Hayata glandulifera (Orchidaceae), New Genus and Species From Northern Vietnam

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ABSTRACT: New orchid related to *Cheirostylis, Goodyera*, *Rhomboda* and *Zeuxine* discovered in lowland central part of northern Vietnam is described in rank of separate genus *Hayata*. Proposed genus differs from *Goodyera* in 2 separate lateral stigmas; in not hairy hypochile; in massive, knob-like mesochile and in large 2-lobed, dentate epichile. It differs from *Cheirostylis* in large flowers with completely free sepals (newer forming tube); in peculiar bunches of capitate glands on lateral walls of hypochile and in not swollen succulent rhizome forming normal adventitious roots, not modified into ridges or pillows covered by root hairs. From *Rhomboda* discovered genus differs in absence of any keels on the lip; in specific papillae bunches inside hypochile and in not winged column. New genus may be also close to *Zeuxine*, from which it differs in plant habit, large flowers, large dentate lobes of epichile and in specific shape of stelidia and rostellar arms. Described plant not fits well with any genera of subtribe Goodyerinae and certainly desires generic segregation. Besides Vietnamese plant, described genus includes *H. tabiyahanensis* from Taiwan and *H. sherriffii* from Bhutan. Standard taxonomical treatment of new genus and key for its species identification is presented in the paper.

KEY WORDS: Orchidaceae, Taxonomy, *Hayata glandulifera,* new genus and species, northern Vietnam.

INTRODUCTION

A number of plants new for the flora of Vietnam and taxa new for science were discovered in 2008-2009, during winter field studies of Vietnamese flora and vegetation according to botanical exploration programs of U.S.A. National Geographic Society and Henry Luce Foundation. Very unusual species of orchids named, as *Hayata glandulifera* is one of the most interesting discoveries made during this session. This unique plant described here was found as a very rare plant on the territory of Xuan Son national park that represents extreme southeastern extension of the Hoang Lien Son Range, in the watershed of the Red River. The plant was observed in lowland rocky wet valley at foothills of karstic limestone hills. Discovered species has certain relation to *Cheirostylis, Goodyera*, *Rhomboda* and *Zeuxine*, but does not fits well with any known genera. On the base of its specific floral morphology, new genus is established in this paper. It is named in honour of Japanese botanist, Professor of Imperial University of Tokyo, Bunzō Hayata, discoverer of *Hayata tabiyahanensis* (accepted as a type species for new genus), who also primarily recognized uncertain generic position of this plant (Hayata, 1916). One another orchid that also belongs to newly established genus is *Hayata sherriffii* described recently from Bhutan (Pearce, Cribb, 1990). Discovered Vietnamese plant is typical element of highly endangered primary lowland limestone flora and bright example of strict local endemism. Description of new genus and species, as well as standard taxonomical treatment and key for species identification are follow below.

Hayata Aver., gen. nov.

Plantae terrestres, lithophilae vel epiphyticae, ad 20 cm alt., foliis petiolatis ellipticis viridibus. Scapus tomentosus, floribus sessilibus campanulatis. Sepala libera, concava. Petala semiorbicularia. Labellum e hypochilio, mesochilio et epichilio compositum. Hypochilium concavum, glandulis capitatis magnis 6–7 ab utroque latere congestis vel nervo-cristatis . Mesochilium in modum tubi massivi. Epichilium bilobum, lobis aequiformibus subquadratis, crenulatis vel irregulariter dentatis. Columna 4–5 mm lg., 2–3 mm lt., stigmatis 2, stelidiis et rostelli brachiis eminentibus.

Type: *Hayata tabiyahanensis* (Hayata) Aver. (=*Zeuxine tabiyahanensis* Hayata).

Terrestrial, lithophytic or epiphytic sympodial herb with erect or ascending leafy floriferous stem. Rhizome leafless, thick, short or long, creeping, at nodes with well developed or short, rudimentary roots densely cowered with root hairs. Floriferous stem erect or ascending, thick, juicy, to 20 cm tall, with 2-6 leaves at the base; in upper part covered with 2-4 broad membranaceous light green to whitish cuneate, acuminate sterile bracts; stem glabrous at the base, densely hairy above. Leaves convolute, petiolate; leaf blade, oblique elliptic, acute to acuminate, more or less attenuate at the base, uniform green. Scape short or long, tomentose, bearing 1-10 lax flowers. Floral bracts

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triangular-cuneate, conduplicate, acuminate, sparsely hairy at the base, glabrous to the apex. Ovary erect, pubescent. Flowers, campanulate, 8-10 mm long, at right angle to ovary, resupinate, sessile. Sepals free (newer united), sparsely hairy at the base, all forward directed, parallel to the floral axis. Dorsal sepal ovate, concave, galeate, acuminate, with slightly upward attenuate apex. Lateral sepals oblong, obtuse, hardly oblique. Petals glabrous, strongly oblique, half circular-spatulate, to the apex densely connivent and forming broad hood with the dorsal sepal. Lip divided into hypochile, mesochile and epichile. Hypochile boat-shaped, adnate to the column base at basal half; inside with papillose keel, or not keeled, with large sea-anemone-like bunch of papillae on each sidewall; free distal part with slightly upturned margins. Mesochile, with 2 fleshy connivent entire lobes forming short massive tube. Epichile with narrow base, 2-lobed; the lobes spreading at right angle, rectangular or sub-quadrate, serrate to irregular dentate along distal margin. Column forward directed, ovate, with 2 lateral convex hemispheric irregularly tuberculate stigmas; at front with 2 forward directed fleshy stelidia, hooked at apex; rostellar arms forward directed, obliquely-lanceolate, with narrow base, widening to spatulate apical part. Anther large, papillose. Pollinia 2, sectile, with stipe and small viscidium. Fruits dry ellipsoid capsules.

Genus includes 3 species known in Southern Bhutan, Taiwan and northern Vietnam.

Etymology. The genus is named in honour of famous Japanese botanist, Professor of Imperial University of Tokyo, Bunzō Hayata, who firstly recognized uncertain generic position of his *Zeuxine tabiyahanensis* discovered in Taiwan.

Note. New genus may be close to such genera as *Cheirostylis* Blume, *Goodyera* R.Br., *Rhomboda* Lindl. and *Zeuxine* Lindl., but can not be associated with any of them according to their morphology. It differs from *Goodyera* in 2 separate stigmas; in not hairy hypochile; in massive, knob-like mesochile and in large 2-lobed, dentate epichile. New plant differs from *Cheirostylis* in large flowers with completely free sepals (newer forming tube); in peculiar bunches of capitate glands on lateral walls of hypochile and in not swollen succulent rhizome forming normal adventitious roots, not modified into ridges or pillows covered by root hairs. From *Rhomboda* discovered plant differs in absence of any keels on the lip; in specific papillae bunches inside hypochile and in not winged column. New genus may be also close to *Zeuxine*, from which it differs in plant habit, large flowers, large dentate lobes of epichile and in specific shape of stelidia and rostellar arms. Straight forward directed fleshy stelidia, hooked at apex and forward directed, obliquely-spatulate rostellar arms are very characteristic for species of this genus, which do not fits well with any known genera of subtribe Goodyerinae hence certainly desires generic segregation.

Three known species of *Hayata* are strict local endemics, which demonstrate disjunctive generic areal with three isolated geographical points in southern Bhutan, Taiwan and in the center of northern Vietnam. The understanding of such unusual distribution not rare observed in orchids certainly needs special investigation.

Key to species to known species

1. Hypochile keeled on both sides, with bristle-like papillae on keels; spice rather long-pedunculate; sepals with pink tint …….. …….. 1. *H. tabiyahanensis*
1. Hypochile not keeled at sides, on each side with stalked sea-anemone-like calli; spice short-pedunculate; sepals white or with greenish tint ……... 2
2. Stem to 20 cm tall, erect, with well developed roots; spike with 6-10 flowers; leaves to 12 cm long; lip pure white; petals 9 mm long, as long as median sepal; epichile lobes quadrate, sinuate-dentate along margin ……..…… 2. *H. sherriffii*
2. Stem 10-15 cm tall, ascending from long creeping rhizome, roots short rudimentary; spike with 1-2(3) flowers; leaves to 8 cm long; lip white with yellow center; petals 9-10 mm long, a bit longer than lateral sepal; epichile lobes rectangular or sub-quadrate, with 4-6 large irregular dents along margin ……...…….. 3. *H. glandulifera*

1. *Hayata tabiyahanensis* (Hayata) Aver., comb. nov. - *Zeuxine tabiyahanensis* Hayata, 1916, Icon. Pl. Formos. 6: 89.

Adenostylis tabiyahanensis Hayata, 1916, Icon. Pl. Formos. 6: 89, nom. altern.
Cheirostylis nemorosa Fukuy., 1935, Bot. Mag. (Tokyo) 49: 760.
Zeuxine nemorosa (Fukuy.) T.P.Lin, 1977, Native Orch. Taiwan. 2: 69.
Macodes tabiyahanensis (Hayata) S.S.Ying, 1977, Col. Ill. Indig. Orch. Taiwan. 1: 478.
Cheirostylis tabiyahanensis (Hayata) N.Pearce & P.J.Cribb, 1999, Edinburgh Journ. Bot. 56, 2: 278.

Described from Taiwan ("*Hab. Tabiyahanzan*"). Type ("*B.Hayata, Mai. 1916*") – TI (holotype).

Distribution: Taiwan. Endemic.

2. *Hayata sherriffii* (N. Pearce & P. J. Cribb) Aver., comb. nov. - *Cheirostylis sherriffii* N. Pearce & P. J. Cribb, 1999, Edinburgh Journ. Bot. 56, 2: 275.

Described from Bhutan ("*Chungsing, 20 m N of Hatisar*"). Type ("*1949-3-29 Ludlow; Sherriff; Hicks 18539*") – BM (holotype).

Distribution: Southern Bhutan. Endemic.

3. *Hayata glandulifera* Aver., *sp. nov.* Figs. 1 & 2

Plantae terrestres vel lithophilae, ad 15 cm alt., foliis (2)3(4), 4–8 cm lg., 1.5–3 cm lt. Scapus ad 5 cm lg., dense tomentosus, floribus albis 1–3, 9–10 mm lg., 6–7 mm lt. Sepala 8–9 mm lg., 3.5-4 mm lt. Petala 9–10 mm lg., 4–4.5

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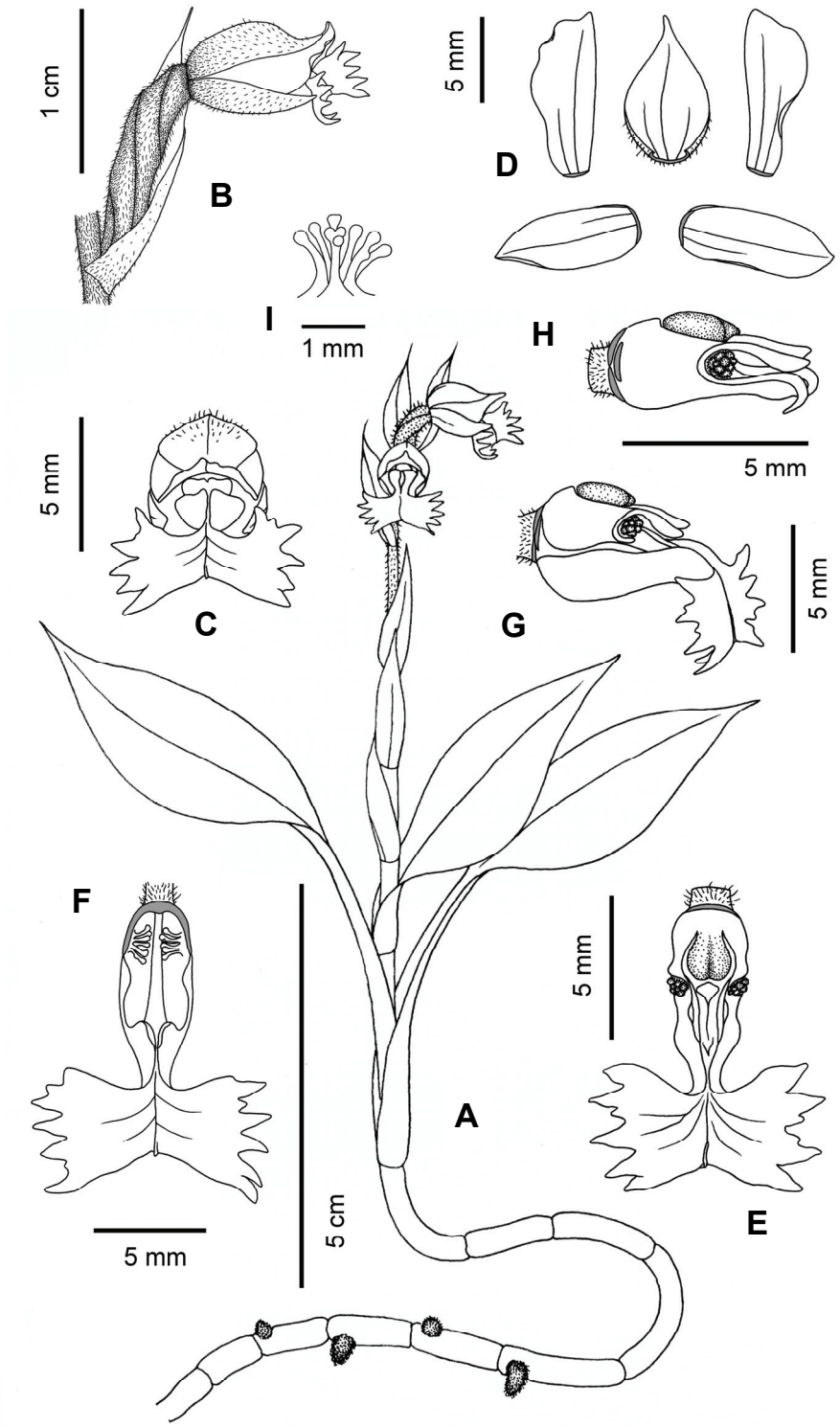


Fig. 1. ***Hayata glandulifera*** **Aver. A: Flowering plant. B: Ovary and flower, side view. C: Flower, frontal view: D: Flattened sepals and petals. E: Column and flattened lip, view from above. F: Flattened lip, view from above. G: Column and lip, side view. H: Column, side view. I: Bunch of glands rising on each internal side wall of hypochile (all drown from the type** ***HAL 12692*** **by author).**

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Fig. 2. *Hayata glandulifera* Aver. Flowering plant in natural habitat and inflorescence (type specimen, *HAL 12692*). Photographs made by author.

mm lt. Hypochilium 4-4.5 mm lg., 3–4 mm lt., glandulis capitatis magnis 6–7 ab utroque latere congestis. Mesochilium 1.5-2 mm lg. Epichilium bilobum, lobis 4.5–5.5 mm lg., 4–5 mm lt., irregulariter dentatis. Columna 4.5–5 mm lg., 2.5–3 mm lt.

Type: VIETNAM, Phu Tho Province, Tan Son District, Xuan Son Municipality, Du village (Xuan Son national park), around point 21°06'57"N 104°57'17"E. Primary broad-leaved closed wet forest on very steep rocky slopes and cliffs of low remnant mountains composed with highly eroded solid marble-like limestone at elevation 400-500 m a.s.l. Terrestrial creeping herb on mossy wet decaying log-timber in humid shady rocky valley of small stream. Flowers white, sepals with light greenish tint, lip at the center with small light yellow spot. Very rare. 16 February 2009. *L.Averyanov, P.K.Loc, N.T.Vinh, L.T.Son, HAL 12692* (LE).

Terrestrial or lithophytic herb with creeping rhizome and ascending leafy floriferous stem. Rhizome, to 25 cm long and 5 mm wide, light green, thick, at nodes with more or less short rudimentary roots. Floriferous stem ascending, 10-15 cm tall, with (2)3(4) leaves at the base; in upper part covered with 3-4 sterile bracts. Leaves petiolate; petiole and sheath to 5 cm long, 4-6 mm wide at the base; leaf blade thick, slightly succulent, 4-8 cm long, 1.5-3 cm wide, uniform glossy green, with indistinct dark green reticulate network of nerves. Scape to 5 cm long, densely tomentose with soft simple hairs bearing 1-2 (or more?) lax flowers. Floral bracts white, sub-hyaline, with 3 light green nerves, 1.5-2 cm long, 3-5 mm wide, longer than ovary. Ovary 1-1.2 cm long, 2-3 mm broad, densely pubescent with soft simple hairs. Flowers odorless, not widely opening, campanulate, 9-10 mm long. Sepals white with green tint along mid-vein. Dorsal sepal 8-9 mm long, 5 mm wide. Lateral sepals 8-9 mm long, 3.5-4 mm wide. Petals white, 9-10 mm long, 4-4.5 mm wide, undulate along lateral margin, free at the base, to the apex densely connivent and forming broad hood with the dorsal sepal. Lip white, with yellow spot at the center (yellow distal margin of connivent lobes of mesochile), 10-13 mm long from base to apex of epichile. Hypochile 4-4.5 mm long, 3-4 mm wide; adnate to the column base in basal half; in free distal part with slightly upturned margins; inside on each lateral wall with sea-anemone-like bunch of 6-7 large capitate, arc-divergent glands 1-1.2 mm long; bottom of hypochile with low longitudinal thickening. Mesochile 1.5-2 mm long. Epichile lobes rectangular or sub-quadrate, each 4.5-5.5 mm long, 4-5 mm wide, with 4-6 large irregular dents along distal margin. Column 4.5-5 mm long, 2.5-3 mm wide; stelidia 2-2.5 mm long, rostellar arms 1.8-2 mm long. Anther large, sub-quadrate to indistinctly obovate, 1.8-2 mm long and wide. Fruits unknown.

Etymology. Species name refers peculiar capitate glands inside hypochile.

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Flowering time. February.

Ecology. Broad-leaved closed evergreen humid forests on rocky limestone at elev. 400-500 m a.s.l. Creeping terrestrial or lithophytic herb on shady slopes, usually along small forest stream valleys on wet mossy substrate.

Distribution. Vietnam (Phu Tho Province, Tan Son District). Endemic. Fig. 3.

New species was found as a very rare plant on the territory of Xuan Son national park (Fig. 3) in small remnant fragment of primary lowland limestone forest. Like recently discovered *Vietorchis aurea* and *Zeuxinella vietnamica* (Averyanov and Averyanova, 2003; Averyanov, 2008) discovered species represents element of the lowland highly endangered flora typical for wide limestone areas of northern Vietnam in prehistoric ages and now nearly extinct.

Comparison of morphological features on three known species of the genus *Hayata* are presented in table 1.

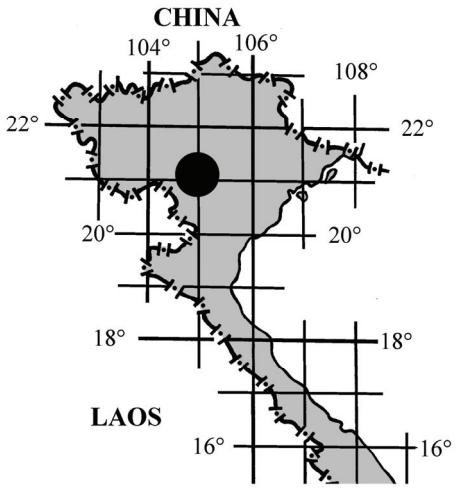


Fig. 3. Locality of *Hayata glandulifera* discovery on the map of Vietnam.

Table 1. Comparison of *Hayata tabiyahanensis, H. sherriffii* and *H. glandulifera.*

Morphological character	*H. tabiyahanensis*	*H. sherriffii*	*H. glandulifera*
Stem	Erect, up to 20 cm	Erect, up to 20 cm	Ascending, 10-15 cm
Rhizome	Short	Short	Up to 25 cm long, creeping
Roots	Well developed	Well developed	Short, rudimentary
Leaves	10 x 5.5 cm	12 x 4.5 cm	8 x 3 cm
Inflorescence	Peduncle long, spike with 3-8 flowers	Peduncle short, spike with 6-10 flowers	Peduncle very short, spike with 1-2 flowers
Hypochile	Keeled on both sides with papillae on keels	Not keeled; on each side with sea-anemone-like calli	Not keeled; on each side with sea-anemone-like calli
Flower color	Sepals tinged with light pink toward the apex, petals and lip white	Sepals and petals pale green, lip white	Sepals tinged with light green along mid-vein, petals white, lip white with yellow center
Petals	8-9 mm long, as long as median sepal	9 mm long, as long as median sepal	9-10 mm long, a bit longer than lateral sepal
Lobes of epichile	Quadrate; serrate along margin	Quadrate; sinuate-dentate along margin	Rectangular or sub-quadrate, with 4-6 large irregular dents along margin

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來自北越的新屬與新種—裂唇早田蘭 (蘭科)

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摘要：來自北越中部低山區的新屬早田蘭與已知的指柱蘭、斑葉蘭、*Rhomboda* 與線柱蘭有密切關係。早田蘭與斑葉蘭屬不同在它具有二個分離的側面柱頭，唇瓣基部內無毛，具有大塊結狀的唇瓣中段與先段形成二片具有裂齒。它與指柱蘭之不同在有甚大的花朵而且花瓣分離，唇瓣基部內側壁上具有腺体，地下莖不具有膨大的節間，與地下莖並沒有被覆根毛。與 *Rhomboda* 屬之不同在新屬唇瓣上不具任何龍骨，唇瓣基部具有內側腺体，蕊柱不具有翅狀附屬物。新屬與線柱蘭屬非常相近，但新屬之外形，大的花朵，裂唇與蕊柱先端之附屬物均可與之區別。除了越南的產地外，新屬尚有分佈於台灣之裂唇早田蘭與分佈於布丹的 *H. sherriffii*。本文內尚介紹了新屬之分類處理與檢索表。

關鍵詞：蘭科、分類、裂唇早田蘭、新屬與新種、北越。

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