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(II)
Restoration of *Gnetum edule* (Willd.) Blume: A threatened medicinal plant of wet tropical biome in India

The many medicinal plants found in India, which are mostly used by the natives for medical purposes, have gained widespread recognition and acceptance throughout the world because of their unique benefits, which include excellent outcomes, little to no negative effects, and accessibility for the general people. Indigenous and traditional medical methods have been used for a very long time and have demonstrated promise in treating a variety of feared illnesses, including the most recent worldwide COVID-19 epidemic. Many plants that are harvested from natural stands are also in danger of going extinct, therefore, there is global concern over the forecast of a sixth mass extinction. Prioritizing conservation activities for different plant species requires determining the threat status, which has been the focus of concentrated efforts since the 1990s (Gowthami *et al.,* 2021). Among the threatened plants, *Gnetum edule* is also listed, belonging to the family Gnetaceae (Barik *et al.*, 2018). It is a large, evergreen woody and twining climber conifer. It is native to Southwest India and usually grows near perennial streams. The oils obtained from the seed kernels are used for the treatment of rheumatism, the stems and roots are used as antiperiodic. Other uses for the treatment of ailments like bronchitis, piles, inflammation, jaundice, arthritis have been found (Nambiar *et al.,* 1985; Valappil *et al.,* 2019; Jena *et al.,* 2021). The fresh nuts have been shown to have high antioxidant activity (Valappil *et al.,* 2019). The presence of primary and secondary metabolites of *Gnetum edule* has been shown in earlier reports. The secondary metabolites like saponins, tannins, resins and alkaloids have been documented earlier (Ali *et al.* 2020). Other studies have revealed the presence of secondary metabolites like flavonoids, glycosides, phenols, phytosterols and quinine. Primary metabolites like carbohydrates and proteins have been reported. Some reports have shown the presence of saponins while others have documented the absence of saponins and triterpenoids (Priya and Anjana, 2019; Preetham *et al.,* 2015). The population of *G. edule* is declining at alarming rate due to habitat destruction. Therefore, an attempt has been made to restore the population through stem cutting and natural wildlings. The paper highlights the importance of vegetative propagation in the restoration of threatened medicinal plants in India.

Collection of stems and wildlings

Stem of *Gnetum edule* and wildlings were collected from Koira Range of Bonai Forest Division in 2021. Cutting stems with nodes, were dipped in rooting hormone (FAST roots, Divine Tree, 50 gm). After one-hour, stems were kept in wet cloth until putting in polybags.

Preparation of soil polybags

The preparation of nutrient soil for proper propagation and growth, organic manure (Vermi compost, Trust Basket, 5 kg), fungicide (Gamaxine Powder, British Polymed), NPK (Npk 20:20:20, Unitedlys, 380 gm), sand and forest soil were taken. The ratio of sand and soil was 1:3.

Selection of sites for plantations

The studied plant is an indicator of a perennial stream. Therefore, the natural perennial streams of Bonai Forest Divion were selected. Associated taxa of *Gnetum edule* is also observed.

Plantation and monitoring

After 90 days, wildlings and propagated stems were taken. During plantations, organic manure and fungicides were used. Fencing was done using bamboo and net. After plantation in every 3 month the growth was observed until next 21 months.

One of the main goals of the conservation plan is the restoration of threatened species. Because of the observed population loss, the authors have chosen to restore *Gnetum edule* in this study. Thirty node-containing stems were gathered to propagate through stem-cutting method. Stems measuring 8 to 9 inches and 1.5 to 2.0 cm in width were kept for collecting. Following rooting hormone application, the stems were placed in a polybag filled with standard soil. It was found that only 12 stems had survived after 90 days. In the Bonai Forest Division in Sundargarh, Odisha, twelve designated areas selected close to perennial streams received the transplanted saplings. Twenty wildlings were gathered and placed with standard soil in polybags. Every wildling was seen to be securely tucked into their polybags. They were planted in twenty distinct locations near streams. It was found that forest soil

works well for producing *G. edule* standard soil. Three parts forest soil, one part sand, three handfuls NPK, five handfuls organic fertilizer, and one handful gammaxene were added to a standard soil mixture. It was noticed that for restoration the identified area should be near perennial stream with flora like *Diospyros malabarica, Disporum cantoniense, Piper longum, Terminalia arjuna, Ardisia solanacea, Christella dentata, Lygodium flexuosum, Cyclosorus terminans, Dictyospermum ovalifolium, Zingiber roseum* etc (Table 1). The steps of restoration in the present study are illustrated in Figure 1 and discuss the work of other researchers in the same aspects.

The development of vegetative propagation methods for threatened medicinal plants is an important task. In this aspect, the method described here for the restoration of *Gnetum edule* will be very helpful in restoring other threatened medicinal plants in wild. The study also concludes that for the restoration of threatened taxa, apart from the stem cutting method,

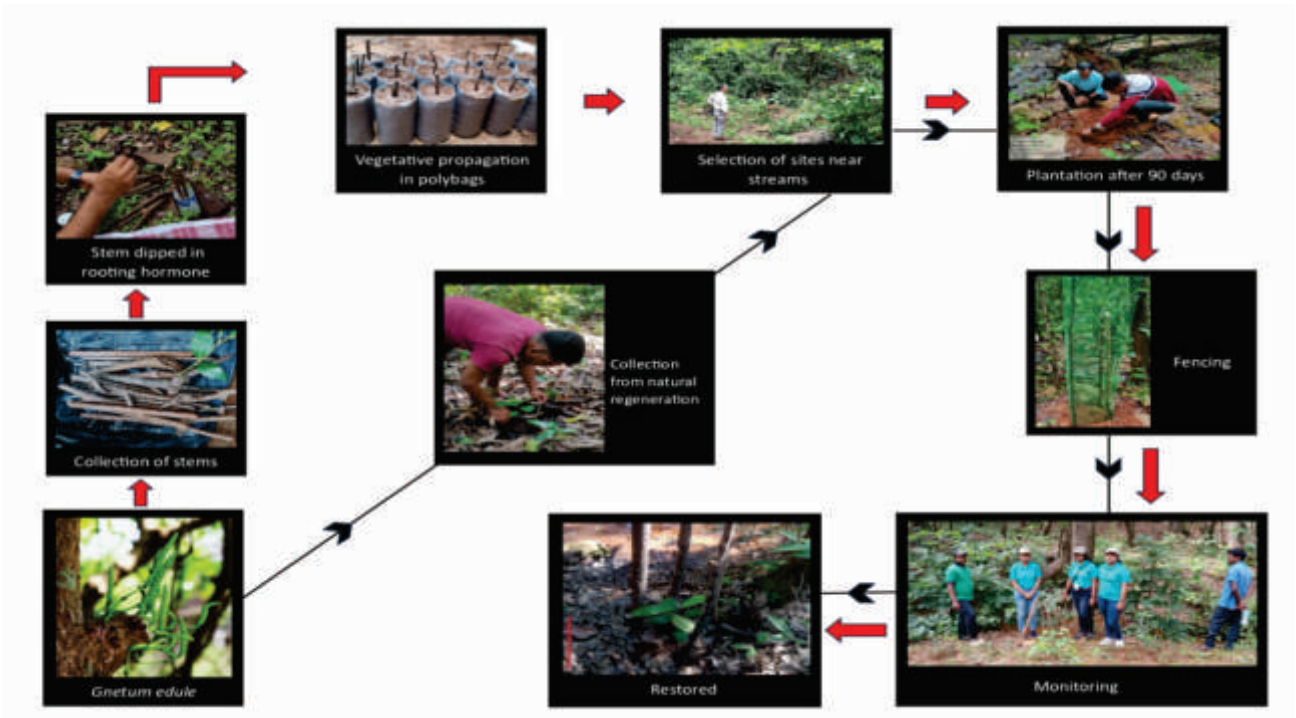

Fig. 1: Steps of restoration (*Gnetum edule*) in study areas

Table 1 : Keys for the selection of sites for restoration works

Keys for selection of sites	1. Near perennial water stream 2. Hill forest 3. Semi-evergreen forest 4. Marshy and wet places 5. Near water stream in Dry Deciduous Forest 6. Shady places inside forest 7. Associated flora a) *Diospyros malabarica,* b) *Disporum cantoniense* c) *Piper longum* d) *Terminalia arjuna* e) *Ardisia solanacea* f) *Christella dentata* g) *Lygodium flexuosum* h) *Cyclosorus terminans* i) *Dictyospermum ovalifolium* j) *Zingiber roseum*

Fig. 2 : Vegetative parts of *Gnetum edule* in wild

wildlings through natural regeneration can be used for same habitat. (Fig. 2)

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