

Conservation threats and host tree assessment of critically endangered *Gastrochilus calceolaris* at Orong, Samdrupjongkhar.

Report submitted to San Diego County Orchid Society



In-situ *Gastrochilus calceolaris* captured from project area during survey time

Submitted By:

(Ugyen Chopel)

Address: Forest Range Office, Samdrup Jongkhar Division, Eastern Bhutan.

Telephone Number: +975 17903750 or +975 77903750

E-mail address: uchophel39@yahoo.com

Alternative e-mail address: uchophel39@gmail.com

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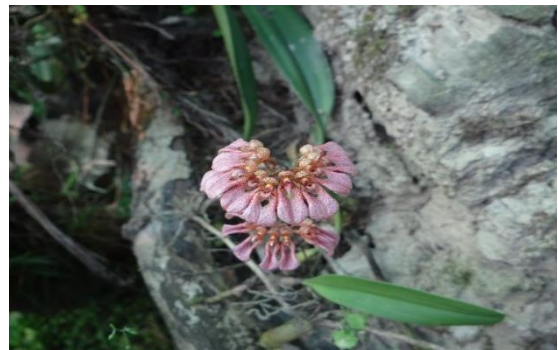
I extend my sincere gratitude to all forester colleagues for their kind cooperation and support during the fieldwork and other project activities.

My special thanks also go to people of Orong village who have actively participated in the awareness program as well as orchid field survey trips in the project area.

*With this, I would like to take this pleasure to present herewith two newly recorded orchids species (***Bulbophyllum delittescens*** & ***Bulbophyllum roxburghii***) from project area contributing to addition country's rich orchid flora.*



Bulbophyllum delittescens Hance



Bulbophyllum roxburghii (Lindly) Rchb. f.

Background and rationale

The Shoe-Shaped *Gastrochilus* (*Gastrochilus calceolaris*) is one of the species among 20 known species. It is an epiphytic orchids which is listed as critically endangered species under IUCN category (IUCN, 2008). Globally, it is reported from Bhutan, India, Nepal, Myanmar, China, Thailand, Vietnam and Malaysia. In Bhutan, its distribution is reported from Samtse, Sarpang, Chukha, Thimphu, Wangdiphodrang and Punakha (Pearce and Cribb, 2002; Gurung, 2006). There was no recorded distribution report from the eastern Bhutan. However, it is found in Samdrupjongkhar district growing in broadleaved forest.

Due to increasing human population and over exploitation of natural resources, the orchid species are constantly under great threats especially endangered species like *Gastrochilus calceolaris*. To date, there is no such comprehensive studies done on endangered orchids like *Gastrochilus calceolaris*. The Literatures published about orchids in Bhutan such as, A Centaury of New orchid in Bhutan, 2017, Illustrated Guide to the Orchids of Bhutan, 2006, Orchids of Bhutan, 2002 mention only about general distribution and does not highlight anything about conservation status and threats.

In Bhutan, there are number of federal government acts, plans and policies which pertain to Biodiversity conservation in Bhutan, such as Forest and Nature Conservation Act, 2023, Biodiversity Act of Bhutan, 2003, National Biodiversity Strategies and Action Plan (NBSAP), 2014, Forest and Natural Conservation Rule and Regulation, 20203. Yet, in Bhutan specific species conservation plans are very limited to only few selected endangered and iconic species such as tiger, snow leopard, white-bellied heron, black-necked crane.

None of the above specified documents, conservation management plan and community forest management plan do not highlight the protection and conservation of endangered *Gastrochilus calceolaris* and any other orchids species.

Similarly, none of rare and endangered orchids species recorded in Bhutan, are listed in schedule I of Bhutan's forest and nature conservation act which is prime legal document in protecting the biodiversity of the country.

Although much research was being initiated in the field of forestry, there still are information gaps that we need to fill up, especially on endangered orchids species. The future survival of endangered orchids species in its natural habitat is uncertain as it is under constant threats due to potential habitat losses, fragmentation and degradation which are being triggered by the increasing human population growth and other developmental activities like construction of

road, transmission line, agriculture expansion, hydropower project development and many more. Other factor such as forest fire and overgrazing also threatens the survival of endangered species. Likewise, global climate change is one of the most significant factors responsible for loss of biodiversity and degradation of environmental health across the globe.

Therefore, it is felt that an immediate study on the species is needed with the overall objective to reliably assess its conservation threats and simultaneously build empirical data on the endangered species with regards to ecological and conservation threats that would help community forest management group members, other local government leaders, policy maker and conservationist in making evidence-based decisions for sustainable utilization and management of natural resources.

In the past, no comprehensive study on orchids has been done particularly on critically endangered orchids species covering the southern eastern region of Bhutan, therefore, study on “Conservation threats and host tree assessment of critically endangered *Gastrochilus calceolaris* at Orong, Samdrupjongkhar.” is being carried out to fill up such information gaps and to generate new scientific evidence contributing to a better understand the conservation of this critically endangered orchids species in Bhutan.

Project location

This project was carried out in one of the blocks in southern eastern parts of Bhutan. The area extends about 296 km² (Fig. 1) and is rich in orchids diversity and the critically endangered orchids species are found growing in the block. The several orchids species are important for both botanical and horticulture value which is not yet explored. Two orchids species have been reported as new records for orchid flora of Bhutan from this locality.

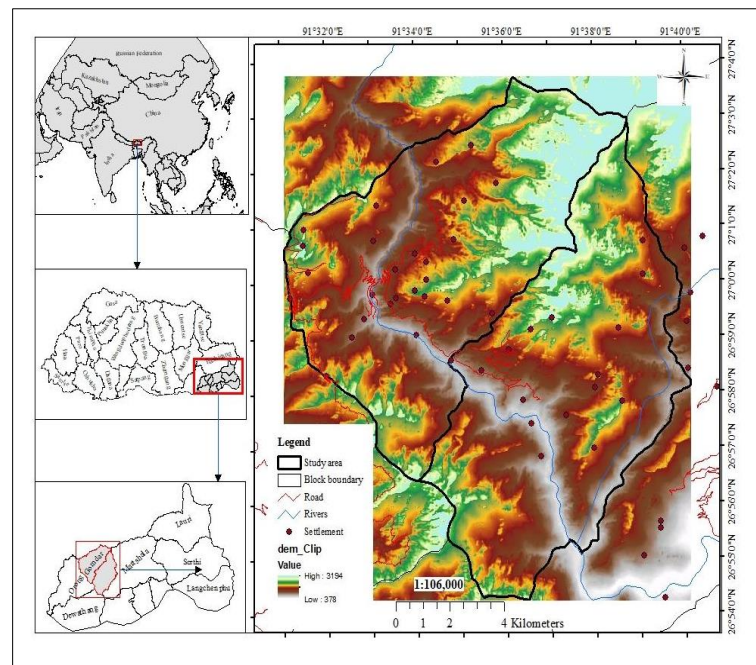


Figure 1: (A) Location of Bhutan in world map. (B) Administrative boundary of Bhutan and location of project area. (C) Study area boundary and settlement

However, many orchid species including the critically endangered *Gastrochilus calceolaris* in

this area are on the verge of extinction due to habitat loss and deforestation.

Likewise, overexploitation from natural resources especially illegal extraction of host tree for construction by local community and lack of conservation program along with community awareness about the importance of orchids conservation are major threats to orchids in this area. In recent years, roads have been randomly constructed passing through the orchid habitat rich jungle, which has resulted in uprooted, fallen apart or detached orchids from host trees. Therefore, it is necessary to take immediate action to rescue these orchids to conserve them in their natural habitats. One of the roads was constructed through the habitat of critically endangered *Paphiopedilum fairrieianum* causing great threats to long term survival of endangered species.

Project objective

1. The primary objective of the research project is to assess the conservation threats and abundance of *Gastrochilus calceolaris* in the study area.
2. To identify the preferred host trees species composition and diversity including growth zone on host tree by the *Gastrochilus calceolaris* in the study area.
3. Assess people's perception towards the species conservation in the area and sensitize them on the importance of protection and conservation of critically endangered orchid species.

To achieve above research objectives the following research questions would be asked:

1. What are the major threats to survival of critically endangered species in the study area?
2. Which is the preferred host tree species and growth zone for endangered orchids?

What is the perception of local communities about the conservation of endangered orchids?

Materials and method

Using the geographic information system (GIS) tools, the study area was stratified by vegetation type from land use and aspect from digital elevational model (DEM) while, altitude range was stratified into three broad categories such as low, mid and high altitude. The combination of stratified and systematic sampling method was adopted, and transect line laid in each habitat. In each habitat, laid the transect line and layout the plot of equal size by maintaining the equal interval distances between the plots. The data were collected from each plot by establishing quadrat measuring 20 x 20 m plot size. Inventorying of critically endangered *Gastrochilus calceolaris* and other orchids species within the plot was done. All the orchid species irrespective of terrestrial and epiphytic orchids occurring within the sampling quadrat were identified and their number counted and recorded in format (**Annexure I**). For the *Gastrochilus calceolaris* and other epiphytic orchids, the host trees were identified

and its diameter at breast height (DBH) was measured. Similarly, the epiphyte position on host tree (Zone) (Mojjol et al, 2009) was recorded in the format (**Annexure I**).

The field data was processed using pivotal table function of Microsoft Excel. Both descriptive and inferential statistical tools were applied for analyzing the data. The statistical test was performed using the SPSS software version 22. The species diversity and relative abundance and evenness values were calculated by using Shannon-Wiener diversity index H' .

Results

Orchid species diversity

The total 178 species of orchids belonging to 79 genera were documented from the project area out of which 3% species were mycotrophic, 35% terrestrial, 8% lithophyte and 54% species were epiphyte (Fig. 2). Out of 79 genera *Bulbophyllum* is the largest recorded genera with 18

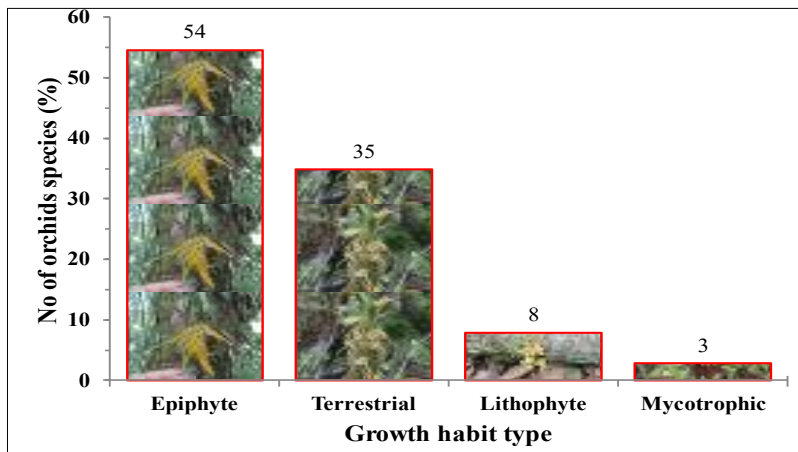


Figure 2. Percentage of orchid species in each growing habit

numbers of species followed by *Dendrobium* and *Calanthe* with 17 and 12 numbers of species respectively. While 43 numbers of genera have one species. Two species namely *Bulbophyllum delittescens* and *Bulbophyllum roxburghii* are recorded new to orchid flora of Bhutan.

Host tree and orchids

A total of sixty-five tree species under sixty-two genera were enumerated from the study area with a total tree population of about 370 individuals. The diameter at breast height (DBH) of the trees were grouped into seven classes and their corresponding tree population was presented (Fig. 3). The highest numbers of trees were found under

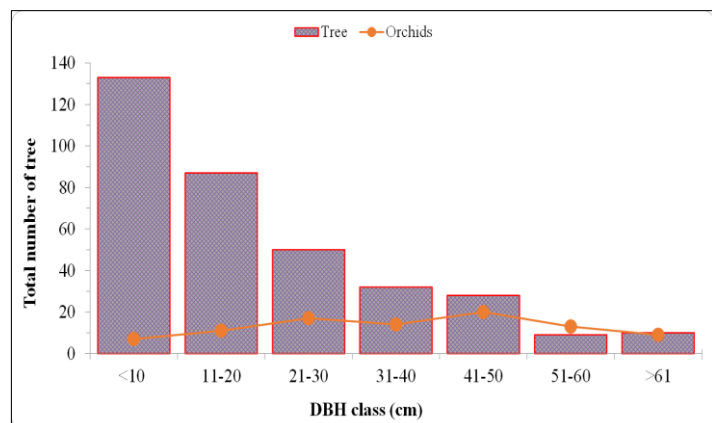


Figure 3. Total number trees and number of orchid species in under DBH class

10 cm below DBH class and lowest in above 61cm DBH class. Among the seven DBH class maximum epiphytic orchids species was found growing in 41-50 DBH class, while lowest number of orchid species was found in lower DBH class (Fig. 3).

Population status

The orchid species diversity, population status and threats of each orchids species was accessed during the survey and field data collection. The population of orchids in the study area were categorized into four different categories namely rare, occasional, frequent, and common species based on abundances. About 11% of species were rare (Fig. 4), these include *Anoectochilus brevilabris*, *Bulbophyllum leopardinum*, *Bulbophyllum secundum*, *Cephalanthera damasonium*, *Cleisostoma linearilobulatum*, *Cymbidium hookerianum*, *Dendrobium devonianum*, *Dendrobium moschatum*, *Esmeralda clarkei*, *Lacananorchis sikkimensis*, *Nervila falacata*, *Panisea uniflora*, *Paphiopedilum fairrieianum*, *Papilionanthe vandar um*, *Pecteilis susannae*, *Schoenorchis gemmate*, *Biermannia arunachalensis*, *Porpax*

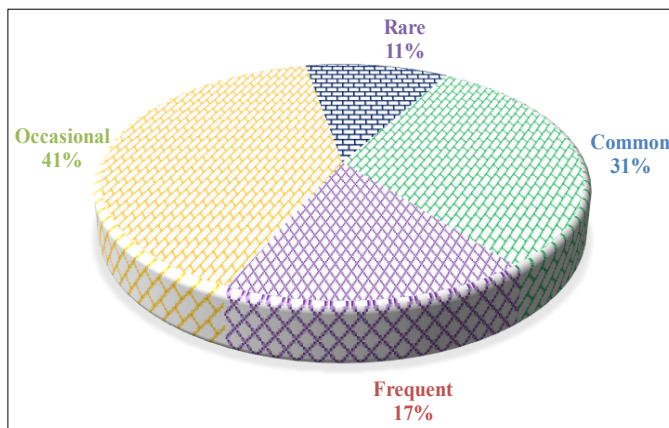


Figure 4. Population status of orchids

fibuliformis, *Liparis petiolata*, *Thalasis longifolia*. Likewise, 41% were occasional, some examples of this category are *Acampe rigida*, *Agrostophyllum brevipes*, *Bulbophyllum emarginatum*, *Bulbophyllum griffithii*, *Bulbophyllum muscicola*, *Bulbophyllum odoratissimum*, *Bulbophyllum rigidum*, *Bulbophyllum rolfei*, *Bulbophyllum*

thomsonii, *Calanthe alismifolia*, *Calanthe graffithii*, *Calanthe mannii*, *Calanthe sylvatica*, *Dendrobium candidum*, *Dendrobium cathcertii*, *Dendrobium falconeri*, *Dendrobium longicornu*, *Dendrobium spatella*, *Epigenium fuscescens*, *Epigenium navicularis*, *Eria acervata*, *Eria coronaria*, *Eria discolor*, *Eria ferruginea*, *Galeola falconeri*, *Galeola lindleyana*, *Gastrochilus calceolaris*, *Habenaria pectinata*, *Ione cirrhata*, *Liparis nervosa*, *Liparis petiolata*, *Malaxis acuminata*, *Nervilia aragona*, *Oberonia maxima*, *Oberonia obcordata*, *Odontochilus crispus*, *Peristylus gooderoides*, *Platanthera clavigera*, *Rhynchostylis retusa*, *Sunipia intermedia*, *Vanda bicolar*, *Zeuxine goodyeroides*, *Zeuxine flava*. Similarly, 17% and 31% of species were frequent and common, some of these species are includes such as *Aerides odoratum*, *Aerides roseum*, *Bulbophyllum affine*, *Bulbophyllum*

retusiusculum, *Ceratostylis himalaica*, *Cleisostoma racemiferum*, *Cymbidium iridiodes*, *Cymbidium longifolium*, *Dendrobium chrysanthum*, *Dendrobium fimbriatum*, *Dendrobium porphyrochilum*, *Dendrobium transparens*, *Epipogium roseum*, *Eria amica*, *Gastrochilus acutifolius*, *Goodyera procera*, *Liparis bootanensis*, *Luisia zeylanica*, *Malaxis khasiana*, *Micropera mannii*, *Oberonia emerginata*, *Oberonia falcate*, *Odontochilus grandiflorus*, *Orinchochilus difformis*, *Otochilus lancilabius*, *Peristylus fallax*, *Phaius tankervilleae*, *Pholidota pallida*, *Pholidota protracta*, *Platanthera edgeworthii*, *Pleione praecox*, *Satyrium nepalense*, *Smitinandia micrantha*, *Vanda alpine*, *Vanda cristata*, *Vanda griffithii*.

Threats to orchid species

Four major factors are identified as threatening factors for survival of orchid species in the study area, which includes grazing, developmental activities, habitat loss and timber harvesting (Fig. 5).

Among the four major factors, timber harvesting is one of the topmost factors causing threats to survival of orchid species. The local people do the timber harvesting both legally and illegally, whereby the host trees along with orchids are felled causing damage to natural orchid habitat.

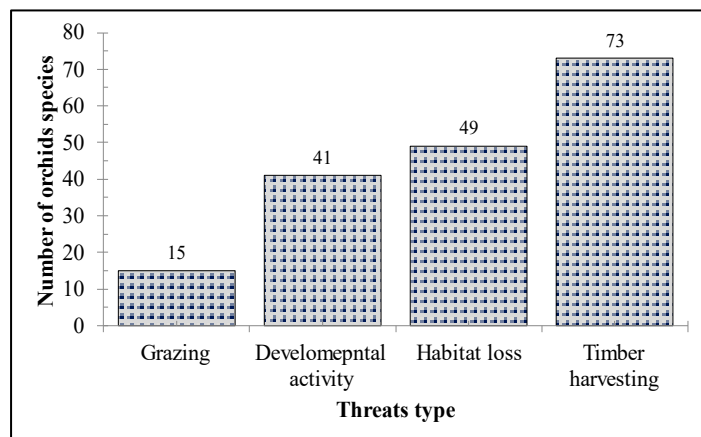


Figure 5. Threats to survival of orchid species

The second major threat to orchids is habitat destruction or habitat loss caused through various anthropogenic activities which includes deforestation for logging, firewood collection and forest encroachment for agriculture farming. The third major threats were through



Figure 6. Road construction through rugged terrain and orchid habitat

developmental activities such as random construction of roads passing through the orchid rich habitats (Fig. 6), high grid transmission line construction and irrigation channel construction were some important factors for the threats to orchids in study area. The construction of farm road passing through the pristine forest good orchid habitat has resulted in loss of many orchid species. An endangered orchid *Paphiopedilum fairrieianum* is on the verge of extinction due to habitat loss during road construction in the project area.

The grazing was also found to be one of the factors causing threats to survival of orchids especially terrestrial orchids species, as cattle grazing in natural forest grazed and trampled the terrestrial orchids.

Awareness rising program.

One of the main causes for loss of orchid species in the project area is lack of awareness in local people about the conservation importance of orchids. During the project period, local communities were strengthened through a community awareness program. People's participatory methods were applied for awareness raising in different communities (Fig. 7). The community people were educated on the importance conserving of orchids using educational materials such as poster, power point, photographs and video. This also included discussion and sharing of ideas about conservation of the wild orchids. The local people were also involved during field data collection and trained on use of equipment, identification of both host tree and orchids species. An orchid excursion program was also organized to familiarize local people with wild orchids, their habitats, and populations status. Community people actively participated in the excursion program. The participants were especially curious about the orchid species diversity, medicinal uses, and specific host of epiphyte orchids.



Figure 7. Local people participating during field data collection (survey) and author in field.



Figure 8. *Gastrochilus calceolaris* deposited into division orchidarium for ex-situ conservation.

Rescue or rehabilitation of orchid population

The critically endangered *Gastrochilus calceolaris* (Smith) D. Don was nearly destroyed due to farm road construction, however, it was not too late to save this critically endangered orchid from destruction as it was saved by research team. The team collected all the plants and deposited them into the Divisional Forest Office head office orchidarium, Samdrupjongkhar (Figure 8). Upon completion of road construction, the rescue plants were taken to its natural habitat for replanting back to its

natural habitat since the In-situ conservation is far better than Ex-situ conservation work. During the project implementation period, team have managed to save more than 200 individuals of various orchid species and it was transplanted to suitable hosts and habitat.

Major achievement of the project

- ✓ Documented about 70-80% of orchid species diversity of the project area and identified their major threats as well as population status.
- ✓ More than 200 individuals of different orchid species were rescued which is dislocated during the farm road construction of road and tree felling.
- ✓ The local communities were made aware of the importance of orchids conservation.
- ✓ Prepared posture and simple pamphlet of orchid species diversity of project area containing color images of each species, habitat, population status and threats distributed to institutions and community of project area.

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Annexure 1: Data collection format

A. Plot detail

1. Transect #/Plot ID: 2. Easting: 3. Northing: 4. Altitude: 5. Aspect: 6. Slope %:
 7. Canopy density: 8. Forest type/habitat type: 9. Biotic pressure: 10. Plot size:
 11. Basal area: 12. Date: 13. Name of recorder:

B. Species and host & non host plants details:

Sl No	Orchids species detail				Host & non host plants detail					Remarks
	Orchid species	No of individual	Habit (T, E, L, M)	Epiphyte position on host tree **	Host plant species	DB H (cm)	Est. Ht (m)	Bark texture (Rough & smooth)	Habit (ET, DT, ES, DS)	

7. Code for canopy density class: 1. Dense (>70%), 2. Open (<70%), 3. Very open (no real canopy; isolated trees only) to determine the light intensity.

9. Code for biotic pressure: 1. Timber harvesting, 2. Grazing, 3. NWFP collection, 4. No sign

** Code for epiphyte position on host tree (Zone): Zone 1: Basal; from the ground to the diameter at breast height (dbh). Zone 2: Trunk; from the dbh to the first branch. Zone 3: Canopy; from the first branch to the tip of the tree (Mojjil *et al*, 2009).

Annexure 2: Images of orchids species found and captured from the project area.



Chiloschista parishii Seidenfaden



Cymbidium lancifolium J. D. Hooker



Gastrochilus acutifolius (Lindley) Kuntze



Cymbidium elegans Lindley



Goodyera procera (Ker Gawler) J.D.Hooker



Dendrobium denudans D. Don
