Effect of IBA and types of cuttings on rooting of Ixora

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Abstract
The study was conducted to find out “Effect of Indole butyric acid (IBA) on cutting on rooting of Ixora” at farm of Horticulture Section, College of Agriculture, Nagpur in 2019-2020. The experiment was laid out in Factorial Completely Randomized Design with fifteen treatments and three replications. The treatments comprised three types of cuttings i.e. Softwood cuttings, Semi hardwood cuttings and Hardwood cuttings and five concentrations of IBA, 0 ppm, 1000 ppm, 2000 ppm, 3000 ppm, 4000 ppm. The result obtained from the present investigation in respect of root parameters, it was observed that, minimum days to rooting was observed in treatment T13 (hardwood cuttings treated with IBA 2000 ppm). However, maximum number of roots cutting-1, length of main root, survival percentage of rooted cuttings, root volume, fresh weight of roots cutting-1 and dry weight of roots cutting-1 was noticed in hardwood cuttings with 2000 ppm IBA.

Keywords: IBA, propagation, cutting, Ixora, days to rooting, survival percentage

Introduction
Ixora (Ixora coccinea L.) is a popular hedging plant in subtropical regions of India. Ixora, acquired from Sanskrit ‘KVANA’ name of Malaysian Deity which means Iswara to whom flowers were offered. Coccinea means scarlet coloured. Hindus think the bush as scared to Shiva and Vishnu. It is a dense, multi-branched evergreen shrub, usually grows up to a height of 1.2–2 m, but able attain 3.6 m high. It is otherwise known as West Indian Jasmine and belongs to the family Rubiaceae. The plants have leathery leaves and produce large clusters of tiny flowers. They produce orange, gold, pink and red flower and it’s also known as “Jungle flame” and “flame of the woods”. Flowers are suitable for indoor decoration, as they remain fresh for a long time after plucking and have great economic importance through good aesthetic beautification of the environment. Ixora is a moderate to root plant species and rooting ability is moderate under natural conditions. Adventitious root formation is a key step in vegetative propagation of woody or horticultural species and problems associated with rooting of cuttings frequently result in significant economic losses. The hormone, that stimulates the growth of adventitious roots is called auxin, commercially in the form of Indole butyric acid (IBA) and Naphthalene Acetic Acid (NAA). Effect of auxin on initiation of rooting of cuttings of horticultural crops has been reported by many workers. Among the various vegetative methods, propagation by stem cutting is the most successful, convenient and economical method of propagation.

Materials and Methods
An experiment entitled, “Propagation studies in Ixora”, was conducted at an experimental field of Horticulture Section, College of Agriculture, Nagpur, during Kharif season of the year 2019-2020. The experiment was laid out in a factorial completely randomise design (FCRD) with 15 treatment combinations which were replicated thrice. The present experiment was conducted in plastic carats having size of 36 x 56 x10 cm³. The carats were filled with propagation media of 2:1:1 ratio of sand, well decomposed farm yard manure (FYM) and silt. The mixture was filled in each carats. The uniform cuttings were selected. Copper oxychloride was used as a fungicide to check the fungus attack. The planting media was of moderate...
fertility having pH value 7.5. The three types of cuttings were selected for planting i.e. softwood, semi-hardwood and hardwood cuttings. The cuttings were treated for 30 minute with different concentrations of IBA i.e. 1000 ppm, 2000 ppm, 3000 ppm and 4000 ppm and control (water dipping). Observation starting from 30 days after planting up to 120 DAP.

Results and Discussion

Effect of cuttings

The data in respect of days to rooting of cuttings, hardwood cuttings of Ixora shows minimum days C1 (27.73 days) to rooting which was significantly superior over semi hardwood cuttings C2 (35.93 days) and softwood cuttings C1 (40.93 days). Similar results were also recorded by Patel and Dave et al. (1996) [19].

As regards number of roots per cutting, was significantly influence by different types of cuttings. Hardwood cuttings of Ixora recorded maximum number of roots cutting -1 C1 (7.24 roots) which was significantly superior over semi-hardwood cuttings C2 (4.35 roots) and softwood cuttings C1 (3.00 roots) which shows that the hardwood cuttings are best for commercial propagation of Ixora. Similar results were observed by Thakor et al. (1996) [22] in Ixora and Ramesh kumar (2002) [17] in bougainvillea.

The data in respect of length of roots of cuttings, the maximum root length C3 (7.04 cm) was recorded in hardwood cuttings which was significantly superior over semi-hardwood cuttings C2 (6.38 cm) and softwood cuttings C1 (3.14 cm). These results are in close conformity with the findings of Ramesh Kumar (2002) [17] and Sahariya et al. (2013) [18] in bougainvillea.

The data in respect of survival percentage of cuttings, the maximum survival percentages of cuttings C3 (62.33%) was observed in hardwood cuttings which was significantly superior over remaining types of cuttings such as semi-hardwood cuttings, C2 (49.06%) and softwood cuttings, C1 (36.86%) respectively. Similar results were stated by Gupta (1989) in hibiscus.

The data in respect of root volume, the maximum root volume C1 (5.80 ml) was recorded in hardwood cuttings which was significantly superior over semi-hardwood cuttings C2 (3.69 ml) and softwood cuttings C1 (1.58 ml). As regards fresh weight of roots, the maximum fresh weight of roots was recorded in hardwood cuttings C3 (3.71 g) which was significantly superior over semi-hardwood cutting C2 (2.92 g) and softwood cuttings C1 (1.69 g) respectively. Similar results were also recorded by Parminder and K. Singh (2003) [14] in bougainvillea.

The data in respect of dry weight of roots, maximum dry weight of roots was recorded in hardwood cuttings C1 (2.24 g) which was significantly superior over semi-hardwood C2 (1.50 g) cuttings and softwood cuttings C1 (0.67 g) respectively. Similar results were also recorded by Parminder and K. Singh (2003) [14] in bougainvillea and Hamid Babaie et al. (2014) [5] in ficus benjamina.

Table 1: Effect of indole butyric acid (IBA) and types of cuttings on rooting of Ixora

| Treatments | Days to rooting | Number of roots | Length of main root (cm) | Survival percent (%) | Root volume (ml) | Fresh weight of root (g) | Dry weight of root (g) |
|------------|----------------|----------------|------------------------|----------------------|-----------------|-------------------------|-----------------------|
| Cutting    |                |                |                        |                      |                 |                         |                       |
| C1- Softwood | 40.93          | 3.00           | 3.14                   | 36.86                | 1.58            | 1.69                    | 0.67                  |
| C2- Semi-hardwood | 35.93          | 4.35           | 6.38                   | 49.06                | 3.69            | 2.92                    | 1.50                  |
| C3- Hardwood | 27.73          | 7.24           | 7.04                   | 62.33                | 5.80            | 3.71                    | 2.24                  |
| F test     | Sig.           | Sig.           | Sig.                   | Sig.                 | Sig.            | Sig.                    | Sig.                  |
| S.E (m)±    | 0.37           | 0.05           | 0.07                   | 1.00                 | 0.05            | 0.04                    | 0.02                  |
| C.D at 5%   | 1.08           | 0.14           | 0.22                   | 2.90                 | 0.16            | 0.12                    | 0.06                  |
| IBA concentration |            |                |                        |                      |                 |                         |                       |
| A0, 0 PPM  | 40.66          | 3.81           | 4.73                   | 37.44                | 2.63            | 1.95                    | 1.04                  |
| A1, 1000 PPM | 32.22          | 5.30           | 5.80                   | 48.11                | 4.01            | 2.95                    | 1.60                  |
| A2, 2000 PPM | 30.77          | 5.76           | 6.37                   | 60.33                | 5.13            | 4.05                    | 2.01                  |
| A3, 3000 PPM | 34.66          | 4.81           | 5.51                   | 55.22                | 3.55            | 2.61                    | 1.40                  |
| A4, 4000 PPM | 36.00          | 4.56           | 5.20                   | 46.00                | 3.14            | 2.31                    | 1.32                  |
| F test     | Sig.           | Sig.           | Sig.                   | Sig.                 | Sig.            | Sig.                    | Sig.                  |
| SE (m)±    | 0.40           | 0.06           | 0.09                   | 1.29                 | 0.07            | 0.06                    | 0.03                  |
| CD at %    | 1.40           | 0.18           | 0.28                   | 3.74                 | 0.22            | 0.18                    | 0.09                  |
| Interaction C x A |          |                |                        |                      |                 |                         |                       |
| F test     | Sig.           | Sig.           | N.S.                   | N.S.                 | N.S.            | N.S.                    | N.S.                  |
| SE (m)±    | 1.02           | 0.13           | 0.20                   | 2.74                 | 0.16            | 0.13                    | 0.07                  |
| CD at %    | 2.97           | 0.39           | --                     | --                   | --              | --                      | --                    |

Effect of IBA

The cuttings treated with A2 (IBA 2000 ppm) required minimum number of days (30.77 days) to rooting of cuttings which was followed by the treatment, A1 (IBA 1000 ppm) (32.22 days). The maximum days to rooting of cuttings, A0 (40.66 days) was recorded in control treatment. From the above results, it was shown that, IBA (2000 ppm) increases the number of roots and auxin are effective on initiation of rooting of cutting of Horticultural crops has been reported by many workers, (Sherer et al., 1985) [20] Leaky et al., 1982) [8] Similar results were also reported by Patel and Dave et al. (1996) [20] in Ixora and Asl et al. (2012) [1] in bougainvillea.

The maximum number of roots cutting -1 was recorded in treatment A2 (IBA 2000 ppm) (5.76 roots) which was significantly superior over all other treatments. The minimum number of roots cutting -1 A0 (3.81 roots) was recorded in control treatment. Similar results were obtained with the findings of Asl et al. (2012) [1] and Sahariya (2013) [18] in bougainvillea.

The treatment A2 (IBA 2000 ppm) produced maximum root length (6.37 cm) which was significantly superior over all other treatments and minimum root length A0 (4.73 cm) was recorded in control treatment. The similar results are also observed by Singh (1981) [7, 14, 15, 18, 20] in Ixora, Mehraj et al. [2]
(2013) \textsuperscript{10}, Shiva and Nair (2008) \textsuperscript{21} in hibiscus and Maryam Shirzad et al. (2012) \textsuperscript{9} in Ficus benjamina. The treatment A\textsubscript{2} (IBA 2000 ppm) recorded maximum survival percentage of cuttings (60.33\%) which was statistically significant over all other treatments. The minimum survival percentage of cuttings observed in control treatment, A\textsubscript{0} (37.44\%). The above findings were also recorded by Niaz et al. (2002) \textsuperscript{12} and Mehraj et al. (2013) \textsuperscript{10} in bougainvillea.

The significantly maximum root volume (5.13 ml) was recorded in the treatment A\textsubscript{2} (IBA 2000 ppm) which was statistically superior over all other treatments. The minimum root volume, A\textsubscript{0} (2.63 ml) was recorded in control treatment. The above results clearly indicated that, the root volume of plant was significantly superior in hardwood cuttings and in IBA at 2000 ppm (A\textsubscript{3}). The maximum root volume in IBA (2000 ppm) might be due to proper concentration of IBA and type of cutting (hardwood cutting) as the number of root, length of root and fresh weight of root were significantly superior in hardwood cutting and IBA (2000 ppm).

Cuttings treated with A\textsubscript{2} (IBA 2000 ppm) recorded significantly maximum fresh weight of roots (4.05 g) which was statistically superior over all other treatments. The minimum fresh weight of roots A\textsubscript{0} (1.95 g) was recorded in control treatment. Similar results were also recorded by Deshmukh and Barad (2006) \textsuperscript{3} in bougainvillea and Karimiyan et al. (2013) \textsuperscript{6} in Ficus benjamina.

The maximum dry weight of roots (2.01 g) was recorded in the treatment A\textsubscript{2} (IBA 2000 ppm) which was significantly superior over all other treatments of A\textsubscript{1} (IBA 1000 ppm) (1.60 g), A\textsubscript{3} (IBA 3000 ppm) (1.40 g), and A\textsubscript{4} (IBA 4000 ppm) (1.32 g) respectively. The minimum dry weight of roots A\textsubscript{0} (1.04 g) was recorded in control treatment. Similar results were recorded by Sahariya et al. (2013) \textsuperscript{18}, Nogueira et al. (2007) \textsuperscript{13} in bougainvillea, Shiva and Nair (2008) \textsuperscript{21} in hibiscus and Karimiyan et al. (2013) \textsuperscript{6} in Ficus benjamina.

Conclusion
From the present study, it can be concluded that, in respect of root parameters, it was observed that, minimum days to rooting, maximum number of roots cutting\textsuperscript{2}, length of main root, survival percentage of rooted cuttings, root volume, fresh weight of roots cutting\textsuperscript{1} and dry weight of roots cutting\textsuperscript{1} are recorded with T\textsubscript{3} i.e. hardwood cutting and 2000 ppm IBA.

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