

Conventional herbarium for rare orchid species

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Abstract

The present study paper deals with the herbariums of rare orchid species collected and conserved at National Research Centre for Orchids, (ICAR), Pakyong, Sikkim. In this initial effort a total of 60 orchid species with 29 genera have been incorporated, assembled mostly from NE region of India including Sikkim. This effort is to record all the available species of orchids in the campus with their proper names along with their phenology etc. for future reference.

Keywords: Herbarium, orchid species

Introduction

Herbarium is the collection of dried plant specimens mounted on sheets of paper, identified by experts and labeled by their proper scientific names, together with other information like (where they were collected, how they grew, date of collection, collector's name etc.), label is usually mounted in the lower right-hand corner of the sheet. These specimens are filed in cases according to families and genera, available for ready reference. Like Botanical Gardens, herbaria are the "dictionaries" of the plant kingdom, the reference specimens essential to the proper naming of unknown plants.

The material in the herbarium remains a permanent record of flora of those regions, and in certain cases, where, natural calamities or other factors have totally destroyed the vegetation, the collections in the herbarium provide evidence what once existed there. The present investigation is carried out at the National Research Centre for Orchids (NRCO), Pakyong, East Sikkim,

India. The Centre is situated at 1,300 m above MSL on hilly terrain of Eastern Himalaya. Working on various aspects of orchids both hybrids & species including collection, characterization, evaluation and conservation of orchid germplasm gathered from various parts of the state of Sikkim, NE India, as well as other parts of India mostly southern India.

Materials and methods

Different Orchid species in flowering stages were collected during 2011-2012 from National Research Centre for Orchids, Pakyong, Sikkim, and were processed into mounted herbarium sheets following conventional methodology (Jain & Rao, 1977) which includes drying of plants, poisoning, mounting, stitching, labeling etc. and their identity confirmed with the help of some selected literature including Bose *et al.*, (1999), Chhetri *et al.*, (2013), De & Hajra (2004), Hynniewta *et al.*, (2000), King & Pantling (1898), Lucksom (2007), Pearce

& Cribb (2002), Polunin & Stainton (1984), Pradhan (2005 & 2006). After proper processing, the completed herbarium sheets were deposited at NRC for Orchids with label mentioning scientific name of each species, collection number, date of collection, field note mainly flower color, fragrance, and those minute characters which will no longer remain when dried.

Results and discussion

The detailed data of total 60 species from 26 genera which were recorded in herbarium sheets are provided in table 1 along with their geographical distribution and flowering, fruiting period.

Table 1: Names of the orchid species with their exsiccatae, field note, distribution & phenology.

Sl. No.	Name of the Orchid species & Exsiccatae	Field Note	Geographical Distribution	Flowering & Fruiting
1.	<i>Aeridesroseum</i> Loddiges ex Lindl. & Paxton; <i>G.M. Chhetri</i> 55, dated 04.06.12	Flowers fragrant, Off-White, flushed with light purple, lip purple, anther cap pointed as beak. Lip with conical spur.	N.E. India, Bhutan, Myanmar, China (Yunnan), Thailand, Vietnam.	May-June
2.	<i>Aniapenangiana</i> (Hook.f.) Summerhayes; <i>G.M. Chhetri</i> 21, dated 01.03.12	Flowers pale-green with reddish-purple sheaths.	NE India, China, Myanmar, Thailand, Vietnam.	February-April
3.	<i>Arundinagraminifolia</i> (D.Don) Hochreutiner; <i>G.M. Chhetri</i> 06, dated 18.10.11	Lip dark purple with 2 white calli, sepals & petals light purple.	India, Bangladesh, Bhutan, China, Indonesia, Malaysia, Myanmar, Nepal Pacific Islands, SE Asia & Sri Lanka.	April - December
4.	<i>Bulbophyllum affine</i> Lindl.; <i>G.M. Chhetri</i> 60, dated 15.06.12	Flowers greenish white with purple nerves, lip yellow with dark purple edges, apex acute column yellow.	N.E. India, China, Vietnam.	June-July
5.	<i>Bulbophyllumguttulatum</i> (Hook.f.) N.P. Balakrishnan; <i>G.M. Chhetri</i> 05, dated 18.10.11	Flowerscreamishwith purple dots. lip purple.	India, Bhutan, Nepal.	August - October
6.	<i>Bulbophyllumodoratissimum</i> (J.E. Smith) Lindl.; <i>G.M. Chhetri</i> 51, dated 01.06.12	Flowers white, tiny in cluster, anterior margins of sepals in-rolled forming cylindrical tips, lip yellow.	N.E. India, Nepal, Myanmar, China, Thailand, Vietnam.	May - September
7.	<i>Calanthe triplicata</i> (Willmatt.) Ames.; <i>G.M. Chhetri</i> 38, dated 28.04.12	Flowers white with long incurved spur, lateral sepals with green acuminate tips, lip 4-lobed, callus 3, pinkish.	India, Bhutan, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Philippines, Sri Lanka, Vietnam, Australia, Madagascar, SW Pacific Islands.	April - July
8.	<i>Coelogyne cristata</i> Lindl.; <i>G.M. Chhetri</i> 18, dated 01.03.12	Flowers pure white, fragrant with 3 long & 2 short yellow lamellae, which are hairy, basal part orange.	Eastern Himalayas	Jan-April
9.	<i>Coelogyne fimbriata</i> Lindl.; <i>G.M. Chhetri</i> 08, dated 18.10.11	Flowers light yellow, petals narrow-linear, lip with dark brown shades and nerves, margins ciliate with brown hairs.	N.E. India, Bhutan, Cambodia, Indonesia, Laos, N.E. Malaysia, Myanmar.	September - December

10.	<i>Coelogyneflaccida</i> Lindl.; <i>G.M. Chhetri 24</i> , dated 19.03.12	Flowers creamish, fragrant, lip off-white with brown nerves at lateral lobe, apical lobe curved, disc with 3 lamellae.	N.E. India, Bhutan, China, Myanmar.	February - May
11.	<i>Coelogynefuscescens</i> Lindl.; <i>G.M. Chhetri 12</i> , dated 31.10.11	Flowers brownish, lip with brown shades.	N.E. India, Bhutan, Myanmar, Nepal, Thailand.	October - January
12.	<i>Coelogyne nitida</i> (Wall. ex Don) Lindl. <i>G.M. Chhetri 52</i> , dated 01.06.12	Flowers white, fragrant, ca.3 cm across, lip with yellow blotch at apical lobe & lateral lobes with brownish nerves.	India, Bhutan, China, Myanmar, Nepal.	April - July
13.	<i>Coelogyneprolifera</i> Lindl.; <i>G.M. Chhetri 50</i> , dated 30.05.12	Flowers yellow, sepals recurved, petals filiform, apical lobe of lip strongly reflexed, disc orange-yellow.	N.E.India, China, Laos, Myanmar, Nepal.	May - July
14.	<i>Coelogynepunctulata</i> Lindl.; <i>G.M. Chhetri 11</i> , dated 31.10.11	Flowers white with yellow blotches on lip. Fragrant.	N.E.India, China, Myanmar, Thailand.	October - December
15.	<i>Coelogyne stricta</i> (D.Don) Schltr.; <i>G.M. Chhetri 20</i> , dated 01.03.12	Flowers creamish-white, fragrant, lip with orange blotches at base & middle with 2 calli.	N.E.India, Bhutan, Laos, Myanmar, Nepal, Thailand, Vietnam	March - June
16.	<i>Coelogyneviscosa</i> Reichb.f.; <i>G.M. Chhetri 17</i> , dated 14.02.12	Flowers white, fragrant, lateral lobes of lip with brown nerves & apical lobe yellow & decurved, lip with 3 brown lamellae, column yellowish-brown inside, hooded.	N.E.India, Laos, Malaysia, Myanmar, Thailand, Vietnam.	December - May
17.	<i>Cymbidium devonianum</i> Lindl. ex Paxton; <i>G.M. Chhetri 40</i> , dated 28.04.12	Flowers brownish-green with purple spots and nerves.	N.E.India, Bhutan, S. China, Myanmar, Nepal, Thailand, Vietnam	April- July
18.	<i>Cymbidium pendulum</i> (Roxb.)Swartz; <i>G.M. Chhetri 42</i> , dated 04.05.12	Sepals & petals with creamish white margins and red-purple central nerve.	N.E.India, Myanmar.	April- July
19.	<i>Cymbidium tigrinum</i> Parish.ex Hook.; <i>G.M. Chhetri 39</i> ; dated 28.04.12	Flowers greenish, fragrant, lip white with red-purple spots, lateral lobes brown inside.	N.E.India, China, Myanmar.	March - June
20.	<i>Dendrobium aduncum</i> Wall. ex Lindl.; <i>G.M. Chhetri 59</i> , dated 12.06.12	Flowers fragrant, purple, lip whitish, pubescent with acuminate tips, anther cap deep purple. Mentum curved, tip pointed forward.	N.E.India, Bhutan, Myanmar, China, Thailand, Vietnam.	March - August
21.	<i>Dendrobium amoenum</i> Wall. ex Lindl.; <i>G.M. Chhetri 49</i> , dated 28.05.12	Flowers fragrant, white with purple tips, lip with yellowish-green blotch at centre & purple lines at lateral lobes, lip margins undulated.	NE India, Bhutan, Nepal.	May - July
22.	<i>Dendrobium anceps</i> Sw.; <i>G.M. Chhetri 33</i> , dated 26.04.12	Leaves & stems flat, flowers arising from leaf base, flowers yellowish green, petals straight.	NE India, Bhutan, China, Myanmar, Nepal, Thailand.	April - June
23.	<i>Dendrobium aphyllum</i> (Roxb.) C.E.C. Fischer; <i>G.M. Chhetri 34</i> , dated 26.04.12	Flowering stem leafless, flowers arising from nodes, 1-2/node, light purple, lip creamish towards apex with purple nerves towards base.	NE India, Thailand, Vietnam, Myanmar, China.	March - June
24.	<i>Dendrobium chrysotoxum</i>	Flowers fragrant, yellow.	NE India, Cambodia,	April - July

	Lindl.; <i>G.M. Chhetri 36</i> , dated 28.04.12		Java, Laos, Myanmar, Vietnam.	
25.	<i>Dendrobium crepidatum</i> Lindl. ex Paxton; <i>G.M. Chhetri 32</i> , dated 26.04.12	Flowering shoot leafless, flowers from node, 1-2/node, tiny, creamish with light purple towards apex, lip with yellow blotch.	NE India, China, Laos, Myanmar, Nepal, Thailand, Vietnam.	April - June
26.	<i>Dendrobium densiflorum</i> Lindl.; <i>G.M. Chhetri 07</i> , dated 18.10.11	Flowers yellow, fragrant, lip orange-yellow, floral bracts creamish.	NE India, China, Bhutan, Myanmar, Nepal.	April- July October- December
27.	<i>Dendrobium devonianum</i> Paxton; <i>G.M. Chhetri 43</i> , dated 08.05.12	Flowers fragrant, creamish with purple tips at lip & petals. Sepals & petals purple netted, lip with 2 yellow blotches, margins fimbriate.	NE India, Bhutan, China, Myanmar, N Thailand, Vietnam.	May - July
28.	<i>Dendrobium denudans</i> D. Don; <i>G.M. Chhetri 02</i> , dated 17.10.11	Flowers yellowish-green, lip curved with purple stripes, spur purplish.	NE India, Bhutan, Nepal.	September - November
29.	<i>Dendrobium falconeri</i> Hook.; <i>G.M. Chhetri 45</i> , dated 11.05.12	Flowers fragrant, off-white, with purple tips, lip with dark purple blotch at centre & yellow shade on lateral lobes.	NE India, Bhutan, China, Myanmar, N Thailand, Vietnam.	May - July
30.	<i>Dendrobium farmeri</i> Paxton; <i>G.M. Chhetri 30</i> , dated 26.04.12	Flowers creamish with light purple towards tips, lip with yellow prominent blotch, pedicellate ovary purple.	NE India, Malaysia, Myanmar, Nepal, Thailand, Vietnam.	May - July
31.	<i>Dendrobium fimbriatum var. oculatum</i> Hook.; <i>G.M. Chhetri 31</i> , dated 26.04.12	Flowers strongly scented, yellow, lip with maroon blotch at centre, margins strongly fimbriate & undulated.	India, Myanmar, Bhutan, China, Laos, Malaysia, Nepal, Thailand, Vietnam.	March - May
32.	<i>Dendrobium gibsonii</i> Lindl.; <i>G.M. Chhetri 44</i> , dated 08.05.12	Flowers orange-yellow, fragrant, lip with 2 red-purple blotches. lip margins undulated & fimbriate, inflorescence drooping, pedicel long.	NE India, Bhutan, China, Myanmar, Nepal, N. Thailand, Vietnam.	May - July
33.	<i>Dendrobium kingianum</i> Bidwill ex Lindl.; <i>G.M. Chhetri 26</i> , dated 09.04.12	Flowers purple darker towards apex, fragrant, lip trilobed with dark purple stripes, calli 3, yellow.	Introduced. Native of Australia.	April - June
34.	<i>Dendrobium longicornu</i> Lindl.; <i>G.M. Chhetri 01</i> , dated 17.10.11	Flowers white, with yellow nerves at lip. Lip curved with purple stripes, spur purplish.	NE India, Bhutan China, Myanmar, Nepal, N Vietnam	August - December
35.	<i>Dendrobium nobile</i> Lindl.; <i>G.M. Chhetri 41</i> , dated 03.05.12	Flowers whitish- purple with darker towards tips, lip with purple blotch at centre.	India, Nepal, Bhutan, China Laos, Myanmar, Taiwan, Thailand, Vietnam.	March - July
36.	<i>Dendrobium thyrsoflorum</i> Rchb.f. ex E. Andre; <i>G.M. Chhetri 37</i> , dated 28.04.12	Sepals & petals white, lip yellow.	NE India, China, Laos, Myanmar, N Thailand, Vietnam.	April - June
37.	<i>Dendrobium williamsonii</i> Rchb.f. <i>G.M. Chhetri 35</i> , dated 26.04.12	Stems & leaves with black hairs, flowers yellowish white, lip with orange blotch at centre, apical part with long hairs, flowers scented.	NE India, China, Myanmar, Vietnam.	March - June
38.	<i>Drymodagynopus</i> (Hook.f.) Garay, Hamer & Siegerist;	Flowers white with yellow movable lip, pedicellate ovary	NE India, Bhutan, Thailand.	November - March

	<i>G.M. Chhetri 16</i> , dated 01.02.12	yellow.		
39.	<i>Epidendrumxanthinum</i> Lindl.; <i>G.M. Chhetri 14</i> , dated 01.02.12	Flowers red with 3 yellow, calli.	Introduced. Originated in Columbia and Brazil	April-July
40.	<i>Erialasiopetala</i> (Willd.) Ormerod; <i>G.M. Chhetri 25</i> , dated 09.04.12	Peduncle, pedicellate ovary & dorsal side of sepals pubescent, sepals & petals lemon-green, lip deflexed at apex which is yellow-green, lateral lobes purplish.	India, Himalayas, China, Taiwan, Yunnan, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Thailand, Vietnam, Java and Sumatra	March-May
41.	<i>Eriapaniculata</i> Lindl.; <i>G.M. Chhetri 27</i> , dated 12.04.12	Inflorescence 2-4 from top part of stem, flowers fragrant, pale green, pubescent, lip whitish with red-purple spots sepals & petals with similar spots.	NE India, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, Cambodia, Vietnam.	December - May
42.	<i>Eriavittata</i> Lindl.; <i>G.M. Chhetri 23</i> , dated 19.03.12	Flowers greenish, fragrant, purple nerves, lip with 4 lamellae, margins dentate.	NE India, China, Myanmar, Thailand	February - May
43.	<i>Goodyeraprocera</i> (Ker Gawler) Hook. <i>G.M. Chhetri 28</i> , dated 12.04.12	Flowers tiny, white, bracteate, peduncle & bracts pubescent.	India, Sri Lanka, Nepal, Bhutan, Myanmar, China, Taiwan, Japan, Thailand, Cambodia, Vietnam, Peninsular Malaysia, Sumatra, Java, Borneo, Philippines.	April - June
44.	<i>Liparislongipes</i> Lindl.; <i>G.M. Chhetri 03</i> , dated 18.10.11	Flowers yellowish-green, with unpleasant smell, lip curved.	India, Bhutan China, Malaysia, Nepal, Sri Lanka, Thailand.	October - December
45.	<i>Liparisplantaginea</i> Lindl.; <i>G.M. Chhetri 61</i> , dated 15.06.12	Flowers green, sepals & petals revolute forming linear shape, lip cordate.	NE India, Bhutan, Thailand, Vietnam.	June – August
46.	<i>Mastigionappendiculatum</i> (Rolfe) Garay, Hamer&Siegerist; <i>G.M. Chhetri 09</i> , dated 18.10.11	Dorsal sepal & petals with purple filiform drooping hairs at apex, lateral sepals 13-15 cm long, narrowed into thread like structure, lip dark purple, movable.	India, Bhutan, Laos, Vietnam.	September - November
47.	<i>Oberoniaa caulis</i> Griff.; <i>G.M. Chhetri 10</i> , dated 18.10.11	Inflorescence long, upto 20-30 cm, flowers orange-yellow.	NE India, Bhutan, China, Myanmar, Thailand, Vietnam.	October - December
48.	<i>Otochilusfuscus</i> Lindl.; <i>G.M. Chhetri 13</i> , dated 01.02.12	Flowers whitish-brown, column brownish-yellow, winged towards apex.	NE India, Bhutan, China Cambodia, Myanmar, Nepal, Thailand, Vietnam	February - June
49.	<i>Paphiopedilum insigne</i> (Wall. ex Lindl.) Pfitzer; <i>G.M. Chhetri 15</i> , dated 01.02.12	Flowers pale-green, dorsal sepals with purplish brown spots, apical part white.	NE India, China.	October - March
50.	<i>Paphiopedilumspicerianum</i> (Rchb.f. ex Masters & T. Moore) Pfitzer; <i>G.M. Chhetri 22</i> , dated 31.10.11	Dorsal sepal rounded, pure-white with purple central nerve, lip greenish, staminode purple, shaded with white.	NE India, China, N Myanmar.	October - February
51.	<i>Papilionanthe teres</i> (Roxb.) Schltr.; <i>G.M. Chhetri 57</i> , dated 12.06.12	Flowers purplish, lateral sepals drooping, lip bilobed, purple at apex & yellow at base, lateral lobes erect and	N.E. India, Nepal, Bhutan, Myanmar, China, Thailand.	April-June


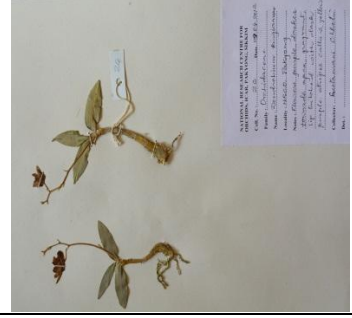







		overlapping.		
52.	<i>Phaiustantervilleae</i> (Banks ex I'Heritier) Bl." G.M. Chhetri 29, dated 06.04.12	Flowers scented, large, sepals & petals brown inside & white outside, lip yellow towards base & purple towards apex, lip spur incurved with bifurcate tips.	India, Sri Lanka, Bhutan, Myanmar, China, Japan, Thailand, Cambodia, Vietnam, Peninsular Malaysia, Sumatra, Java, Borneo, New Guinea, Philippines, Australia, Pacific Islands	April - July
53.	<i>Pholidotaimbricata</i> Hook.; G.M. Chhetri 53, dated 02.06.12	Inflorescence pendulous, flowers in two rows, bracteate, pinkish-white, lateral sepals incurved and winged at midrib, dorsal sepals & petals overlapping, apical lobe of lip deflexed, bilobed, disc with 3 calli.	India, Nepal, Bhutan, Bangladesh, Myanmar, China, Thailand, Cambodia, Vietnam, Peninsular Malaysia, Sumatra, Java, Borneo, New Guinea, Philippines, Australia.	March- July
54.	<i>Podochilusculratus</i> Lindl.; G.M. Chhetri 04, dated 18.10.11	Flowers terminal, pinkish, spur pouch-like.	N.E.India, Nepal, Myanmar, Thailand and Vietnam	September-October
55.	<i>Pterocerasteres</i> (Bl.) Holttum; G.M. Chhetri 56, dated 12.06.12	Flowers fragrant, yellow with maroon spots, apical lobe of lip tubular with maroon tip, like beak, lateral lobes erect.	N.E.India, Nepal, Myanmar, Thailand, Cambodia, Vietnam, Peninsular Malaysia, Sumatra, Java, Borneo, Philippines.	May - July
56.	<i>Renantheraimschootiana</i> Rolfe.;G.M. Chhetri 48, dated 25.05.12	Flowers deep red, lateral sepals broad, petals with red spots at tips, lip tiny with pointed triangular lateral lobes & white pointed 5 calli. Dorsal sepal reddish-orange.	N.E.India, China, Myanmar, Vietnam.	May - July
57.	<i>Rhyncostylisretusa</i> (L.) Bl.; G.M. Chhetri 58, dated 12.06.12	Flowers in long pendulous spike, dense, strongly fragrant, pinkish white with purple streaks, lip dark purple, deflexed with recurved apex, coriaceous, spur ca. 0.5 cm long.	India, Sri Lanka, Nepal, Myanmar, China, Thailand, Cambodia, Vietnam, Peninsular Malaysia, Sumatra, Java, Philippines	May - July
58.	<i>Thuniamarshalliana</i> Rchb.f.; G.M. Chhetri 54, dated 04.06.12	Flowers white, fragrant, strongly pubescent, apical lobe with brown nerves, margins strongly undulated & fringed, disc with 5 yellow calli, outer 2-ciliate.	NE India, Bhutan, China, Indonesia, Malaysia, Myanmar, Nepal, Thailand, Vietnam.	May-July
59.	<i>Vanda coerulescens</i> Griff.; G.M. Chhetri 19, dated 01.03.12	Flowers purplish, fragrant, lip dark purple with 5 keels, sepals & petals tessellated.	NE India, China, Myanmar, N Thailand	March- June
60.	<i>Vanda cristata</i> Lindl.; G.M. Chhetri 46, dated 22.05.12	Flowers pale-green, upper surface of lip fleshy, red-purple with creamish lines, lower surface green, apex bifurcate.	NE India, China, Bhutan, Nepal.	March- June

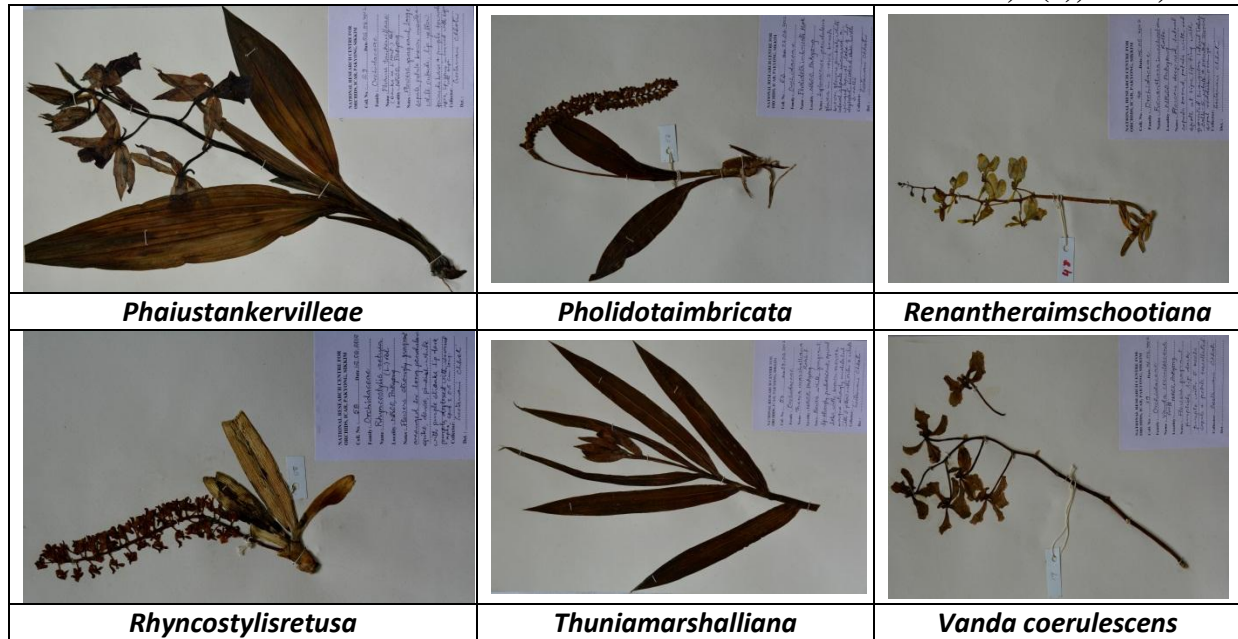
Herbaria serve as invaluable conservatory of flora of different parts of the world (Jain & Rao, 1977). Herbarium also serves as an aid in teaching under-graduate and post-graduate students of plant based subjects. It plays a vital role in various research fields by providing materials for anatomical, palynological and chemo-taxonomical studies. For ethno-botanical research also the herbaria have proved to be very valuable source of information. Thus, Herbarium

specimens form an important record of what plants grew where over time. They may have been produced as a voucher for an environmental survey botanical research, and serve as a permanent record allowing anyone to go back and check the identification, re-sample or repeat research. The production of herbarium specimen is therefore an important aspect of botanical studies.

Digitalization of some rare orchid species for herbarium

		
<i>Aerides roseum</i>	<i>Aniapenangiana</i>	<i>Bulbophyllum guttulatum</i>
		
<i>Coelogyne nitida</i>	<i>Coelogyne flaccida</i>	<i>Cymbidium tigrinum</i>
		
<i>Cymbidium devonianum</i>	<i>Dendrobium chrysotoxum</i>	<i>Dendrobium falconeri</i>

		
<i>Dendrobiumfimbriatum</i>	<i>Dendrobiumgibsonii</i>	<i>Dendrobiumkingianum</i>
		
<i>Dendrobiumnobile</i>	<i>Dendrobiumthyrsiflorum</i>	<i>Dendrobiumcrepidatum</i>
		
<i>Epidendrumxanthinum</i>	<i>Eriapaniculata</i>	<i>Eriavittata</i>
		
<i>Goodyeraprocera</i>	<i>Liparislongipes</i>	<i>Oberoniaacaulis</i>
		
<i>Paphiopedilumspicerianum</i>	<i>Paphiopediluminsigne</i>	<i>Papilionanthespecies</i>



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References

Bose, T.K., Bhattacharjee, S.K., Das, P., Basak, U.C., 1999. Orchids of India (Revised Edn.). NayaProkash, Kolkata. India.

De, A., Hajra, P.K., 2004. Taxonomic study of the Genus *Vanda* (*Sensulato*) in India. J. Orchid Soc. India 18 (1-2): 25 – 40.

Chhetri, G.M., De, L.C., Medhi, R.P., 2013. Color analysis in flowers of some species of *Vanda* W. Jones ex R. Brown (Orchidaceae) with the help of RHS color chart. Pleione 7(1): 18 - 22.

Hynniewta, T.M., Kataki, S.K., Wadhwa, B.M., 2000. Orchids of Nagaland. Botanical Survey of India. Kolkata. India.

Jain, S.K., Rao, R.R., 1977. A Handbook of Field and Herbarium Methods. Today & Tomorrow's Printers and Publishers. New Delhi. India.

King, G., Pantling, R., 1898. The Orchids of the Sikkim-Himalaya. In Annals of the Royal Botanic Garden, Kolkata. India.

Lucksom, S.Z., 2007. The Orchids of Sikkim & North East Himalaya. Development Area, Gangtok. Sikkim, India.

Pearce, N.R., Cribb, P.J., 2002. The Orchids of Bhutan in Flora of Bhutan, Vol. 3(3): 1-643, Royal Botanic Garden. Edinburgh.

Polunin, O., Stainton, A., 1984. Flowers of the Himalaya, Oxford University Press, New Delhi. India.

Pradhan, M. 2005. 100 Sikkim Himalayan Orchids. Mumbai, India.

Pradhan, M. 2006. 100 North East Indian Orchids. Mumbai, India.