COMMUNICATION

AN ASSESSMENT OF THE POPULATION STATUS OF THE THREATENED MEDICINAL PLANT \textit{ILlicium griffithii} Hook.f. & Thomson in West Kameng District of Arunachal Pradesh, India

Tashi Dorjee Bapu & Gibji Nimasow

26 January 2021 | Vol. 13 | No. 1 | Pages: 17504–17512
DOI: 10.11609/jott.6082.13.1.17504-17512
An assessment of the population status of the threatened medicinal plant *Illicium griffithii* Hook.f. & Thomson in West Kameng District of Arunachal Pradesh, India

Tashi Dorjee Bapu ¹ & Gibji Nimasow ²

¹,² Department of Geography, Rajiv Gandhi University, Itanagar, Arunachal Pradesh 791112, India.

¹ tashi.bapu@rgu.ac.in (corresponding author), ² gibji.nimasow@rgu.ac.in

**Abstract:** *Illicium griffithii* Hook.f. & Thomson, a medicinal plant of the family Schisandraceae, is an Endangered species listed by the IUCN. A decline in population of this plant due to climate change as well as increasing human influences on the natural resources has been a matter of great concern among the researchers. In order to estimate the existing population of this plant, a field-based study employing linear transect method was conducted in four phases, May–June 2017, May–June 2018, April–May 2019, October–November 2019 covering an area of 700km² (approx.) in West Kameng District of Arunachal Pradesh that lies within the Himalayan biodiversity hotspot. The study recorded 3,044 live individuals of *I. griffithii* including 1,372 seedlings, 1,358 saplings, and only 314 mature trees. Additionally, 126 dead trees were also recorded. The study confirmed that the plant has a good regeneration rate but with a poor survival rate of saplings. Besides, large-scale collection of its fruits for trade and anthropogenic disturbances in the study area appears to be the major threat to its existing population. Therefore, proper training of the local people on large-scale cultivation of this plant together with awareness towards judicious harvesting of fruits from the wild may be the significant approach to conservation.

**Keywords:** Endangered species, regeneration, survival, risk assessment.
INTRODUCTION

People largely depend on plants for food security and a multitude of plant products, from medicine to fibre. In short, plants are vital to our existence, which enhances our lives in innumerable ways. Medicinal plants are an important source of raw material for traditional medicines and a large number of people derive employment and income from collection, processing and trade of these plants (Sarma & Sharma 2014; Bapu & Nimasow 2019). Today biodiversity and ecosystems (home to medicinal plants and other raw materials) are facing threat from over exploitation, habitat loss and fragmentation (Bapu & Nimasow 2018), climate change, pollution and invasion of alien species (IUCN 2003) and disturbance of community structure (Novacek & Cleland 2001).

The present population and regeneration status largely determines the existence of the species and is significant in conservation management. The regeneration status of a species is usually assessed from the population dynamics of seedlings and saplings in a forest community (Duchok et al. 2005). The age and diameter of a plant have been the basis for the prediction of regeneration status of tree species according to several researchers (Pritts & Hancock 1983; Khan et al. 1987; Bhuyan et al. 2003; Duchok et al. 2005). The presence of sufficient seedlings, saplings and young trees and the ability of the seedlings and saplings to survive and grow largely portray the successful regeneration of the species (Good & Good 1972; Saxena & Singh 1984). Although the species habitat changes over time naturally, the exposure to human interference and other causative factors largely influence the species structure and regeneration. The number of seedlings and saplings in an area allows assessing the regeneration potential of a species (Saxena & Singh 1984).

*Ilicium griffithii* Hook.f. & Thomson belongs to the family Schisandraceae (Kew Science 2019). It is distributed sporadically in Bhutan, Hongkong, Vietnam, and India (Dung et al. 1995; Mukhia 2006). In Arunachal Pradesh, it occurs mostly in subtropical and temperate broad-leaved forests of West Kameng, Tawang, Lohit, and Lower Subansiri districts (Paul et al. 2013) and in very small numbers in Pakke Tiger Reserve of East Kameng District (Tag et al. 2012). It is an important medicinal plant of the temperate broad-leaved forests of northeastern India (Saha & Sundriyal 2010) with an average life span of 25–30 years (IUCN). This species is observed to be present in the second and third storey in the forest stratification in Arunachal Pradesh (Kaul & Haridasan 1987). It is known by different names in different places, most commonly as ‘Lishi’ / ‘Lissi’. It is called “Dombursching” and “Munsheng” by Monpas of West Kameng and Tawang, “Taihelang” by Apatanis, Loshsing/Loshu by Membas (Paul et al. 2013) and “Anasphal” in Hindi. The fruits are star-shaped, consisting of 7–13 follicles / carpels, containing one seed each. These seeds in the fruits contains shikimic acid which is used for manufacturing antiviral / anti influenza drug Tami flu (Ghosh et al. 2012; Cui et al. 2014; Candeias et al. 2018). About 41 constituents of essential oils have been identified from the fruits and seeds that consists mainly of 4-methyl-6-(2-propenyl)-1,3-benzodioxole, linalool, p-methoxy phenyl acetone, terpinen-4-ol, limonene and safrole (Dutta et al. 1997; Saraswathy et al. 2010), for which it has high demand in the spice and perfumery industries. Recently, scientists have also found cancer fighting properties especially against lung cancer cells (Vijayakumar et al. 2012). Traditionally, the carpels of fruits are used for flavouring butter-salted tea (Inchaa-Jhha/Tsaajhhaa) and to increase the potency of ‘Ara’ (local wine) by ‘Monpas’ of West Kameng and Tawang districts of Arunachal Pradesh (Bapu & Nimasow 2017). It is also used as medicine to cure cough, toothache, abdominal pain and food poisoning by the local people and is considered carminative, stomachic, and galactagogic (Hung et al. 2016). *Ilicium* flowers from January to April and fruiting occurs by the end of April (Saha & Sundriyal 2010) and it matures by September end.

International Union for Conservation of Nature and Natural Resources (IUCN) reported a decline in the habitat of *I. griffithii* due to land use changes and unregulated collection of seeds, fruits and tree felling. Further, the experts in Conservation Assessment and Management Plan (CAMP) workshop, 2003 reported a decline of more than 60% of its population over 84 years (three generations length). Hence, the species has been enlisted as Endangered in IUCN Red Data Book (Saha et al. 2015). It is reported to be Critically Endangered in Meghalaya and Near Threatened in Arunachal Pradesh (Ved et al. 2003, 2005). Paul et al. (2013) reported that the plant is found growing abundantly in the natural forests of Arunachal Pradesh, but raised concern about its endangerment due to localized distribution, occurrence in unprotected areas with high anthropogenic disturbances and adverse impact of climate change. Further, the local people used to collect its fruits from the forests for their nominal source of income (Duchok et al. 2005; Bapu & Nimasow 2019) and fell the trees for fuel wood and other purposes (Bapu & Nimasow 2017). Therefore, in the present study, an attempt has
been made to examine the current population structure and regeneration status of *I. griffithii* in the wild so as to understand the future prospects of its regeneration.

**STUDY AREA**

The study was carried out in West Kameng District of Arunachal Pradesh (Figure 1) covering an area of about 700km² out of the total 5,013km². The study area is located in between 27.083–27.833°N & 92.083–92.416°E. The district shares an international boundary with Bhutan in the west and is bordered by Sonitpur and Darrang districts of Assam in the south, East Kameng District in the east and Tawang District in the north. The topography of the district is mostly mountainous and its greater part falls within the higher mountain zone, consisting of tangled peaks and valley. The study area was selected on the basis of the reports of large-scale exploitation of *I. griffithii* (Image 1) for medicinal purposes from the district in the past decades (Kalita & Khan 2013).

![Figure 1. Study area (ArcGIS 10.3)](image-url)
Assessment of the population status of *Illicium griffithii* Bapu & Nimasow

**Database and Methodology**

**Database**

1. Toposheets of survey of India for delineation of study area.
2. Shuttle Radar Topographic Mission Digital Elevation Model (SRTM DEM) for selection of study sites based on altitude.
3. Garmin Global Positioning System (GPS) for locating the species occurrence.

4. Camera to substantiate the field study.

**METHODS**

**Field method and data collection**

Since the population size of *I. griffithii* is not known, non-probability sampling technique was used. Based on previous site history on availability of *I. griffithii*,
proximity of camping and other human settlements, human use, closeness to nearby forest area and reports from the local people on occurrence, a purposive sampling technique was applied to select the sites. The site selection, however, was primarily based on altitude viz. below 1,000m, 1,000–1,500 m, 1,500–2,000 m, 2,000–2,500 m, 2,500–3,000 m and above 3,000m. In total 10 sites, namely, Morshing, Sanglem, Bomdila, Namshu-Chander, Lubrang, Nyukmadung, Senge, Mandala Phudung, Shergaon, and Tenzingaon, were selected from various altitude categories and linear transect survey was carried out. The plants along the line transect were recorded in GPS in three categories based on girth (circumference) at breast height (gbh), i.e., seedlings (<5cm), saplings (5–10 cm), and tree (>10cm). The distance covered in a line transect was purely based on the natural barrier and distance covered in a specific period of time in each site with an average distance of 6.42km. The minimum and the maximum distances covered were 2km and 64.2km, respectively. The distance covered was classified into three classes for better analysis and representation, viz., <5 km, 5–10 km and >10 km (Table 1). Further, the plants located in the study sites were categorised into various altitudinal zones (Table 2). The population status was studied by observing and recording the number of individuals of the species during 2017–2019 in four different time periods, viz., May–June, 2017, May–June 2018, April–May 2019, October–November 2019 based on phenological cycle of the fruit. Further, the information on medicinal plants extraction and trade were collected through open-ended participatory discussion with the local informants (Joshi & Edingtong 2010; Bapu & Nimasow 2017). The collected data was represented with suitable tables and graphs.

RESULTS AND DISCUSSION

Linear transect survey carried out at 10 sites recorded 3,170 individuals of *Illicium griffithii*, out of which 1,372 were seedlings, 1,358 saplings, 314 mature trees, and 126 were dead plants. The population structures of the live plants found in these sites along the line transect have been presented in Table 1. The number of plants recorded in 10 sites varies from 38 to 852 individuals. Out of the total 3,044 live plants, the mature trees were only 314. The Namshu-Chander site recorded the highest with 105 individuals whereas Tenzingaon recorded the lowest with only two mature trees. Out of the total number of 1,358 saplings, Namshu-Chander had the highest number of individuals (319) whereas Tenzingaon had the lowest number of individuals (11). Out of the total 1,372 seedlings, the highest number of individuals was recorded in Morshing (518) followed by Namshu-Chander (259), Lubrang (157) and the lowest in Shergaon (21). Overall, the number of live plants was highest in Namshu-Chander as the area is located relatively away from the settlements. Further, the Namshu Village Council has imposed a ban on the felling of *Illicium* for the last 30 to 35 years which is also a contributing factor for the abundance of the species in the wild. Morshing area recorded higher numbers of seedlings and saplings which may be attributed to the decline in fruit collection thereby allowing regeneration of the species. Moreover, recently the village council has also imposed certain restrictions on the felling of trees. Among the mature trees, the largest girth was recorded in Namshu-Chander site (1.80m gbh) followed by Morshing (1.55m gbh). The plant was found scattered and isolated in Tenzingaon and Shergaon areas. In the Tenzingaon area, large-scale land fragmentation and land conversion is taking place for agriculture and horticulture purposes leading to loss of species or habitat. The respective village councils of Senge and Lubrang have also banned the felling of *Illicium* recently. During the field survey frequent occurrence of stump sprouting was observed which reflects the coppicing ability of the species.

The distribution of various girth classes, i.e., seedlings (<5 cm), saplings (5-10 cm) and trees (>10 cm) of the species showed significant difference among the sites (Figure 2). The individual girth class followed the trend: seedlings > saplings > trees in the >10km distance category. The trend in <5 km and 5–10 km distance categories, however, were: seedlings < saplings > trees (Table 1 & Figure 2). The overall trend in terms of number of individuals in different category of growth was: seedlings (1,372) > saplings (1,358) > trees (314). So, the regeneration status of *Illicium* appears to be satisfactory in contrast to the poor regeneration of the species as reported by Duckhok et al. (2005). The difference in findings may be attributed to the declining trend of fruit collections compared to the late 1990s and early 2000s period. Because large-scale collection of *Illicium* fruits was reported from Arunachal Pradesh during 1990 till early 2000 which restricted the natural growth of the plant (Paul et al. 2013). The potential of species regeneration can be understood by the presence of seedlings and saplings in an area (Saxena & Singh 1984). The survival rate of the seedlings was found to be high in the study area which is in agreement with Paul et al. (2013) but in contrast to the findings of...
Assessment of the population status of *Illicium griffithii* Bapu & Nimasow


Duchok et al. (2005). This might be due to a decline in the collection of *Illicium* fruits, thus contributing to its natural regeneration since 2010. Nevertheless, the establishment of saplings in comparison to number of trees present was very poor (trees < saplings) due to selective felling of larger girth trees for creating fields of plantation crops and other agricultural purposes, construction related activities, and for fences and fuel wood which are the underlying factors hindering the survival rate of saplings. Thus, the variations in number of individuals among different classes may be ascribed to the prevailing environmental factors and degree of disturbances (Duchok et al. 2005). The villagers informed that *illicium* bears fruit in alternate annual cycles resulting in good production in a particular year but poor production in the next year. Similar finding has also been reported by others (Ved et al. 2003). People of Nyukmadung and nearby areas also informed that a huge forest area, mostly dominated by *I. griffithii* was gradually converted to pasture land in Nyukmadung after the establishment of a Yak Farm in 1989.

The survey revealed that the maximum occurrence of *I. griffithii* (1442 individuals or 47.37%) was observed in the altitudinal range of 2,600–2,800 m followed by 2,400–2,600 m (741 individuals), 2,800–3,000 m (636 individuals), 2,200–2,400 m (209 individuals), and 2,000–2,200 m (16 individuals) (Table 2). It was further observed that the species was growing abundantly in the altitudinal range of 2,500–2,750 m. Although, the present study found that the species was growing between 2,000–3,000 m (± 20 m), some earlier studies found it to be growing between 1,600–2,500 m (Hussain & Hore 2008), 1,700–3,000 m (Paul et al. 2013), 2,000–2,800 m (Gajurel et al. 2015). Such variation might be due to the tolerance level of the species or to a bioclimate zone which is favourable for its growth.

It is reported that the price of the fruits ranged

![Figure 2. Population structure of *Illicium griffithii* (distance surveyed).](image)

![Figure 3. Number of individuals per km in the study sites. Source: Field survey 2017–2019.](image)

Table 1. Population structure of live *Illicium griffithii* and distance covered in 10 sites.

<table>
<thead>
<tr>
<th>Distance category</th>
<th>Site</th>
<th>No. of seedlings (&lt;5 cm gbh)</th>
<th>No. of saplings (5cm-10cm gbh)</th>
<th>No. of trees (&gt;10cm gbh)</th>
<th>Total</th>
<th>Distance covered in a transect (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;5 km</td>
<td>Mandala Phudung</td>
<td>67</td>
<td>53</td>
<td>21</td>
<td>141</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Tenzingaon</td>
<td>25</td>
<td>11</td>
<td>2</td>
<td>38</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>Sanglem</td>
<td>50</td>
<td>12</td>
<td>3</td>
<td>65</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>Senge</td>
<td>124</td>
<td>238</td>
<td>9</td>
<td>371</td>
<td>2.9</td>
</tr>
<tr>
<td>5–10 km</td>
<td>Shergaon</td>
<td>21</td>
<td>29</td>
<td>11</td>
<td>61</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>Bomdila</td>
<td>116</td>
<td>149</td>
<td>18</td>
<td>283</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td>Lubrang</td>
<td>157</td>
<td>251</td>
<td>17</td>
<td>425</td>
<td>5.1</td>
</tr>
<tr>
<td>&lt;10 km</td>
<td>Nyukmadung</td>
<td>35</td>
<td>70</td>
<td>20</td>
<td>125</td>
<td>12.8</td>
</tr>
<tr>
<td></td>
<td>Namshu-Chander</td>
<td>259</td>
<td>319</td>
<td>105</td>
<td>683</td>
<td>11.9</td>
</tr>
<tr>
<td></td>
<td>Morshing</td>
<td>518</td>
<td>276</td>
<td>58</td>
<td>852</td>
<td>13.2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1372</td>
<td>1408</td>
<td>264</td>
<td>3044</td>
<td>64.2</td>
</tr>
</tbody>
</table>

(Source: Field survey, 2017-19)
from Indian Rupees (INR) 120–150 per kg (Paul et al. 2013) and INR 100–200 during the early 2000 (Bapu & Nimasow 2017), which went down to INR 50 per kg during 2010, leading to less interest in fruits collection (Bapu & Nimasow 2019). Illicium fruits are mainly marketed through middlemen from the district which are sold at nearby markets at higher prices (Paul et al. 2013; Bapu & Nimasow 2017, 2019). Further, the local people informed us that the demand for fruits of Illicium was high during 2002–2007 (Bapu & Nimasow 2017) and fetched around INR 10,000–15,000 annually to a household (Bapu & Nimasow 2019). They also informed that the demand in the market has gone down, and therefore the price of the Illicium fruits is as low as INR 40 at present, however, interactions with the Range Forest Officer, Bomdila revealed that the low market demand is mainly due to the monopoly in the market. The actual rate in international market is as high as INR 700–800 per kg and around INR 400 in Mumbai, Maharashtra (Tsering Dorjee Megeji pers. comm., Range Forest Officer, Bomdila). The collection and trade of Illicium fruits in the district is regulated by issuing permit to the traders by the forest department. Some years back, however, the officials of Bomdila Forest Division reportedly seized Illicium products owing to improper documents for trade.

Many studies on population and regeneration status of a specific species have focused mostly on the number of individuals in a unit area (Dhar et al. 1997; Duchok et al. 2005; Paul et al. 2019) and number of individuals along linear transects (Nimachow et al. 2010). On an average, 32 individuals of I. griffithii in 1.0km linear transect was recorded in West Kameng District. The average number of seedlings, saplings and trees in the linear transect were 23, 24, and 5 individuals per km, respectively. The total number of seedlings (per km) ranged from 3–43, saplings 4–82 and trees 1–11. The maximum number of seedlings (per km) were recorded in Senge (43 individuals), followed by Morshing (39), Mandala Phudung (34), Lubrang (31) and lowest in Nyukmadung (3). The highest saplings (per km) was also reported in Senge (82) followed by Lubrang (49),
Assessment of the population status of *Illicium griffithii* Bapu & Nimasow

Mandala Phudung and Namshu (27) and lowest in Tenzingaon (4). The number of mature trees (per km) was recorded highest in Mandala Phudung (11) followed by Namshu-Chander (9) and the lowest in Tenzingaon and Sanglem (1 each). The sites located far away from the human settlements recorded a higher number of plants whereas the sites located near the settlements had a lesser number of plants owing to the higher rate of anthropogenic influences, as presented in Table 3. The local communities use *Illicium* mostly for pole, fences and others. Currently, the major threats to the species were deforestation, harvest of trees for various purposes including construction work and erection of fences, etc. and trampling of plants by bovines. Looking at the multiple uses of the plant, plantation and other conservation measures are essential for sustainability of the plant. The Bomdila Forest Division had ventured and planted *I. griffithii* in around one hectare of land at one mile area near Bomdila during 1990–1991 which was found to flourish during the field survey. Hence, more such efforts by the governmental and non-governmental organizations with community participation might be helpful in regeneration and conservation of the plant.

CONCLUSION

A comprehensive study to understand the existing population status of a species is considered to be the most important in order to effectively protect the species from extinction (Vischi et al. 2004). The present study provides comprehensive information on population structure, regeneration status and distribution of *Illicium griffithii* Hook. f. & Thomson in West Kameng District of Arunachal Pradesh (India). The plant was found growing between altitudinal range of 2,100–2,930 m but showing its abundance between 2,500–2,750m. The study found a good number of *I. griffithii* in natural stand but only in a limited area. The dominance of saplings and seedlings over trees at all the sites was recorded which indicates its good regeneration potential. Adding to this, the localized distribution of the species, excessive extraction of large trees for various purposes and changing global climate has put a pressure on the population of the species. Although, the collection of fruits has declined in recent years, the silent illegal trade from deep inside of the forest cannot be ruled out. Cultivation and awareness on the value of such species can play an important role in the livelihood strategies of the local people in the study area. Therefore, proper awareness with regards to importance and market value of the species in particular and maintenance of the ecosystem as a whole is the need of the hour. The government and other organizations should encourage cultivation of *Illicium* and other important medicinal plants as a part of agroforestry, which in turn will help in conservation of these plants. Further, imparting proper training to the villagers on scientific way of fruits collection could ensure the sustainable utilization of the plant and its products. Finally, the present study opens up scope for further research on habitat suitability and impact of climate change of this endangered medicinal plant.

REFERENCES


Assessment of the population status of *Illicium griffithii*

Bapu & Nimasow


Communications

Diversity and distribution of snakes in Trashigang Territorial Forest Division, eastern Bhutan


Fish communities and associated habitat variables in the upper Sabansiri River of Arunachal Pradesh, India


An assessment of the population status of the threatened medicinal plant Illicium griffithii Hook.f. & Thomson in West Kameng District of Arunachal Pradesh, India

– Tashi Dorjee Bapu & Gijbi Nimasow, Pp. 17504–17512

Short Communications

The discovery of a melanistic Leopard Panthera pardus delacouri (Linnaeus, 1758) (Mammalia: Carnivora: Felidae) at Bukit Kudung in Jeli, Kelantan, Peninsular Malaysia: conservation and ecotourism

– Kamarul Hambali, Nor Fakhira Muhamad Fazli, Aainaa Amir, Norashikin Fauzi, Nazia Khan, Hidayatullah, Azrul Hisham, Izzuddin Ismail, Kamarul Hambali, Nor Fakhira Muhamad Fazli, Aainaa Amir, Norashikin Fauzi, Nazia Khan, Hidayatullah, Azrul Hisham, Izzuddin Ismail, Pp. 17513–17516

On the epidemiology of helminth parasites in the Hangul Deer (Mammalia: Artiodactyla: Cervidae) of Dachigam National Park, India

– Muniza Manzoor, Pp. 17517–17520

Histopathological findings of infections caused by canine distemper virus, Trypanosoma cruzi, and other parasites in two free-ranging White-nosed Coatis Nasua narica (Carnivora: Procyonidae) from Costa Rica

– Marcos Antônio Melo & David de Almeida Braga, Pp. 17564–17568

On a new species of Macrobrachium Spence Bate (Decapoda: Palaemonidae) from Ayeeyawady River, Myanmar


Review of the tiger beetle genus Calomera Motschulsky, 1862 (Coleoptera: Cicindelidae) of the Philippines


Rediscovery of Martin’s Duskhawk Anacioscochroa mortini (Selys, 1897) (Odonata: Aeshnidae) from Western Ghat, peninsular India, with notes on its current distribution and oviposition behavior

– Kalesh Sadasivan, Manoj Sethumadavan, S. Jeevith & Baiju Kochunarayanan, Pp. 17543–17547

A note on the current distribution of reedtail damselfly Protosticta rupestigaster Kimmins, 1958 (Odonata: Zygoptera: Platystictidae) from Western Ghat, and its addition to the odonate checklist of Kerala

– Kalesh Sadasivan & Muhammad Jafer Patol, Pp. 17548–17553

Notes

Assessment of threat status of the holly fern Cyrtomium micropterum (Kunze) Ching (Polyodiopsida: Dryopteridaceae) in India using IUCN Regional guidelines

– C. Bagath Singh & A. Benimain, Pp. 17554–17560

First report of the Asiatic Brush-tailed Porcupine Atherurus macrourus (Linnaeus, 1758) (Mammalia: Rodentia: Hystricidae) from West Bengal, India

– Suraj Kumar Dash, Abhisek Chettri, Dipanjan Naha & Sambandam Sathyakumar, Pp. 17561–17563

Record of the world’s biggest pangolin? New observations of bodyweight and total body length of the Indian Pangolin Manis crassicaudata Gray, 1827 (Mammalia: Pholidota: Manidae) from Manmr District, Sri Lanka

– Priyan Perera, Hirusha Randimal Algewatta & Buddhika Vidanage, Pp. 17564–17568

First record of To Guillenonotus (Wied, 1820) (Hymenoptera: Psittaciformes: Psittaciidae) in Cantareira State Park, Brazil: new colonization or simply unnoticed?

– Marcos Antônio Melo & David de Almeida Braga, Pp. 17564–17568

Some new records of scarab beetles of the genus Onthophagus Latreille, 1802 (Coleoptera: Scarabaeidae) from northern Western Ghats, Maharashtra, with a checklist


Ecological importance of two large heritage trees in Moyar River valley, southern India


A new record of pyrenocarpous lichen to the Indian biota

– Mitesh B. Patel, Pp. 17604–17606

First record of the oat-like grass Trisetopsis aspera (Munro ex Thwaites) Röser & A.Wölk (Poaceae): a new record for the flora of central Western Ghats of Karnataka, India


Bulbophyllum spathulatum (Orchidaceae), a new record for Bhutan

– Pema Zangpo, Phub Gyeltshen & Pankaj Kumar, Pp. 17592–17596

On the occurrence and distribution of the narrowly endemic Andaman Lantern Flower Ceropogia andamancica (Apocynaceae: Ceropogieae)


The oat-like grass Trisetopsis aspera (Munro ex Thwaites) Röser & A.Wöl (Poaceae): a new record for the flora of central Western Ghats of Karnataka, India


Some new records of scarab beetles of the genus Onthophagus Latreille, 1802 (Coleoptera: Scarabaeidae) from northern Western Ghats, Maharashtra, with a checklist


Ecological importance of two large heritage trees in Moyar River valley, southern India


The oat-like grass Trisetopsis aspera (Munro ex Thwaites) Röser & A.Wöl (Poaceae): a new record for the flora of central Western Ghats of Karnataka, India


Star Grass Lily Iphigenia stellata Blatter (Colchicaceae) – a new addition to the flora of Gujarat, India

– Mitess B. Patel, Pp. 17604–17606

A new record of pyrenocarpous lichen to the Indian biota