagation of saffron (*Crocus sativus L.*) through tissue culture: A review. *The Journal of Horticultural Science and Biotechnology*, 98(1), 10-30.
21. Thakur, Rishu, Aditi Rana, Hena Dhar, Ruchi Soni, Anuradha Sharma, Kanishak Kaushal, Salwee Yasmin. (2024). "Enhancing saffron (*Crocus sativus L.*) Growth in the Kashmir valley with resilient and widely effective Plant Growth-Promoting Rhizobacteria (PGPR) under field conditions." *Industrial Crops and Products* 222 119475.
22. Wang, Z., Li, X., Xu, J., Yang, Z., & Zhang, Y. (2021). Effects of ambient temperature on flower initiation and flowering in saffron (*Crocus sativus L.*). *Scientia Horticulturae*, 279, 109859.
<https://doi.org/10.1016/j.scienta.2020.109859>
23. Zhou, T., Qiu, X., Zhao, L., Yang, W., Wen, F., Wu, Q., & Pei, J. (2022). Optimal light intensity and quality increased the saffron daughter corm yield by inhibiting the degradation of reserves in mother corms during the reproductive stage. *Industrial Crops and Products*, 176, 114396.

Table 1: Growth parameters of Saffron under Shevaroy hills condition.

Part icul ars	Plant height			No. of Leaves			Leaf length			No.of corms			Sukers			No. of plants produced Stigma		
Acc. No	Op en	Sh ad e	Pol y Ho use	Op en	Sh ad e	Pol y ho use	Op en	Sh ad e	Pol y ho use	O p e n	Sha de	P ol y h o u s e	Op en	Sh ad e	Pol y ho use	Op en	Sh ad e	Pol y ho use
T 37	10.32	19.85	6.92	6	7	6	9.76	17.00	5.12	0	2	0	4	7	2	0	0	0
T42	10.13	15.42	8.32	5	8	4	10.32	16.32	6.04	0	2	0	2	9	3	1	1	0
T46	0	19.39	7.61	0	5	6	0	12.51	11.81	0	2	0	0	7	9	0	0	0
T59	10.92	17.24	5.72	4	6	5	8.52	13.74	8.65	0	4	0	11	7	7	1	0	1
T63	0	13.21	6.71	0	5	6	0	16.12	12.12	0	9	0	0	5	6	0	0	0
T67	0	18.13	7.47	0	8	5	0	10.93	10.31	0	9	0	0	3	3	0	0	0
T84	9.31	19.12	5.84	6	7	6	9.11	12.60	7.61	0	4	0	8	3	4	0	0	0
T107	9.32	18.94	6.72	7	7	6	8.32	12.66	6.32	0	32	0	3	3	3	0	2	0
T112	8.42	15.28	7.32	8	5	5	8.98	13.29	7.71	0	6	0	3	3	3	0	0	0
T123	11.89	20.47	10.68	9	4	5	8.31	12.00	12.14	0	5	0	3	3	3	5	4	2
T134	8.51	18.62	10.28	7	7	4	9.20	19.25	5.20	0	0	0	6	5	3	0	0	0
T139	11.14	19.81	6.78	4	7	7	9.12	12.10	8.13	0	2	0	5	3	3	2	1	1
Mea n	7.497	17.957	7.531	4.667	6.333	5.417	6.803	14.043	8.430	0	7.00	0	3.75	4.833	4.083	0.75	0.67	0.42
CD(P=0.05)	4.126** *	3.051** *	0.672** *	2.284** *	0.612** *	0.722** *	3.861** *	2.394** *	2.120** *	0	11.226***	0	3.559** *	1.938** *	2.472** *	0.769** *	1.087** *	1.537** *
SEd	2.020	1.461	0.322	1.094	0.293	0.346	1.850	1.147	1.016	0	5.378	0	1.705	0.928	1.184	0.333	0.471	0.661

(*** Highly Significant at 5% level, NS- Non Significant)