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THE GENUS ORTHODONTOPSIS IGNATOV & B.C.TAN (BRYACEAE, BRYOPHYTA) IN RUSSIA, MONGOLIA AND CHINA

РОД ORTHODONTOPSIS IGNATOV & B.C.TAN (BRYACEAE, BRYOPHYTA) В РОССИИ, МОНГОЛИИ И КИТАЕ

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Abstract

Orthodontopsis bardunovii Ignatov & B.C. Tan was described from Altai and Western Sayan Mts. in 1991, as a new species and genus. Since that time its distribution and ecology were much elucidated. Recently this species was collected also in Khubsugul Region in the Northern Mongolia. The closest relative of *O. bardunovii* is the species from Yunnan Province of China *Orthodontopsis lignicola* (Broth.) Ignatov & Tan, comb. nov. (*Funaria lignicola* Broth., *Orthodontium lignicola* (Broth.) Da-cheng Zhang, *Orthodontium bilimbatum* X.J.Li & Da-cheng Zhang). Illustrations and comparison of these two species of the genus *Orthodontopsis* are provided.

Резюме

Orthodontopsis bardunovii Ignatov & B.C. Tan был описан с Алтая и Западного Саяна в 1991 г. как новый род и вид. С тех пор значительно уточнены данные о его распространении на Алтае, вид найден в Прихубсугулье в Монголии. Выявлен ближайший родственник данного вида – это описанный из Юннаня *Orthodontopsis lignicola* (Broth.) Ignatov & Tan, comb. nov. (*Funaria lignicola* Broth., *Orthodontium lignicola* (Broth.) Da-cheng Zhang, *Orthodontium bilimbatum* X.J.Li & Da-cheng Zhang). Приводятся иллюстрации и детальное сравнение этих двух видов.

Orthodontopsis bardunovii Ignatov & B.C. Tan was described by two specimens from South Siberia, one from Altai Mts. and another from the nearby Western Sayan Mts. (Ignatov & Tan, 1991). Originally this new species and genus was compared with *Orthodontium*, which is obviously the closest relative of *Orthodontopsis*, but differs in two important characters: unbordered leaves in all species of the genus (vs. differentiated leaf border in *Orthodontopsis*) and presence of exostome (vs. reduced exostome in *Orthodontopsis,* cf. Meijer, 1951).

Shortly after the description, a number of new localities of *O. bardunovii* were found in Altai (Ignatov, 1993; Pisarenko, 2001), and recent collections of Tsegmed from Khubsugul Lake surrounding in North Mongolia expanded the distributional range of this species up to a distance of ca. 1100 km.

Also recently, Zhang & Li (1996) described a new species from Yunnan, *Orthodontium bilimbatum* X.J.Li & Da-Cheng Zhang that has an intermediate position between *Orthodontium* and *Orhtodontopsis*. *Orthodontium bilimbatum* has bordered leaves, but only slightly reduced exostome, which is similar to that in some species of *Orthodontium*. Subsequent revision of historic collections revealed that the species described by Brotherus (1929) as *Funaria* (*Entosthodon*) *lignicola* is the same as *Orthodontium bilimbatum*, thus the combination *Orthodontium lignicola* (Broth.) Da-cheng Zhang has been proposed (Li, 2002).

The comparison of materials from the South Siberia, Mongolia and South-West China has been undertaken in order to understand the relationships of these taxa.

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The collections from South Siberia and Mongolia are fairly homogeneous in the overall appearance and size. In most collections from Altai strongly eroded exostome teeth remnants can be seen (Fig. 1), in some cases exostome is totally absent. Similar irregular exostome teeth were found in Mongolian specimen, too (Fig. 2). In all other characters Mongolian plants are identical to South Siberian plants.

The type material of *Funaria lignicola* has plants sufficiently smaller than those in Siberian and Mongolian populations (leaves ca. 2 cm long vs. ca. 4 cm long, stem 1-2 mm vs. 2-4 mm long, etc.). However, the type material of *O. bilimbatum* has the dimensional range almost identical to that known in *Orthodontopsis bardunovii*. Thus, we consider that the smaller size of plants from the type collection of *Funaria lignicola* can be explained simply by their non-optimal development.

Peristome characters in the type of *Funaria lignicola* and type of *Orthodontium bilimbatum* are identical, and exostome teeth are obviously better developed than that in *Orthodontopsis bardunovii*: teeth are usually composed of 5-7 plates ('articules'), which remain in between all segments after the careful capsule removal, and their basal portion is not eroded (cf. Fig. 1-2 and Fig. 3), and median line is present (Fig. 2 in Zhang & Li, 1996).

Another character separating Yunnanese and Siberio-Mongolian plants is the structure of costa and leaf border. In the southern populations, cells here have more strongly incrassate walls and the costa almost never has substereid cells that are common in the leaf costa of northern populations. However, these differences are not stable and their ranges of differences are somewhat overlapping.

The present situation, probably, can be interpreted in a way supporting a close relationship of Yunnanese and Siberian-Mongolian plants. Then the next question is raised on their generic placement: are they be better classified in *Orthodontium* or the genus *Orthodontopsis* can be retained for two of them.

When describing their new genus *Orthodontopsis*, Ignatov & Tan noted two main diagnostic characters, in comparison with the genus *Orthodontium*: lack of exostome and presence of leaf border. The former of these two characters must be excluded now. At the same time there are some other shared characted between *Orthodontopsis bardunovii* and *Orthodontium lignicola*, that differ them from other species of *Orthodontium*: (1) presence of leaf border; (2) the anomalous position of archegonia on the stem surface without obvious arrangement; (3) rhizoidal gemmae that were described first by Zhang & Li (1996) for Yunnanese plants and found later in some Siberian plants, although not in all (Fig. 1). These three characters separate *Orthodontium* and *Orthodontopsis*, thus supporing the generic status of the latter.

Another evidence on the not immediately close relationship of *Orthodontium* and *Orthodontopsis* was found in the analysis of Pedersen (2000), who compared *Orthodontopsis* with several possible relatives in the course of generic revision of Bryaceae based on phylogenetics of morphological characters. Pedersen found that *Orthodontopsis* displays, in some analyses, a closer relationship to *Synthetodontium* and *Perssonia* than to *Orthodontium*.

Genus **Orthodontopsis** Ignatov & B.C.Tan

Plants in loose tufts or growing as separate individuals. Stem without central strand and a very weakly differentiated cortical layer, simple or branched at base. Rhizoids numerous in lower part of stem, mostly colorless, rarely brownish, branched, with uniseriate swallen rhizoidal gemmae at ends of some of these branches. Foliage dense. Leaves dull green, erect to spreading when moist, more erect, flexuose or often strongly spiral-twisted when dry, narrowly oblong-lanceolate to linear-lanceolate, acute, gradually narrowed towards base, somewhat keeled in lower 1/3–1/4, entire or weakly serrulate below the apex, bordered up to 0.9 of leaf length; costa ending few cells below apex, in transverse section with ventral cells almost identical to laminal cells, with stereid band (sometimes mixed with substereids and more rarely almost totally composed of substereids) and dorsal epidermis that is well differentiated mostly in lower part of leaf and more weakly developed or sometimes totally lacking in distal part of leaf; laminal cells oblong-hexagonal, mainly with length to width ratio (2.0-)2.5-4(-5):1, thin-walled, toward leaf base slightly larger and relatively longer (3-5:1), oblong-rectangular; leaf border mostly bi-(tri-)-stratose, composed of 1-3 rows of cells with narrow or moderately narrow lumen, narrowly linear in front view. Perichaetial leaves not much differentiated. Autoicous. Antheridia terminal at lateral shoot ends, archaegonia terminal and also scattered along stem. Sporophytes found regularly on many plants in each population, one from one shoot, mature in early summer. Seta pale brown, twisted, flexuose, often curved

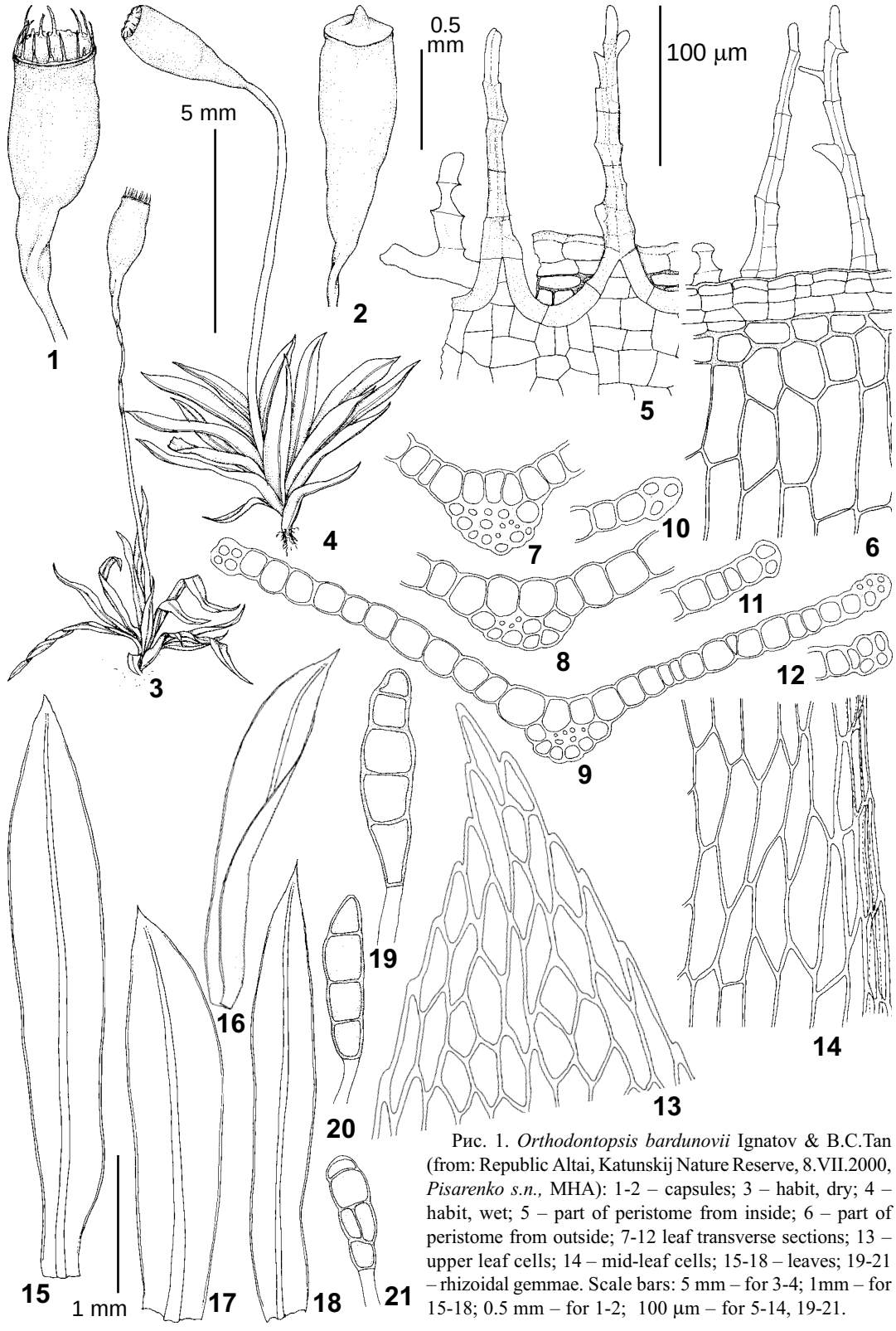

Рис. 1. *Orthodontopsis bardunovii* Ignatov & B.C.Tan (from: Republic Altai, Katunskij Nature Reserve, 8.VII.2000, *Pisarenko s.n.,* MHA): 1-2 – capsules; 3 – habit, dry; 4 – habit, wet; 5 – part of peristome from inside; 6 – part of peristome from outside; 7-12 leaf transverse sections; 13 – upper leaf cells; 14 – mid-leaf cells; 15-18 – leaves; 19-21 – rhizoidal gemmae. Scale bars: 5 mm – for 3-4; 1mm – for 15-18; 0.5 mm – for 1-2; 100 μm – for 5-14, 19-21.

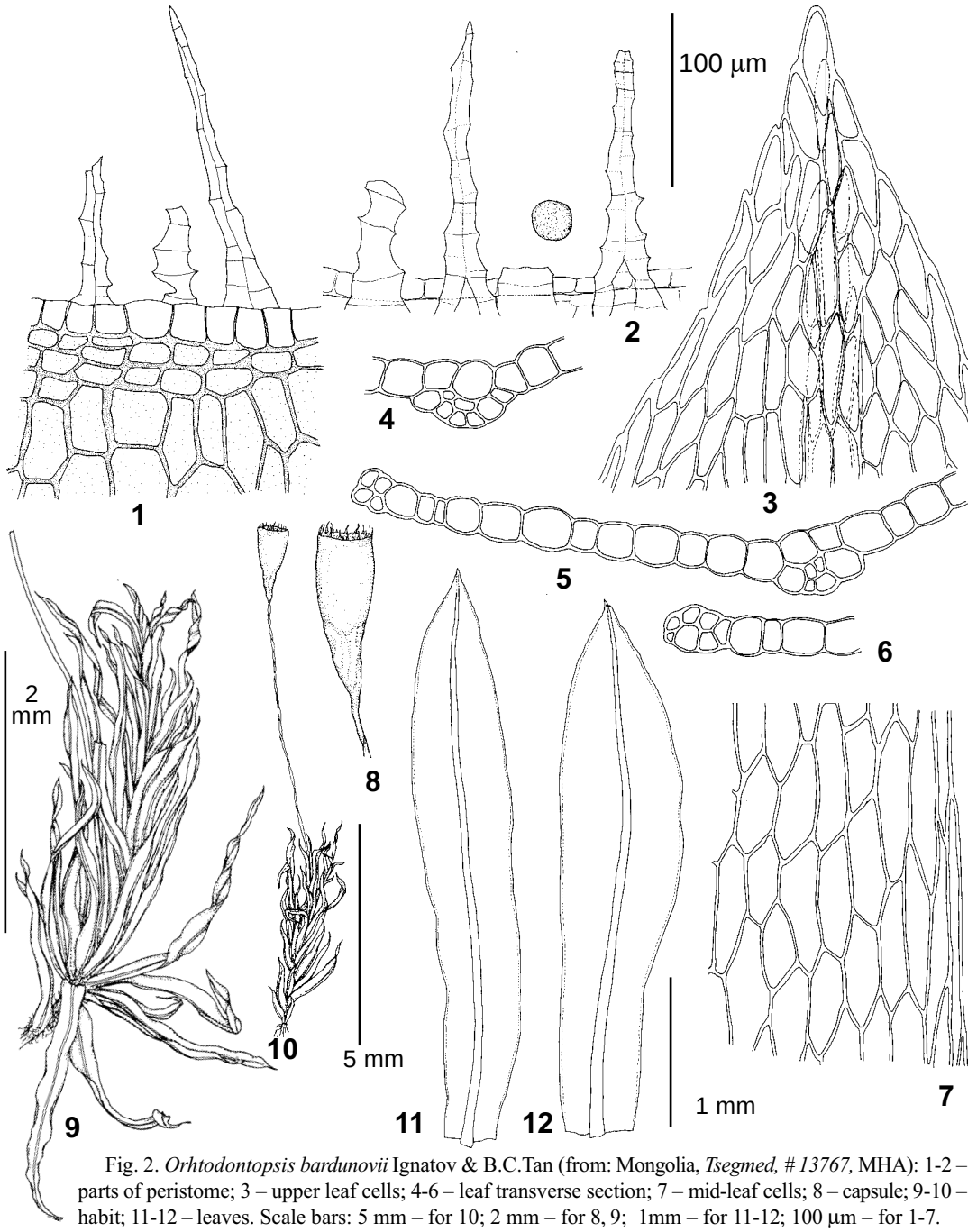

Fig. 2. *Orhtodontopsis bardunovii* Ignatov & B.C.Tan (from: Mongolia, *Tsegmed, # 13767,* MHA): 1-2 – parts of peristome; 3 – upper leaf cells; 4-6 – leaf transverse section; 7 – mid-leaf cells; 8 – capsule; 9-10 – habit; 11-12 – leaves. Scale bars: 5 mm – for 10; 2 mm – for 8, 9; 1mm – for 11-12; 100 μm – for 1-7.

below capsule, 3-5 times longer than capsule. Operculum shortly conic to flat with short and obtuse conic beak. Capsule pale-brown, more or less symmetric, but due to seta flexuosity varying from erect to inclined or horizontal, cylindric, gradually tapering to a neck that consitutes ca. 1/3 of capsule length. Exothecial cells elongate-rectangular, thin-walled, except 3-6 rows below mouth. Annulus absent. Perisome much reduced: endostome with long and narrow cilia, without basal membrane; exostome with irregular, short and eroded to totally reduced teeth; peristome parts pellucid to pale brownish, smooth, very fragile. Spores spherical, finely papillose, 15-20 μm in diameter. Calyptra not known.

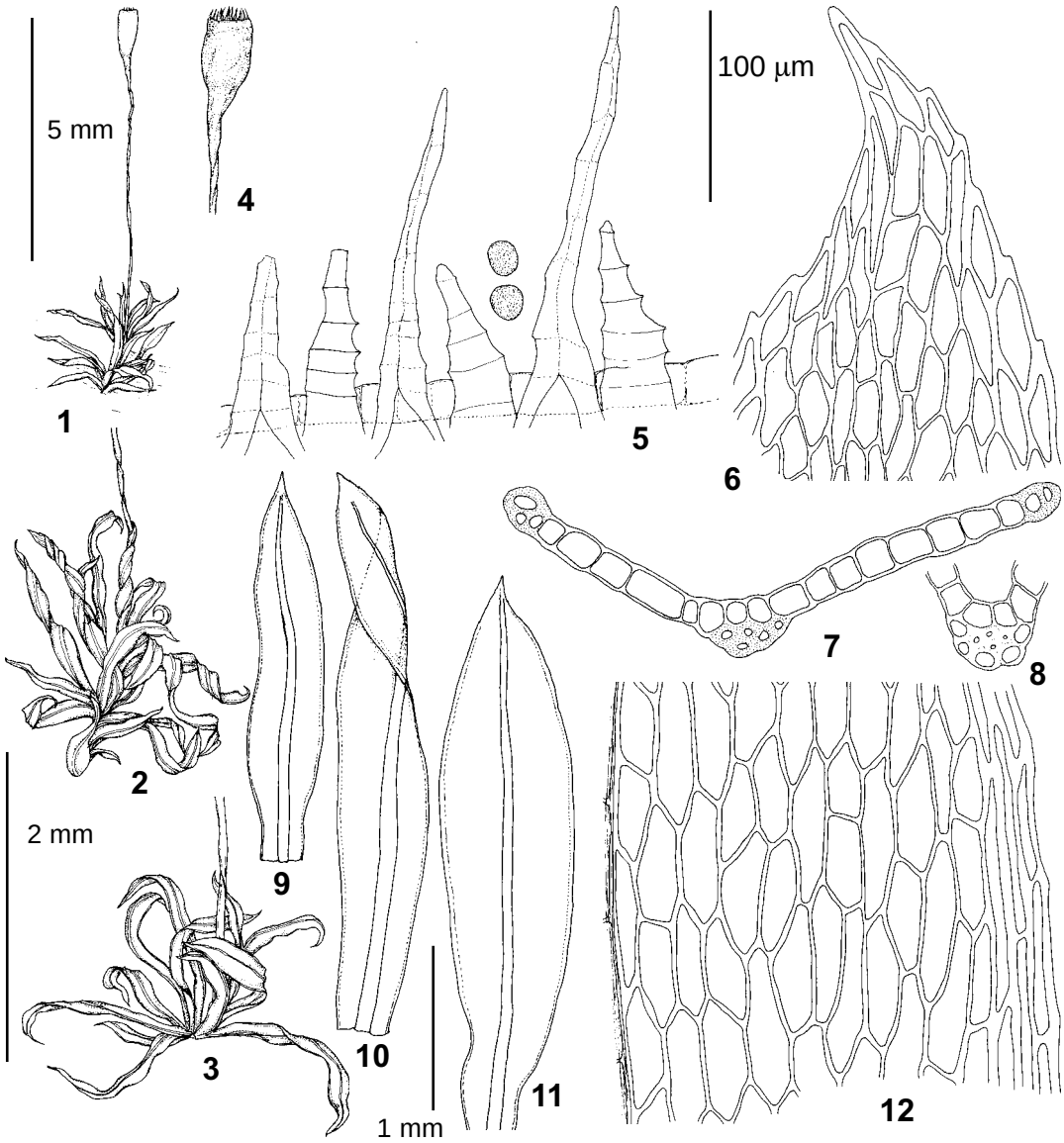

Fig. 3. *Orthodontopsis lignicola* (Broth.) Ignatov & B.C.Tan (from the holotype of *Funaria lignicola*, Handel-Mazzettii, Diar. Nr. 1285, W): 1-3 – habit; 4 – capsule; 5 – part of peristome; 6 – upper leaf cells; 7 – leaf transverse section in upper half of leaf; 8 – costa transverse section in lower third of leaf; 9-11 – leaves; 12 – basal leaf cells. Scale bars: 5 mm – for 1; 2 mm – for 2-4; 1 mm – for 9-11; 100 μm – for 5-8, 12.

Orthodontopsis bardunovii Ignatov & B.C.Tan, J. Hattori Bot. Lab. 71: 169. 1992. Holotype: "Altai Mts., 50 30'N – 89 10'E, 2100 m, Karakem River valley near Ayulyuyuzyuk Creek mouth, Pinus sibirica forest. On soil and wood at base of fallen trunk. 20.VI.1989. M.Ignatov (MHA!, isotype FH).

Stem 2-5 mm long, leaves (2.0-)2.5-3.5(-5.0) mm long, (0.25-)0.4-0.6 mm wide; laminal cells (35-)45-70(-90) x 15-22(-27) μm. Seta 3-6 mm long, capsule ca. 2 mm long. Exostome teeth irregular, much eroded, up to 30 μm long, consisting of 3-5 plates. Endosome segments 100-150(-200) μm long.

In Altai this species occurs in quite narrow altitudinal belt at 1400-2100 m alt., or, in other terms, 200-300 m below forest-line. Forest here is composed by *Pinus sibirica* or *Larix sibirica*. Late melting of snow (in late May – beginning of June) and sporadic snowfalls throughout summer

time make the environment rather cold, resulting in low fungi activity and thus slow wood decomposition. Many logs laid for many years, but only slightly decayed. Their basal face and overhanging surfaces become very eroded, with many 'cavities', and these hollows provide the ideal habitats for *Orthodontopsis*. These conditions can be found only in a really wild areas. In the proximity of settlement, forest has been used heavily for timber and firewood and even if some logs can be found, their concentration is too low to maintain the population of *Orthodontopsis*. We never saw *Orthodontopsis* within the proximity of settlements, as well as in proximity to tourist places (where timber is collected for building fire).

Selected specimens examined: **Mongolia:** Khubsugul, Zhankhoi Pass, *Larix* forest, on rotten log, 12.VII.2005, *Tsegmed, #13767* (MHA). **Russia:** ***Altai Mts***.: Kayakkatuyaryksky Creek, 1800 m, *Ignatov, #8/2* (MHA); same place, 1600 m, *Ignatov, #8/104* (MHA); same place, 1950 m, *Ignatov, #8/93* (MHA); Kayra Creek, 1600 m, *Ignatov, #14/1* (MHA); Seminskiy Pass, 1800 m, *Ignatov & Ignatova, #25a/26* (MHA); Katunsky Range near Srednee Multinskoe Lake, 1800 m, 8.VII.2000, *Pisarenko s.n.* (MHA); ***Western Sayan Mts***: Karasu Creek, 1700 m alt., 16.VII.1968,*Bardunov s.n.* (IRK, MHA).

Orthodontopsis lignicola (Broth.) Ignatov & B.C.Tan, comb. nov. – ***Funaria lignicola*** Broth., Symb. Sin., 48. 1929. Holotype: "Handel-Mazzettii, iter sinense 1914-1918, sumptibus Academiae scientiarum Vindobonensis susceptum Nr 7137. *Funaria lignicola* Broth., sp. nova (Entosthodon) det. Brotherus. Yunnan bot-occid.: in montis Waha prope pagum Yungning regione frigide temperata infra casulam Maoniubi. Subst. truncis Abietum alt s. m. ca. 3800-4030 m. Leg 21.VII.1915 Dr. Frh. v. Handel-Mazzettii (Diar. Nr. 1285)" (WU!, isotypes: W!, S!, H!). – ***Orthodontium lignicola*** (Broth.) Da-cheng Zhang , *Flora Yunnanica* 18: 385. 2002 [this combination has been done in 2000 in the 3d volume of Moss flora of China but without requirements of the International Code of Botanical Nomenclature and, thus, is considered illegitimate (Cao & Koponen, 2004)] – ***Orthodontium bilimbatum*** Xing-Jiang Li & Da-Cheng Zhang, Acta Bot. Yunnanica, 18: 416. 1996. Type: Yunnan Mt., Meilixueshan, Deqin Xianm 3400 m alt., 29.IX.1994 Zhang D.C. #333; Tianchi, Zhongdian Xian, 3750 m, 20.IX.1994 Zhang D.C. #333 (HKAS!).

Stem 1.5-4 mm long, leaves (2.0-)2.5-4.5(-5.0) mm long, (0.25-)0.4-0.6 mm wide; laminal cells 60-100 x 18-24 μm. Seta 5-8 mm long, capsule ca. 2 mm long. Exostome teeth up to 100 μm long, consisting of 6-8 plates, sometimes with median line. Endosome segments 100-150(-200) μm long.

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