

Biology

NOTES ON ANATOMY AND MORPHOLOGY OF *Taxus mairei* (CULTIVATED YEW) FROM NEPAL

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Abstract

There are about 30 taxa of gymnosperms in Nepal. *Taxus*, commonly called as Yew, is the genus with two naturally occurring taxa namely *Taxus wallichiana* Zucc. and *Taxus contorta* Griffith. Another species *Taxus mairei* (Leme'e & H. Le'veille') S.Y. Hu ex T.S. Liu is found as cultivated species and not in naturalized habitat. The delimitation of the taxa belonging to the genus *Taxus* by morphological as well as anatomical features seems reliable method. This study aims at the presenting notes on the anatomical and morphological features to identify *T. mairei* in Nepal. For the current study, we collected specimens from the cultivated localities; and their herbarium specimens were prepared. The laboratory works were done in the lab of GoldenGate International College, Nepal. The distinct and short morphological as well as anatomical features of the species were presented with necessary illustrations. Morphologically the species was identified by dark glossy green above, not straight leaves, the petioles were twisted on dorsal surface and less persistent bud scales. The distinct anatomy was the presence of 12-16 rows of stomata. Although, genetic separation is possible, the extraction of DNA from herbarium is difficult due to very less and fragmented DNA. The outcome of this research could be used in future for detailed taxonomic studies of other gymnosperms in context of Nepal.

Keywords: *Cultivated, gymnosperm, DNA, yew, genetic*

Introduction

The Western and Eastern Himalayan provinces bordered Nepal making it distinct habitat for flora and fauna (NBSAP 2014). There are 33 taxa belonging to the gymnosperm in Nepal distributed from Western to Eastern part (Rajbhandari and Baral 2010; Rajbhandari *et al.* 2015). In Nepal, the naturally occurring *Taxus* is distributed at 2200-3450 m from East to West in association with other gymnosperms (Gajurel *et al.* 2014; Rajbhandari *et al.* 2015). However the cultivated species *Taxus mairei* (Lemée & H. Lév.) S.Y. Hu ex T.S. Liu occur up to 2250 m (Rajbhandari *et al.* 2015; Gajurel 2016).

The species of *Taxus* in Nepal are dioecious with presence of red aril in seed that flower in April-October while the seeds dispersal occur by the help

of birds and animals (Polunin and Stainton 1984; Gajurel *et al.* 2014). Two species *T. wallichiana* and *T. contorta* have been used in furniture, incense, fodder (Gajurel *et al.* 2014). These two species occur in natural habitat while another species *T. mairei* is found as cultivated in Nepal (Gajurel *et al.* 2014). Due to high timber value and medicinal property; the species of the genus *Taxus* has been under heavy exploitation (Gajurel *et al.* 2014).

The collection of specimens of species of *Taxus* lack complete information affecting the identification process; besides, genetic study is also less possible due to less extraction of the DNA from dried specimens (Spjut 2007). The taxonomic differentiation of the species of *Taxus* have been difficult due to characters that vary with environment (Möller *et al.* 2007). There has been

no study carried out aiming at the morpho-anatomical separation of this species occurring in Nepal. Therefore, this study has main objective to study anatomical sections of stem and leaf along with morphology of the species collected from Nepal.

Materials and Methods

The sites selected for the anatomical study included Godawari, Lalitpur and Sundarijal, Kathmandu. The species was collected with systematic sampling (fifteen samples from the only tree in Sundarijal and fifteen samples from different patches in Godawari); and the leaf and stem were preserved in 70% alcohol following the method as in Gajurel (2008). The herbarium specimens were dried in soft blotting paper by procedure mentioned in Gajurel (2008) and Siwakoti & Rajbhandary (2015). When the specimens were dried, they were mounted in standard herbarium sheets following Siwakoti & Rajbhandary (2015). These were submitted to college herbarium housed at GoldenGate International College, Battisputali, Kathmandu.



Figure 1. Specimens of *Taxus mairei* (JG 16/101)

For the anatomy, fine sections were sliced with razor and stained in saffranin, washed and mounted in glycerine for temporary purpose (Gajurel 2008; Siwakoti & Rajbhandary 2015). For the photography, the magnification 4X and 10X (Olympus) were used. Photographs were taken with Nikon Coolpix L820. The collected

specimens were identified with standard literatures (Spjut 2003, 2007).

Results and Discussion

The collected species of *Taxus mairei* (Lemée & H. Lév.) S.Y. Hu ex T.S. Liu in Sundarijal was a single small tree and not in the natural habitat. It occurred in cultivated habitat in the Godawari, Lalitpur. Such occurrence is in accordance with different studies carried out in Nepal, where author found young patches of few individuals in different localities (Thomas *et al.* 2013).

The altitudinal distribution of this species determined in present study was 1400-1500 m. Other studies also reported the altitude for the species below 2250 m; which is the similar altitudinal distribution range for this species (Poudel *et al.* 2012; Rajbhandari *et al.* 2015).

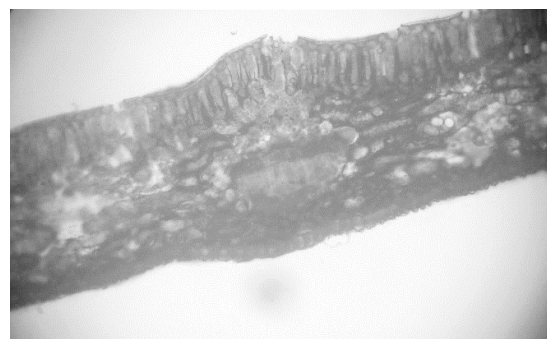


Figure 2a. VS of Leaf (Godawari)

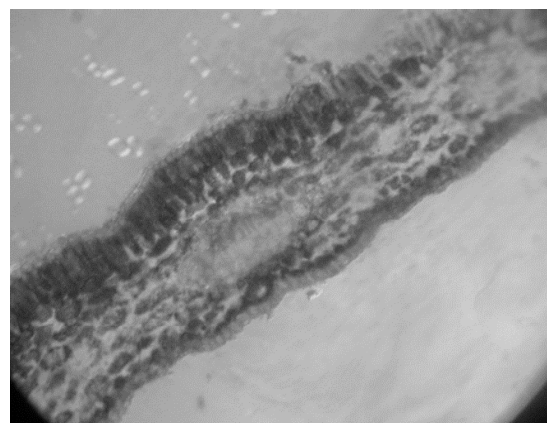


Figure 2b. V.S Leaf (Sundarijal)

We found that the species *Taxus mairei* was evergreen, small or medium sized tree with 5-7 m in height. The main branch of the tree was zigzag, bud scales were not found to be persistent. It had

flat leaf but the leaf margins were slightly tapering, dark green above or dark glossy green, paler below (figure 1). The leaves of the plant were spreading at nearly right angles to branchlets, leaves oblong with an acute apex, 0.5–2.5 X 0.2–0.4 cm, and the petioles were twisted on dorsal surface. The plants were difficult to separate on the basis of sex before flowering. This species is distinguished from typical *T. wallichiana* and *T. contorta* by the leaves appearing slightly wider, not having straight leaves, less markedly curved across the adaxial surface, paler green below than above and the petioles were twisted on dorsal surface. This finding is similar to Spjut (2007).

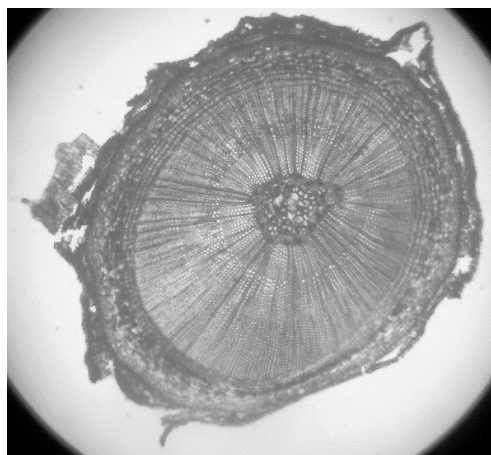


Figure 3a. T.S. of Stem (Godawari)

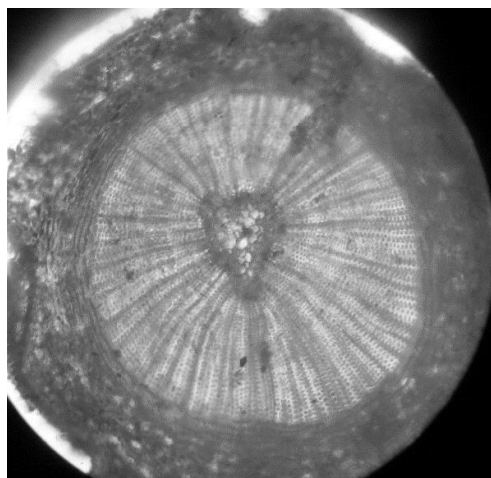


Figure 3b. T.S. of Stem (Sundarijal)

The anatomy of the leaf showed that the upper epidermal layer was thin-walled; lower epidermal cells were larger with the in 12–16 irregular continuous rows of stomata, crowded (figure 2).

These were also irregularly rectangular (figure 2). It also showed that one-layered epithelium of the axial resin ducts and commonly consists of 5-6 cells (figure 3). The epidermal layer is quite distinct with stomata (figure 3). The secondary growth was visible with annual rings. The anatomical structure showed such distinct growth rings (figure 3). One of the important anatomical feature was axial tracheids; polygonal in section rarely with intercellular spaces (figure 3). The medullary rays were uniseriate (figure 3). The internal structure of the stem and leaf of the species of *Taxus mairei* has not been presented before from Nepalese specimens with detailed figures. However, the anatomical studies related to *T. mairei* has been done from other parts (Spjut 2007). Both morphological and anatomical description were similar to study carried out by Spjut (2007).

Conclusion

Although there are relatively few number of gymnosperms in Nepal; only two species of *Taxus* are present in natural habitat while another one found in cultivated habitat. It is very difficult to separate these species. As this study is based on collections from some cultivated localities from Nepal; it would be useful to separate the species from other two naturally occurring ones. A morphological study was done along with the anatomical comparison. The species was identified by dark glossy green above, not straight leaves, the petioles were twisted on dorsal surface and less persistent bud scales based on the morphology. The distinct anatomy was the presence of 12-16 rows of stomata in leaf. Although, the separation of the species on the basis of genetics is possible, the extraction of DNA from herbarium is difficult due to fragmented DNA. Therefore, the morpho-anatomical studies has been done for identifying the plant. The outcome of this study could be used in future for detailed study.

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