

Short note

## ***Research notes on vegetative propagation of Chiuri (Diploknema butyracea (Roxb.) H.J.Lam)***

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**C**hiuri (*Diploknema butyracea*) is an under-utilized but economically important tree species of Nepal primarily grown for butter and bee keeping (MEDEP, 2010). Belonging to the family 'Sapotaceae', it is a fairly large tree native to Nepal, and is also spread in other countries such as India, Bhutan, and the Philippines (Zargar & Kumar, 2018). In Nepal, it is found from the Terai region to 1500 m above the mean sea level (Jackson, 1994). Although Chiuri is spread across the country, it is culturally and economically important for Chepang Community in the Chure region of central Nepal (PA, 2010). The potential benefit of this species is yet to be harnessed (Chikanbanjar *et al.*, 2021a). However, this tree species is not yet domesticated, and proper farming system is yet to be established (Chikanbanjar *et al.*, 2021b). Traditionally, Chiuri trees are planted in the *khorias* (wastelands), but in recent years, this species is also planted in *bari*, i.e., small farmland (Chikanbanjar *et al.*, 2021b).

Good planting material is a prerequisite for efficient production system of any crop (Honja, 2014). However, the planting materials used for Chiuri plantation is seed-based, and hence takes longer period (6–10 years) to bear fruits (Chikanbanjar *et al.*, 2021b). There is also possibility that the young plants raised from seed may not be true to type due to cross pollination, and there could be inconsistent in quality (Bhuyan & Kobra, 2007). Success of rooting in stem cutting was 79.7% in *Aisandra butyracea*, and was possible with the use of rooting hormone (500ppm IBA plus NAA) during the month of summer (Tiwari & Dhar, 1997). However, the air layering was only 30% successful with the use of rooting hormone

(1000ppm NAA, Tiwari & Dhar, 1997). Cuttings from juvenile tree of *Diploknema butyracea* was found successful from sprouting (92%) to survival (87.8%) to hardened plant (77.8%), but the response of cuttings from mature tree was very poor in all aspects such as sprouting (38%), survival (5.6%) and hardened plant (0%) (Zargar & Kumar, 2018). The failure of the cuttings from branches of older and already bearing tree may be due to the presence of sclerenchyma tissue in the phloem of mature trees which obstruct the emergence of the root (Goodin, 1965). However, the rooting success of juvenile plant may not be very useful until and unless it shortens the fruit bearing time.

Although, good rooting success was achieved with the cuttings sourced from juvenile plant (Zargar & Kumar, 2018), yet the uncertainty of the time to fruiting of these plants overshadows the implication of this approach. Hence, it may not be recommended for propagation of Chiuri. Propagation of Chiuri is yet to be studied in a systematic manner, and there is no recommended technique to produce good quality planting materials of this species (Zargar & Kumar, 2018). Thus, good planting materials in the form of a grafted plants could change the farming approach of Chiuri, thereby providing true to type plants from elite mother plants and significantly shortening the fruiting time from 6–10 years to as short as 2–3 years. Early flowering would not only reduce time to fruiting, but it would also increase scope for bee keeping much earlier than the traditional planting material (plant raised from seeds).

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The study was designed to determine the possibility of best vegetative propagation technique (grafting) of Churi growing in Chitwan district of Nepal to produce high quality planting materials.

## Materials and methods

The study was conducted in the month of February through May in the premises of Sungava Krishi Farm, in Bharatpur Metropolitan City of central Nepal. The scions were prepared from the Chiuri plants at Shaktikhor (Chitwan), and were grafted with the rootstocks prepared from the one-year plants at the Sungava Agriculture Farm (SAF), Bharatpur Metropolitan City (Figure 1: a–d). General caring of the grafted plants (e.g., watering and weeding) was done from time to time as per the requirement.

### Plant materials

#### Type of plant used

The Chiuri plant used for the purpose of this research was the early flowering type collected from Shaktikhor located within Ward Number 3 of Kalika Municipality, Chitwan. A healthy flowering mother tree (about 30 m tall as observed visually) at its fruiting stage was selected for the purpose of preparing scions. The tree had begun flowering since October until February. The Chepangs of Shaktikhor were consulted for the selection of the mother tree. The fruiting mother tree is called 'Aasare' or 'Wayo' in Chepang

language (Chikanbanjar *et al.*, 2021b), and it reaches its defoliated stage in the month of October. Fruit is harvested during July–August.

### Scions

The branches of a healthy flowering mother tree were used for the preparation of scions.

### Rootstocks

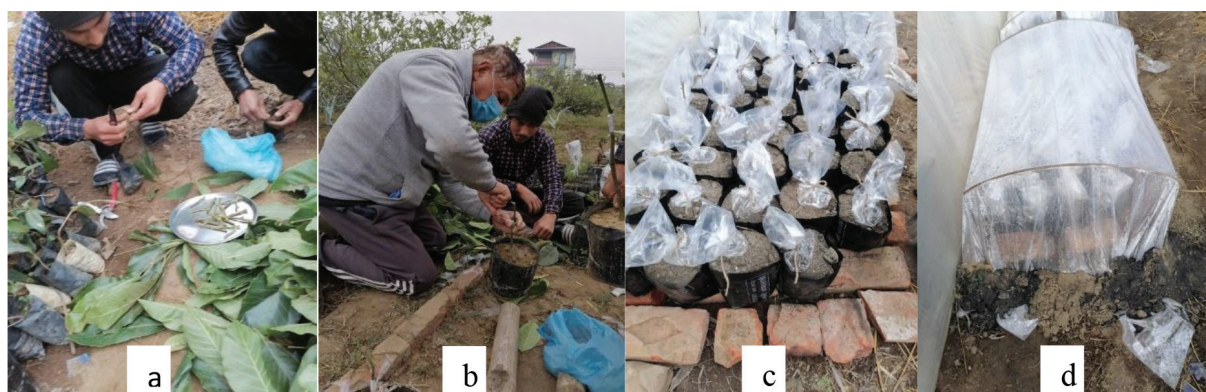
About one year-old Chiuri plants (with around 1 cm thick stems) raised from the seeds at the nursery within the SAF were selected for rootstocks. Care was taken to select healthy and disease-free plants for rootstocks.

### Preparing the scions

The scions of about 3–4 cm length and 1 cm thickness and with three–four good buds were prepared with 1 to 2-inch slanted-cuts on either side after removing the leaves, and were quickly transferred to the premises of the SAF located within the Bharatpur Metropolitan City for the purpose of grafting.

### Preparing the rootstocks

The selected rootstocks were decapitated at about 10 cm height from the ground-level. A two to three-inch incision was made on the center of each rootstock using a sharp knife, and a small piece of wood was inserted into it to keep the two sections apart.



**Figure 1:** a) Preparation of scions from branches; b) Cleft grafting; c) Covering of scions up to graft union for better humidity and temp.; and d) Additional low plastic cover to protect the grafted plants from low temp

### ***Grafting the scions and rootstocks***

Cleft grafting technique was used for propagation of Chiuri. The scions so prepared were inserted into the rootstocks ensuring the union of their cambiums after removing the wood pieces in the rootstocks; plastic tape was used to tie their unions. Care was taken to make it airtight to prevent desiccation of the scions. Each grafted plant was covered with a transparent plastic bag from top and tied little bit below the union to maintain humidity and desirable temperature for the plant. All the plants were then kept in a low tunnel house to maintain better temperature. Successfully grafted plants (with emergence of first leaves) were removed from plastic-house, and kept in a shade-house.

### ***Holding the grafted plants***

The successfully grafted plants were kept in a greenhouse covered with shade, and were moved to open field after emergence of two leaves.

### ***Biometric data***

The biometric data were collected from the successfully grafted plants, such as length of scion, girth of scion and number of leaves.

## **Results**

### ***Grafting success***

The cleft-grafts of Wayo type of Chiuri were approximately 53.0% successful (Table 1; Figure 2) during the spring–summer season.

**Table 1: Success status of Cleft Grafting Technique in Wayo type of Chiuri**

No. of plants grafted	Success of grafted plants	Percentage of success
40	21	52.5%

Source: Chiuri plants, Shaktikhor, Chitwan, 2021



**Figure 2: A successfully grafted Chiuri plant**

### ***Length of scion***

The length of the scions ranged from 1.5 cm to 3.2cm after 145 days of grafting (Table 2).

### ***Girth of scion***

The girth of the scions ranged from 1.0 cm to 2.5 cm after 145 days of grafting (Table 2).

### ***Number of leaves***

The number of leaves per grafted plant ranged from 3 to 6 after 145 days of grafting (Table 2).

**Table 2: Biometric data collected from the successfully grafted Chiuri plants after 145 days of grafting**

No. of plants	Length of scion (cm)	Girth of scion (cm)	No. of leaves
1	2.0	2.5	3.0
2	2.0	2.0	3.0
3	1.5	2.0	3.0
4	2.0	2.2	4.0
5	2.1	1.6	3.0
6	3.0	1.1	5.0
7	3.2	2.5	6.0
8	3.2	2.0	6.4
<b>Average</b>	<b>2.4</b>	<b>2.0</b>	<b>4.1</b>

Source: Chiuri plants, Shaktikhor, Chitwan, 2021.

## Discussion

This is the first report of grafting success in Chiuri, and although the success percentage is relatively low, yet this has opened the possibility for more grafting research in *D. butyracea*. The success rate could be low due to lower ambient humidity and lower temperature during the graft–union period. In Mango, higher grafting success with cleft grafting technique was found with higher temperature (max. 30°C and min. 15.6°C) and humidity (50.5%) than lower temperature (max. 28.5°C and min. 11.4°C) and humidity (48.5%, Damtew & Assefa, 2018). Chiuri is a deciduous tree and ideally, deciduous trees are grafted during the dormant period for higher success (Dimri *et al.*, 2005). However, the defoliation time of Chiuri in Makwanpur depends on the type of Chiuri; the Wayo type defoliates in September (Chikanbanjar *et al.*, 2021b). Cleft grafting was the technique used in this research, but other grafting techniques may also be tested to identify the best grafting technique. Besides, seasons may also significantly influence graft success (Vasav *et al.*, 2012). Grafting success of Chiuri opens opportunity for production of quality planting materials in contrast to plants raised from seeds or no hardening success with cuttings raised from mature plants (Zargar & Kumar, 2018). The growth of the scion length is quite slow in contrast to scion girth and number of leaves. The growth of scion length of grafted mango was much higher (22.49 cm in 120 days, Damtew & Assefa, 2018) in contrast to Chiuri (2.4 cm in 145 days), signifying slower growth rate of Chiuri.

## Conclusion

Cleft grafting technique was found to be successful in propagating Chiuri plants (Wayo type) from their planting materials, such as scions and rootstocks.

## References

Bhuyan, M.A.J. and Kobra, K. (2007). Fruit characteristics of some uncommon mango varieties under Joydebpur condition. *Journal of Agricultural Research* 32 (3): 493–500.

Chikanbanjar, R., Pun, U.K., Bhattra, B. and Kunwar, R.M. (2021a). Chiuri (*Diploknema butyracea* (Rox.) H.J. Lam): A tree species for improving the livelihood of Chepang in Makwanpur, Central Nepal. *Ethnobotany Research and Applications* 21 (15): 1–11.

Chikanbanjar, R., Pun, U.K. and Bhattra, B. (2021b). Status and types of Chiuri (*Diploknema butyracea* (Rox.) H.J. Lam) trees owned by indigenous Chepang Communities in Makwanpur, Nepal. *Journal of Institute of Forestry* 18: 119–226.

Damtew, M. and Assefa, W. (2018). Influence of grafting season and rootstock age on the success and growth of Mango (*Mangifera indica* L.) cv. Apple using cleft grafting. *International Journal of Novel Research in Life Sciences* 5 (3): 12–18.

Dimri, D.C., Petwal, A. and Kamboj, P. (2005). Determination of optimum time for chip budding in Apple cv. Red Fuji. *Acta Horticulture* 696: 173–176.

Goodin, J. R. (1965). Anatomical changes associated with juvenile–to–mature growth phase transition in Hedera. *Nature* 208: 504–505.

Honja, T. (2014). Review of mango value chain in Ethiopia. *Journal of Biology, Agriculture and Health Care* 4: 230–240.

Jackson, J. K. (1994). Manual of Afforestation in Nepal (Volume 2). Forest Research and Survey Centre, Babarmahal, Kathmandu, Nepal. pp. 365.

MEDEP (2010). Resource Analysis of Chiuri (*Aesandra butyracea*) in Nepal. Kathmandu: Micro–enterprise Development Programme (MEDEP–NEP 08/006).

PA (2010). Chiuri – the Butter Tree of Nepal (Practical Action Brief). (Accessed on December 13, 2021).

- Tiwari, A. and Dhar, U. (1997). Studies on the vegetative propagation of Indian butter tree (*Aisandra butyraceae* (Roxb.) Baehni). *Journal of Horticultural Science* 72 (1): 11–17.
- Vasav, V. P., Narkhede, S. S., Gunaga, R. P. and Rane, A. D. (2012). Effect of seasons on grafting success in Karanj. *PKV Research Journal* 36 (1): 49–51.
- Zargar, A. R. and Kumar, D. (2018). Effect of maturity stage of donor plant on propagation of *Diploknema butyracea* through branch cutting. *World Journal of Agricultural Research* 6: 1–4.