

Japanese Species of *Parmelia* Ach. (sens. str.), Parmeliaceae (4)

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Four species of Japanese *Parmelia* are revised. The occurrence of *P. omphalodes* and *P. saxatilis* in Japan is reported for the first time. Specimens previously reported as *P. fertilis* should be identified as *P. praesquarrosa*, a new species, which is clearly separated from the former by the presence of squarrose rhizines and the lack of helmet-shaped lobules. *P. pseudoshinanoana* can not be considered as the lobulate morphotype of *P. shinanoana*, though these two species have similar lobes white-rimmed with marginal pseudocyphellae.

(Continued from J. Jpn. Bot. 69: 204–213, 1994)

Parmelia omphalodes (L.) Ach., Meth. Lich. 204. 1803.

Lichen omphalodes L., Sp. Pl. 1143. 1753. Type collection. Specimens and Dillenius 1742, pl. 24: fig. 80A (lectotype in OXF).

Parmelia saxatilis f. *munda* Schaer. in sensu Asahina, J. Jpn. Bot. 26: 354, 1951.

Thallus adnate on rocks or less commonly on bark of trees, mineral gray with brownish or blackish brown tinge, 4–7 cm broad, lobes subirregular to sublinear, contiguous or imbricate, 2–4 mm wide, obtuse or rotund at the apices, isidia and soredia lacking, upper surface more or less shiny, continuous or sometimes foveolate, sometimes brownish or blackish brown especially near the apices of lobes, often cracked along older pseudocyphellae, pseudocyphellae marginal and laminal, marginal pseudocyphellae inconspicuous, discontinuous, sometimes gray or blackish gray, laminal pseudocyphellae linear elongate, usually more than 1 mm long and forming a subreticulate network, white-rimmed and more or less elevated, blackening and indistinct on older lobes;

medulla white; lower surface black, moderately rhizinate, the rhizines simple to furcate, 0.5–1.5 mm long. Pycnidia common, conidia about 6 μm long. Apothecia not common, substipitate, 3–12 mm in diameter, amphithecium rugose and distinctly pseudocyphellate, hymenium 50–65 μm high, spores often poorly developed, 7–10 \times 10–15 μm .

Chemistry. Atranorin, salazinic acid, lobaric acid (+ or –), fatty acids (+ or –), and rarely with trace of protocetraric acid.

Distribution. Europe, North America including Alaska and Canada (Hale 1987), Aleutian and Kurile Islands, Japan and Korea.

Parmelia omphalodes seems to be one of the commonest circumpolar arctic and boreal species of the genus and exhibits a great range of variation of thallus color (from whitish mineral gray to blackish brown), dimension of pseudocyphellae (from short and rather sparse to long and well developed as a laminal network), and secondary lobation (from heavily lobulate to without secondary lobules). Skult (1984) made a notable study of the species in Finland and

recognized three subspecies under *P. omphalodes*: ssp. *omphalodes*, ssp. *discordans* (Nyl.) Skult, and ssp. *pinnatifida* (Kurok.) Skult. Subspecies *discordans* was separated by the presence of protocetraric acid and ssp. *pinnatifida* by the absence of lobaric acid from ssp. *omphalodes*. Subspecies *discordans* was often recognized as a separate species, *P. discordans* Nyl., by many lichenologists (Culberson 1970, Kurokawa 1976, Hale 1987) even in recent years. On the other hand, Hale (1987) simply reduced ssp. *pinnatifida* as a synonym of *P. omphalodes*, though Kurokawa (1976) proposed that it should be separated as a distinct species. I will not make further discussion about these subspecies in this paper, simply because no specimen referable to *P. discordans* and *P. pinnatifida* Kurok. has been found in Japan.

Populations of *P. omphalodes* in Japan are morphologically referable to European *P. omphalodes* ssp. *omphalodes*. Even though Skult (1984) reported *P. omphalodes* ssp. *pinnatifida* from Japan, no specimen referable to the subspecies has been found. Although I have not had a chance to examine the specimen (Yasuda 376 collected on Mt. Akagi, Prov. Kozuke) reported as *P. omphalodes* ssp. *pinnatifida* by Skult, the specimen may be referred most probably to *P. pseudoshinanoana*, which has marginal pseudocyphellae and richly branched lobules as in ssp. *pinnatifida*.

In Japan, *P. omphalodes* has been confused with *P. saxatilis*, *P. pseudosaxatilis* Asah. (Asahina 1951, 1952), and *P. cochleata* (Yoshimura 1974), probably because all of them have similar whitish gray thalli. In fact, Japanese *P. omphalodes* looks quite different from that found in Europe. The thallus is usually whitish to greenish gray in Japan but it is generally dark chestnut brown or even blackish brown in Europe (Skult 1984). The difference in color of the thalli does not seem to be so important to separate species. In addition, the closer study of Japanese populations revealed that they are mostly saxicolous as in Europe

and no significant morphological difference has been found between Japanese and European populations. In Japan, this species is rarely corticolous, being found on twigs of *Pinus pumila* in the alpine zone.

The present species resembles *P. fertilis*, from which it is distinguished by well developed pseudocyphellae usually white-rimmed and more or less elevated and often forming a subreticulate network. It also lacks helmet-shaped secondary lobules, which are characteristic of *P. fertilis*. This species has lobes similar to those of *P. adaugescens*, which is clearly distinguished from the former by the large spores (12–15×20–28 μm).

In Japan, *P. omphalodes* seems to be very common in Hokkaido and Honshu (Fig. 12). It has been usually collected on rocks in subalpine and alpine areas at elevations 300–1700 m in Hokkaido and 1000–3100 m in Honshu. In contrast, it is extremely rare in southwestern Japan, especially in Shikoku and Kyushu. For instance, it has been collected only once in Shikoku (Prov. Iyo: Mt. Ishizuchi, elevation 1850–1980 m, H. Kashiwadani 5339) and only once in Kyushu (Prov. Tsushima: Mt. Shira-dake, Shimo-agata-gun, H. Koyama s. n.). On the other hand, *P. fertilis* is usually corticolous at elevations of 20–1100 m in Hokkaido and 100–2500 m in Honshu. In addition, *P. fertilis* is very common even in Shikoku and Kyushu and is found in southernmost Kyushu. Thus, the distribution range of *P. omphalodes* seems to cover a little higher in elevation or a little northern in latitude than that of *P. fertilis* in Japan.

Sixty-one specimens collected in Japan are annotated and are preserved in TNS, duplicates of some of which have been distributed in H.

It should be noted here that lobaric acid is quite rare in Japanese populations, having been found only in three of 61 specimens, even though the acid seems to be a constant component in European specimens (Kurokawa 1976). Fatty acids are known in ten of 61 specimens, joint occurrence of lobaric and fatty acids

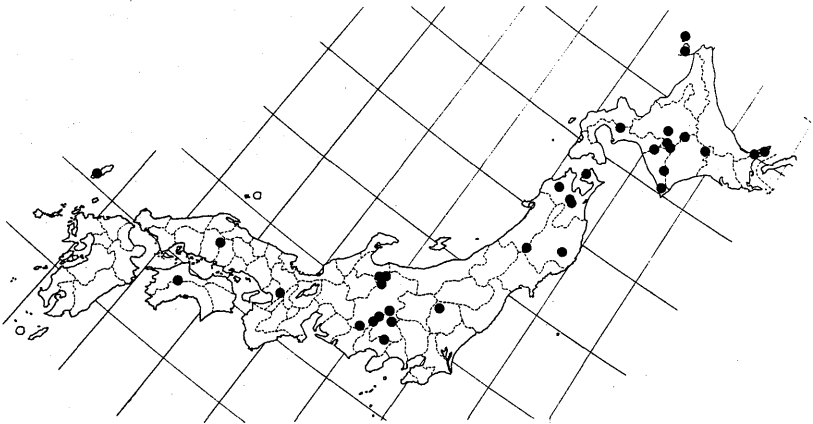


Fig. 12. Geographical distribution of *P. omphalodes* in Japan.

having been demonstrated in two of them by TLC tests.

***Parmelia praesquarrosa* Kurok., sp. nov.**

Quoad habitum et fabricum internum apotheciorum ad *P. squarrosam* accedit, sed ab ea differt essentialiter isidiis destitutis. *P. fertili* primo aspectu maxime simile, sed rhizinis squarrose ramosis.

Chemistry. Atranorin, salazinic acid, and trace of protocetraric acid (+ or -).

Type collection. Prov. Shimotsuke: Senjogahara, Nikko, on trunk of *Malus sieboldii*, elevation about 1400 m, S. Kurokawa 81081 (holotype in TNS and isotypes distributed as Kurokawa et Kasiwadani: Lich. Rar. Crit. Exs., no. 521 under *P. fertili* Müll. Arg.).

Thallus adnate to loosely adnate on bark of trees or very rarely over mosses on rocks, mineral gray, lobes subirregular to sublinear, contiguous or often imbricate, without isidia and soredia, more or less serrate at the margin, obtuse or subtruncate at apices, 2–4 mm wide, often with secondary lobules on the margins, the lobules not divided, rotund or subtruncate at apices, very rarely hood- or helmet-shaped, upper surface dull, often foveolate, rarely white-pruinose in part, often cracked tangentially or along pseudocyphellae, pseudocyphellae more or less white-rimmed

but hardly elevated, marginal and laminal, marginal pseudocyphellae not conspicuous, laminal pseudocyphellae angular to linear, variable in length, 0.5–1.5 mm or sometimes more than 2 mm long and fusing into a subreticulate network, fissured especially on older lobes; medulla white; lower surface black, densely rhizinate, rhizines black, shiny, simple or densely squarrosely branched, often projecting beyond the lobe margins, 0.5–2 mm long. Pycnidia common, conidia weakly bifusiform, about 5 μ m long. Apothecia common, substipitate, 2–10 mm in diameter, margins inrolled, disc brown to dark brown, radially fissured with age, amphithecium finely reticulate-pseudocyphellate, pseudocyphellae not elevated, hymenium 50–65 μ m high, spores 7–10 \times 11–16 μ m.

Distribution. Japan, Korea, and Saghalien.

The present new species (Fig. 13) is easily confused with *P. subdivaricata*. However, the lobes are mostly subirregular and are more or less serrate at the margin in *P. praesquarrosa*, whilst they are sublinear elongate and are subentire at the margin in *P. subdivaricata*. In addition, pseudocyphellae are more or less white-rimmed but not elevated in *P. praesquarrosa* (Fig. 2B), whereas they are distinctly white-rimmed and conspicuously elevated in *P.*

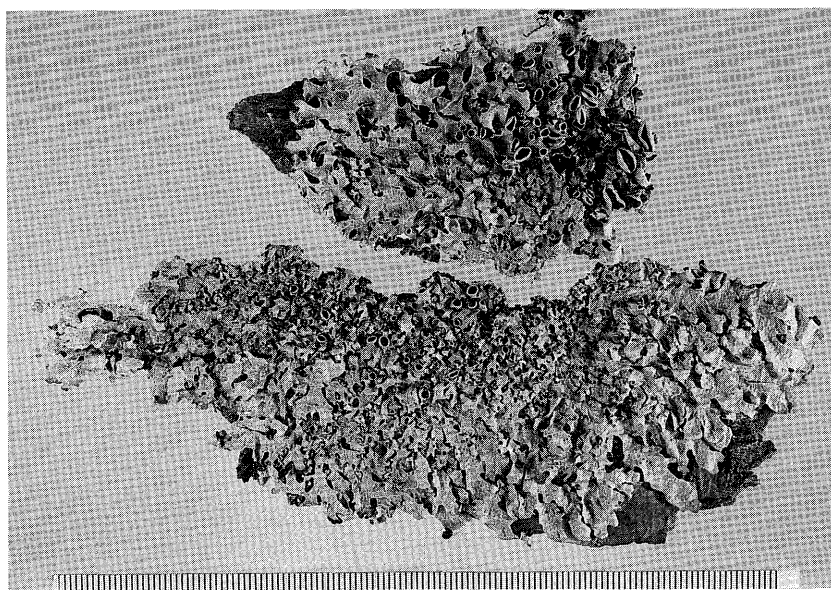


Fig. 13. Holotype of *P. praesquarrosa*. Scale indicates mm.

subdivaricata (Fig. 2D).

Hale (1987) considered *P. squarrosa* to be the isidiate morphotype of the present species (as *P. fertilis*). However, *P. squarrosa* often produces fatty acids, which have found in none of 156 specimens examined of the present species. Although *P. praesquarrosa* morphologically very much resembles *P. squarrosa* as pointed out by Hale, therefore, it can not be regarded as the non-isidiate counterpart of *P. squarrosa*.

As mentioned under *P. fertilis*, this species has been confused with *P. fertilis*, from which it is clearly separated by having squarrosely branched rhizines. Laminal pseudocyphellae are sublinear elongate and often fuse into a subreticulate network, while they are mostly short and hardly form a network in *P. fertilis*. Especially when this species has some helmet-like secondary lobules, it may be confused with *P. fertilis*. However, it is clearly distinguished from the latter by the presence of squarrosely branched rhizines.

The present species is commonly distributed

through Japan Archipelago from Hokkaido to Kyushu, with the range extension northwards to Saghalien and westwards to Korea. It is common on various deciduous trees such as *Betula ermanii*, *Quercus mongolica*, *Syringa reticulata*, *Tilia japonica*, etc. as well as on conifers such as *Abies sachalinensis* near the coast to montane areas about 1000 m above the sea level in Hokkaido. It is also common on deciduous trees such as *Betula platyphylla*, *Fagus crenata*, *Malus sieboldii*, *Sorbus commixta* in montane areas at elevations 300–1600 m as well as on trunk of *Pinus thunbergii* near the coast in Honshu. Hale (1987) reported this species as *P. fertilis* from Canada and Taiwan. Unfortunately, I have not had a chance to see Canadian specimens. Kurokawa 2586, on which Hale's report from Taiwan was based, is now identified as *P. subdivaricata*.

Exsiccata examined. S. Kurokawa, Lich. Rar. Crit. Exs., no. 27 (distributed as *P. fertilis* Müll. Arg.).

Representative specimens examined. Saghalien. Aikawa, Y. Asahina s. n. Kamikiminai, Tomunai-gun, H. Sase 28. Japan. Hokkaido. Prov. Kitami: 2 km north-west of Hamatombetsu, Esashi-gun, S. Kurokawa 70854, 70855, 70857 (TNS, H), 70866. Prov. Tokachi: Mt. Rakko, Hiroo-gun, on trunk of

Syringa reticulata, elevation about 260 m, S. Kurokawa 70576. Prov. Ishikari: Mt. Teine, on trunk of *Tilia japonica*, elevation 600–700 m, Y. Endo, 26, 28, 30. Prov. Nemuro: Ochiishi, on trunk of *Abies sachalinensis*, elevation about 50 m, S. Kurokawa 65784 (TNS, H). Prov. Kushiro: Lakeside of Onnetoh, Mt. Meakan, on trunk of *Alnus hirsuta*, elevation about 610 m, S. Kurokawa 65583b. Prov. Iburi: Shishamodai, Chitose City, elevation about 900 m, H. Kashiwadani 8329, 8330, 8332. Honshu. Prov. Mutsu: Uchida, Tanabu-machi, Shimokita-gun, S. Kurokawa 550303 (TNS, H); Mt. Osorezan, Shimokita Peninsula, S. Kurokawa 550384 (TNS, TUR). Prov. Rikuchu: Mt. Yakeishi, Izawa-gun, H. Suzuki 453. Prov. Iwaki: Matsukawa-ura, Sohma-gun, on trunk of *Pinus thunbergii*, S. Kurokawa 58083, 64459 (TNS, H), 64456 (TNS, MEL). Prov. Shimotsuke: Sanno Pass, Nikko, elevation 1400–1739 m, S. Kurokawa 64062 (TNS, H). Prov. Musashi: Mt. Kumotori, Chichibu, on trunk of *Sorbus commixta*, elevation about 2000 m, H. Shibuichi 3807. Prov. Etchu: Tateyamaji, Kamiichimachi, Nakaniikawa-gun, elevation about 130 m, S. Kurokawa 74009 (TNS, H). Prov. Kaga: Mt. Hakusan, on bark of *Fagus crenata*, elevation about 1400 m, H. Kashiwadani 2866. Prov. Shinano: on trail from Harinoki Pass to Ohmachi, Kitaazumi-gun, S. Kurokawa 51621 (TNS, H). Prov. Ohmi: Nishizaka, Maebara City, on bark of *Diospyros kaki*, H. Kashiwadani 16032. Prov. Tango: Miyazu, M. Togashi s. n. Prov. Tajima: Mt. Hyonosen, Shiso-gun, elevation 900–1200 m, H. Kashiwadani 3376, 3407. Prov. Inaba: Mt. Tubo, on trunk of *Pinus densiflora*, Y. Ikoma 2023. Prov. Bingo: Mt. Kenashi-yama, Hiba-gun, S. Kurokawa 73158. Prov. Aki: Kammuri-yama, Saheki-gun, on *Cryptomeria japonica*, elevation about 730 m, S. Nakanishi 12401 (TNS, H). Shikoku. Prov. Awa: Mt. Kohtsu-san, Oe-gun, on trunk of *Fagus crenata*, elevation about 1100 m, S. Kurokawa 83012, 83015. Prov. Iyo: Mt. Ishizuchi, on trunk of *Quercus mongolica* var. *grosseserrata*, T. Yanagisawa 1484. Kyushu. Prov. Buzen: Mt. Hikosan, S. Kurokawa 63155, 63167 (TNS, H). Korea. Ootsubo, Y. Asahina s. n.

Parmelia pseudoshinanoana Asah., J. Jpn. Bot. 26: 334, 1951. Type collection. Omiyaguchi 2-gome, Mt. Fuji, Prov. Suruga, Japan, Y. Asahina 52 (lectotype in TNS and isolectotype in US).

Parmelia laevior f. *microphylla* Hue, Nouv. Arch. Mus. Paris, ser. 3, 1: 166, 1899. Type collection: Japan, Faurie 518 (lectotype in PC).

Thallus adnate on bark or very rarely on rock, fragile, pale greenish mineral gray rarely with pale brownish tinge, 6–15 cm broad, lobes sublinear, contiguous to imbricate, 1.5–3.5 mm wide, the margins densely lobulate, the lobules often branched, dorsiventral, subsascending to suberect, 0.1–0.8 mm wide, often more than 4 mm long, usually white

pruinose at the tips, lobes and lobules distinctly white-rimmed with marginal pseudocyphellae, upper surface more or less shiny, laminal pseudocyphellae lacking; medulla white; lower surface black, moderately to densely rhizinate, the rhizines simple to squarrosely branched, 1–3 mm long. Pycnidia not seen. Apothecia rather rare, substipitate, 2–4 mm in diameter, disc pale to dark brown, irregularly split with age, amphithecium smooth or more or less foveolate, with pseudocyphellae only near the margin of apothecia, hymenium 55–60 μm high, spores poorly developed, 8–10 \times 13–17 μm .

Chemistry. Atranorin and salazinic acid.

Distribution. Endemic to Japan (Honshu and Shikoku).

This species is characterized by the continuous marginal pseudocyphellae with distinct white rim (Fig. 1B), subsascending or suberect numerous lobules (Fig. 14), and the squarrosely branched rhizines. It may be considered to be related to *P. shinanoana*, because they both have distinct marginal



Fig. 14. Part of lectotype of *P. pseudoshinanoana*, showing dorsiventral lobules. Scale indicates mm.

pseudocyphellae and lack laminal ones. Since these two species also seem to have been differentiated in Japan, *P. pseudoshinanoana* may be considered to be the lobulate morphotype of *P. shinanoana*. However, it never produces gyrophoric acid, which is a constant component in the cortex of the latter. In addition, the rhizines are simple or squarrosely branched in the former, whereas they are simple or furcate in the latter. Therefore, it can not be regarded to relate to *P. shinanoana*.

The present species may be confused with *P. pinnatifida*, an European species, since these two species have similar lobules. However, it can be clearly distinguished from the latter by the presence of squarrosely branched rhizines. Skult (1984) reported *P. pinnatifida* (as *P. omphalodes* ssp. *pinnatifida* (Kurok.) Skult) from Japan, citing Yasuda 376 collected on Mt. Akagi. Although I have not had a chance to see Yasuda 376, the specimen may be identified with *P. pseudoshinanoana*.

Parmelia pseudoshinanoana grows on bark of conifers such as *Abies veitchii*, *Tsuga diversifolia*, etc. as well as on trunk of deciduous trees such as *Fagus crenata*. However, one specimen (Mt. Kohtsu-san, Oe-gun, Prov. Awa, Shikoku, elevation about 1100 m, S. Kurokawa 83009) was collected on rock. The distribution range known at present includes Honshu and Shikoku. The northernmost locality known at present is Nikko, Prov. Shimotsuke in northern Kanto District. It is noteworthy that this species has been collected neither in Hokkaido, northern Honshu, nor Kyushu.

Exsiccatae examined. Kurokawa, Lich. Rar. Crit. Exs., nos. 35 and 129.

Representative specimens examined. Japan. Honshu. Prov. Shimotsuke: Sanno pass, Nikko, elevation 1400–1730 m, S. Kurokawa 64059. (TNS, H, MEL). Prov. Musashi: Mt. Ryogami, Chichibu, S. Kurokawa 550574 (TNS, US), 550575; Mt. Nokogiridake, S. Kurokawa 59193 (TNS, MEL, US). Prov. Shinano: Mt. Gakidake, Kitazumi-gun, S. Kurokawa 520639 (TNS, US); Hatchozaka, Mt. Kobushi, elevation 1500–1900 m, S. Kurokawa 59207 (TNS, US); Mt. Mikuni, Minamisaku-gun,

S. Kurokawa 58554 (TNS, US). Prov. Suruga: Mt. Fuji, elevation about 1750 m, S. Kurokawa 72044 (TNS, H). Shikoku. Prov. Iyo: Mt. Ishizuchi, elevation 1000–1600 m, S. Kurokawa 60048 (TNS, H).

***Parmelia saxatilis* (L.) Ach., Meth. Lich. 204. 1803.**

Lichen saxatilis L., Sp. Pl. 1142. 1753. Type collection. Sweden, sheet 1273.61 (lectotype in LINN) – not seen.

Thallus adnate on rock or on twigs, greenish to pale brownish mineral gray, 4–8 cm broad, lobes sublinear to subirregular, contiguous to crowded, 1.5–4 mm wide, upper surface shiny, continuous to irregularly cracked with age, often foveolate, pseudocyphellae marginal and laminal, effigurate, marginal pseudocyphellae subcontinuous, laminal pseudocyphellae rather short, 0.3–1.5 mm long, sometimes forming a subreticulate network, isidia formed mostly along the pseudocyphellae, granular to cylindrical and sparsely branched, becoming very dense on older lobes; medulla white; lower surface black, densely rhizinate, the rhizines simple to furcate, 1–2.5 mm long. Pycnidia and apothecia not seen in Japanese specimens.

Distribution. Boreal and arctic regions in both hemispheres including Japan.

Chemistry. Atranorin, salazinic acid, lobaric acid (+ or –) and fatty acids (+ or –).

Parmelia saxatilis, the type species of the genus, is the best-known and most widespread species in the genus, occurring in both hemispheres. It is apparently closely related to *P. omphalodes*, from which it is clearly distinguished by the presence of isidia. It also resembles *P. squarrosa* in having numerous cylindrical isidia. However, it lacks squarrose rhizines, which are formed at least in part by *P. squarrosa*.

Hale (1987) stated that the presence or absence of an accessory substance lobaric acid was loosely correlated with geography. According to him, all specimens in the Appalachian region in the United States

have lobaric acid and about two-third of the collections contain the acid in Europe, whilst most specimens contain only salazinic acid in South America. It is noteworthy that lobaric acid has been demonstrated in all specimens collected in Japan by TLC. Dey (1978) reported that accessory fatty acids (probably protolichesterinic acid and trace amount of unidentified fatty acid) were also found in *P. saxatilis* collected in North America. Although fatty acids were demonstrated along with lobaric acid in a specimen collected in Canada (Rathtrevor Beach Park, 1 mile south of Englishman River, Vancouver Island, corticolous, S. Kurokawa 8752), they have been found in no specimen of the species collected in Japan. Thus, lobaric acid as well as fatty acids can be considered as accessory components in the present species and are occasionally produced together.

Although *P. saxatilis* is one of the commonest and widespread species in the genus as mentioned above, the occurrence of the species in Japan has long been considered to be suspicious. For instance, Hale (1987) had opinion that most corticolous specimens from Japan usually identified as *P. saxatilis* in herbaria should be identified as *P. squarrosa* and did not cite any specimen collected in Japan as *P. saxatilis*. Isidiate specimens collected in exposed alpine zones in Japan, especially on rocks or on twigs of *Pinus pumila*, however, have lobes with furcate rhizines and contain lobaric acid along with atranorin and salazinic acid. They are apparently different from *P. squarrosa* and are reported here as *P. saxatilis*. In Japan, at present, *P. saxatilis* is known only from a few localities in the alpine zone of Honshu and the occurrence of the

species in Hokkaido is fully suspected.

In 1971, Kurokawa and Nakanishi reported *P. saxatilis* from the Hidaka Mts., Hokkaido, stating some of the specimens contained unidentified fatty acids. They are now identified as *P. squarrosa*.

Although number of specimens collected in Europe, North America, and the Aleutian Islands have been examined through the present study, specimens collected only in Japan will be cited below.

Specimens collected in Japan. Honshu. Prov. Etchu: Mt. Shirouma-dake, Shimoniikawa-gun, on twigs of *Pinus pumila*, elevation about 2800 m, H. Shibuichi 7098; Mt. Tengunoatama, Shirouma, Shimoniikawa-gun, on twigs of *Pinus pumila*, elevation about 2800 m, K. Yoshida 5729; Mt. Oyama, Tateyama Mts., on twigs of *Pinus pumila*, elevation 2700–3000 m, S. Kurokawa 82034. Prov. Shinano: Mt. Kinpu, Minamisaku-gun, on granite, elevation about 2550 m, H. Shibuichi 4271; the same locality, on rock, elevation 1950–2400 m, Y. Jinzenji 194; Mt. Kisokoma, Nishichikuma-gun, on twigs of *Pinus pumila*, elevation 2820 m, S. Nakanishi s. n.

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黒川 道：ウメノキゴケ科カラクサゴケ属の日本産の種(4)

日本産カラクサゴケ属の研究の第4報として *P. omphalodes* (イワカラクサゴケ 新称), *P. praesquarrosa* (ナメラカラクサゴケ), *P. pseudoshinanoana* (チヂレシナノゴケ), *P. saxatilis*

(ミヤマカラクサゴケ 新称)の特徴や分布について報告した。イワカラクサゴケの日本での産出は従来疑問視されていたが、無性生殖器官を持たない岩石生の標本の大部分がこれに当たることを確認

した。ナメラカクサゴケの学名として *P. fertilis* が使われてきたが、前報で示した通り *P. fertilis* のタイプ標本はトゲナシカクサゴケに一致するので、ナメラカクサゴケは新種として記載し、*P. praesquarrosa* の学名を与えた。ヨーロッパで普通に見られるミヤマカクサゴケは日本では産出し

ないと考えられていたが、ハイマツ帯でハイマツの枝や岩石上に着生し、裂芽をもち、単一または不規則に叉状に分枝した仮根があり、ロバール酸を含んでいて、ヨーロッパ産のものとよく一致するので *P. saxatilis* と同定した。