Bulletin of Arunachal Forest Research, Vol. 35(1&2), 44-55: 2020 ISSN 0970-9487

The hundred orchids of Sessa Orchid Sanctuary, Arunachal Pradesh, India

Jambey Tsering[1]*, Koj Rinya[2]
[1]Orchid Research Centre, Tipi, Bhalukpong – 790114, Arunachal Pradesh, India
[2]State Forest Research Institute, Itanagar – 791111, Arunachal Pradesh, India
*Corresponding Email: jamserng@gmail.com

Abstract

One hundred orchids of Sessa Orchid Sanctuary identified at species level are presented in this paper. During the last five years, many random field studies were carried out in the sanctuary. A total of 149 species were observed inside the sanctuary out of which 100 are identified at species level. All the species were digitally captured and their habitat, population status, distribution and threats were recorded. A modified method called as DAFORE scale is used to identify the population status of each species.

Keywords: Conservation, DAFORE scale, Diversity, Threat, West Kameng.

INTRODUCTION

Sessa Orchid Sanctuary is believed to be the home of more than two hundred orchid species. The sanctuary with just 100 km^2 is very rich in orchid diversity and abundance. Many endemic orchids of the state were discovered from the sanctuary. The orchid exploration in the sanctuary was mainly carried out by Orchid Research Centre, Tipi, and during the last four decades seven new species were discovered from the sanctuary which are *Biermannia jainiana, Cheirostylis sessanica, Cleisostoma tricallosum, Gastrochilus sessanicus, Gastrodia arunachalensis, Sarcoglyphis arunachalensis* and *Spathoglottis arunachalensis* (Hegde and Rao, 1984, 1985; Rao 1983, 1988, 1990, 1997; Tsering and Prasad, 2020). Moreover, many species were reported as new distributional records for the country. Myco-heterotrophic orchids like *Epipogium roseum, Eulophia zollingeri* and *Galeola lindleyana* were also reported from the sanctuary.

The exact number of orchid species found in the sanctuary is also not known and most of the earlier reported orchids were preserved in the form of herbarium specimen, lacking digital photographs. Information on population status, distribution and threats of orchids are not available. Thus, the present article is an outcome of an attempt to digitally document orchid species found within the sanctuary. A list of 100 orchids is presented in this article. Their habitat, population status, distribution and threats are also presented.

STUDY AREA

Sessa Orchid Sanctuary is located in West Kameng district of Arunachal Pradesh. It was established in the year 1987 and notified in 1989 under the Indian Wildlife (Protection) Act – 1972. It has an area of approx. 100 km2 (Figure 1). It conjoins with Eagle Nest Wildlife Sanctuary in the south and west, sharing around 34 km border. East to northeastern border is bounded by Tenga Reserve Forest while Norther border is bounded by recently created community reserve forest known as Singchung Bugun Village Community Reserve (Ghosh, 2018).

The sanctuary consists of mostly steep mountains and a ridge of high peak (approx. 8 km length) originates in the north-west part of the sanctuary which passes towards south east

direction and then turns towards north east direction. A number of rivulets originates from either side of the peak ridge, which then forms into four medium-sized rivulets namely *Tippi Nalah, Diji Nalah, Tangah Nalah* and *Dogong Kho*. Due to steep mountain terrain, there are hundreds of small to medium-sized water falls. The largest water fall (approx. 35 m high) known as 'Sessa fall' is located in the heart of the sanctuary. A nature trail is developed from Sessa village to Sessa fall which is approximately 2.9 km long. NH–13 road (BCT Highway) which connects Balipara in Assam to Tawang in Arunachal Pradesh (22 km) passes through the eastern side of the sanctuary. Another road (unpaved) known as Tenga – Doimara road (15 km) passes from north-west to south west part of the sanctuary.

The sanctuary has different types of vegetation due to high altitude variations (550 – 3090 m asl). Forest types can be classified as tropical, subtropical, temperate mixed and temperate coniferous forests. Some of the important tree species found in the lower altitude includes *Albizia procera, Aglaia spectabilis, Duabanga grandiflora, Syzygium cumini, Macaranga denticulata, Premna bengalensis, Tetrameles nudiflora* and *Terminalia myriocarpa*. Temperate mixed forest (1800 – 2800 m) is dominated by Oak, *Magnolia* and *Rhododendron*, while temperate coniferous forest (2800 – 3110 m) is dominated by *Abies spectabilis, A. delavayi, Tsuga dumosa* and *Taxus baccata*. There are also large clumps of bamboo, especially *Arundinaria sp.* (at 1800 – 2750 m),

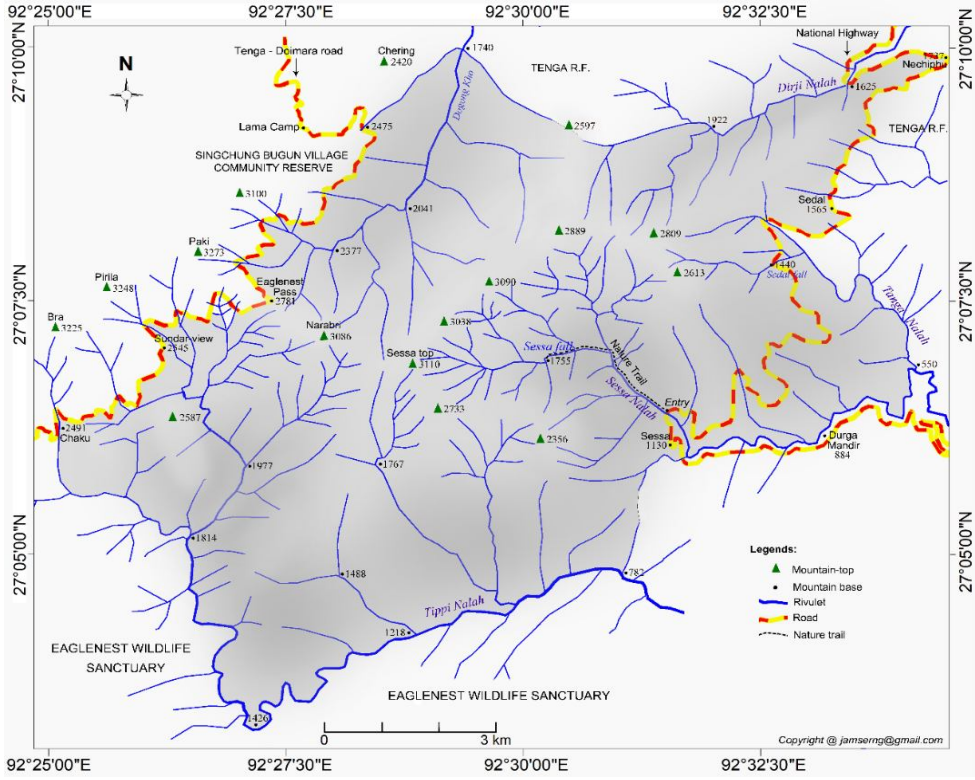


Figure 1: Map of Sessa orchid sanctuary

Dendrocalamus hamiltonii, Yushania pantlingii (at 2,700 – 2900 m near Eaglenest pass), *Thamnocalamus spathiflorus* (above 2700 m) and *T. spathiflorus* (over 3,050 m on Pirila ridge).

METHODOLOGY

Random field survey was conducted between the year 2016 to 2020. The study was mainly conducted along three stretches: i). BCT national highway (11 km^2), ii). Tenga – Doimara road (3.6 km^2) and iii). Nature trail at Sessa (2.9 km^2). Habitats were recorded and digital photographs of each species in flowering stage were taken. Few orchids which were rescued from fallen trees are brought to orchid nursery at Sessa for detailed studies.

Population status of the recorded species were categorized under six categories at local level based on 'modified DAFOR scale' called DAFORE scale. DAFORE stands for dominant (D), abundant (A), frequent (F), occasional (O), rare (R) and extremely rare (E). It is an assessment tool used to identify the abundance of any species on a semi-quantitative or visual assessment at qualitative level (Sutherland, 1996). The main difference between the DAFOR scale and DAFORE scale is that the earlier is useful to asses in large habitat or area, whereas, the later is suitable for small habitat. Species are categorized under Extremely Rare (E) when only one population of the species is observed in the entire study area. Other five categories have same definition in both the methods.

A map of the sanctuary (figure 1) showing important locations, mountain-top, mountain base, rivulets, roads and nature trail was developed using ILWIS software based on GPS coordinates recorded and the data available with Orchid Research Centre, Tipi.

RESULTS AND DISCUSSION

Orchid Diversity

Sessa orchid sanctuary is very rich in orchid diversity as well as other plant species. Out of the three study sites, maximum diversity of orchid was observed along the nature trail at Sessa and the least diversity was observed along Tenga – Doimara road. During the last five years, around 149 species were observed within the sanctuary out of which 100 are identified at species level (table 1). Altogether 42 orchid genera are identified. The largest genera observed in the sanctuary are *Coelogyne* (12 sp), *Dendrobium* (11 sp), *Bulbophyllum* (10 sp) and *Liparis* (8 sp). Epiphytic orchids are highest in number (75 species) followed by terrestrial (25 species) and lithophyte (1 species).

Out of 100 identified orchids, 19 are reporting for the first time from the sanctuary. These orchids include *Aerides rosea, Arundina graminifolia, Bulbophyllum emarginatum, B. hirtum, B. leopardinum, B. secundum, Calanthe mannii, Coelogyne griffithii, C. stricta, Cymbidium erythraeum, Dendrobium denudans, Eulophia zollingeri, Goodyera repens, Mycaranthes pannea, Odontochilus crispus, Papilionanthe vandarum, Pholidota chinensis, Pinalia excavata* and *Thunia alba var. bracteata.*

Orchids such as *Aerides rosea, Arundina graminifolia, Coelogyne prolifera, Eria ferruginea* and *Pinalia stricta* were mainly seen growing in tropical areas. *Satyrium nepalense var. ciliatum* which is basically found in temperate coniferous forest (2800 m) to sub-alpine forest (4000 m) was commonly observed in the temperate mixed forest (2400 – 2800 m).

Sarcoglyphis arunachalensis is an endemic orchid of Arunachal Pradesh found

only in West Kameng. Two individuals of this species were observed growing on branches of a medium-sized tree.

All the three myco-heterotrophic orchids (*Epipogium roseum*, *Eulophia zollingeri* and *Galeola lindleyana*) reported earlier were also observed in the sanctuary. All these three orchids were seen in blooming during rainy season (May – June).

A new species of *Spathoglottis* was recently discovered from the sanctuary named as *S. arunachalensis* (Tsering and Prasad, 2020). The species was found growing near roadsides with some 200 individuals, however, the type habitat is now disturbed by highway construction works.

Orchid Abundancy

As per the DAFORE scale, 02 species were found as abundant, 08 were frequent, 26 were occasional, 59 were rare and 05 were extremely rare. Not a single species was found under dominant category.

Species categorized as Extremely Rare in distribution are *Anoectochilus roxburghii, Crepidium acuminatum, Cymbidium elegans, C. mastersii* and *Galeola lindleyana.* In 2016, around 200 individuals of *Anoectochilus roxburghii* was seen growing in a small habitat along the nature trail at Sessa, but the population was later not observed during the subsequent years.

Out of 100 identified species, 59 were found as rare in distribution. Most of the terrestrial species qualifies for rare category except few which are *Anthogonium gracile, Arundina graminifolia, Calanthe biloba, Calanthe mannii* and *Satyrium nepalense var. ciliatum.*

Anthogonium gracile and *Thunia alba* has the largest population size. These two species are categorized as Abundant. *Anthogonium gracile* is a terrestrial orchid found in subtropical to temperate regions showing high altitudinal range of 1580 m. It is commonly found along roadsides and steep mountains. *Thunia alba* is an epiphytic orchid found growing on trees as well as on rock crevices. It is a sub-tropical orchid and commonly grows on large trees. Both the species have invasive growth nature and may not be included under any threated plant list.

Table 1: Orchids of the Sessa orchid sanctuary

Sl.	Orchids	Habitat	Altitude	Population status
1.	*Acanthephippium striatum* Lindl.	Found on moist forest floor rich in humus	1300 – 1350 m	Rare
2.	*Aerides rosea* Lodd. ex Lindl. & Paxton	Epiphytic on large trees in lower altitude	550 – 800 m	Rare
3.	*Anoectochilus brevilabris* Lindl.	Primary forest on humus rich soil	1300 – 1400 m	Rare
4.	*Anoectochilus roxburghii* (Wall.) Lindl.	Primary forest on humus rich soil	1350 m	Extremely Rare
5.	*Anthogonium gracile* Wall. ex Lindl.	Terrestrial, mostly on road-sides and steep mountains	1200 – 2780 m	Abundant
6.	*Arundina graminifolia* (D.Don) Hochr.	Terrestrial, under shrubs, grasses and on slopes	650 – 2000 m	Occasional
7.	*Bulbophyllum cauliflorum*	Epiphytic on branches of medium-	1200 –	Occasional

	Hook.f.	sized trees on steep mountains	1300 m	
8.	*Bulbophyllum emarginatum* (Finet) J.J.Sm.	Epiphytic on tree trunk with climber like habit	1600 m	Rare
9.	*Bulbophyllum gamblei* (Hook.f.) Hook.f.	Epiphytic on large trees in primary forests	1100 – 1400 m	Occasional
10.	*Bulbophyllum guttulatum* (Hook.f.) N.P.Balakr.	Epiphytic on trees and moss-covered rocks	1230 – 1250 m	Rare
11.	*Bulbophyllum gymnopus* Hook.f.	Epiphytic on large trees	1400 – 1600 m	Occasional
12.	*Bulbophyllum hirtum* (Sm.) Lindl. ex Wall.	Epiphytic on large trees	1500 m	Rare
13.	*Bulbophyllum leopardinum* (Wall.) Lindl. ex Wall.	Epiphytic on medium-sized trees	1550 m	Rare
14.	*Bulbophyllum obrienianum* Rolfe	Epiphytic on large trees in primary forest	1400 m	Rare
15.	*Bulbophyllum odoratissimum* (Sm.) Lindl. ex Wall.	Epiphytic on branches of medium-sized trees	1200 – 1300 m	Occasional
16.	*Bulbophyllum secundum* Hook.f.	Epiphytic on large trees	1500 m	Rare
17.	*Calanthe biloba* Lindl.	Terrestrial, under shade on humus rich soil	1100 – 1300 m	Occasional
18.	*Calanthe mannii* Hook.f.	Terrestrial, under trees and shrubs	1700 – 1850 m	Occasional
19.	*Ceratostylis himalaica* Hook.f.	Epiphytic on large trees in open forests	1100 m	Rare
20.	*Cleisostoma linearilobatum* (Seidenf. & Smitinand) Garay	Epiphytic on medium-sized trees	1300 m	Occasional
21.	*Cleisostoma racemiferum* (Lindl.) Garay	Epiphytic on medium-sized trees, commonly observed along roadsides	1200 – 1350 m	Occasional
22.	*Coelogyne barbata* Lindl. ex Griff.	Epiphytic on large-sized trees	1600 m	Rare
23.	*Coelogyne fimbriata* Lindl.	Epiphytic on trees, commonly found on slopes	900 – 1200 m	Frequent
24.	*Coelogyne flaccida* Lindl.	Epiphytic on trees in primary forest	1200 – 1500 m	Occasional
25.	*Coelogyne fuscescens* Lindl.	Epiphytic on trees in dense forests	1200 – 1600 m	Frequent
26.	*Coelogyne griffithii* Hook.f.	Epiphytic on trees and moss-covered rocks on slopes	1300 – 1500 m	Occasional
27.	*Coelogyne nitida* (Wall. ex D.Don) Lindl.	Epiphytic on large trees	1400 – 1600 m	Occasional
28.	*Coelogyne occultata* Hook.f.	Lithophytic along with grasses on slopes	2540 m	Occasional
29.	*Coelogyne ovalis* Lindl.	Epiphytic on medium to large-sized trees	900 – 1200 m	Frequent
30.	*Coelogyne prolifera* Lindl.	Epiphytic on trees in lower altitude	600 – 1100 m	Occasional
31.	*Coelogyne punctulata* Lindl.	Epiphytic on trees in slopes	1200 – 1300 m	Occasional

32.	*Coelogyne schultesii*	Epiphytic on branches of large trees	1400 m	Rare
33.	*Coelogyne stricta* (D.Don) Schltr.	Epiphytic on trees and moss-covered rocks	1300 – 1500 m	Frequent
34.	*Cremastra appendiculata* (D.Don) Makino	Terrestrial on humus rich soil	1400 m	Rare
35.	*Crepidium acuminatum* (D.Don) Szlach.	Terrestrial in dense forest	1290 m	Extremely Rare
36.	*Cryptochilus sanguinea* Wall.	Epiphytic on trees and moss-covered rocks	1400 – 1500 m	Rare
37.	*Cymbidium devonianum* Paxton	Epiphytic on moss covered trees	1200 m	Rare
38.	*Cymbidium elegans* Lindl.	Epiphytic on branches of large-sized tree	1700 m	Extremely Rare
39.	*Cymbidium erythraeum* Lindl.	Epiphytic on large dead trees	2400 m	Rare
40.	*Cymbidium goeringii* (Rchb.f.) Rchb.f.	Terrestrial, under shrubs	2200 m	Rare
41.	*Cymbidium hookerianum* Rchb.f.	Epiphytic on old trees	2300 m	Rare
42.	*Cymbidium iridioides* D.Don	Epiphytic on tree trunk and on moss covered rocks	1700 – 1750 m	Rare
43.	*Cymbidium mastersii* Griff. Ex Lindl.	Epiphytic on large-sized trees	1600 m	Extremely Rare
44.	*Dendrobium amplum* Lindl.	Epiphytic on tree branches	1100 – 1300 m	Occasional
45.	*Dendrobium chrysanthum* Wall. ex Lindl.	Epiphytic on trees and on moss covered slopes	1250 – 2150 m	Occasional
46.	*Dendrobium densiflorum* Lindl.	Epiphytic on branches of large trees	1300 – 1350 m	Rare
47.	*Dendrobium denudans* D.Don	Epiphytic on trees in steep slopes	1300 – 1400 m	Rare
48.	*Dendrobium devonianum* Paxton	Epiphytic on tree branches in moist forests	1200 m	Rare
49.	*Dendrobium fimbriatum* Hook.	Epiphytic on trees in dry forests	1200 m	Rare
50.	*Dendrobium hookerianum* Lindl.	Epiphytic on small trees in moist forests	1280 m	Rare
51.	*Dendrobium longicornu* Lindl.	Epiphytic on large-sized trees in moist forests	1300 – 1500 m	Occasional
52.	*Dendrobium monticola* P.F.Hunt & Summerh.	Epiphytic on medium-sized trees in dry forests	1300 – 1400 m	Frequent
53.	*Dendrobium nobile* Lindl.	Epiphytic on trees and moss-covered slopes	1800 m	Rare
54.	*Dendrobium wardianum* R.Warner	Epiphytic on small trees in subtropical forests	1250 m	Rare
55.	*Epipogium roseum* (D.Don) Lindl.	Terrestrial on humus rich soil in moist forests	1250 – 1300 m	Rare
56.	*Eria carinata* Gibson	Lithophytic	1220 m	Rare
57.	*Eria coronaria* (Lindl.) Rchb.f.	Epiphytic on trees in moist forests	1250 m	Rare
58.	*Eria ferruginea* Lindl.	Epiphytic on trees in moist forests	750 – 1100 m	Occasional
59.	*Esmeralda clarkei* Rchb.f.	Epiphytic on large-sized trees	1750 m	Rare

60.	*Eulophia zollingeri* (Rchb.f.) J.J.Sm.	Terrestrial on humus rich moist forests	1350 m	Rare
61.	*Galeola lindleyana* (Hook.f. & Thomson) Rchb.f.	Terrestrial on humus rich soil in between stream rocks	1150 m	Extremely Rare
62.	*Gastrochilus acutifolius* (Lindl.) Kuntze	Epiphytic on trees in moist forests	1240 m	Rare
63.	*Gastrochilus calceolaris* (Buch.-Ham. ex Sm.) D.Don	Epiphytic on branches of medium-sized trees	1360 m	Rare
64.	*Gastrochilus dasypogon* (Sm.) Kuntze	Epiphytic on branches of trees	1300 m	Rare
65.	*Goodyera repens* (L.) R.Br.	Terrestrial, temperate open forests	1850 m	Rare
66.	*Goodyera vittata* (Lindl.) Benth. Ex Hook.f.	Terrestrial on moss covered rocks under shade	1450 m	Rare
67.	*Liparis bootanensis* Griff.	Epiphytic on trees in primary forests	1530 m	Rare
68.	*Liparis cespitosa* (Lam.) Lindl.	Epiphytic in moist forests	1560 m	Rare
69.	*Liparis cordifolia* Hook.f.	Terrestrial in moist forests	1290 m	Rare
70.	*Liparis elliptica* Wight	Epiphytic on small trees	1150 m	Rare
71.	*Liparis nervosa* (Thunb.) Lindl.	Terrestrial under shades	1450 m	Rare
72.	*Liparis plantaginea* Lindl.	Epiphytic on trees in open forests	1300 – 1500 m	Occasional
73.	*Liparis resupinata* Ridl.	Epiphytic on large trees	1450 m	Rare
74.	*Micropera mannii* (Hook.f.) Tang & F.T.Wang	Epiphytic on large trees	1200 m	Occasional
75.	*Mycaranthes floribunda* (D.Don) S.C.Chen & J.J.Wood	Epiphytic on trees	900 – 1100 m	Occasional
76.	*Mycaranthes pannea* (Lindl.) S.C.Chen & J.J.Wood	Epiphytic on large trees	800 – 900 m	Occasional
77.	*Neogyna gardneriana* (Lindl.) Rchb.f.	Epiphytic on large tree trunk	1350 – 1500 m	Rare
78.	*Nephelaphyllum pulchrum* var. *sikkimensis* Hook.f.	Terrestrial under shades	1200 m	Rare
79.	*Odontochilus crispus* (Lindl.) Hook.f.	Terrestrial in moist forests	1400 m	Rare
80.	*Odontochilus lanceolatus* (Lindl.) Blume	Terrestrial in moist forests	1610 m	Rare
81.	*Ornithochilus difformis* (Wall. ex Lindl.) Schltr.	Epiphytic on medium-sized trees	1200 – 1400 m	Occasional
82.	*Otochilus albus* Lindl.	Epiphytic on trees in open forests	1300 – 1400 m	Frequent
83.	*Otochilus fuscus* Lindl.	Epiphytic on trees in open forests	1200 – 1400 m	Frequent
84.	*Panisea demissa* (D.Don) Pfitzer	Epiphytic on trees in moist forests	1280 m	Rare
85.	*Panisea tricallosa* Rolfe	Epiphytic on trees in moist forests	1350 m	Rare
86.	*Papilionanthe vandarum* (Rchb.f.) Garay	Epiphytic on large tree trunk	1700 m	Rare
87.	*Phaius flavus* (Blume) Lindl.	Terrestrial in moist forests floor and moss-covered rocks	1250 – 1300 m	Rare
88.	*Pholidota chinensis* Lindl.	Epiphytic on trees in lower altitude	900 m	Rare

89.	*Pholidota rubra* Lindl.	Epiphytic on large trees	1100 m	Rare
90.	*Pinalia excavata* (Lindl.) Kuntze	Epiphytic on trees in slopes	1350 m	Rare
91.	*Pinalia stricta* (Lindl.) Kuntze	Epiphytic on trees	600 – 650 m	Rare
92.	*Pleione praecox* (Sm.) D.Don	Epiphytic on trees and moss-covered rocks	1750 – 2250 m	Occasional
93.	*Sarcoglyphis arunachalensis* A.N.Rao	Epiphytic on large trees	900 m	Rare
94.	*Satyrium nepalense* var. *ciliatum* (Lindl.) Hook.f.	Terrestrial in open temperate forests	2400 – 2750 m	Occasional
95.	*Spathoglottis arunachalensis* J.Tsering & K.Prasad	Terrestrial on slopes along roadsides	1235 m	Rare
96.	*Sunipia bicolor* Lindl.	Epiphytic on large trees	2200 m	Rare
97.	*Thunia alba* (Lindl.) Rchb.f.	Epiphytic on large trees and lithophytic on rock crevices. Commonly found along roadsides	1250 – 1600 m	Abundant
98.	*Thunia alba var. bracteata* (Roxb.) N.Pearce & P.J.Cribb	Epiphytic on large trees	1350 m	Rare
99.	*Vanda cristata* Wall. ex Lindl.	Epiphytic on medium-sized trees	1200 – 1700 m	Frequent
100.	*Zeuxine goodyeroides* Lindl.	Terrestrial on moss-covered forest floor	1450 m	Rare

Threats to the Orchid Biodiversity

Main threat identified in the sanctuary are timber and firewood harvesting, shifting cultivation, human disturbances, development activities and illegal orchid collections. Though large-scale tree felling is not seen in the sanctuary, but occasional illicit felling was observed, especially along the national highway. A road length of 28 km touches the eastern part of the sanctuary, which is identified as the key zone for timber and firewood harvesting. Timber harvesting was also observed in the vicinity forest area including the Eagle Nest Wildlife Sanctuary which shares border with Sessa Orchid Sanctuary in the southern part.

A small village known as Sessa with around 46 families is located at the south-eastern part of the sanctuary. Shifting cultivation was seen practising by the villagers with slow but steadily increasing in cultivation area. The village people often visit in the core region of the sanctuary for collection of non-timber forest produces which causes habitat disturbances to terrestrial orchids.

Another major threat observed during the past few years is the developmental activities. A national highway passes through the steep mountains of the sanctuary. Widening of the road leading to landslide and dumping of soil in the forest has caused severe habitat destruction along downsides of the entire road length. The ongoing tunnel construction at Nechiphu and proposed railway line through sanctuary would also likely to affect the natural habitat.

The main entry point for eco-tourists is at Sessa with a nature trail of 2.9 km that leads to a beautiful water fall known as ‘Sessa Fall’. The trail is well maintained by the Khellong Division of Environment and Forest Department and can be accessible throughout the year. Around 60 different orchids were seen along the trail. During the past few years,

the population of Jewel Orchids which were found along the nature trail were observed drastically reduced. The population of several other species like *Calanthe biloba*, *Dendrobium chrysanthum* and *Phaius flavus* were also observed as decreasing. With increasing awareness on the importance of ornamental orchids and its high demand among orchid enthusiast and orchid growers, illegal collection has increased in the past years, posing a serious threat to the extremely rare orchids.

Norther part of the sanctuary is well protected and no anthropogenic threats to the orchids were reported. Norther part of the sanctuary shares border with Singchung Bugun Village Community Reserve (SBVCR) and Eagle Nest Wildlife Sanctuary. A road named 'Tenga – Doimara road' passes through this area which is the only walkable entry point. Two check posts have been created, one each by Shergaon Forest Division and SBVCR. Both the check posts are effectively working ensuring proper checking of trespasses and illegal activities. Besides, these check posts have helped the protection of Sessa Orchid Sanctuary.

CONCLUSION

Sessa orchid sanctuary is very rich in both orchid diversity as well as in orchid abundancy. Present study could able to report only 100 species. Many more species are expected to be explore in coming days. Many anthropogenic threats have been identified within the sanctuary which needs immediate attention.

ACKNOWLEDGEMENTS

Sincere thanks are due to the PCCF & Prl. Sec. (E&F) and PCCF (RE), DFO Khellong FD and DFO Shergaon FD of the Department of Environment and Forest, Government of Arunachal Pradesh for facilities and encouragement.

REFERENCES

Rao. A.N., 1983. *Cleisostoma tricallosum* Hegde et Rao — A new orchid from Arunachal Pradesh. Orchid Review. 91, 54-55.

Ghosh, S., 2018. Two conservation communities from Northeast India win biodiversity awards. Environment and Ecology. Assessed on 24th April 2021 [Available at https://vikalpsangam.org/article/two-conservation-communities-from-northeast-india-win-biodiversity-awards/]

Hegde, S.N., Rao, A.N., 1984. *Biermannia jainiana* Hegde et Nageswara Rao — A new species of orchid from Arunachal Pradesh, India. Bulletin of the Botanical Survey of India. 26(1-2), 97-99.

Hegde, S.N., Rao, A.N., 1985. *Gastrodia arunachalensis* Hegde et A.N. Rao — A new species of orchid from Arunachal Pradesh. Orchid Review. 93, 171-172.

Rao, A.N., 1988. Two new species of *Cheirostylis* (Orchidaceae) from Arunachal Pradesh, India. Nordic Journal of Botany. 8(4), 339-340.

Rao, A.N., 1990. A new species of Sarcoglyphis (Orchidaceae) from Arunachal Pradesh, India. Nordic Journal of Botany. 10(2), 161-162.

Rao, A.N., 1997. A new species of *Gastrochilus* from Arunachal Pradesh (India). The Journal of the Orchid Society of India. 11(1&2), 1-3.

Sutherland, W.J., 1996. Ecological Census Techniques: A Handbook. Cambridge University Press.

Tsering, J., Prasad, K., 2020. *Spathoglottis arunachalensis* (Orchidaceae), a new species from Arunachal Pradesh, India. Phytotaxa. 432(3), 289-295.

Photo plate – 1

Aerides rosea

Anoectochilus brevilabris

Anoectochilus roxburghii

Calanthe biloba

Arundina graminifolia

Coelogyne prolifera

Cymbidium mastersii

Crepidium acuminatum

Dendrobium chrysanthum

Photo plate – 2

Epipogium roseum

Eulophia zollingeri

Galeola lindleyana

Phaius flavus

Pinalia stricta

Sarcoglyphis arunachalensis

Thunia alba

Spathoglotis arunachalensis

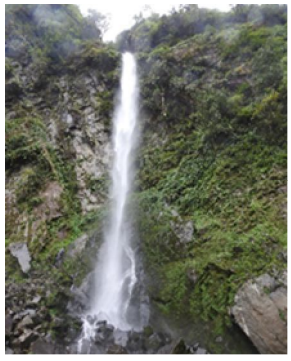
Anthogonium gracile

Eria ferruginea

Photo plate – 3

High mountain ridge

Sub-tropical vegetation



Sessa fall

Shifting cultivation

Nechiphu tunnel

Vegetation destroyed by road construction at Nechiphu

Timber and firewood harvesting