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TAXONOMICAL AND PHYTOGEOGRAPHICAL NOTES ON SOME LICHENS FROM NORFOLK ISLAND

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A b s t r a c t : 33 species are enumerated from Norfolk Island, South Pasific. For some of them, notes on taxonomy and nomenclature are supplied. A detailed analysis of the distribution of species mentioned outside Norfolk islands reveals a prevalence of cosmopolitan and pantropical elements. One of the species has only been found in tropical America until now. Links to New Zealand seem to be closer than those to the Australian mainland, but a few species were reported only from smaller islands until now.

Introduction

Two small collections of lichens from Norfolk Island, Australia, one from Mrs. Merval Hoare, a resident of the island, comprising 28 specimens, and a second from Dr. R.D. Hoogland consisting of 15 specimens, gave opportunity for some taxonomical and phytogeographical considerations, which are the subject of the following critical notes.

I have to thank Mrs. Merval Hoare, who presented her private collections to the Vienna Natural History Museum (Herb.W), Dr. Hoogland, who drew my attention to his own specimens, and the curators of Herbarium Australiense, CSIRO, Canberra (CANB), who sent on loan to Vienna Dr. Hoogland's material.

Since Ferdinand Bauer was the first botanical collector on Norfolk Island, who also brought home four samples of lichens in 1803, which were identified by St. L. ENDLICHER and published in 1833, the number of known species has

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considerably increased, but many of the older identifications are doubtful as a consequence of changed concepts in lichen taxonomy. The most important older contribution is MAIDEN's enumeration of 1903. For a long time there were no additions to his list, so that Mrs. Hoare's and Dr. Hoogland's collections, though by-products of other activities, are of great value. In 1984, Elix and Streimann were the first "professional" lichenologists to visit Norfolk Island, and their results certainly will be the main source for future information on the subject. Nevertheless, it seems sill usefull to give a short account of the two earlier collections, the more as they are supposed to throw light on some plant geographical connections that have not been realized to their full extent until now.

Enumeration of the species represented

M.H. added in brackets to the name of a lichen means that it has been collected by Mrs. Merval Hoare in 1976, R.D.H., that Dr. Hoogland has been its collector in 1967. The species are arranged in alphabetical order.

1. *Caloplaca aurantiaca* (LIGHTFOOT) Th. FRIES (M.H.)
2. *Caloplaca l.-b.-moorei* A. ZAHLBRUCKNER (M.H.)
3. *Cladonia squamosa* (SCOPOLI) HOFFMANN (R.D.H.)
4. *Clathroporina saxatilis* A. ZAHLBRUCKNER (R.D.H.)
   a. *Clathroporina exocha* (NYLANDER) MÜLLER Arg. (Elix)
5. *Collema subflaccidum* DEGELIUS (M.H.)
6. *Dirinaria applanata* (FEE) AWASHTI (M.H.)
7. *Dirinaria picta* (SWARTZ) CLEMENTS et SHEAR
8. *Lecanora albellaria* MÜLLER Arg. (M.H.)
9. *Leptogium brébissonii* MONTAGNE in WEBB et BERTHELOT (R.D.H.)
10. *Pannaria mariana* (FRIES) MÜLLER Arg. (M.H.)
11. *Parmeliella duplicata* MÜLLER Arg. (R.D.H.)
12. *Parmotrema cristiferum* (TAYLOR) HALE (M.H., R.D.H.)
13. *Parmotrema saccatilobum* (TAYLOR) HALE (M.H.)
14. *Parmotrema tinctorum* (NYLANDER) HALE (R.D.H.)
15. *Pertusaria* spec., an nova (M.H.)
16. *Physciopsis minor* (FEE) B.MOORE (M.H.)
17. *Physma brysinum* (ACHARIUS) TUCKERMAN (M.H., R.D.H.)
18. *Pseudocyphellaria aurata* (SMITH) VAINIO (M.H., R.D.H.)

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19. *Pseudocyphellaria chloroleuca* (J.D.HOOKER et TAYLOR) Du RIETZ (R.D.H.)
20. *Pseudocyphellaria pickeringii* (TUCKERMAN) D. GALLOWAY (R.D.H.)
21. *Ramalina arabum* (ACHARIUS) MAYEN EX FLOTOW (M.H.)
22. *Ramalina australiensis* NYLANDER (R.D.H.)
23. *Ramalina canariensis* J. STEINER (R.D.H.)
24. *Ramalina celastri* (SPRENGEL) KROG et SWINSCOW (M.H., R.D.H.)
25. *Ramalina glaucescens* KREMPELHUBER (M.H., R.D.H.)
26. *Sticta caliginosa* D. GALLOWAY (R.D.H.)
27. *Teloschistes flavicans* (SWARTZ) NORMAN (M.H., R.D.H.)
28. *Usnea intercalaris* KREMPELHUBER (M.H.)
29. *Usnea tamborensis* (HEPP) MOTYKA (M.H.)
30. *Usnea trichodeoides* VAINIO emend. MOTYKA (R.D.H.)
31. *Xanthoparmelia scabrosa* (TAYLOR) HALE (M.H., R.D.H.)
32. *Xanthoria ectanea* (ACHARIUS) RÄSÄNEN ex FILSON (M.H.)

Taxonomical and nomenclatural notes

Caloplaca l.-b.-moorei A. ZAHLBRUCKNER

GALLOWAY's (1985) version of the name as "*Caloplaca mooreae*" is grammatically and logically sound, but hardly in agreement with the international rules of botanic nomenclature. These only allow for a change of the original spelling, if it is due to a misprint or a similar mistake not intended by the author, but in the present case, ZAHLBRUCKNER had well been aware of what he was doing, as the name written by him on the label of the holotype in Vienna is exactly the same as the printed version. The only change necessary according to the rules is the introduction of hyphens between the initials of the given names and the family name of Miss MOORE, the collector, to whom the species was dedicated.

Clathroporina saxatilis A. ZAHLBRUCKNER and *C. exocha* (NYLANDER) MÜLLER Arg.:

D. GALLOWAY (1985) put *C. saxatilis* into synonymy of *C. exocha* and chose a lectotype preserved in Christchurch. There is no need for a lectotype, however, as ZAHLBRUCKNER's holotype is still present in Vienna (Herb.W) and could be examined by the present author. The description supplied by GALLOWAY for his composite species *C. exocha* does not agree with several morpholo-

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gical features found in the holotype of *C. saxatilis* , especially as far as the thallus is concerned. *C. exocha* has also been collected on Norfolk Island by ELIX and STREIMANN in 1984. The thallus of the sample of this collection sent to Vienna is comparatively smooth for the species and shining, but agrees well with collections from other parts of the world. In the type of *C. saxatilis* as well as in the specimens collected on Norfolk Island by Dr. HOOGLAND the thallus is finely areolate, not coherent as in *C. exocha*, the very small areolae, sometimes rather verrucae, are strongly convex. Quite obviously, this is a different condition from what GALLOWAY describes as "Raised in irregular mounds". Most of the other characters are too variable in *C. exocha* to be useful for separating species.

The new collection differs from ZAHLBRUCKNER's type in growing on bark in the lower part of the trunk of *Araucaria heterophylla*, and in slightly longer spores (130/30 µ). It may represent a minor variety, but the differences don't allow separation on a higher level.

Lecanora albellaria MÜLLER Arg. e descr. in Bull.Herb.Boissier 3: 632 (1895)

There is perfect agreement in all the distinctive characters between MÜLLER's diagnosis and Mrs. HOARE's collection. The type comes from Queensland, Australia. As some doubts, however, remain as to its generic affinities, a detailed description is provided to facilitate future research.

The whitish thallus is very thin, but grossly uneven (that seems to be what MÜLLER Argoviensis calls "granular": very small, thickish areolae are scattered all over a very thin, membranous veil, that is called "hypothallus" in the original diagnosis, though this interpretation is fairly doubtful. Usually, there is no sharp delimination against the dark substrate except where one of the scaly layers of the bark ends abruptly. Apothecia of different age are densely crowded on its surface, the youngest strongly resembling granules of the thallus. They are smaller in the Norfolk specimen than in the type, usually not more than 1/3mm in diameter, cup-shaped with a persistent, entire or subentire margin equalling the thallus in its colour, and a pale brownish to ochraceous, concave disc. MÜLLER's observation that they are similar to *Gyalecta* gives a good impression of their general appearance. The exciple consists of two distinct layers: the outer one is narrow and ± dark brown, the inner one wider colourless and densely crowded with big, hyaline crystals. The parathecium (medulla in CORNER's,

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1929, sense) and the hypothecium are proso-plectenchamatic, and perfectly colourless, the latter characterized by the presence of a few larger, more or less rounded cells (heterogenous trama in the terminology of MOSER-ROHR-HOFER, 1960). Algae are lacking everywhere in the basal portion of the apothecium and present only in small number in the lateral part of the exciple. It is doubtful, wether the apothecium can be regarded as truly lecanorine. The hymenial layer is covered by small, orange to brownish crystals. Paraphyses are unbranched, slenderly filiform, longer than the asci and embedded in mucus, not swollen at apex. The ascus wall is distinctly thickened in the apical region with a narrow channel down from the apex itself. Spores are obliquely arranged in one row, elliptical to oblong-elliptical, 12 - 13/7 - 7,5 µ, usually with one big central oil-dropled. No other species could be found especially from the Pacific region, that bears any closer resemblance to our sample.

Pertusaria spec., an nova (?)

At the present state of knowledge of the genus *Pertusaria* as a whole, but especially in the Pacific region, the description of new species, moreover from a sterile specimen, does not seem justified. Mrs. HOARE's collection does not agree with any taxon known from either Australia, New Zealand or any of the Pacific islands, so that it may be entirely new to science or new at least for this part of the world. A detailed description is provided, therefore, but no name given in order not to anticipate the results of future research and create superfluous binomials.

The vegetative thallus is irregular in outline, rather thin, membranaceous, 5 or more cm in diameter, pale greenish-white to greenish-grey, with very narrow cracks, that are sometimes anastomosing to form almost areolate spots especially near the centre, but seems to be rather smooth at first glance, slightly uneven from irregular distribution of crystals, in some parts surrounded by a very narrow, black prothallus, which is lacking in others. In transverse section it is 180 - 200 µ high, covered by a layer of dead hyphae parallel to the surface and dissolved to a hardening, slimy mass still showing the original structure and stratification, often with a similar layer at the base towards the substratum, the interior filled for the greatest part with densely aggregated, hyaline crystals which are rather big even when single, above the crystals with a narrow algal layer of protococcoid

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algal cells usually forming balls, single cells globose to slightly ovoid, and with slender, hyaline, loosely and irregularly interwoven hyphae.

The surface of the thallus is densely crowded with what seems to be ordinary warts surrounding fruiting bodies, but in this species the warts are entirely sterile, and not a single apothecium could be found. The warts are much stouter than isidia in the isidiate species of the genus described hitherto and often break up at the top to form circular to irregular soredia. This may result in the end in a cup-like shape of the warts when most of the diaspores have been shed. The original shape of the warts is irregularly capitate to clavate with a distinct constriction near the base, the upper part being either subglobose or even somewhat flattened, but more often tuberculate as if crowned by two or more horns, and in a few cases nearly coralloid with slightly elongated tubercles. These warts rarely surpass 0,6 - 0,8 mm in height and 0,8 - 1 mm in transverse diameter, but sometimes the protuberances in the upper part lead to an irregular extension in one or the other direction.

The anatomy shows typically all the features peculiar to the warts surrounding apothecia of *Pertusaria* as aptly illustrated, for instance by MOSER-ROHRHOFER (1975), so that there is little doubt about the generic affinities in spite of the absence of apothecia. The external layer of dead hyphae ("Epinecralschicht") is lacking for the greater part of the warts, but is sometimes forming a kind of a collar round their base. The central cavity is filled with big crystals as in other parts of the thallus, algae being there rather few at some distance from the surface. The surface itself is usually formed by a shiny mass, into which nearly perpendicular, much branched, sometimes slightly irregular, hyaline hyphae not reaching the surface as a rule are embedded. Between the crystals hyphae are found in strands forming an irregular network.

The most peculiar feature of the present collection is the transformation of the warts usually bearing apothecia into isidia-like protuberances becoming sorediate finally, while true isidia of much smaller size are absent.

MAIDEN (1903) also mentioned a species of *Pertusaria* from Norfolk Island without giving a name, as the available material had been too poor.

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Ramalina spp.

While the identification of *Ramalina arabum*, which is not indicated for Australia by STEVENS (1987), but included in GALLOWAY's lichen flora of New Zealand offered no problems for identification, all the other taxa included here still need further investigation for this part of the world. *R. canariensis* is only mentioned for Australia by STEVENS, not for New Zealand by GALLOWAY. Though the collection of Dr. HOOGLAND is slightly different from the type mainly in size, the apical and marginal soredia and the wide, mostly simple branches of the thallus seem to be sufficiently reliable characters to assign it to that species.

Ramalina australiensis was called *R. myriocłada* MÜLLER Arg. by GALLOWAY, but STEVENS correctly substituted the older, though less widely known name for it. Using the key provided by STEVENS, the two remaining species, *R. celastri* and *R. glaucescens* in my own interpretation following GALLOWAY should be looked for among the varieties of *R. subfraxinea* NYLANDER, though none of them really corresponds to either of those. Likewise, the identification of *R. australiensis* as used here according to STEVENS either leads to *R. tropica* N. STEVENS or to *R. subfraxinea* var. *norstictica* N.STEVENS. Nevertheless, I am still inclined to follow GALLOWAY, as his own descriptions fully agree with the identifications in herb.W, while STEVENS' key and descriptions are neither in accordance with the material here nor are applicable to the new collections in every detail apart from the characters used for the key.

Usnea intercalaris KREMPELHUBER

The holotype of *Usnea nexilis* MOTYKA and an isotype of *U. intercalaris* in herbW do not show any significant differences. They are regarded as synonyms by the present author, therefore. *U. nexilis* was originally described from Norfolk Island, *U. intercalaris* from Fiji. MOTYKA's (1937) descriptions are somewhat controversial. While he maintains that the thallus of *U. intercalaris* is more slender, the numerical values show just the opposite. The main axis of the one is not more distinctly articulate than that of the other. In *U. intercalaris* , the medullary layer of the thallus should grow red at once with KOH, while in *U. nexilis* it should become yellow first and red later on. In the type-specimens studied it does not become red or yellow in either, but remains unchanged or assumes a pale brownish pink.

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There are two specimens from Norfolk Island among Mrs. HOARE's collections, both collected on the same fence post at Cascade on February 17, 1976. One of them is deep purple to purplish brown and bears a greater number of minute papillae on the main axis of the thallus than the other, which has remained unchanged yellowish to greenish yellow all the years up to now. KOH only gives a reaction in places, where the cortex had broken away already a longer time ago and the medulla had been exposed to air. The yellowish specimen becomes pale pink in that case.

Usnea tamborensis (HEPP) MOTYKA

The medullary layer is growing intensely yellow with KOH, but not changing to red later on as indicated by MOTYKA (1938). Other chemical reactions not mentioned previously are C + yellow and Pd + intensely yellow to orange.

Xanthoria ectanea (ACHARIUS) RÄSÄNEN ex FILSON

ACHARIUS (1810, 1814) was perfectly clear about what he had in mind, when he described the species as distinct from present day *Xanthoria parietina* (LINNAEUS) Th. FRIES. According to him, the thallus is irregularly subimbricate with narrower lobes which are sometimes ± complicate along their longitudinal axis, the apothecia are plane at last, the orange disc equal in colour to the margin, that is vanishing eventually. These characters of the apothecium are the reason for specific recognition of the taxon until today. Contrary to *X. aureola* (ACHARIUS) ERICHSEN, the thallus lobes are perfectly smooth and plane, the apothecia usually smaller. European specimens are not different from those from Norfolk Island in any detail. For further information about the status and morphology of the species, HILLMANN (1920) may be consulted.

Strangely enough, the specimens from Norfolk Island and ACHARIUS' diagnosis are entirely different from what FILSON (1969, 1979) described as *X. ectanea* from Australia. The lobes are ± concave, not convex, not distinctly radiating, the apothecia are usually smaller, normaly not convex even at a late stage, the disc is scarcely darker than the thallus, etc. FILSON's description indicates a lichen similar to what ACHARIUS (1810) called *Lecanora rutilans*.

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Phytogeographical notes

While for a long time only comparatively few data had been available for lichens from Australia, New Zealand and the Pacific islands, recent years brought a tremendous increase of interest among lichenologists in this area. This increased interest is documented by a considerable number of monographs on individual lichen genera, two recent floras (FILSON and ROGERS, 1979, for South Australia; GALLOWAY, 1985, for New Zealand) and also by very valuable contributions of lichenologists to pacific phytogeography in general. Especially GALLOWAY's extensive treatments of biogeographical elements and distribution patterns of New Zealand (1979) and Australian (1987) lichens are of great importance. In 1988, the same author attempted a causal explanation of distribution patterns of lichens in the temperate Southern hemisphere with the help of plate tectonics. Distribution patterns of lichens in the whole Pacific Region were studied by JØRGENSEN in 1983. On a smaller scale, the phytogeographical position of Norfolk Island between Australia and New Zealand offers a number of interesting topics from the lichenological point of view.

Of the total of 33 species treated here 6 are cosmopolitan, 1 doubtfully cosmopolitan, 5 are pantropical (though Norfolk Island itself is situated comparatively far outside the tropics), 2 palaeotropical, 1 known only from the Neotropics until now, 1 palaeotropical, but confined to more southern regions, e.g. not reported from SE-Asia, 1 hardly to interprete in general terms, the rest australasian in a wider sense. Among those, 2 were considered to be endemics of New Zealand until now, one was known only from the Australian mainland, one only from Indonesia and New Guinea, two only from smaller Pacific islands. It would be premature to draw too far reaching conclusions from this list, as many parts of the world including many Pacific islands and even the Australian mainland are not sufficiently investigated from a lichenological point of view.

Cosmopolitan species:

These include *Cladonia squamosa*, *Collema subflaccidum*, *Leptogium brébissonii*, *Pseudocyphellaria aurata*, *Teloschistes flavicans* and *Xanthoria ectanea*.

Collema subflaccidum was found in New Zealand and Tasmania, but, strangely enough, not in Australia. It may have been overlooked or misinterpreted

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there, however.

Pseudocyphellaria aurata is generally considered to be cosmopolitan on a large scale, but has a preference for tropical, subtropical and warm temperate regions as far as I am aware.

Doubtfully cosmopolitan species:

Caloplaca aurantiaca is certainly very widespread in temperate to subtropical regions, but I could not find any records from either Australia or New Zealand (if FILSON and ROGERS', 1979, assumption is true, that all the Australian collections under this name are in fact *Bombyliospora domingensis* var. *aurantiaca* A. ZAHLBRUCKNER, which might prove too general). It may be absent also from South America. The specimen from Norfolk Island shows certain peculiarities, such as a coherent, suborbicular, membraneous thallus with a few tiny warts and sometimes nearly shining surface, surrounded by a distinct black prothallus. Thus, it may represent a local variety that has evolved far from the main area of distribution of the species, but as long as no modern revision of this difficult group within *Caloplaca* exists, no final taxonomic conclusions can be drawn. The differences may be due as well only to the smooth bark on which the specimen was growing contrary to its usual habits, and there are no distinctive characters indicating specific diversity from *C. aurantiaca* properly.

Pantropical species:

Dirinaria applanata, D. picta, Parmotrema cristiferum, P. tinctorum, Ramalina arabum. Parmotrema cristifierum has not yet been reported from Australia.

Palaeotropical species:

Physma byrsinum, Ramalina celastri.

Neotropical species:

Physciopsis minor is known only from S. America and the West Indies. The only other species closely resembling *P. minor* is *Physcia tenuisecta* ZAHLBRUCKNER from New Zealand, which may be better accommodated in *Physciopsis* in future. A comparison of the specimen from Norfolk Island with the type specimen of *Physcia tenuisecta* in herb.W brought to light exactly those differences, which ZAHLBRUCKNER (1941) already had mentioned in his original diagnosis:

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The colour of the very narrow thallus-lobes is pale greyish in *P. tenuisecta*, brownish grey in *P. minor*. A black hypothallus is lacking in the former, present in the latter species. *P. minor* is sorediate, lacking apothecia, in *P. tenuisecta* many small apothecia, but no soredia are present. There seems to be no doubt from comparison with herbarium material that the identification as *P. minor* is correct. It is hardly possible to interprete the absence of this species from Australia and New Zealand and its presence on Norfolk Island, if it is not assumed that it has been overlooked in other parts of the Australasian region until now.

Widespread, but area of distribution hardly to interprete in general terms:

Ramalina canariensis has hitherto been found in the Mediterranean region, the Canary Islands, South Africa, South America and Australia. It seems to be of Gondwana origin, therefore, and has reached Macaronesia and the Mediterranean region on a later migration. The assumption, that it has become extinct in wide areas of the northern hemisphere originally having been cosmopolitan sounds less satisfactory.

Palaeotropical, but absent from the northern part of this region:

Usnea trichodeoides has been reportet from central and tropical E-Africa, Madagascar, Réunion in the Mascarene Islands, Australia.

Australian species:
Parmelliella duplicata, Pseudocyphellaria pickeringii (Australia, New Zealand, New Caledonia, Sandwich Islands), *Xanthoparmelia scabrosa* (West Pacific, Australia, New Zealand), *Clathroporina exocha*.

Australia and Pacific islands, not reported from New Zealand:

Pannaria mariana

Australia, New Zealand:

Ramalina australiensis, R. glaucescens, Sticta caliginosa

Australia, but not New Zealand:

Lecanora albellaria (cr. taxonomic notes)

New Zealand, but not Australia:

Caloplaca l.-b.-moorei, Clathroporina saxatilis, Pseudocyphellaria chlororleuca (also Lord Howe-Islands).

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Pacific Islands, but neither Australia, nor New Zealand:

Parmotrema saccatilobum, *Usnea intercalaris* (reported from Norfolk Island already by MAIDEN, 1903)

Endemic on Norfolk Island (?)

Pertusaria sp.

In the terminology of GALLOWAY (1979, 1987), the cosmopolitan and pantropical elements are prevailing in the lichen flora of Norfolk Island. On the other hand, the austral element (cool temperate according to JØRGENSEN, 1983) is of little or no importance on the specific level - none of the species chosen as examples by GALLOWAY or JØRGENSEN were found -, but the presence of three species of *Pseudocyphellaria* offers a link on the generic level. This latter is mentioned with examples for the neoaustral element by GALLOWAY (1987), though it is certainly more widespread with many species also in warmer regions, e.g. the very widespread *P. aurata* . Its centre of distribution are the cool temperate regions of the southern hemisphere, however.

Norfolk Island has more species in common with New Zealand alone than with Australia. Though it is situated at a slightly lower latitude, the distance is slightly shorter to New Zealand than to Australia. Species confined to smaller Pacific islands today may be remnants of an older stock. It seems premature, however, to give a more detailed explanation for the facts reported in this paper.

Zusammenfassung

33 Arten von Flechten aus zwei neueren Kollektionen von Norfolk Island, S[illegible]-pazifik, werden aufgezählt. Zu einigen davon werden kurze taxonomisch[illegible] und nomenklatorische Kommentare beigefügt. Eine detaillierte Analyse de[illegible] erbreitung der erwähnten Taxa ergibt ein schwaches Übergewicht kosmo[illegible]litischer und pantropischer Elemente, eine Art war bisher nur aus dem [illegible]ischen Amerika bekannt. Die Verbindungen zu Neuseeland scheinen enger zu sein als jene zu Australien, obwohl auch hier Elemente vorherrschen, die beiden gemeinsam sind. Einige Arten sind bisher nur von kleineren pazifischen Inseln bekannt.

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