International Scholars Journals

International Journal of Horticulture and Floriculture ISSN 2167-0455 Vol. 5 (4), pp. 318-323, April, 2017. Available online at www.internationalscholarsjournals.org © International Scholars Journals



*Full Length Research Paper*

# Effect of IBA concentrations on the rooting of pomegranate (*punica granatum* L.) cv. ganesh hardwood cuttings under mist house condition

**Krishan Kumar Singh**

Department of Horticulture, Chauras Campus, HNB Garhwal Central University, Srinagar (Garhwal) 246174, Uttarakhand, India.
E-mail: forekrishna@gmail.com

Accepted 14 March, 2014

**The experiment site was conducted under mist chamber at Horticulture Research Center, HNB Garhwal Central University, Chauras Campus Srinagar (Garhwal), Uttarakhand, India, situated in the Alaknanda valley at 30$^0$ 13' 25.26'' N and 78$^0$ 48' 04.93'' E and 563 m above mean sea level. The average temperature and relative humidity inside the mist house during experiment was 30±3 $^0$C and 77±5%, respectively. The soil temperature measured was around 25±2 $^0$C. The hardwood cuttings of *Punica granatum* L. cultivar Ganesh were collected from healthy vigorous shoots of 4-6 year old plants. For preparing rooting media one part sandy soil and one part of FYM were mixed thoroughly. The stem cuttings of *Punica granatum* L. treated with IBA solutions of different concentrations i.e. 1, 2, 3, 4, 5g.L$^{-1}$ and control by quick dip method. The experiment was replicated thrice with 10 cuttings in each treatment. A total of 180 cuttings were tested. Among all the treatments, maximum number of sprouted cuttings (7.33), average length of sprout (20.53 cm), average number of leaves (25.33), percentage of rooted cutting (73.33), number of primary roots (29.26), and average length of roots (24.88 cm) was noticed in 5g.L$^{-1}$ concentration of IBA.**

**Keywords**: *Punica granatum* L., stem cutting, IBA, rooting percentage.

## INTRODUCTION

Pomegranate (*Punica granatum*L.) of the family Punicaceae is native to Asia especially to Afghanistan, Iran and the Himalayan region. At present pomegranate is grown all over the world in the tropic and subtropic conditions. The plant has high adaptability, under tropical conditions there are usually three flushes and each may also result in flowering. In the subtropics, tree flowers in spring along with aflush of vegetative growth. Fruits of the this flush ripens late in summer, whereas the vegetative during same period flowers in the next spring.

Small deciduous shrub or small trees (6-10 m) are largely crooked. The plants are deciduous under subtropical and evergreen under tropical conditions. Leaves may be clustered, opposite or sub opposite on small axillary branchlets, leaves shiny, dark green and shining above and light greenbelow. Calyx is fleshy gamosepalous and persistent, toothed, 5-8 in number, red, pale yellow in colour, patels red white variegated in single or double whorl, generally crinkled, stamens numerous/ infinite, placed irregularly on the calyx tube, unequal in length, filament slightly curved at tip. Ovary is 3-7 celled and many ovules in each cell, yellowish red stigma depressed. Fruit is a round/globose berry with persistent calyx also with reminent of style and stamens. Seeds are angular, hard to soft.

*Punica granatum* L can be propagated from seeds as well as from softwood, semi-hardwood and hardwood cutting. Softwood and semi-hardwood cuttings root easily when taken in spring or summer. Hardwood cuttings from dormant plants also root easily, although use of rooting

hormone improves rooting percentages. Root cuttings may be dug in early spring and planted in the greenhouse. Plantings established with root cuttings are normally poor because of root inconsistency.

Pomegranate could be propagated either sexually by seeds or vegetatively using stem cuttings and sometimes as layers or suckers or by grafting (Hartmann *et al*., 1997). Grafting and layering of pomegranate trees is rarely done, because many different types of grafts have not been successful enough for use in commercial production. Tissue culture is another method of production that calls for the growth of the plant in a sterile environment using the tissue, seed, or cuttings (Abdelrahman and AI-Wasel, 1999).

(Melgarejo *et al*., 2008; Polat and Caliskan, 2009). Propagation from cuttings (cloning) produces a plant with the same characteristics as the parent and thus maintains desirable fruiting traits. Cutting is undoubtedly, the main method used for the pomegranate tree propagation. The cutting rooting is regulated by a number of factors, whose lack can limit the process. Cuttings are the easiest and most satisfactory method for pomegranate propagation with 15-20 cm in length and pencil size or larger in diameter and use of semi-hardwood or hardwood rooting hormone is possible.

## MATERIALS AND METHODS

### Study area

The experiment site was conducted under mist chamber at Horticulture Research Center, Chauras Campus. Geographically Srinagar valley is spread between latitude $30^0$, 12' 0" to $30^0$ 13' 4" North and longitude $78^0$ 0' 45" to $78^0$ 0' 50" East. The valley is about 6 km long and 1 to 1.2 km wide located on both side of famous Alaknandariver at an elevation 540 m above MSL and about 132 km from Haridwar in Himalayan region. The valley shows a semi-arid and sub-tropical climate. Except during rainy season, the rest of the months are usually dry with the exception of occasional showers during winter or early spring. The average minimum and maximum temperature, relative humidity and rainfall vary from $7.42^0$c to $35.3^0$, 42.24% and 2.50 to 235.24 mm respectively.

## METHODOLOGY

Hardwood stem cuttings of *Punica granatum* L. were collected from 4 to 5 year old plants and 15 cm long stem cuttings with basel portion. For preparing the rooting media, sandy soil and farm yard manure (FYM) in ratio of 1:1 by v/v were mixed thoroughly, cleaned for stones and grasses, then the mixture was filled in root trainers. The basal ends of the cuttings were dipped in dilute solutions, $1g.L^{-1}$, $2g.L^{-1}$, $3g.L^{-1}$, $4g.L^{-1}$, $5g.L^{-1}$ of indole-3-butyric acid by quick dip method for 10 seconds before planting them in the rooting medium. The treated cuttings were planted carefully in the root trainers. After the treatment, the cutting were immediately planted in 20x5 cm size of root trainer and inserted 7.5 cm in the rooting media. The experiment was replicated thrice with 10 cuttings in each treatment and a total of 180 cuttings were tested.Experiment was conducted in the mist house which had the arrangement for intermittent misting to 60 seconds at every 30 minutes interval between 8 am and 8 pm. The number of sprouted cuttings, number of sprout per cutting, length of sprout per cutting, percentage of root per cutting, number of primary roots per cutting, percentage of secondary rooting, length of root per cutting, diameter of root, fresh weight and dry weight of roots were recorded after three months. The data recorded were subjected to statistical analysis for least significant difference (RBD) as described by Snedecor and Cochran (1968).

## RESULTS AND DISCUSSION

A perusal of Table. 1 shows that the effect of different concentrations of IBA significantly affected the various growth characters of Hardwood cuttings in *Punica granatum* L.The maximum number of sprouted cuttings (7.33) was recorded under $5g.L^{-1}$concentration of IBA followed by $4g.L^{-1}$concentrationof IBA. The minimum number of sprouted cuttings (4.33) was recorded in control. High carbohydrate and low nitrogen have been reported to favour root formation (Carlson, 1929). These findings agreed with the finding of Bose *et al.* (1968) in Bougainvillea. The maximum average length of sprout per cutting (20.53 cm) was recorded under $5g.L^{-1}$concentration of IBA followed by $4g.L^{-1}$concentration of IBA, while, the minimum average length of sprout per cutting (9.36 cm) was recorded under control. Application of IBA at the right time proved beneficial effect on the cutting of *Bougainvillea peruviana* (Singh, 2001c). The present findings are similar to the findings of Bose *et al*., (1968)with respect to average length of sprout per cutting.The maximum average number of sprout per cutting (9.20) was recorded under $5g.L^{-1}$ concentration of IBA followed by $4g.L^{-1}$concentration of IBA while the minimum average number of sprout per cutting (4.67) control. The findings of the present study are similar to the findings of Pratima *et al.,* (2011) in respect of average number of sprout per cutting. The maximum average number of leaves per cutting (25.33) was recorded under the$5g.L^{-1}$concentration of IBA followed by $4g.L^{-1}$ concentration of IBAwhile the minimumaverage number of leaves per cutting (11.67) was recorded under control during present investigations. It might be due to wood maturity of cutting which probably reserves high starch and sugar. The appropriate planting time, application of IBA as well as genetic makeup of genotype use may have played some role in augmenting the

**Table 1.** Effect of IBA concentrations on survival performance and vegetative growth of Pomegranate (*Punica granatum* L.)

| Treatments | Number of sprouted cutting | Length of sprout (cm) | Diameter of sprout (mm) | Number of sprout per cutting | Number of leaves |
|---|---|---|---|---|---|
| 1g.L$^{-1}$ IBA | 5.33 | 15.52 | 2.17 | 5.00 | 22.67 |
| 2g.L$^{-1}$ IBA | 5.00 | 15.95 | 2.07 | 5.83 | 22.00 |
| 3g.L$^{-1}$ IBA | 5.67 | 17.00 | 2.83 | 6.00 | 18.33 |
| 4g.L$^{-1}$ IBA | 6.00 | 18.21 | 2.87 | 8.50 | 24.00 |
| 5g.L$^{-1}$ IBA | 7.33 | 20.53 | 3.00 | 9.20 | 25.33 |
| Control | 4.33 | 9.36 | 1.00 | 4.67 | 11.67 |
| CD at 5% | 1.39 | 2.05 | 0.60 | 0.99 | 7.03 |

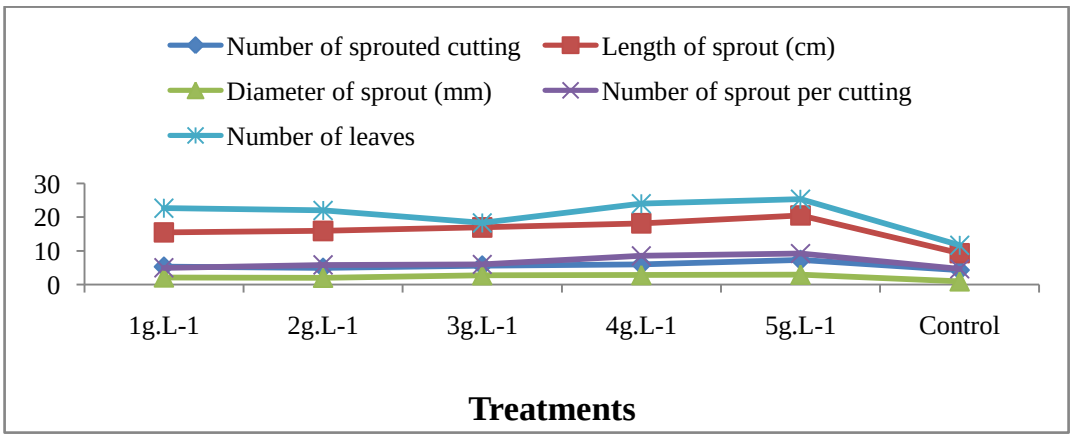


**Figure 1.** Effect of IBA on number of sprouted cutting, length of sprout, diameter of sprout, number of sprout/cutting and number of leaves in *Punica granatum* L. cutting.

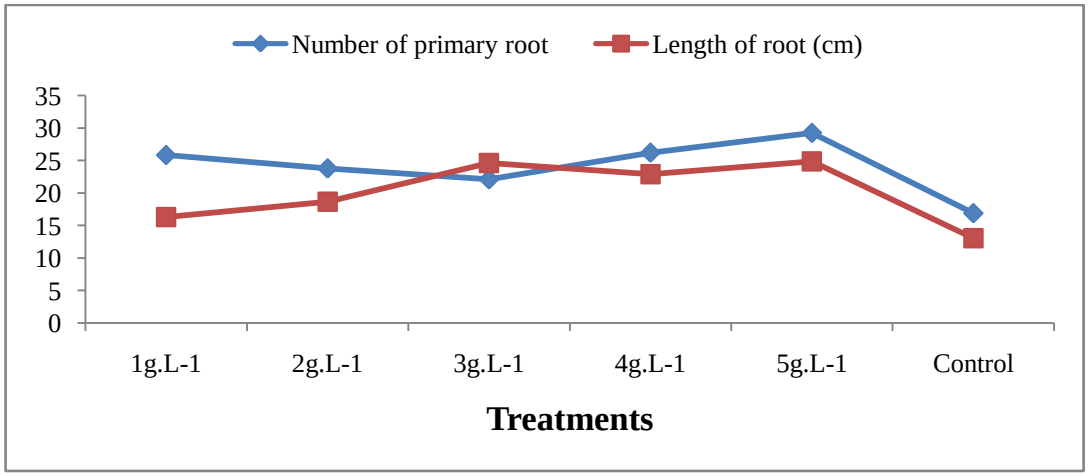


**Figure 2**. Effect of IBA on number of primary roots, length of root (cm), in *Punica granatum* L. cutting.

number of leaves per cutting (Singh and Singh, 2002). The findings of Vijayakumar (1973) also reported similar results in respect to average number of leaves per cutting (Fig. 1).

Among IBA concentrations, 5g.L$^{-1}$ concentration of IBA showed the highest percentage of rooted cutting (73.33%) followed by 4g.L$^{-1}$ concentration of IBA. The minimum percentage of rooted cutting (43.33 %) was recorded under control. The enhanced hydrolytic activity in presence of applied IBA coupled with appropriate planting time might be responsible for the increased percentage of rooted cuttings. These findings agreed

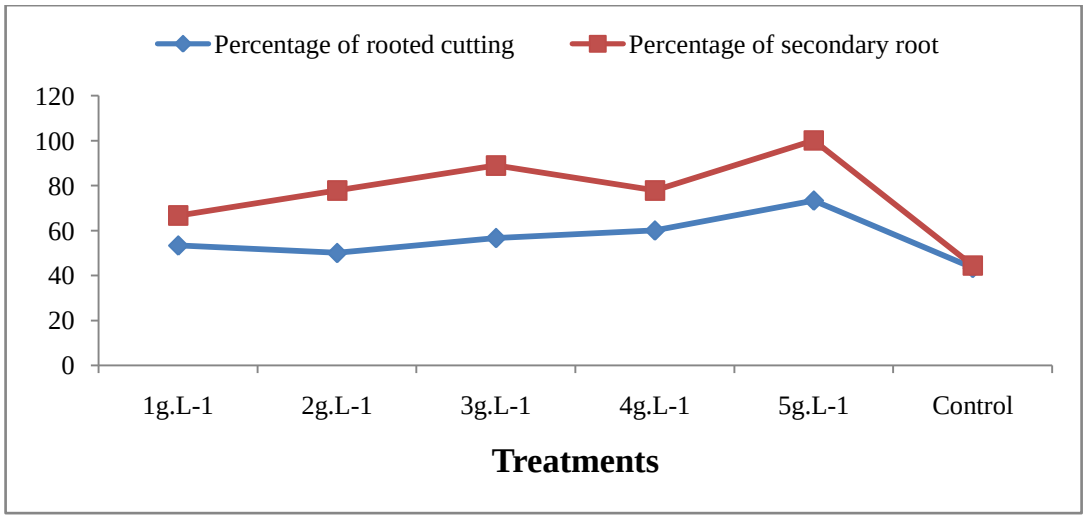


**Figure 3**. Effect of IBA on percentage of rooted cutting, percentage of secondary root in *Punicagranatum*L. cutting

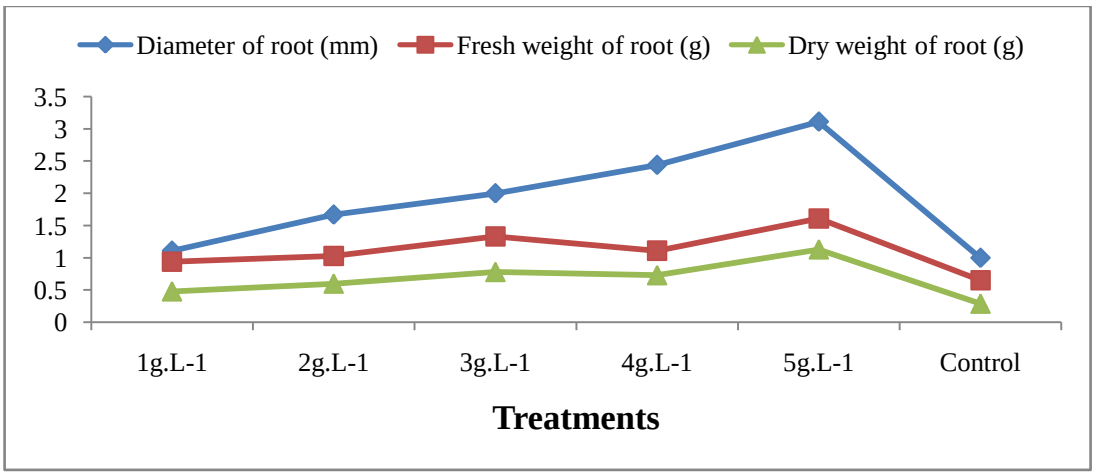


**Figure 4**. Effect of IBA on diameter of root, fresh weight of root and dry weight of root in *Punicagranatum*L. cutting

with the finding of Leonel*et al.* (1995) in *(Litchi chinensis* Sonn.) and Vijayakumar (1973) in guava. The maximum number of primary roots per cutting (29.26) was produced under 5g.L$^{-1}$concentration of IBA followed by 4g.L$^{-1}$concentration of IBA while the minimum number of primary root per cutting (16.89) was recorded under control. According to Bose *et al*. (1968) cutting of *Bougainvillea* and other ornamental shrub species produced large number of roots, weight of fresh and dry root when treated with IBA at 3000-6000 ppm. The above finding also agree with the finding of Koyunce and Senel, 2003 in respect to average number of primary roots per cutting.

The maximum average length of roots per cutting (24.88 cm) was recorded under the treatment 5g.L$^{-1}$concentration of IBA followed by the treatment 3g.L$^{-1}$ concentration of IBA, while the minimum average length of roots per cutting (13.06 cm) was recorded in control during present investigations. The maximum diameter of roots (3.11 mm) was recorded under 5g.L$^{-1}$ concentrations of IBA followed by 4g.L$^{-1}$ concentration of IBA, The minimum diameter of root (1.00) was recorded under control Auxin application has been found to enhance the histological features like formation of callus and tissue and differentiation of vascular tissue (Mitra and Bose, 1954). These finding were similar to Mahros (2002) in *Bougainvillea glabra* cv. variegata with respect to length of roots per cutting. Evidence suggests that auxin increases rooting percentages, shortens the rooting period and ensures improved uniformity in plants (Hartmann *et al*., 2002). The maximum percentage of secondary roots per cutting (100.00 %) was recorded

**Table 2.** Effect of IBA concentrations on rooting performance of Pomegranate (*Punica granatum* L.).

| Treatments | Percentage of rooted cutting | Number of primary root | Length of root (cm) | Diameter of root (mm) | Percentage of secondary root | Fresh weight of root (g) | Dry weight of root (g) |
|---|---|---|---|---|---|---|---|
| 1g.L$^{-1}$ IBA | 53.33 | 25.85 | 16.30 | 1.11 | 66.66 | 0.94 | 0.48 |
| 2g.L$^{-1}$ IBA | 50.00 | 23.79 | 18.66 | 1.67 | 77.77 | 1.03 | 0.60 |
| 3g.L$^{-1}$ IBA | 56.67 | 22.11 | 24.63 | 2.00 | 88.89 | 1.33 | 0.78 |
| 4g.L$^{-1}$ IBA | 60.00 | 26.22 | 22.92 | 2.44 | 77.77 | 1.11 | 0.73 |
| 5g.L$^{-1}$ IBA | 73.33 | 29.26 | 24.88 | 3.11 | 100.00 | 1.61 | 1.13 |
| Control | 43.33 | 16.89 | 13.06 | 1.00 | 44.44 | 0.65 | 0.29 |
| CD at 5% | 13.95 | 5.19 | 5.66 | 0.63 | 30.64 | 0.37 | 0.32 |

under 5g.L$^{-1}$ concentrations of IBA followed by 3g.L$^{-1}$ concentration of IBA, while the minimum percentage of secondary roots per cutting (44.44 %) was recorded under control. The above finding also agree with the finding of Koyunce and Senel, 2003 in respect to percentage of secondary roots per cutting. Mist chamber creates a humid atmosphere by means of artificial mist around the planted cuttings and enhanced the process of rooting (Lynn and Hartmann, 1957). Mist chamber provides most favourable environment for better rooting of patchouli cuttings (Selvarajan and Rao, 1982).

The maximum average fresh weight of root per cutting (1.61 g) was recorded under 5g.L$^{-1}$ concentration of IBA, followed by 3g.L$^{-1}$ concentration of IBA. The minimum average weight of fresh root per cutting (0.65 g) was recorded under control. Application of IBA at the right time proved beneficial to the cutting of *Bougainvillea peruviana* (Singh, 2001c). The above findings also agree with the finding of Vijayakumar (1973) in respect to the average fresh weight of root per cutting. The maximum average dry weight of roots per cutting (1.13 g) was recorded under 5g.L$^{-1}$ concentration of IBA followed by 3g.L$^{-1}$ concentration of IBA. The minimum average dry weight of roots per cutting (0.29 g) was recorded in control. These finding are agreed with the finding of Mahros (2002) in Bougainvillea glabra cv. Variegate (Table. 2).

## CONCLUSION

Among various concentration of IBA, 5g.L$^{-1}$concentration of IBA shows the best performance in terms of number of sprouted cutting, maximum number of secondary root, percentage of rooted cuttings, length of sprouts, no of sprouts/cuttings, no of primary roots. Hence, it can be concluded from the experiment that the higher concentration of IBA positively affect the rooting behavior in stem cuttings of Pomegranate cv. Ganesh.

## REFERENCES


Abdelrahman, S. and A. AI-Wasel, 1999. *In vitro* clonal propagation of AI-Belehi pomegranate (*Punica granatum L.*). J. King Saud Univ. Agric. Sci., 11:3-14.

Bose, T.K.; Singh, P.K. and Bose, S. 1968. Propagation of tropical ornamental plants from cutting under mist. Indian J. Hort, 27: 213-217.

Carlson, M.C., 1929. Micro-chemical studies of rooting and cuttings. Bot. Gaz. 87: 64.

Hartmann, H.T., D.E. Kester, F.T. Jr. Davies and R.L. Geneve, 1997. Plant Propagation: Principles and Practices. 6th Edn., Prentice-Hall of India Private Ltd., New Delhi, India.

Koyunce, F. and Senel, E. 2003. Rooting of Black Mulberry (*Morusalba L*.) Hardwood cutting. J. Fruit and ornamental plant Research. Vol. 11, pp. 53-55.

Leonel, S. Rodrigues, J.D. 1993. Effects of growth regulators and boric acid on lychee (Litchi chinensis Sonn.) cuttings.*Sci. agric. (Piracicaba, Braz.)* vol.50 (1): 33-39.

Lynn, C. and Hartmann, H. T. (1957).Rooting cuttings under mist.CalfoniaAgric, 11: 145.

Mahros, O.M. 2002. Rootability and growth of some types of *Bougainvilleas* cutting under IBA stimulation. Assiut. J. Agri. Sci., 31(1):19-37.

Melgarejo, P., Martinez, J., Martinez, J.J. and Sanchez, M. 2008. Preliminary Survival Experiments in Transplanting Pomegranate. In: Production, Processing and Marketing of Pomegranate in the Mediterranean Region: Advances in Research and Technology Zaragoza, Melgarejo-Moreno, P., J.J. Martinez-Nicolas, J. Martinez-Tome (Eds.). CIHEAM Publication, Europe, pp: 163-167.

Mitra, G.C. and Bose, N. 1954.Rooting and histological responses of detached leaves to B- Indolebutyric acid with special reference to *Boerhavia diffusa Linn*. Phytomorphology, 7:370.

Polat, A.A. and O. Caliskan, 2009.Effect of indolebutyric acid (IBA) on the rooting cutting in various pomegranate genotypes. ActaHortic. (ISHS), 818: 187-192.

Pratima, P. and Rana, V.S. (20011). Effect of pre-conditioning treatments, IBA and collection time on the rooting of semi- hardwood cuttings of kiwifruit, *Actinidia deliciosa* Chev. Int. J. Farm Sci.1(2):30-36.

Selvarajan, M. and Rao, M. V. N. (1982).Studies on rooting of patchouli cuttings under different environments.South Indian Hort., 30: 107-111.

Singh, A. K. (2001c). Effect of wood type and root promotion chemical on rooting of *Bougainvillea peruviana* L. Adv. Hort and Forestry, 8:179-184.

Singh, A.K. and Singh V.S. 2002. Influence of wood maturity and auxins on the regeneration of *Bougainvillea* cuttings. Prog. Hort., 34(2):196-199.

Snedecor, G.W. and Cochran, W.G. (1968).*Statistical Methods*.Ox ford and IBH Pub.CO. Kolkata. 469p.

Vijaykumar, N., 1973. Studies on the propagation of guava (*Psidiumguajava*L.) by cuttings.*Ph.D. Thesis*, Univ. of Udaipur.