

Orchids of Bhutan

III: The Genus *Epipogium* in Bhutan

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IN *THE ORCHIDS OF BHUTAN* (Pearce and Cribb 2002), we can read the following:

“The genus *Epipogium* was established (as *Epipogum*) in 1747 by S. [sic. J.]G. Gmelin in his *Flora Sibirica* [sic. Sibirica]. Since the original description, there have been no less than four different published spellings for the genus, causing a confusion that was reviewed by Sprague and Green (1937). Most authors have since used *Epipogium*, the earliest use of which was in 1792 by Moriz Balthasar Borkhausen in his *Tentamen Dispositionis Plantarum Germaniae*.”

Pearce and Cribb (2002) also mention that the genus includes “about” five species with *Epipogium aphyllum* Sw. reported from a few locations in Bhutan; *Epipogium roseum* (D.Don)

Lindl. from Darjeeling and Sikkim, India; and *Epipogium sessanum* S.N.Hegde & A.N. Rao from the West Kameng district of Arunachal Pradesh, India. An additional *Epipogium* taxon was discovered by Clarke in the Sind Valley of Kashmir and described as *Epipogium tuberosum* Duthie (Duthie 1906), but is listed as a synonym of *E. roseum* by Pearce and Cribb, albeit with a question mark. The “fifth” species that Pearce and Cribb refer to is most certainly *Epipogium japonicum* Makino, which is not reported from Bhutan, or from the Himalayan region. The *World Checklist of Selected Plant Families* (also known as the *Kew Monocot Checklist*), on the other hand, lists only three valid species altogether in *Epipogium*: *E. aphyllum*, *E. japonicum* and *E. roseum*, placing *E. sessanum* and *E. tuberosum* as synonyms of *E. roseum*. These considered synonyms are by no means the only “taxa” treated as such by Kew. No less than 17



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other scientifically described “names,” including varieties and forms, have received the same treatment.

Plants of *Epipogium* were for a long time considered to be “saprophytic” (living on dead material), and existing in a harmonious symbiotic relationship with a mycorrhizal fungus. This view has changed in recent times, however, and a more common view today is that the orchid really feeds on the fungus and gives nothing back. It appears that the orchid allows the fungus to enter its root hairs and to develop tiny “balls” of a thread-like structure known as pelotons in the cells. The pelotons are then digested by the orchid as an energy source through a process known as mycotrophy (Zettler 2005). It is believed that all orchids utilize a fungus partner during some stage of their lives, particularly when the seed germinates and before the seedling has the ability to produce chlorophyll and its own energy or food through photosynthesis. But some orchid species have taken this relationship much further and in a “single-minded” way. Species of *Epipogium* lack chlorophyll entirely throughout the life

- [1] *Epipogium aphyllum*, myco-parasitic plant habit in leaf mold, Högberget, Sweden.
- [2] *Epipogium aphyllum*, with nonresupinate flowers, Högberget, Sweden

span, and therefore have no known ability to produce their own food. The plants seem to be completely dependent on their fungus partners and really parasitize them, presumably without killing them. There appears to be no hard evidence that the fungus receives any reward for its role (Zettler 2005).

Due to the development of this mycoparasitic habit, the *Epipogium* plants lack leaves and the pale inflorescences have an ethereal and “mystical” quality about them wherever they appear, often in deep shade under large trees. They are also unpredictable in terms of when they flower. Only when the conditions are favorable will the inflorescences develop. It is believed that plants of *E. aphyllum*



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need a mild and humid spring in order to flower, which takes place later, during the summer. If the conditions are less than perfect, many of the flower buds, which were initiated the previous fall, will die prematurely and the plant will remain hidden. After flowering, parts of the plant die but the coralloid root system can produce long “stolons” where new plants eventually develop and which may appear quite a distance from the original plant. Sometimes several years pass by before the beautiful and ghost-like flowers appear again, and at a different site (Mossberg and Nilsson 1977).

Before the Thunder Dragon Orchid Conservation Project (TDOCP) was initiated in 2008 as a collaborative effort between the team of the first author and Thomas Höijer of Jakobsberg, Sweden, and the National Biodiversity Centre in Serbithang, Bhutan, only *E. aphyllum* was reported from Bhutan by Pearce and Cribb (2002). Since then two more taxa have been added through the TDOCP, which correspond to Kew’s number of accepted species. Rather amazingly they represent all accepted species of a genus that is distributed from the extreme western parts of Europe, throughout temperate Asia all the way to Japan and Korea, including the Himalayas, and possibly, but doubtfully,

also tropical Africa. We are going to take a closer look at these species, but also question some of the listed Kew synonyms.

The second taxon on our list is *E. roseum*, which is mentioned by Sithar Dorji in his field guide to the orchids of Bhutan (Dorji 2008), but no preserved specimens were apparently made. The author died prematurely the same year and no field journals have been discovered that may reveal where he found this species. Since then, a couple of new populations of *E. roseum* have been documented by the TDOCP team. In May of 2010 a large population was discovered near the little village of Saleng, in the district of Mongar. Inflorescences were scattered over a rather wide area, growing in deep shade among leaf mold in a mixed semideciduous forest. A second population was discovered in May of 2013, in the Saktien Wildlife Sanctuary of Trashigang. A large bundle of plants was growing on and around a rotten tree stump, where also a fungus had produced a rich amount of fruiting bodies (mushrooms). The identity of the fungus, which is suspected to be the fungal partner for the orchid, is uncertain at this time. The identity of a bee-like insect that appeared to be pollinating the flowers is also unknown. Efforts were made to

[3] *Epipogium roseum* habititat near Saleng, studied by Stig Dalström.

[4] *Epipogium roseum*, myco-parasitic plant habit in leaf mold, Saleng, Bhutan.

catch, or at least photograph, the busy little visitor, but without success. Before a second attempt could be made, a generous portion of the plant cluster had ended up in the herbarium press due to some seriously dutiful efforts by the “herbariumeer” in charge at the time, and no more visiting insects would dare to approach the site.

In 2006, *An Illustrated Guide to the Orchids of Bhutan* was authored by Dhan Bahadur Gurung (2006). Much of the taxonomy in this little handbook follows the 2002 treatment by Pearce and Cribb, with a few exceptions. One such exception concerns a plant that appears at the end of the field guide, under “undetermined species” on page 165. This plant was tentatively identified as *Epipogium* aff. *roseum* by Gurung, and was discovered in flower on October 10, 1999, along the Chuselumpa mountain ridge near Hetsho Thangka. This ridge is located



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a few kilometers southeast of the city of Wangdue in central Bhutan, toward the Tsirang highway and east of the river Punatsang Chhu. The plant was growing among decaying wood chips in a stand of *Cupressus corneyana*, at an elevation of about 7,800 feet (2,600 m). This particular area is dominated by *Cupressus* forest and with oaks as codominants.

The photo in the field guide shows a pale inflorescence with a few resupinate (with the lip lowermost) flowers and some additional buds near the apex. Although few morphological details can be observed in the photo, one particular feature stands out that helps us along the way toward a positive identification. At least it clearly tells us what it is not. The large and curved spur near the base of the lip is bent forward and toward the lamina of the lip. *Epipogium roseum* has a large spur that points in the other direction and is parallel

with and slightly curved toward the ovary. The Chuselumpa plant is therefore clearly not the same as *Epipogium roseum*, which is illustrated with a line drawing in *The Orchids of Bhutan* (Pearce & Cribb 2002). When we compare the Chuselumpa plant with *E. aphyllum* on the other hand, we can see that both have flowers with forward-curved spurs, but in the case of *E. aphyllum* the flower is nonresupinate (lip uppermost), and the lip has distinct side lobes, whereas the Chuselumpa plant has a cordate-ovate lip without distinct side lobes. Another significant difference can be observed underground. *Epipogium aphyllum* has an irregular and coral-shaped rhizome whereas the Chuselumpa plant has a thick and ovoid tuber, similar to *E. roseum*.

Our conclusion is that the Chuselumpa plant represents something different from both *E. aphyllum* and *E. roseum*. The

flower of *E. sessanum* is described as lacking a spur altogether. This eliminates this taxon from the equation and we obviously need to expand our search in order to find a positive identification for the Chuselumpa plant.

Epipogium tuberosum Duthie was described in the Annals of the Royal Botanic Garden, Calcutta (Duthie 1906), and is based on a plant collected by C.B. Clarke (No. 31230) at 6,000 feet (ca. 2,000 m) in the Sind Valley of Kashmir. The description reads as follows:

“Whole plant 1 to 3 dm. high, glabrous. Root tuberous, not coralloid. Scape usually swollen above the base and tapering upwards, bearing a few membranous broad-based bracts. Raceme laxly 3–5 flowered, floral bract ovate-lanceolate, acuminate, entire, longer than the slenderly stalked subglobose ovary, 5-nerved. *Sepals* and *petals* 8 mm. long, broader than those of *E. aphyllum*, all 3-nerved. *Lip* without side lobes, 9 mm. long, its upper surface with three carunculate ridges, margins not erose. *Spur* as in *E. aphyllum*, but more slender and with a less rounded apex. *Stigma* occupying a deep cavity on the anterior face of the column. *Pollinia* globose, with caudicles equal to them in length, glands minute globular.”

Then follows: “Very similar to the preceding [*E. aphyllum*, authors’ note] in general appearance, but specifically distinct by reason of its tuberous non-coralloid root, its entire lip and by the very different pollinia and column.”

The description of *E. tuberosum* fits the Chuselumpa plant very well as can be seen in Gurung’s photo, and we have little doubt that it is an accurate identification of a distinct species. The only question that remains to be answered is whether any other listed name also correlates with this species and may have been described earlier, thus having nomenclatural priority?

In 1904, two years prior to the description of *E. tuberosum*, Tomitaro Makino described *Epipogium japonicum* based on a plant collected by Viscount Nobumitsu Aoki in a shady forest at the eastern foot of Mount Nyohō, in the province of Shimotsuke, Japan (Makino 1904). Although no original plant material or illustrations have been seen by us, the overall description and the mentioning of the “patent-nutant” (nodding) flowers with a descending (as opposed to ascending) spur distinguish this taxon from both *E. aphyllum* and *E. roseum*, and corresponds

well with *E. tuberosum*. A drawing of what is identified as *E. japonicum* can be seen in the recently published *Flora of China* (Editorial Committee of Flora Republicae Popularis Sinicae 2010, plate 278), and this illustration looks very much like the Chuselumpa plant. Because *E. japonicum* was described first, this name has priority over *E. tuberosum*. It is possible that some features exist that distinguish these very similar but geographically separated taxa from each other, but that is unknown to us at this time.

Epipogium sessanum, finally, is an interesting taxon that needs further scrutiny. In the original description by Hegde and Rao we can read the following:

“During a field inspection at Orchid Sanctuary, Sessa, West Kameng district, Arunachal Pradesh, a few saprophytic plants, resembling *Epipogium roseum* were noticed. Upon close observation it was found that the specimen lacked spur of the lip unlike *Epipogium* but simulating the lip of *Stereosandra* in its gross morphological features.”

Then follows, “However, when the specimen [sic. specimens] were further studied critically, it was found that they belonged to the genus *Epipogium* in column and anther characters rather than *Stereosandra*” (Hegde and Rao 1982).

The illustration that accompanies the original description shows a dissected flower with a lip that lacks a spur. The general shape of the lip also appears rather “primitive,” without a visible callus and resembling the sepals, except for a minor angle on each side near the base. Since the authors mention that “plants” (plural) were observed, it suggests that more than one plant was found, assumingly with similar morphology. Since individual plants have separate tubers rather than a divided coralloid rhizome (similar to *E. roseum* and different from *E. aphyllum*), it is assumed here that they represent two separate clones. And if both plants have flowers without a spur, then we must conclude that this feature very well can have taxonomic significance justifying a separate specific treatment. Judging from the type illustration, however, the plant looks very similar to *Stereosandra javanica* Blume, as this species is illustrated in *Flora of China* (Editorial Committee of Flora Republicae Popularis Sinicae 2010, plate 276), and in *The Orchids of Peninsular Malaysia and Singapore* (Seidenfaden and Wood 1992). *Stereosandra javanica* is also reported from Tipi in the West Kameng district of Arunachal Pradesh



by Hegde and Rao (Pearce and Cribb 2002). When a critical comparison is made between the type illustration of *E. sessanum* and of *S. javanica*, it reveals morphologic similarities that strongly suggest that these taxa should be treated as conspecific, or at least congeneric as members of *Stereosandra*. The differentiation mentioned by Hegde and Rao, referring to unspecified column and anther characteristics, is unconvincing. Finn Rasmussen, however, determined that a specimen sent to him (one flower) belonged to *E. roseum* (Hegde and Rao 1982). Rasmussen is then quoted in the original publication: “the labellum of the specimen (*Hegde s.n.*) is (only) slightly broader than the petals and lacks the typical *Epipogium* spur. This is a highly interesting phenomenon perhaps a clue to how *Stereosandra* could have evolved from *Epipogium* like ancestors.”

There is no explanation provided by Rasmussen in the original publication of *E. sessanum* of why the flower that was sent to him for examination belongs to



- [5] *Epipogium roseum*, myco-parasitic habit on old tree stump, Joengkhar, Bhutan.
- [6] *Epipogium roseum*, with re-supinate flowers, Joengkhar, Bhutan.

E. roseum despite the fact that the type plant (Hegde s.n.) demonstrates quite different morphological features, unless specimens of the two species were mixed up somehow. There is a drawing of a single flower of *E. roseum* included in the type illustration of *E. sessanum* for comparison, and it seems plausible that a flower of *E. roseum* may have been sent to Rasmussen for examination by mistake, instead of the intended flower of *E. sessanum*. Rasmussen's quote would then refer to the actual type specimen and illustration of what became *E. sessanum*. In any case, based on the described diagnostic features and what can be seen in the type illustration, we believe that *E. sessanum* belongs in *Stereosandra* rather than in *Epipogium*.

In summary, we acknowledge Kew's listing of *E. aphyllum*, *E. japonicum* and *E. roseum* as valid species of the genus but disagree with placing *E. sessanum* and *E. tuberosum* as synonyms of *E. roseum*.

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References

Dorji, S. 2008. *The Field Guide to the Orchids of Bhutan*. Bhutan Orchid Science Society, Thimphu, Bhutan.
 Duthie, J. F. 1906. The Orchids of the North-Western Himalaya; *Epipogium tuberosum*. *Ann. Roy. Bot. Gard. (Calcutta)* 9(2):151.
 Editorial Committee of Flora Republicae Popularis Sinicae. 2010. *Flora of China; Illustrations*. Volume 25. Science Press, Beijing, China and Missouri Botanical Garden Press, St. Louis.
 Gurung, D.B. 2006. *An Illustrated Guide to the Orchids of Bhutan*. DSB Publication, Thimphu, Bhutan.
 Hegde, S.N. and A.N. Rao. 1982. *Epipogium sessanum* Hegde et Rao — A New Species of Orchid from Arunachal Pradesh, India. *J. Econ. Taxon. Bot.* 3: 597–601.
 Makino, T. 1904. *Epipogium japonicum* Makino, Observations on the Flora of Japan. *Bot. Mag. (Tokyo)* 18:131.
 Mossberg, B. and S. Nilsson. 1977. *Nordens Orkidéer*. Wahlström and Widstrand, Stockholm, Sweden
 Pearce, N.R. and P.J. Cribb (2002). *The Orchids of Bhutan*. Royal Botanic Garden, Edinburgh, and Royal Government of Bhutan.
 Seidenfaden, G. and J.J. Wood. 1992. *The Orchids of Peninsular Malaysia and Singapore. A Revision of R. E. Holttum: Orchids of Malaya*. Olsen and Olsen, Fredensborg, Denmark.
 Sprague, T.A. and M.L. Green. 1937. *Epipogium* or *Epipo-*



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gium. *Kew Bull.* (9):475–476.
 Zettler, L.W. 2005. Nature's Fungal Connoisseurs. *New Insight into the Mysterious Orchid-Fungal Association. Orchids* 74(4):292–297.

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- [7] Dhan Bahadur Gurung, author of *An Illustrated Guide To The Orchids Of Bhutan*.
- [8] *Epipogium roseum*, intimate myco-parasitic habit on old tree stump, Joengkhar, Bhutan. Note the tiny fungal fruiting bodies.
- [9] *Epipogium japonicum*, inflorescence of the plant from Chuselumpa, Bhutan.