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EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES TO THE GALAPAGOS ISLANDS 1905-1906

VII

NOTES ON THE LICHENS OF THE GALAPAGOS ISLANDS

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While acting as botanist to the recent expedition sent by the California Academy of Sciences to the Galapagos Islands, I made a considerable collection of lichens. I am not a lichenologist in any sense of the word, and it is with some hesitation that I approach a subject with which I have so little acquaintance. However, as I made a number of notes on the subject while collecting there, and as very little has been written on the general distribution etc. of the *Lichenes* of these islands, it seems worth while to publish those notes, along with a list of the species which were secured. This list is probably far from complete, for I was more interested in collecting and studying the distribution of the vascular plants; and it was often the case that lichens were carefully collected only where no vascular plants in good condition were to be found, as was sometimes the case when the lower islands were visited during the dry season. Notwithstanding the rather neglectful

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way in which this group of plants was treated, sixteen species were found which had not before been reported from the islands, and the range of quite a number of species already known was considerably extended. There were, however, some fifteen species reported by former expeditions to the islands, which do not appear in my collection. Some of these have been taken but once.

I wish here to express my thanks to Dr. W. G. Farlow of Harvard University for his kindness in making the identification of the lichens in this collection—a task which, with my limited knowlege of the subject, would have been impossible for me. In the list of species which follows, bibliographic references are omitted—it would have been too great a favor to ask of Dr. Farlow to look them up, and I did not feel competent to undertake it.

In order to bring our knowledge of the lichenaceous flora of these islands down to date, all species which have been reported from them, but which escaped me in my collecting, are included in the list.

When one lands for the first time on almost any of the islands, one is immediately struck with the great abundance of lichens. This is true not only in the case of the larger and higher islands, which reach sufficient elevation to receive a considerable amount of moisture from the fog-banks which strike their sides, and which consequently support a more or less luxuriant vegetation; but it is also true in the case of the smaller and lower islands, where the amount of moisture received throughout the greater part of the year is very scanty, and where, in consequence, desert or semi-desert conditions prevail. On islands of both sorts, lichens often lend a striking appearance to the vegetation, the fruitcose forms being the most important in this respect. *Alectoria sarmentosa* is one of the most common of these. It is found largely in the transition region*, where the branches both of trees and of bushes are often heavily covered with masses of this rather filmy species. On the south side of Indefatigable Island, it

* For a discussion of the botanical regions of these islands, see Stewart: Proc. Cal. Acad. Sci., 4th Ser., v. I, pp. 208-211.

gives a distinct color to the vegetation of the transition region; and on Duncan Island above 500 ft. elevation, it occurs to such an extent as to give the trees and shrubs on the upper part of the island, when seen from a distance, the appearance of being covered with a light green foliage, even during the dry season, when they are out of leaf. Similar but less marked conditions are found at Villamil, Albemarle Island, and on Jervis Island.

Next to *Alectoria* the *Usneas* are probably the most striking of the fruticose forms, and the two species in the collection, *U. ceratina* and *U. longissima*, were usually found in situations similar to those of *Alectoria*. In the transition region they cover the branches of trees with long festoons, and occasionally they are found in the moist regions. The greatest display of *Usneas* is at Cowley Bay on the east side of Albemarle Island, where they occur abundantly above 1800 ft. elevation, mostly on branches of *Bursera graveolens*. This tree, in all the regions where it occurs, seems to form a favorite host (if I may use that term in this connection) for a considerable number of lichens, not only of fruticose, but of foliose and crustaceous forms as well.

Of the three species of *Ramalina* in the collection, *R. complanata* is usually found on the dryer parts of the islands, forming small tufts on dead sticks and twigs. *R. farinacea* occurs where conditions are not so dry as in the last instance, and sometimes even in the moist regions; while *R. usneoides* occurs in both dry and moist situations. It was found on both Barrington and Charles islands under very dry conditions, and on Albemarle and Indefatigable islands, where conditions were moist.

Both of the species of *Rocella* collected were found in the dry and lower transition regions. *R. peruensis* occurs commonly on bushes and small trees, forming tufts pendant from the branches. There seems to be a great difference in the width of the thallus in different specimens, especially toward the ends of its branches. In some the branches are very slender, while in others they are a millimeter in width near the tips. The second species, *R. portentosa*, occurs almost exclusively on rocks. It often forms large masses, especially in protected places on the under side of projecting blocks of lava, where it

has a tendency to grow larger than in more open situations. It is the largest fruticose lichen found on the islands.

The *Cladonias* are found, for the most part, under decidedly moister conditions than are the other species of fruticose lichens. *C. adspersa* and *C. fimbriata* were found growing near the top of the main mountain on Chatham Island, along with ferns and other mesophytic plants. At the time the specimens were collected, this portion of the island was heavily enveloped in fog, and on subsequent visits to this locality the same condition prevailed. *C. ceratophylla* was found under somewhat similar conditions near the summit of James Island. The fourth species in the collection, *C. pycnoclada,* is found under both xerophytic and mesophytic conditions. It occurs in large tufts on the lava on the west side of the mountain at Tagus Cove, Albemarle Island; and although it is found at a high altitude here, the surrounding vegetation was decidedly xerophytic in character—a condition which on this side of the mountain continues to the top, because this is the leeward side, and is not bathed by the fog-laden wind. It was also found on Chatham Island along with lycopods and ferns, and was taken by Snodgrass and Heller from the mountain at Iguana Cove on Albemarle Island, at an elevation of 925 m. Although this elevation was not reached at Iguana Cove by any of the members of our party, the conditions there must be very moist, if one may judge from the conditions found nearer the base of the mountain.

Parmelia latissima is the most common of the foliose species, occurring throughout the transition and the moist regions, and often heavily covering branches of trees and bushes, sticks, and dead logs. It was specially abundant about the summit of Duncan Island, where the vegetation is quite open; but in the moister portions of the islands where the vegetation is dense, it is found sparingly. Two other foliose species which occur both in the upper transition and in the moist regions, are *Sticta aurata* and *S. quercizans,* both of which are found usually on the bark of trees; and while in places they are fairly common, they never so completely cover the trees as does the *Parmelia* just mentioned. Another species characteristic of both the upper transition and the moist regions is *Chiodecton sanguineum,* whose conspicuous red thallus is often found adher-

ing to branches, dead sticks, grass culms, etc. Two species which occur mostly in the dry regions are *Physcia picta* and *Lecanora punicea,* both of which are found largely on the branches of *Bursera graveolens,* although the first is also one of the common forms inhabiting lava-boulders in the dry regions. Foliose lichens are neither as abundant as a whole, nor do they lend as striking an aspect to the vegetation in the places where they occur, as do the fruticose forms.

Of the rock-inhabiting forms, *Placodium murorum* and *Physcia picta* seem to be the most common. They often cover the lava-boulders on the lower parts of the islands to such an extent as to give them, when seen from a short distance, the appearance of being covered with paint. Rock-encrusting forms are seldom found on lava of recent origin, but rather where oxidation has set in, and at least the surface of the lava has begun to disintegrate. They are seldom found in the moist regions, even where there are exposures of lava which apparently would furnish them with a suitable habitat. Two forms which encrust the branches of trees are *Verrucaria ocraceo-flava* and *Pyrenula aurantica,* both of which are found in the dry regions.

From the above it is seen that lichens are common throughout the dry and the transition regions, but decrease in numbers in the moist regions. The transition is distinctly the region for lichens, probably because there is more moisture in this region than lower down; but why they are not more abundant in the moist regions where there is a still greater amount of moisture, I am unable to say. In the moist regions, in so far as the epiphytic forms are concerned, their place seems to be taken by the leafy hepatics, which often cover the trees and bushes in great profusion. Foliose and fruticose forms present the greatest display where there is at least a fair amount of moisture, while the encrusting forms seem to have a distinct preference for the dryer parts of the islands.

Alectoria Ach.

A. sarmentosa Ach.—Abingdon Isl.: very abundant on the branches of small trees and bushes at 500-900 ft. (No. 415). Albemarle Isl.: Cowley Bay, common on the branches

of *Bursera graveolens* above 1000 ft. (No. 416); Villamil, common at 200-400 ft. CHATHAM ISL.: Wreck Bay, common on the branches of trees and bushes in the neighborhood of 700 ft. (No. 417). DUNCAN ISL.: very abundant above 500 ft. INDEFATIGABLE ISL.: Academy Bay, very abundant on the branches of trees at 100-350 ft.; northwest side, common on trees at 950 ft. (No. 420); southeast side, covering trees and bushes at 350-550 ft. JERVIS ISL.: very abundant on small bushes, 450-750 ft. (no. 421).

Arthonia Ach.

A. gregaria (Weig.) Koerb.—DUNCAN ISL.: *Snodgrass and Heller.* Not obtained by the Academy's expedition.

A. nivea Willey—GALAPAGOS IDS.: *Hassler Expedition.* Not obtained by any of the more recent expeditions that have visited the islands.

A. platyspeilea Nyl.—GARDNER ISL. (near Hood): *Snodgrass and Heller.* Not obtained by the Academy's expedition.

A. sp. Willey—GALAPAGOS IDS.: *Hassler Expedition.*

Buellia De Not.

B. straminea Tuck. in herb.—ALBEMARLE ISL.: Christopher Point, *Snodgrass and Heller.* Not obtained by the Academy's expedition.

B. sp. Farlow—BINDLOE ISL.: *Snodgrass and Heller.*

Chiodecton Ach.

C. sanguineum (Sw.) Wainio—ABINGDON ISL.: *Snodgrass and Heller.* DUNCAN ISL.: sterile specimens were obtained from the culms of grasses on the moister parts of the island at about 1300 ft. (No. 422). INDEFATIGABLE ISL.: southeast side, common on the trunks of trees above 650 ft. (No. 423). JAMES ISL.: James Bay, common on the trunks and branches of trees in the neighborhood of 2000 ft., but was not noticed some eight hundred feet higher up near the summit of the island, (Nos. 424-425).

Cladonia (Hill) Wainio emend.

C. adspersa Floerke—Chatham Isl.: Wreck Bay, abundant covering rocks and moist earth on the southeast side of the main mountain at 1900-2000 ft. (No. 426).

C. ceratophylla Eschw.—James Isl.: James Bay, common on dead logs and other decaying vegetation above 2150 ft. (No. 427).

C. fimbriata Hoffm.—Albemarle Isl.: Villamil, common on rocks and dead wood at 500 ft. (No. 428). Chatham Isl.: Wreck Bay, common on moist soil at 2000 ft. with *C. adspersa,* (No. 429).

C. pycnoclada (Gaud.) Nyl.—Albemarle Isl.: Iguana Cove, *Snodgrass and Heller;* Tagus Cove, in large masses 1 ft. or more in diameter, on lava beds above 2500 ft. (No. 430). Chatham Isl.: Wreck Bay, forming occasional masses of a considerable size on bushes at about 1700 ft. (No. 431).

C. sp.—Duncan Isl.: on rocks at 900 ft. (No. 432).

C. sp.—James Isl.: James Bay, on the trunks of trees and on the fronds of dead ferns at 2800 ft.

Coenogonium Ehrenb.

C. sp.—James Isl.: James Bay, common on the trunks of trees at 2000 ft. (No. 433).

Lecanora Ach.

L. glaucovirens Tuck.—Galapagos Ids.: *Hassler Expedition.* Not obtained by any of the later expeditions to these islands.

L. pallescens Ach.—Barrington Isl.: occasional, encrusting the dead branches of trees, (No. 434). Charles Isl.: on the branches of trees at 800 ft. (No. 435).

L. punicea Ach.—Tower Isl.: common on the trunks and branches of *Bursera graveolens,* (No. 436).

Lecidea Ach.

L. flavo-areolata Nyl.—Galapagos Ids.: *Hassler Expedition.* Not obtained by any of the subsequent expeditions to these islands.

Pannaria Del.

P. molybdaea (Pers.) Tuck.—INDEFATIGABLE ISL.: southeast side, rare on trees at 625 ft. (No. 437).

Parmelia Ach.

P. camtschadalis Eschw.—JAMES ISL.: James Bay, rare on dead trunks of trees at about 2150 ft. (No. 438).

P. latissima Fée—ALBEMARLE ISL.: Iguana Cove, abundant on rocks on the side of the cliff above the cove, (No. 439). CHARLES ISL.: common on rocks and tree trunks at 1000 ft. (Nos. 440-441). DUNCAN ISL.: on rocks and dead twigs at 1200 ft. (Nos. 442-443). JAMES ISL.: James Bay, common on the trunks of trees at about 2000 ft. (No. 444).

P. perlata Krumph.—ALBEMARLE ISL.: Iguana Cove, *Snodgrass and Heller.* CHARLES ISL.: *Andersson.*

P. sp. (*P. physodi* Fries., *P. affinis* Andersson)—CHARLES ISL.: *Andersson.* Not collected by any of the later expeditions.

Pertusaria DC.

P. albinea Tuck.—GALAPAGOS IDS.: *Hassler Expedition.* Has not been obtained from these islands since.

P. leioplaca (Ach.) Schaer. forma **bispora**—TOWER ISL.: on the trunks and branches of *Bursera graveolens* (No. 353).

Physcia (DC.) Th. Fr.

P. leucomela (L.) Michx.—JAMES ISL.: *Darwin.* Not obtained by any subsequent expedition.

P. picta (Sw.) Nyl.—BARRINGTON ISL.: common on the branches of bushes and trees, (No. 359). CHARLES ISL.: common on the branches of trees at about 1100 ft. (No. 358). DUNCAN ISL.: common on rocks at 900 ft. (No. 357). SEYMOUR ISL.: south side, very abundant, encrusting rocks, (No. 360).

Placodium DC.

P. murorum DC.—SEYMOUR ISL.: south side, encrusting rocks along with *Physcia picta,* (No. 360).

Pyrenula Fée.

P. aurantiaca Fée—Narborough Isl.: southern part, *Snodgrass and Heller.* Tower Isl.: common on the trunks of *Bursera graveolens,* (No. 362).

Ramalina Ach.

R. complanata Ach.—Albemarle Isl.: Turtle Cove, common on dead branches, (Nos. 363-364). Brattle Isl.: common on bushes, (No. 370). Charles Isl.: common on twigs at 1000 ft. (No. 366). Chatham Isl.: Wreck Bay, common on twigs and bushes, (No. 365). Gardner Isl.: (near Hood), *Snodgrass and Heller.* Hood Isl.: abundant on dead bushes, (Nos. 367-368). Tower Isl.: common on bushes, (No. 369).

R. farinacea Ach.—Albemarle Isl.: Villamil, common on dead twigs at 1350 ft. (No. 372). Duncan Isl.: common on bushes at 1200 ft. (No. 373). Indefatigable Isl.: southeast side, common on bushes, (No. 371). Jervis Isl.: abundant on dead twigs above 450 ft. (No. 374).

R. indica Fr.—Charles Isl.: *Andersson.* Not since obtained from the islands.

R. usneoides Fr.—Albemarle Isl.: Villamil, common on the trunks of trees up to 600 ft. (Nos. 375-376). Barrington Isl.: common on dead bushes, (No. 378). Bindloe Isl.: *Snodgrass and Heller.* Charles Isl.: common on trees up to 600 ft. (No. 377). Indefatigable Isl.: Academy Bay, occasional on the trunks of trees at about 450 ft. (No. 379).

R. sp.—Charles Isl.: covering bushes, indeterminate as to species. Indefatigable Isl.: southeast side, on twigs at 600 ft. probably of the same species as the sterile specimens from Charles Isl.

Rinodina Mass.

R. mamillana Tuck.—Galapagos Ids.: *Hessler Expedition.* Not obtained by any subsequent expedition.

Roccella DC.

R. peruensis *Krempl h.*—Albemarle Isl.: Villamil, abundant on trees and bushes on the lower and dryer parts of the

island, (No. 382). BARRINGTON ISL.: common on trees of *Bursera graveolens,* (No. 392). BRATTLE ISL.: on bushes, (No. 383). CHARLES ISL.: common on the branches of trees on the lower parts of the island, (No. 386). CHATHAM ISL.: Wreck Bay, *Snodgrass and Heller.* HOOD ISL.: common on dead bushes, (Nos. 387-388). INDEFATIGABLE ISL.: northeast side abundant on bushes, (No. 389); southeast side, on dead bushes, (No. 390). JERVIS ISL.: common on trees of *Bursera graveolens,* (No. 391). SEYMOUR ISL.: south, common on bushes, (No. 385). TOWER ISL.: common on trees of *Bursera graveolens,* (No. 384). A species rather characteristic of the dry regions on the islands where it occurs.

R. portentosa Mont.—BARRINGTON ISL.: common on rocks, (No. 393). CHARLES ISL.: covering the lower sides of projecting masses of lava, (No. 396). GARDNER ISL.: (near HOOD), *Snodgrass and Heller.* HOOD ISL.: common on the sides of cliffs, (Nos. 394-395), JAMES ISL.: *Hassler Expedition.* SEYMOUR ISL.: south side, *Snodgrass and Heller.* When found growing in rather dark protected places on the under sides of rocks, it seems to show a pseudo-heilotropism, as it grows outward toward the light.

Sticta Schreb.

S. aurata Ach.—ALBEMARLE ISL.: Iguana Cove, *Snodgrass and Heller.* DUNCAN ISL.: common on dead bushes at 1200 ft. (No. 398). INDEFATIGABLE ISL.: southeast side, common on the bark of trees at 625 ft. (No. 399). JAMES ISL.: James Bay, abundant on the bark of trees above 1500 ft. (No. 397). NARBOROUGH ISL.: southern part, *Snodgrass and Heller.*

S. quercizans Ach.—ALBEMARLE ISL.: Iguana Cove, *Snodgrass and Heller.* CHARLES ISL.: common on the bark of trees above 1000 ft. (No. 400). INDEFATIGABLE ISL.: northwest side, common on the bark of trees above 1000 ft. (No. 401).

Teloschistes Norm.

T. flavicans (Sw.) Mull. Arg.—ALBEMARLE ISL.: *Snodgrass and Heller.* CHARLES ISL.: *Andersson, Snodgrass and Heller.* CHATHAM ISL.: *Baur.* Not obtained by the Academy's expedition.

Usnea Dill.

U. arthrocladon Fée—Narborough Isl.: southern part, *Snodgrass and Heller.* Not obtained by the Academy's expedition.

U. ceratina Ach.—Abingdon Isl.: on the branches of trees 600-1000 ft. (No. 402). Duncan Isl.: on bushes at about 1200 ft. (No. 403). Indefatigable Isl.: northwest side, on the branches of bushes and trees above 600 ft. (No. 404). James Isl.: James Bay, occasional on the branches of trees at 2000 ft. (No. 405). Narborough Isl.: *Snodgrass and Heller.*

U. dasypoga (Ach.) Nyl. var. **plicata** (Hoffm.) Hue.—Charles Isl.: *Andersson.* James Isl.: *Darwin.* Has not since been obtained by the later expeditions to these islands.

U. longissima Ach.—Abingdon Isl.: common on the branches of trees at 1000 ft. (No. 406). Albemarle Isl.: Cowly Bay, common on branches of *Bursera graveolens* above 1800 ft. The branches are often covered with long festoons of this lichen making quite a striking effect, (No. 407). Tagus Cove, common on bushes at 3000 ft. (No. 408).

Verrucaria Scop.

V. ocraceo-flava Nyl.—Barrington Isl.: common on the branches of dead bushes, (No. 411). Charles Isl.: encrusting dead branches at about 600 ft. (No. 409). Hood Isl.: common on dead branches, (No. 412). Tower Isl.: common on the branches of *Bursera graveolens,* (No. 410).

TABLE SHOWING THE DISTRIBUTION OF LICHENS ON THE GALAPAGOS ISLANDS

The sign + indicates that there is a record for the species from the island in question. The abbreviations: "Gardner Ch." and "Gardner Hd." designate respectively Gardner Island near Charles Island, and Gardner Island near Hood Island.

SPECIES	Galapagos	Abingdon	Albemarle	Barrington	Bindloe	Brattle	Charles	Chatham	Culpepper	Duncan	Gardner Ch.	Gardner Hd.	Hood	Indefatigable	James	Jervis	Narborough	Seymour	Tower	Wenman
Alectoria sarmentosa		+	+					+		+				+		+				
Arthonia gregaria										+										
" nivea	+																			
" platyspeilea												+								
" sp.	+																			
Buellia straminea			+																	
" sp.					+															
Chiodecton sanguineum		+								+				+	+					
Cladonia adspersa								+												
" ceratophylla															+					
" fimbriata			+					+												
" pycnoclada			+					+												
" sp.										+										
" sp.															+					
Coenogonium sp.															+					
Lecanora glaucovirens	+																			
" pallescens				+			+													
" punicea																			+	
Lecidea flavo-areolata	+																			
Pannaria molybdaea														+						
Parmelia camtschadalis															+					

TABLE SHOWING THE DISTRIBUTION OF LICHENS ON THE GALAPAGOS ISLANDS—*Continued*

SPECIES	Galapagos	Abingdon	Albemarle	Barrington	Bindloe	Brattle	Charles	Chatham	Culpepper	Duncan	Gardner Ch.	Gardner Hd.	Hood	Indefatigable	James	Jervis	Narborough	Seymour	Tower	Wenman
Parmelia latissima			+				+			+					+					
" perlata			+				+													
" sp.							+													
Pertusaria albinea	+																			
" leioplaca, forma bispora																			+	
Physcia leucomela															+					
" picta				+			+			+								+		
Placodium murorum																		+		
Pyrenula aurantiaca																	+		+	
Ramalina complanata			+			+	+	+				+	+						+	
" farinacea			+							+				+		+				
" indica							+													
" usneoides			+	+	+		+							+						
" sp.							+							+						
Rinodina mamillana	+																			
Roccella peruensis			+	+		+	+	+					+	+		+		+	+	
" portentosa				+			+					+	+		+			+		
Sticta aurata			+							+				+	+		+			
" quercizans			+				+							+						
Teloschistes flavicans			+				+	+												
Usnea arthrocladon																	+			
" ceratina		+								+				+	+		+			
" dasypoga							+								+					
" longissima		+	+																	
Verrucaria ocraceo-flava				+			+						+						+	

From the above it can be seen that of the 47 species, determinate and indeterminate, that have been collected on these islands, the greater number have been taken but from one or two localities. Careful collecting by one who is familiar with lichens, and thoroughly interested in the subject, would probably materially increase the number of species known from the islands, and extend the range of many of the species already known. Especially would this be the case with the smaller forms, which easily escape the notice of the ordinary collector. I make this prediction from my own experience with the vascular plants. It was my good fortune to be the only botanist who has had the privilege of collecting on these islands for any considerable length of time. Most of the former collections of plants from these islands were made by men more interested in some other line of biological work. While the collections they made were in most respects remarkably good, I found that there was a tendency to fail of getting some of the species most common on most of the islands. Possibly the great abundance of such species caused them to be overlooked. The species of *Croton,* for instance, had not been reported from Indefatigable Island until the Academy's expedition visited it; yet there is probably no place on the island where one could go for any distance from the shore without encountering thickets of *Croton* bushes of greater or less extent. Many other instances could be cited of a like nature. Of lichens, two species only (or 4.25%) are said to be endemic; which is in striking contrast with the conditions found among the vascular plants, where 40.9% of the species are endemic.

Lichens have not as yet been reported from either Culpepper or Wenman Island, the two northernmost islands of the group, or from Gardner Island near Charles Island. I remember distinctly having seen an abundance of fruticose lichens, possibly *Alectoria* or *Usnea,* covering the vegetation on the upper and inaccessible portions of Culpepper during our short stay at this island. There is no anchorage at either of these two northern islands so that the vessel had to lie "off and on" at Wenman Island while the party went ashore to collect. On this account our stay there was brief, and as I was very busy getting together during the short time at my disposal as many species as possible of vascular plants, I neglected to

make any collections or observations on the lichen-flora of the island. At the time our party visited Gardner Island near Charles Island, the sea was rough, making landing dangerous. As I was unable to swim, I did not wish to run the risk of attempting to go ashore. When careful collections are made on them, all three of these small islands will probably be found to have quite a lichen-flora.

Stewart, Alban. 1912. "Notes on the lichens of the Galapagos Islands."
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