In the course of our taxonomic study of the genus *Ramalina* basing on herbarium specimens kept in the Institute of Microbiology, Academia Sinica (HMAS), the Institute of Applied Ecology, Academia Sinica (IFP) and the National Science Museum, Tokyo (TNS), we found following seven species to be new to China; *R. almquistii*, *R. hokkaidensis*, *R. intermedia*, *R. obtusata* and *R. pertusa*. In addition, *R. pentecostii* and *R. sekika* were found and they are the second report for the species. *R. pseudosekia* was reduced to a synonym of *R. pollinaria*.

**Key words:** *Ramalina almquistii*, *R. hokkaidensis*, *R. intermedia*, *R. obtusata*, *R. pentecostii*, *R. sekika*, lichens.

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**Materials and Methods**

The specimens used for the present study were primarily based on the herbarium specimens kept in HMAS, IFP and TNS. Specimens collected by Kashiwadani and Moon in China in 1995 and 1999 were also studied. The secondary products of the specimens examined were determined by thin layer chromatography (TLC) using the amended procedures of Culberson & Johnson (1982). To evaluate anatomical variation within the thallus and apothecia, sections were cut by hand with a razor blade. These were mounted in GAW solution and the anatomy and spores were examined with standard light microscopic procedures.

**Notes on Species**


*Ramalina almquistii* is a fistulose species characterized by saxicolous habit, discontinuous medullary hyphae, absence of soredia or isidia, short fusiform ascospores and by the presence of sekikaic or divaricatic acids.

Although this species is widely distributed in East Asia, it has never been recorded from China. Three specimens collected on rocks at Prov.
Liaoning were now identified with the divaricatic acid race of this species. New to China.

Specimens examined. China. Prov. Lianing: Laotieshan, on rock, elevation 250 m, October 7, 1981, X. Chen et al. 5762 (IFP); the same locality, September 1, 1931, Y. Kobayashi 13 (TNS); Kuandian, Baishilazi Reserve, on rock, 1245 m alt, X. Chen 6844 (IFP).


This species was well studied by Kashiwadani (1986) for Japanese specimens. It very much resembles *Ramalina conduplicans* Vain., a species widely distributed in East Asia, in having similar laciniae with punctiform pseudocyphellae. However, it can be distinguished from the latter by the calcilicate laciniae tapering towards the apices and by the presence of stenosporic acid. *R. conduplicans* has dorsiventral laciniae even in the distal branches and produces homosekikaic, sekikaic or divaricatic acids as major chemical substances. New to China.


**Ramalina intermedia** (Del. ex Nyl.) Nyl., Flora 56: 66 (1873). (Fig. 1a & 1b)

Thallus saxicolous, up to 3 cm long. Laciniae discrete or forming swards, sparingly and irregularly branched, growing from a delimited or more or less expanded holdfast. Laciniae greenish yellow, solid, 0.3–1.5(–3) mm wide, flattened towards the basal parts, terete and more or less cylindrical in distal parts, often ending in nodular or granular soredia. Pseudocyphellae sparse, elliptical, flat. Soralia present, laminal or subterminal to terminal, soredia granular, covered by outer layers. Laciniae 150–400 μm thick; upper cortex indistinct, 3–5 μm thick; chondroid tissue weakly cracked, continuous; medulla loose. Apothecia very rare, laminal or submarginal, up to 0.7 mm in diam.; disc flat to more or less convex, without white margin; thalline exciple entire or sorediate; hymenium 35–40 μm high; subhymenium 15–20 μm thick, proper exciple 30–40 μm thick; ascospores shortly fusiform, 11–12× 4–4.5 μm. Pycnidia not seen.

Chemistry: (Race 1) usnic, homosekikaic, sekikaic and 4’-O-methylhomosekikaic acids. (Race 2) usnic, divaricatic and 4’-O-demethyldivaricatic acids.

**Ramalina intermedia** includes a series of forms ranging from discrete and shrubby thalli growing from a delimited holdfast up to 3 cm high with irregularly or dichotomously branched and dorsiventral laciniae near the base (Fig. 1a), to small tufted thalli growing from more or less expanded holdfast up to 1 cm high with more or less terete and weakly branched laciniae (Fig. 1b). Similar morphological variations were also reported for *R. polymorpha* (Ach.) Ach. by Acharius (1797) and Krog and James (1977).

When Kashiwadani (1987) revised Japanese species of *R. intermedia*, he reported the presence of homosekikaic and sekikaic acids as major chemical substance. In addition to the race 1 containing homosekikaic acid agg., divaricatic acid containing specimens (race 2) were also found for this species. The two chemical races were inseparable morphologically and this chemical difference seems to have no taxonomic value.

**Ramalina intermedia** resembles *R. pollinaria* (Westr. ex Ach.) Ach., a saxicolous species widely distributed in the world, in having granular soredia covered by outer layers (Kashiwadani and Moon 2003). However, it can be readily distinguished from the latter by the narrower laciniae and by the absence of evernic and obtusatic acids which are constant components for *R. pollinaria*. It might be confused with *R. polymorpha* (Ach.) Ach., a species widely distributed in the Northern Hemisphere, which differs in having no chemical substances.

During the present study, we found this species...
from three localities in China. They coincide well with the exsiccate specimens of this species preserved in TNS both in morphology and chemistry. The specimen from Mt. Changbai, Jilin Province, was collected among mosses on rocks and determined as the race 1. The specimens from Ping Shui Shan, Jiansi Province were collected on exposed rocks along river and determined as the race 2. This is a new report for this species from China.


**Ramalina obtusata** (Arnold) Bitt., Pringsheim Jahrb. Wiss. Bot. 36: 435 (1901). (Fig. 2)

*Ramalina obtusata* is characterized by corticolous habit, shrubby and fistulose thallus growing from a narrow holdfast, inflated and more or less pellucid thalli without side branches, sparse and small fenestrations, continuous medullary hyphae without isolated clumps of hyphae and the presence of evernic and obtusatic acids as major chemical substances.

Historical review for this species has been provided by Krog and James (1977). Although fertile specimens for this species has not been reported, one specimen (Fig. 2) from Mt. Chanbai, Prov. Jilin has characteristic features written above, which coincide well with those of the lectotype of *R. obtusata* (Arnold: Lich. Exs. 577b—isolectotype in BM!). New to China.


**Ramalina pentecostii** Krog & Swincow, Norw. J. Bot. 23: 167 (1976). (Fig. 3a, 3b, 3c)

*Ramalina pentecostii* is characterized by its corticolous or saxicolous habit (Krog & Swinscow 1976), weakly branched subpendulous laciniae showing bilateral appearance (Fig. 3a), marginal soralia (Fig. 3b) and shortly linear pseudocyphellae, smooth chondroid layer without cracks (Fig. 3c) and by the absence of medullary chemical substance. Apothecial laminal, 0.8–1.5 mm in diameter; disc with white margin; ascospores shortly fusiform, 11–12×5–6 μm in size.

*Ramalina pentecostii* is a poorly known lichen
Fig. 2. *Ramalina obtusata* (Arnold) Bitt., showing a habit (C. Zhao 0320, IFP). Bar = 1 mm.

Fig. 3. *Ramalina pentecostii* Krog & Swinscow (Z. Congfu 2501, IFP). a) habit (bar = 1 cm), b) laciniae showing bilateral appearance by marginal soralia (bar = 0.5 mm), c) cross section of branches, showing smooth chondroid tissue (bar = 100 μm).
and it has been so far known only from Uganda, East Africa (Type collection: Uganda, Toro, Ruwenzori, R.E. Pentecost 115—holotype in BM!). In the course of the present study, we found several specimens comparable to the species collected in Mt. Tianshan, Xinjiang Prov., northwest China. These specimens are quite identical morphologically as well as chemically with the type specimen. One of them (Z. Congfu 25019 is fertile and the description of apothecia is given above, though Krog and Swinscow (1976) reported only sterile specimens. This species is unique in having dorsiventral laciniae with marginal continuous soralia and in producing no chemical substances. This characteristic lichen is not easily mistaken for any other species of Ramalina found in Asia. Specimens of subpendulous thalli of R. farinacea (Pers.) Ach., a corticolous widespread species in temperate regions in the world, might be confused with this species, but it differs in having repeatedly branched laciniae with discrete soralia and in producing depsidones such as protocetraric, norstictic or salazinic acids as major chemical substances.

This is the second record for R. pentecostii in China. All specimens from China were collected on branches of Picea sp., at elevations between 1900 to 2260 m.

Specimens examined. China. Prov. Xinjiang, Mt. Tianshan, Bayi forest centre, Picea sp., 2260 m alt, August 31, 1982, C. Zhao 2242 (IFP); the same locality, on dead wood, 1900 m alt, September 1, 1982 (IFP); Takesi forest centre, on Picea sp., 1950 m alt, September 24, 1982, C. Zhao 2501 (IFP); Zhaosu forest centre, on Picea sp., 2260 m alt, September 26, 1982, C. Zhao 2480 (IFP); Gongliu forest center, September 29, 1982, on Picea sp., 1900 m alt., September 29, 1982, C. Zhao 2629 (IFP).


Although *Ramalina pertusa* has been reported widely distributed in Japan and Taiwan (Kashiwadani 1985, Kashiwadani et al. 2006), it has never been reported from mainland China. One specimen collected at Huanre, Prov. Liaoning, is now identified as this species. New to China.


**Ramalina pollinaria** is a well-known species of the genus characterized by the saxicolous habit, solid and sparingly branched laciniae with granular soredia, narrowly fusiform ascospores (12.5–14×3.5–4.5 μm in size) and by the presence of evernic and obtusatic acids as major medullary substances.

Asahina (1940) described *Ramalina pseudosekika* Asahina from North Korea. The holotype specimen, however, is quite identical morphologically and chemically with the holotype of *R. pollinaria* and can be simply reduced to a synonym of the latter species.

*R. pollinaria* seems to be widely distributed in China.


**Ramalina sekika** Asahina, J. Jpn. Bot. 16: 138 (1941)

*Ramalina sekika* is a saxicolous species similar to *R. pollinaria*, which differs in having evernic and obtusatic acids as chemical substances. It is apparently one of a rare species of the genus, having been so far known only from the type collection in China (Type collection: Laotie-shan, Port Arthur, Prov. Liaoning, China, July 19, 1940, Y. Asahina 333—holotype in TNS!, *tlc*: sekikaic, 4’-O-demethyl sekikaic and salazinic (±) acids). In the present study, we found additional localities for this species in Provinces Liaoning and Jilin, China as cited below. This is the second report for the species.


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