STUDIES ON THE TYPE SPECIMENS OF ODONTOSCHISMA (HEPATICAE) IN ASIA AND THE PACIFIC

M. L. So

ABSTRACT. Five species of Odontoschisma are represented in Asia and the Pacific: O. denudatum (Mart.) Dumort., O. grosseverrucosum Steph., O. purpuratum Herzog, O. sandvicense (Ångstr.) A.Evans, and O. subjulaceum Aust. Two synonyms are proposed and a key to the species in this region is provided. Odontoschisma spaghni (Dicks.) Dumort. is excluded from this region and O. grandistipulum Steph. is treated as a doubtful species. 

KEY WORDS: Hepaticae, Odontoschisma, Asia

INTRODUCTION

Odontoschisma is a small genus of Cephaloziaceae with 46 species names listed in the Index Hepaticarum (Geissler & Bischler 1989). The genus is best developed in the Neotropics (5–6 species), but several species also occur in the northern temperate regions (Paton 1999). Only one species (O. africanum (Pears.) Sim) is present in Africa and a few occur in Asia and the Pacific. In Asia and the Pacific region, out of a total of 10 species names listed, several had been placed under the synonymy of the common O. denudatum. According to Vána (1993: 251), three species, including one endemic, are present in Borneo, but “differences between taxa are narrow, especially with reference to the colour of plant and concavity of leaves.”

Depending on habitat and exposure to light and humidity, plants in this genus are extremely variable in colour, cell size, verruculosity of the cuticle and the presence of gemmae, and separation of species is very difficult. According to Schuster (2002), a distinct border of marginal cells of leaf (as in O. sphagni) and the usual presence of gemmae could be used as reliable characters in species separation.

TAXONOMIC TREATMENT

Odontoschisma (Dumort.) Dumort., Recueil Observ. Jungerm.: 19. 1835.—Type: O. spaghni (Dicks.) Dumort.

Plants usually small with dorsal, lateral-intercalary, ventral or even terminal branching (Crum 2001: 232); flagelliform branches frequent. Underleaves vestigial, often with slime papillae, but these are strongly appressed to stem and easily overlooked. Leaves unlobed, succuluous, somewhat concave to strongly so, cells with large trigones, sometimes confluent, each with a few large oil bodies; gemmae often present at leaf margins at shoot apex or attenuate shoots. Dioicous. Sex organs rarely seen, on short ventral branches. Female bracts and bracteoles larger than leaves, bilobed, perianths cylindrical, mouth lobed, margin entire or ciliate. Androecia with 4–10 pairs of small bracts. Capsules cylindric or obovoid.

1 Biology Department, Hong Kong Baptist University, 224 Waterloo Road, Hong Kong.
Key to the species of *Odontoschisma* in Asia and the Pacific

1. Leaf margin with a thick cuticle ................................. *O. purpuratum*
2. Leaf margin with a thin cuticle ................................... 2

1. Leaves oblong-rotundate, margin not incurved ...................... *O. sandvicense*
2. Leaves orbicular or ovate, margin slightly to strongly incurved ... 3

3. Plants up to 4 cm long, 0.9–1.9(2.5) mm wide ...................... *O. denudatum*
4. Plants 1 cm long, 0.7–1.0 mm wide ............................... 4

3. Leaves closely imbricate, 0.6–0.8 mm long. 0.3–0.4 mm wide ...... *O. subjulaceum*
4. Leaves contiguous, margins flat, 0.35 mm long, 0.25 mm wide .......... 4

............................................................ *O. grosseverrucosum*


Fig. 1, 6: a, b


Illustrations: Inoue (1974: Pl. 63); Stephani (1985: Icon. n. 4666 as *Jamesoniella naviculare*, n. 7888–7889 as *O. denudatum*, n. 7911 as *O. cavifolium*, n. 7912 as *O. exciputatum*); Gao & Cao (2000: Pl. 61); Zhu & So (2001: Fig. 21).


Distribution: Asia, America and Europe.


*Malaysia*: Sabah: Kinabalu, mossy subalpine forest above Paka Cave, on tree trunk, ca. 8000–9000 ft, Jul 1960, *W. Meijer* s.n. (S[B73311]); Mt Kinabalu, on trunk, 7000–8000 ft, *Clemens* 10533 (FH).

*New Caledonia*: Nouméa, 1909, *Le Rat* s.n. as *O. subjulaceum* (PC); Tão, 600 m, June 1910, *Franc* s.n. as *Jamesoniella naviculare* (PC); Monte Koghi, 1 Nov 1909, *Franc* s.n. as *O. subjulaceum* (FH, PC); Ignambi, 1050 m, 15 Sept 1951, H. Hürlimann 2952 (G); Yate, 170 m, 29 Mar 1951, *Guillaumin & Hürlimann* 11693 (G); Yate, 220 m,
Fig. 1. *Odontoschisma denudatum* (Mart.) Dumort. a. Portion of plant, dorsal view. b. Portion of plant, ventral view. c. Marginal cells of leaf. Scale: 0.3 mm (a, b); 0.05 mm (c). All from *Le Rat* s.n., syntype of *O. naviculare* in JE.

1951, *H. Hürlimann* 2323 (JE). **Papua New Guinea.** Morobe, summit of Mt Kaindi, near Wau, 8000 ft, 19 Aug 1984, *M. Thiers* 3414, 3435 (NY). Southern Highlands, Forestry Station Onim, 14 km NNW of Ialibu, 2250 m, 10 Sep 1982, *H. Streimann* 23556 (CANB). **Philippines.** Luzon, Mt Tabayoc, Lake Ingcolos, 2424–2450 m, 15 Feb 1968, *M. Jacobs* B455 (CANB); Mt Caua, Bontoc, *M. Ramos* s.n. as *O. subjulaceum* (S[B73321]).

*Odontoschisma naviculare*, the only species from New Caledonia, was previously distinguished from the closely related *O. denudatum* by the strongly concave leaves and the lack of underleaves. In the key to species of *Odontoschisma* in Sabah (Vána 1993), the only difference between *O. naviculare* and *O. denudatum* seems to be the strongly concave leaves of the former and those in *O. denudatum* are slightly so. But the illustration drawn
from the type of *O. naviculare* (shown here in Fig. 1) indicates that leaves are not very concave. Due to the strong malleability of *O. denudatum* in plant colour, cell size, verruculosity of cuticle, size of trigones and leaf shape, *O. naviculare* could be placed under the synonymy of *O. denudatum*. Schuster (2002: 85) commented that the leaves can be concave, saucer-like, suborbicular and broadly ovate. Furthermore, underleaves are often indistinct in mature portions of the shoot and barely visible in gemmiferous shoots.


![Fig. 2. *Odontoschisma grosseverrucosum* Steph. a. Portion of plant, ventral view. b. Marginal cells of leaf. c. Portion of plant, dorsal view. d. Leaves. Scale: 0.5 mm (a, c); 0.05 mm (b); 1.25 mm (d). All from *Faurie* 22, lectotype in G.](image-url)
type: G-000641!); Faurie 1311 (syntype: G-000639!).

Illustrations: Hattori (1944: Fig. 46c, d); Stephani (1985: Icon. n. 7913); Gao & Cao (2000: Pl. 62).

Description: Hattori (1944: 76).

Distribution: East/Southeast Asia.


*Odontoschisma grosseverrucosum* appears to be a miniature *O. denudatum*. It differs by the smaller size of plant, spreading leaves, somewhat smaller size of subapical cells of leaf (11–15(20) μm), and the presence of verruculose cuticle. But from the range of specimens examined, cell size at the leaf margin varies considerably in different populations: from 11 μm to 24 μm. Even the type material of *O. cavifolium* and *O. exciputatum* (synonymized with *O. denudatum*) have similar cell size as *O. grosseverrucosum*. Furthermore, the cuticle of leaf cells in *O. denudatum* is also described as verruculose in both European (Paton 1999) and American plants (Schuster 1974), but sometimes smooth in shaded populations.

In the Stephani’s collection are several syntypes of *O. grosseverrucosum* and at least two were collected from Japan and four from Taiwan, all by Faurie. Icon. n. 7913 was drawn from Faurie 13.


Illustration: Herzog (1950: Fig. 16).

Description: Herzog (1950: Fig. 16).

Plants pale green to reddish purple, up to 1 cm long, 1.0–1.2 mm wide, leaves imbricating, slightly concave, ovate to rotundate, 0.5–0.6 mm wide and long, submarginal cells 18–20×20–22 μm, thick cuticle of marginal cells with conspicuous extensions of middle
Odontoschisma purpuratum Herzog. a, b. Portions of plant, dorsal view. c. Marginal cells of leaf. d. Gemmae. Scale: 0.3 mm (a, b); 0.05 mm (c, d). All from Richards 2162, isotype in L.

Iamellae from submarginal cells, basal cells 20–22×25–30 μm, trigones large, almost as large as lumen. Underleaves vestigial. Gemmae 1–celled (20 μm), at the apex of imbricating leaves of young shoot. Sex organs not seen.

Distribution: Endemic to Borneo.

Additional specimen examined: Malaysia. Sarawak, G. Dulit, 1932, A. D. Bauwell 104 (L).

Odontoschisma purpuratum is a little known species endemic to Sarawak. According to the key in Vána (1993), the reddish colour is regarded as a distinct feature to distinguish it from O. denudatum. However, some of the shoots in the type material are pale yellowish while several are tinged with purple. Schuster (2002: 85) commented that O. denudatum is very malleable and plants growing in sun may be reddish brown or even purplish black.
Colour then, may not be a reliable character to separate different species. Even though the leaves of this species resemble those of *O. denudatum*, the most distinctive feature is the thick cuticle along the margin of each leaf. Though gemmae were not mentioned in the original description, scattered 1–celled gemmae were seen adhering to the apical portion of a small gemmiferous shoot (drawn here in Fig. 3d). In addition to the type material, only one other collection belongs to this species.


Illustrations: Stephani (1985: Icon. n. 7914 as *O. gracile*, n. 7916 as *O. sandvicense*).

Description: Plants greyish green, soft-textured, 1.0–3.0 cm long, 2.1–2.14 mm wide with leaves, rhizoids numerous on ventral surface, stem 0.2–0.23 mm wide, leaves widely spreading, moderately imbricate to contiguous, 0.9–1.0 mm wide, 0.95–1.05 mm long, dorsal leaf base not decurrent, marginal cells 10–12 X 16–20 μm, median cells 20–25 X 24–30 μm, basal cells 20–25 X 35–38 μm, trigones medium-sized to large, walls thin, cuticle slightly verrucose. Underleaves vestigial. Gemmae on attenuate shoots, 1–2 celled, 20–25 μm in diameter. Male plant not seen. Gynoecia on short lateral branches, perianth cylindric (very battered).

Distribution: Endemic to Hawaii.

Specimens examined: Hawaii. Locality unknown, Baldwin s.n. (FH, M); Hillebrands s.n. as *O. gracile* (NY); Hawaii, Mauna Kea truck trail, Kamuela to Pohakuloa, 5 miles from Kamuela, 20 Jun 1953, H. A. Miller 4712 (MU); Kauai, Kohala, 1938, L. M. Cranwell, *O. Selling & C. Skottsberg 5401* (S[B73313]); Kohala, above Waima Valley, 9 Sep 1938, O. Selling 5038 (S[B73315]); Kauai, Gay summer house, Mar 1910, Faurie 136, det Stephani (BM); Kauai, Alakai Swamp, 4000 ft, 17 Aug 1936, M. C. Neal s.n. (BISH-142006); Kauai, Kokii, Pihea Trail, 25 Mar 1979, G. Y. Daida 263 (BISH-684389); O. Degener 21615L as *O. subjulaceum* (BISH-142016, BISH-142013, HBG as *O. sandvicense*, L); O. Degener 21617 as *O. subjulaceum* (BISH-142023, BM, NY); Kauai, Kokee, 2 Jan 1952, O. Degener 21592h (BISH-142034, HBG); Kauai, Nualolo Trail near Forest Ranger’s Station, Kokee, 3600 ft, May 1933, T. G. Yunker 3656b (NY); Kauai, Lehua Makaneo, 13 Aug 1938, L. M. Cranwell & C. Skottsberg 5297 (NY, S[B73314]); Kauai, Kohoe, 13 Aug 1938, L. M. Cranwell, *O. Selling & C. Skottsberg 5426 as O. subjulaceum* (NY, S[B73333]); Kauai, above Waimea, 1–8 Oct 1895, A. A. Heller 2800 (BISH-142008, BM, FH, MU, NY); Maui, rim of Ukumehame Canyon, 14 Jul 1934, R. D. Sviha 34-143 (BISH-142054); R. D. Sviha 34-128 as *O. subjulaceum* (BISH-142005); Maui, Maunahooma, Jun 1910, C. N. Forbes s.n. as *O. subjulaceum* (BISH-142044, BISH-142010); Molokai, at Puu Kolekole and below to 3000 ft, Kawela Ahupuaa, 31 May 1953, HAM & AHRL 3671 as *O. gracile* (MU); Molokai, along trail from west side of head of Aikolu Canyon to Kokekole, 4000 ft, 1 Jun 1953, H. A. Miller 3733 (MU); Molokai, edge of Waiananu, 31 Mar 1915, C. N. Forbes 698cMo (BISH-142052); Molokai, Jul 1903, C. M. Cooke Jr 51 (BISH-142025); Oahu, Waahila Ridge Trail, 5 Nov 1979, C. S. Futa 55 (BISH-684394); C. S. Futa 53 as *O. subjulaceum*
Fig. 4. *Odontoschisma sandvicense* (Ångstr.) A. Evans. a, f. Portions of plant, dorsal view. b. Portion of plant, ventral view. c. Leaf. d. Marginal cells of leaf. e. Basal cells. f. Gemmae. Scale: 0.5 mm (a–c); 0.05 mm (d–f). a–e from *N. J. Anderson s.n.*, lectotype in S[B-47919]; f, g from *C. M. Cooke, Jr. 4* in FH.

(BISH-684397); Oahu, Beechey s.n. as *O. gracile* (G-20691); Oahu, lower slopes of Konahuanui, above Manoa, 6 May 1895, *A. A. Heller 2277* (FH); Oahu, Pali Road, Jul 1958, *R. Treaster 6193* (NY); Oahu, Mt Kaala, on bark, 28 Jun 1934, *R. D. Sviha 34-7* (BISH-142050); Oahu, Punalu'u, 4 Aug 1935, *R. D. Sviha 35-178* (BISH-142045); Oahu, Palikea ridge trail, 2900 ft, 19 Apr 1975, *E. Funk s.n.* (BISH); Oahu, Kawaiiki ditch trail, Koolau Mts, 1000 ft, 18 Jan 1953, *H. A. Miller 2345* as *M. subjulaceum* (MU); Oahu, Halawa Trail, North Halawa, Koolau Mts, 1150–2300 ft, 14 Dec 1952, *H. A. Miller 2792* (MU); Oahu, Puu Konahuanui Trail, Koolau Mts, 1600–3000 ft, 12 May 1970, *L. E. Bishop 127014, 127016* (BISH); Oahu, Koolau Mts, Poaneho Trail, 2100 ft, 16 Mar 1975, *P. K. Hi-
M. L. So: Studies on the type specimens of *Odontoschisma* 257

...369 (BISH); Oahu, Mauna, 2000 ft, Jul 1899, C. M. Cooke, Jr. 4 (BISH-142009, BISH-142012, FH, NY, S[B73312]); 1899, C. M. Cooke, Jr. 22 (BISH-142011); C. M. Cooke, Jr. s.n. (BISH-142014).

This species is characterized by having contiguous to moderately imbricate spreading leaves, almost flat, not concave, margin without a distinct border, cells with medium-sized trigones, and cuticle slightly verruculose as in most species of *Odontoschisma*, underleaves vestigial, and with numerous rhizoids. It differs from *O. denudatum* which has incurved dorsal leaf bases. The type material of *O. gracile* resembles the smaller branches of *O. sandvicense*, having contiguous, widely spreading, flat leaves and similar size of cells and large trigones. A few gemmae are also present at the apex of gemmiferous shoot.


Illustration: Stephani (1985: Icon. n. 7914).

Description: Plants sterile, rigid, purplish red, shoots up to 1 cm long, 0.8—1.0 mm wide with leaves, rhizoids scanty. Stem 0.18 mm wide, leaves imbricate, strongly concave, 0.6—0.85 long, 0.35—0.45 mm wide, subapical cells of leaves 18×25—27 μm, basal cells 25—27×30—36 μm, trigones large, walls thin, cuticle slightly verruculose. Underleaves vestigial. Gemmae on attenuate shoots, 1-celled, 20—25 μm in diameter. Sex organs not seen.

Distribution: Endemic to Hawaii.


*Odontoschisma subjulaceum* has a julaceous habit and the very concave leaves are closely imbricate. Plants are very small and easily distinguished from *O. sandvicense* which has widely spreading leaves. Two syntypes were mentioned in the protologue of *O. subjulaceum*, but the original material from Australia legit Drummond could not be located and its identity confirmed. This species was not included in the list of Australian hepaticae by Scott & Bradshaw (1986).
Fig. 5. *Odontoschisma subjulaceum* Aust. a. Portion of plant, dorsal view. b. Plant, lateral view. c. Portion of plant, ventral view. d. Gemmae. e. Marginal cells of leaf. f. Leaf. Scale: 0.5 mm (a–c, f); 0.05 mm (d, e). a from Baldwin 233, isolectotype in FH, the rest from isolectotype in MU.

Studies on the type specimens of *Odontoschisma*
EXCLUDENDUM


The leaves of this species have a distinct border of marginal cells which are quite different from the submarginal cells. This border is formed by 1–2(3) rows of cells radially elongate with thickened walls. This species was recorded from Sichuan, China by Yi & Gao (2001: 46) and Yunnan, China by Gao & Cao (2000). But according to the key provided, no mention was made of this distinct border of cells, only that the cell walls of leaves are unevenly thickened. The illustration of this species from Sichuan did not show the distinct border of cells with radially elongate walls and large trigones (compare Paton 1999: 130). Instead, at least six rows of cells of similar size are drawn from the leaf. The only collection (Cao & Li 41339) cited in Yi & Gao (2001) could not be located in IFSBH as stated. However, three Chinese collections, all sterile and incorrectly identified as O. spagni, were available from IFSBH (Guangxi, Xingan, C. Gao 1266; Liaoning, Jinjiangshan, 1973, C. Gao & G. C. Zhang 8532; Sichuan, Jiangtsin Co., 1989, T. Cao & Q. Li 41638). The occurrence of this species in China is doubtful and its presence in Sri Lanka and Java had already been doubted by Vána (1993: 253).

DUBIA


According to the original description and illustration in Icon. 7915 by Stephani (1985), this species does not belong to Odontoschisma at all. It mentioned the large under-leaves connate with the leaves. In the original type material in G and BM, is a mixture of a number of hepatics and mosses. Stephani could have mistakenly taken a specimen of Lophocolea sp. or Heteroscyphus sp. for the description and illustration. Among the mixture are shoots of O. sandvicense, a species fairly common in Hawaii. The leaves are widely spreading and almost contiguous. Furthermore, 1–2 celled gemmae are present in attenuate shoots. Odontoschisma grandistipulum is here treated as a dubious species because the original description and illustration did not refer to any known species of Odontoschisma. The lectotype (Faurie 108) designated here, together with the syntype (Faurie 275) is referable to O. sandvicense.


ACKNOWLEDGMENTS

The author is grateful to the curators of the following herbaria for the loan of specimens including types: BISH, BM, CANB, FH, G, HGB, IFSBH, JE, L, M, MU, NY, PC, S, and W.
M. L. So: Studies on the type specimens of *Odontoschisma*

**LITERATURE CITED**


