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Lichens of Nihoa and Necker Islands

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INTRODUCTION

This paper deals with a collection of lichens from Nihoa and Necker Islands made by Dr. Erling Christophersen during the Tanager expedition to the leeward Hawaiian islands in 1924, which I received in March 1940.

Both Nihoa and Necker are remnants of volcanic cones. Nihoa, 895 feet high, is larger and more elevated, and the vegetation is richer than that of Necker, 276 feet high, which is described as inconspicuous. A short description of the geography, accompanied by some photographs, was published by Christophersen and E. L. Caum as introduction to their catalog of the vascular plants of the leeward islands (B. P. Bishop Mus., Bull. 81, 1931). Practically nothing was known of the flora of Nihoa and Necker. The vascular plants are all phanerogams, and a fairly large and very interesting element is found on Nihoa.

Twenty one species of lichens have been recognized, of which 15 are here described as new; in addition, a manuscript species of Zahlbruckner, recorded previously from Oahu and Kauai, is published here for the first time. Of the remaining five species, a *Candelaria* had to be left unnamed, the determinations of *Rinodina antarctica* and *Physcia crispa* are tentative only, and *Caloplaca albidella* was known before from Oahu. *Physcia picta* is widely distributed in the tropics and subtropics and found in many places in the Hawaiian islands.

Thirteen of the species were collected on Nihoa only, two are confined to Necker, and six are common to both. All specimens

were growing on stone. The rock is basalt, mostly olivine, and most of the lichens were collected on very hard dikes,¹ making it difficult to prepare suitable herbarium specimens. Some rock samples look different, being of a less hard consistency and having an uneven, deeply pitted surface. They resemble coralline limestone, but no positive reaction with HCl was obtained.

The entire lichen flora gives the impression of being nitrophilous, as may be expected from oceanic islands frequented by birds; the specimens all look normal and not overfed. Detailed information, however, as to the localities is lacking. The generally nitrophilous genera *Caloplaca*, *Buellia*, *Rinodina*, and *Physcia* are well represented with 13 species, *Blastenia*, *Candelaria*, *Heppia*, *Lecania*, *Lecanora*, and *Opegrapha* with one species each, and *Ramalina* with two. Three species of *Physcia* are foliaceous, two of *Ramalina* are fruticulose, and the rest are crustaceous.

Caloplaca pallescens is a near relative of *C. diplacia* from tropical America, *Opegrapha hawaiiensis* is probably closely related to *O. Fauriei* from Kauai, Hawaiian islands, *Physcia Fregatarum* comes certainly near to *Ph. Metraxii* from Easter Island, and *Ramalina luxurians* to *R. continentalis* from South America. Because the species in some of the large genera such as *Caloplaca*, *Buellia* (about 400 species), *Lecanora* or *Rinodina* are not well grouped, it is not possible to state the near relatives of the new species. The new species of *Heppia* and *Lecania* seem to be rather isolated types.

The rich development of pycnidia in the leeward island lichens attracted my attention and must be interpreted as indicative of the favorable conditions under which they live. I have recorded them in all the 13 species that form the bulk of the collection and their frequency is apparently very high.

Besides the current abbreviations of chemical reagents in lichenological literature, I have used Pd for Paraphenylene-diamine, and C.U.C. refers to Séguy (Code universal des couleurs, Paris, 1936). The present collection contains about 125 numbers, comprising over 200 herbarium specimens. Most species are represented by several or even numerous specimens. The main collection, including the types of the new species, is in Bishop Museum. Duplicates of most species are preserved in my herbarium.

¹ According to Christophersen; see also H. S. Palmer (B. P. Bishop Mus., Bull. 35, 1927).

LIST OF SPECIES

<i>Opegrapha hawaiiensis</i> , Necker	<i>Caloplaca Crosbyi</i> , Nihoa
<i>Heppia nitida</i> , Nihoa	<i>Buellia neckerensis</i> , Necker, Nihoa
<i>Lecanora Christophersenii</i> , Nihoa	<i>Buellia Nihoae</i> , Nihoa
<i>Lecania hypophaea</i> , Nihoa	<i>Buellia pacifica</i> , Necker
<i>Candelaria</i> species, Nihoa	<i>Buellia paupera</i> , Nihoa
<i>Ramalina desolata</i> , Nihoa	<i>Rinodina intercedens</i> , Nihoa
<i>Ramalina luxurians</i> , Nihoa	<i>Rinodina</i> cf. <i>antarctica</i> , Nihoa
<i>Blastenia sandwicensis</i> , Necker, Nihoa	<i>Physcia</i> cf. <i>crispa</i> , Nihoa
<i>Caloplaca albidella</i> , Necker, Nihoa	<i>Physcia Fregatarum</i> , Nihoa
<i>Caloplaca capitulata</i> , Necker, Nihoa	<i>Physcia picta</i> , Necker, Nihoa
<i>Caloplaca pallescens</i> , Necker, Nihoa	

DESCRIPTION OF SPECIES

1. *Opegrapha hawaiiensis*, new species.

Thallus expansus, cretaceus, tenuis, continuus vel maculatim interruptus, haud rimosus, subfarinosus, hypothallo tenuissimo atrofusco limitatus, reagentibus immutatus. Apothecia \pm crebra, prominentia vel subsessilia, atra, linearia, recta vel saepe flexuosa, simplicia vel pauciramosa, solitaria vel interdum approximata, disco rimiformi angusto, saepius nudo. Excipulum crassum, dimidiatum, hypothecio obscure fusco. Sporae mediocres, tenues, pluriseptatae, altero apice subacutae.

Thallus covering an area of at least 5 cm. square, or several thalli confluent, separated by a blackish fissure, hypothallus often well visible, 1(2) mm. broad, indistinctly fimbriate at the very edge, sometimes indistinct or invisible. Thallus surface slightly undulating or pitted, thinly farinose, \pm smooth or often interrupted by depressions in naked stone. Apothecia 1-2 mm. long, about 0.3 mm. broad, linear, rarely substellate, often with one \pm long branch, usually variously bent, outside of exciple \pm pruinose at base. Pycnidia present but hardly visible from above.

Thallus sections 200-300 μ thick, grayish granular, opaque, but transparent in HNO₃. Gonidial stratum 80-100 μ thick; gonidia 6-10 μ , reaching the surface. Medullary tissue not distinctly hyphose or cellular. Hypothallus about 60 μ thick, dark yellow brown. Exciple developed only laterally, about 165 μ long, 35-50 μ thick along the hymenium, blackish, \pm separated from the dark brown, 35-60 μ thick hypothecium. Thecium about 85 μ high, colorless to the surface, not granular, I+ reddish yellow. Paraphyses 1 μ , branched, discrete in HCl. Asci 60-70 \times 17 μ , thick walled. Spores 8, in two strata, 22-25 \times 3-4 μ , usually 6-septate, one end narrower, no free spores obtainable.

Conidia slightly bent, 12-15 \times 0.8 μ . Sterigmata simple, about 10 μ .

Necker: on comparatively soft basalt, rarely in company with other species such as *Physcia picta*, many specimens; no. 121 is selected as type.

Perhaps closely related to *O. Fauriei* B. de Lesd. from Kauai (Soc. Bot. France, Bull. 57: 463, 1910); it is not too well characterized but seems to differ by larger spores, 27-36 \times 4-6 μ .

2. *Heppia nitida*, new species.

Thallus squamulosus, olivaceo-castaneus, nitidus, squamulae dispersae, umbilicatae, crassae, primum adpressae, subrotundatae leviterque sinuatae, applanatae, mox valde accrescentes marginibus undulatis, erecto-complicatae, caespites latiores formantes, subtus pallidae. Apothecia rara, in squamulis minutis adpressis irregulariter verrucosis immersa, disco minuto impresso obscure fuscurofo. Hymenium altitudine mediocri. Sporae numerosae, globosae. Cortices bene evolutae, cellulosae.

Squamules when young and appressed 1.5-2 mm. large, 0.2-0.5 mm. thick, with free, undulating margins, which soon become inflexed and raised at center, gradually widened to 2-4 mm. and 1(1.5) mm. thick, forming agglomerations with a very undulating and uneven surface from the raised margins. Fertile squamules 1-1.5(2) mm. large, verrucose irregular, less shiny, appressed. Disks solitary or few, 0.1-0.25 (or moist 0.35) mm. broad, concave.

Upper cortex 30-35 μ thick, pale brownish yellow, surface layer 3-4 μ thick, \pm gelatinous, smooth, cells not very distinct, very irregular, 3-5(6) μ , thin walled. Gonidia 5-8(14) μ , globular, intensely bluish green, in lumps, gonidial stratum 70-100 μ thick, appearing dark in air, the hyphal cells 4-6 μ . Medulla colorless or obscured by air, cellular or \pm hyphose with more or less numerous gonidia; hyphae 3.5-4.5 μ , thin walled, cells \pm stretched. Lower cortex distinctly limited, 35-50 μ , colorless, surface \pm dirty yellow, cells 5-8(10) μ , \pm rounded, sometimes perpendicularly oblong. Cortex, especially the upper one, KOH+ dark brownish red. Sections Pd—.

Apothecia quite immersed, developing from the upper stratum of the medulla, about 150 μ deep. Hypothecium about 35 μ thick, \pm colorless, dense. Hymenium 85-95 μ , faintly brownish yellow, upper 25 μ sordid yellowish with a gelatinous cover as much as 17 μ thick. Paraphyses embedded in gelatin, indistinct in water, in KOH 1.7 μ across, \pm constrictedly septate, widened toward the tip. Asci about 70 \times 20 μ , broadly clavate. Spores about 100, 3.5-4.5 μ , globose. Thecium and hypothecium I+ blue, upper part of asci darker. Thecium 135 μ high in another apothecium without spores.

Pycnidia inconspicuous, immersed in the gonidial stratum, globose, pale, 130 μ across, with walls 10-12 μ thick (one measured). Sterigmata 8-10 \times 1.6 μ , simple, parallel. Conidia 2-3 \times 1 μ , ellipsoid.

Nihoa: with *Caloplaca Crosbyi*, suggesting a locality rich in nitrate; type no. 75a.

Distinguished by the shiny, complicated, apparently crowded, umbilicate squamules. A fine and elegant species.

3. *Lecanora Christophersenii*, new species.

Thallus determinatus, continuus, albescens, modice incrassatus, indistincte areolatus, areolis planis, minutis, subfarinosis, rimis tenuissimis separatis, reagentibus immutatus. Apothecia valde crebra, minuta, subimmersa, disco carneoflavido concavo vel plano, margine thallode tenui vel crassiusculo leviter prominente cincto. Thecium tenue, superne sordide flavum, non inspersum. Sporae ellipsoideae minutae. Conidia mediocria, arcuata.

Thallus forming \pm circular areas, 1-2(3) cm. large with the outer sterile part somewhat radiating, abruptly attenuate at the edge, but of normal thickness when bordering upon other crusts. Areoles very indistinctly limited by

very thin or disappearing cracks, 0.3-0.5 mm. wide, 0.3-0.4 mm. thick, opaque, KOH—, I—, CaCl—, Pd—. Apothecia uniform in size, 0.3-0.5 mm., orbicular, disk only slightly raised above the thallus surface.

Most of thallus filled with 5-12 μ large, yellowish green gonidia mixed with large druses of oxalate as much as 50 μ across and with much enclosed air. Thallus indistinctly hyphose without distinct cells. Also stone particles enclosed. Apothecia 100-150 μ deep, without exciple. Hypothecium 35-50 μ high, colorless, with indistinct perpendicular hyphae, 2-2.5 μ thick in KOH. Thecium 45-55(60) μ , colorless all through or surface \pm sordid yellowish, I+ dark blue, yellowish olive granules on surface dissolving in KOH. Paraphyses dense, indistinct, 1-1.5 μ , simple, tips not thickened. Asci 35-50 μ long, when narrow 7 μ across and with uniseriate spores, when broader up to 13 μ , biseriate. Spores 8, rarely fully developed, 8-10 \times 4.5-5 μ , ellipsoid.

Pycnidia in the shape of pale, sordid yellow impressions, common. Walls 8-10 μ , pale. Sterigmata 12-13 μ , simple, parallel. Conidia 15-20 \times 0.8 μ , arcuate to falcate.

Nihoa: apparently common, associated with *Caloplaca capitulata*, *C. albidella*, and *C. pallescens*, *Buellia Nihoae*, etc.; type no. 5.

4. *Lecania hypophaea*, new species.

Thallus subdeterminatus, contiguus, tenuis, glaucescenti-albicans, sublaevigatus, areolatus, areolis planis angulatis, rimis tenuissimis separatis, interdum subfarinosus vel sorediis minutis obsitus, CaCl erythrinus, hypothallo tenui fuscescente. Apothecia dispersa, sessilia, subminuta, saepe irregularia, disco dense pruinoso subgranuloso cinereoalbo, margine tumido prominente irregulari cincto. Hypothecium obscure fuscum. Thecium altum, epithecio granuloso tectum. Sporae incolores, oblongae, tri-septatae.

Thallus one to several cm., large or several confluent, circumference thin and irregular, sometimes with a brownish hypothalline edge. Areoles rarely surpassing 0.5 mm., 0.2-0.3 mm. thick, fissures slightly undulating. Soralia locally developed, about 0.3 mm. wide, orbicular, somewhat prominent, subconvex. Thallus KOH—, Pd—, I—. Apothecia sometimes rather dense, 0.5-1 mm. wide, at first almost closed, circular, finally irregular because of the undulating to plicate, prominent and somewhat inflexed, smooth, concolorous margin.

Thallus sections grayish without distinct cortex, obscured by oxalate granules dissolving in HNO₃. Hyphae densely intricate, 3-3.5 μ , rather thick walled, uniform all through. Gonidia yellowish green (5)8-15 μ , filling most part of thallus and not forming a distinct stratum. Both cortex and medulla CaCl+ intensely red. Apothecia about 0.4 mm. thick, sometimes with an immersed "foot" of 0.2-0.4 mm. Margin 150-100(70) μ thick, somewhat tapering toward the edge, gray, granular, opaque, 150 μ thick below the apothecium with a cortex of about 20 μ , pale sordid yellow in KOH, of perpendicular, intricate hyphae of about 5 μ , inside with a 35 μ thick gonidial layer. No exciple developed. Hypothecium 100(150) μ , \pm dark brown, especially in the center. Thecium 100-120 μ , colorless, I+ blue only in the lower 35 μ , upper part \pm yellowish; uppermost 30-35 μ sordid gray (greenish), \pm granular, CaCl+ red. Paraphyses indistinct in water, in KOH rather free, 2.5 μ thick, tips not thickened. Ripe asci and spores rare, asci about 60 \times 17 μ , spores about 25 \times 5.5 μ , irregularly oblong, 3-septate.

Nihoa: few specimens, among *Caloplaca albidella*, *Lecanora Christophersenii*, etc.; type no. 7.

The new species is remarkable because of the dark brown hypothecium and the oblong, 4-celled spores. So far as I know, no *Lecania* with a dark hypothecium has been described, but in the closely related genus *Lecanora*, we find a number of such species. On the other hand, 4-celled spores occur in several *Lecania* species. It is a rather isolated type in the genus.

5. *Candelaria* species.

Lobes appressed or ascending, much incised, granular-sorediate along the margins, 0.4-0.7 mm. wide and 1-2 mm. long; KOH—.

Nihoa: a few small sterile specimens, associated especially with *Physcia fregatarum*.

Very similar to *C. concolor* (Dicks.) Arn. No group of lobes surpasses 7 mm. in diameter.

6. *Ramalina desolata*, new species.

Thallus caespitosus, rigidus, ochraceo-flavescens vel isabellinus, laciniatus, laciniis suberectis applanatis a basi irregulariter divisus, inferne latioribus, superne angustis, superficie longitudinaliter costata vel verrucosa et albidostriata vel punctata, partim nitida, medulla KOH sordide rubescente. Apothecia \pm crebra, marginalia, podicellata, minuta vel mediocria urceolata, disco roseolo albedo haud pruinoso. Sporae minutae, rectae.

Tufts 2-8 cm. wide, 1.5-3 cm. high, lobes 1-2(2.5) mm. broad, about 0.3 mm. thick, generally \pm concave but not distinctly canaliculate, very irregular in shape and branching, both sides almost concolorous (medulla often denuded at apex), very uneven from longitudinal striae or ridges, partly whitish at the top, often verrucose with dense pycnidia with slightly darker, impressed mouth. Apothecia 1-4 mm. wide, their back shiny, \pm foveolate or uneven.

Thallus cortex 15-18 μ thick on both sides, on underside almost colorless, on the other \pm sordid yellow, apparently cellular with cells of 1-2 μ in a gelatinous tissue without visible hyphae. Chondroid tissue in shape of strands close to the cortex or rarely solitary in the medulla, very irregular in cross section, about 100 μ thick, 300-100 μ broad, refracting, hyphae apparently intricate. The irregularly lacinate medulla (often reaching the cortex) quite dark from air, granules and gonidia, the latter 7-10 μ , hyphae arachnoid, 2-3 μ , rough. Cortex quite colorless in KOH, refracting, hyphae mainly perpendicular to the surface, about 3 μ , indistinct, cells lengthened, 1 μ , \pm parallel. Thallus sections KOH— or very faintly yellow, but after treatment with HNO₃ with masses of rusty needles, Pd+, slowly orange red.

Apothecia 0.3-0.4 mm. thick. Lower cortex 17-25 μ , with gelatinous surface, sordid pale yellowish granular inside, hyphae or cells indistinct in water, in KOH about 3 μ thick with lumina of 1 μ . Medulla for the most part filled with gonidia, a continuous stratum developed below the hypothecium; hyphae 2-3 μ , densely intricate. Exciple indistinct, confluent with the 50 μ thick, colorless hypothecium; hyphae distinctly intricate. Thecium 50-70 μ high,

colorless, I+ dark blue; upper 5-6 μ sordid yellowish granular, granules disappearing in KOH or Pd. Paraphyses 1-1.5 μ , tips widened to 2.5-3 μ , discrete in KOH. Asci about 50 \times 14 μ , clavate. Spores 8, (10)13-15 \times 4.5-5 μ , straight, 1-septate.

Pycnidia immersed, often dense, subglobular, slightly broader than deep, 200 μ across, wall about 50 μ , colorless, gelatinized. The interior filled with long branched hyphae. Conidia 4-5 \times 0.8 μ , bacilliform.

Nihoa: abundant; type no. 34.

7. *Ramalina luxurians*, new species.

Thallus caespitosus, rigidus, flavescens, alutaceus vel fulvescens, laciniatus, nitidus, laciniis suberectis vel decumbentibus, applanatis, laevigatis, latis, irregulariter divisus, apice saepe rotundatis; pseudocyphellis elongatis albidis dense munitus et \pm striatus. Apothecia lateral, pauca usque densissima, minuta, sessilia, disco concavo vel plano tenuiter pruinoso, margine extenuato. Sporae minutae rectae.

Lobes 2-6(8) cm. long, 5-8(10) mm. broad, with few, irregular branches, either furcate at apex or rounded, always with entire cortex. Surface not distinctly striate but the 0.3-0.6 mm. long, often elongate (or irregular) white pseudocyphellae arranged in \pm distinct longitudinal rows, present on both sides. Sections 250-500 μ thick, external 25 μ interspersed with dark yellow granules, in KOH colorless with the 15-18 μ thick cortex visible, cortical hyphae very intricate, dense, about 0.8 μ thick, partly also parallel to the gelatinous surface, in Pd still dark yellow but granules gradually dissolving. Chondroid tissue 90-120(200) μ thick along the cortex, rarely interrupted by narrow wedges of medullary tissue. Medulla narrow, lax, with more or less numerous gonidia and granules, Pd+ reddish yellow, in KOH with rusty crystals. Both sides uniform in structure.

Apothecia mostly 0.5-1 mm., rarely 3-4 mm. large, about 0.5 mm. thick, in some lobes very dense, in others almost absent, sessile to \pm podicellate, only very occasionally found on the margins of the lobes; margin when young thick, yellowish brown, darker than the thallus, gradually becoming thin and paler. Lower side with a sordid yellow cortex 12-15 μ thick. Chondroid tissue about 100 μ thick, for the most part dark sordid, interspersed with yellow granules, KOH+ yellow with dissolving granules, hyphae intricate. Medulla thick but with several strands of chondroid tissue in different directions with numerous gonidia and darkened by granules, reactions as in thallus medulla. Exciple 70-85 μ thick, refracting, with irregularly intricate and horizontal hyphae mixed, lumina about 0.5 μ , lengthened. Hypothecium 50-70 μ , colorless, hyphae intricate. Thecium 65 μ , I+ dark blue as also the hypothecium to a depth of 65 μ ; upper 12-15 μ greenish yellow, granular, dissolving rapidly without color in KOH, slowly in Pd. Paraphyses discrete in KOH, 1.7 μ , apices slightly widened, 2-3 μ , unevenly and constrictedly septate and with solitary short branches. Spores 8, 12-15 \times 4.5-5 μ , straight, one side sometimes plane or even concave, oblong, 1-septate. Pycnidia often numerous but low, in the shape of pale, closed verrucae, often bursting when old and then crater-like. Conidia 4-5 \times 0.8 μ , bacilliform.

Nihoa: probably abundant; type no. 49.

R. luxurians seems to be very nearly related to *R. continentalis* Malme from South America (Ark. f. Bot. Bd. 26A (12):7, 1934)

with similar, lateral apothecia, similar though longer and thinner laciniae, and similar though narrower and more striate pseudocyphellae. Though the medulla of *R. continentalis* is KOH—, Pd—, in *R. luxurians* it takes on a reddish yellow color in Pd and forms rusty crystals in KOH. In *R. luxurians*, the chondroid tissue is firmer though arranged in the same manner, and the cortex interspersed with yellow and granular, the structure of the apothecia is coarser with several strands of chondroid tissue in the thick medulla, and the paraphyses stouter.

At first I was inclined to classify *R. luxurians* as a luxuriant form of *R. desolata* because of the similar structure and reactions. However, the constantly broader, more shiny and abundantly pseudocyphellate lobes with entire apices (in *desolata* more lacinate and often with the medulla laid bare) and the almost exclusively lateral apothecia seem to warrant the specific rank of *R. luxurians*.

8. *Blastenia sandwicensis*, new species.

Thallus effusus, sordide albescens, maculiformis, indistincte vel globuloso-areolatus vel evanescens, KOH immutatus. Apothecia dispersa, sessilia vel appressa, minuta, obscure sanguineo-fusca, disco plano vel mox convexo, margine proprio tenui mox excluso cincto. Excipulum laterale aeruginoso nigricans, subtus deficiens. Epithecium obscure ferrugineo-fulvum, KOH violaceo-coccineum. Sporae ellipsoideae, minutae, isthmo crasso.

Thallus in small patches among other lichens, often apparently absent, rarely subsquamulose, up to 0.5 mm. thick, generally continuous, thin, 0.2-0.3 mm., uneven, when areolate with angular areoles separated by thin cracks. Apothecia (0.4)0.5-0.7(1) mm. large, their color very uniform, about C.U.C. 41 or 661, surface velvety.

Thallus cortex 30-35 μ , most part gray, KOH+ distinctly yellow, cells indistinct. Gonidia 7-10 μ , forming a 50-85 μ thick layer. Medulla scantily developed, \pm hyphose, hyphae of both medulla and cortex 3.5-4.5 μ in KOH; no lumina visible. Apothecia 0.2 mm. thick. Exciple at the very margin 25-30 μ thick, blackish green, reaching 100 μ downward, in KOH + HCl dark bluish green, in HNO₃ sordid violet red. Apothecial base \pm colorless. Hypothecium colorless, with oil drops; hyphae perpendicular. Thecium 85-90 μ high, colorless or sordid gray from oil, I+ dark blue; epithecium 13-15 μ , sordid dark yellow or dark ferruginous yellow, in KOH producing a violet red mist, then colorless. Paraphyses 1.7 μ , tips not thickened, often with 1-2 branches on each side. Asci about 50 \times 13-15 μ , upper 8-10 μ with thicker wall, about 2 μ , and bluntly pointed. Spores 8, 12-15 \times 5.5-7 μ , colorless, polarilocular, ellipsoid, isthmus 4-5 μ .

Pycnidia in the shape of darkened, immersed dots on the surface, pale within. Conidia 2.5-3.5 μ , bacilliform.

Nihoa and Necker: collected in abundance both on hard basaltic lava and on the softer kind resembling limestone; type, no. 119 from Necker.

This is the first *Blastenia* recorded from the Hawaiian islands. It varies with almost subglobose apothecia where the exciple is found on the under side. Some apothecia are almost blackish and then the epithecium is blackish brown-green, dark reddish violet in KOH, and the hypothecium may be \pm yellowish. The species is distinguished by the dark, curiously reddish brown color of its sessile, immarginate apothecia, the only laterally developed, very dark exciple, and the light thallus.

9. *Caloplaca albidella* (Tuckerman) Zahlbruckner, Cat. lich. 7: 63, 1931.

Placodium albidellum Tuckerman, Am. Acad. Arts Sci., Proc. 7: 226, 1868; Synops. North Am. Lich. 2: 147, 1888.

Thallus forming 1-3 cm. large, \pm circular areas limited by a narrow blackish blue hypothalline line, or confluent to larger areas or \pm dissolved, sordid white, indistinctly verrucose-areolate, center very uneven, thicker than the indistinctly radiating, thin marginal parts which are cracked but not distinctly lobate. Often there is a yellowish or greenish gray shade in the color.

Apothecia usually numerous toward the center, sessile, with constricted base, 0.3-0.4(0.5) mm. large, disk plane, sordid reddish yellow to pale ferruginous, or darker, \pm brownish yellow, when young surrounded by a distinct, circular margin, concolorous with the thallus and prominent, the older ones often with a narrow and depressed, but hardly quite hidden margin.

Cortex distinct in KOH, transparent, about 25 μ , cellular, cells 3-4.5 μ . Thallus CaCl—, KOH+ distinctly yellow, KC—, Pd+ pale yellow. Apothecia about 250 μ thick, margin 70-80 μ with gonidia, their cortex indistinct in water, gray, about 20 μ thick. Hypothecium 30-35 μ , colorless, I+ dark blue. Thecium about 60 μ , colorless, I+ dark blue; upper 10-14 μ sordid yellow, KOH+ intensely violet red. Paraphyses discrete in KOH, 1.5-1.7 μ , apices 3-4.5 μ with 2-3 subglobular or clavate, constricted joints, occasionally with one short branch. Asci 50-55 \times 10-12 μ . Spores 8, 9-12 \times 4.5-5.5 μ , narrowly ellipsoid, polarilocular, isthmus 5-6.5 μ broad.

Pycnidia apparently common, immersed, about 100 μ , globular, with rather pale mouth. Wall colorless. Sterigmata 6-8 μ , simple, parallel. Conidia 3.5-4.5 \times 0.8 μ , straight.

Nihoa and Necker.

The commonest lichen in the collection, present on almost every somewhat large rock sample and associated with most of the other reported lichens (*Caloplaca Crosbyi* and *Heppia nitida* excepted). There are slight variations in the material, dependent on the nature of the stone surface and the abundance of nutrition, but on the whole it is very uniform. The thallus may be smoother or more verrucose, even \pm dissolved, and the apothecia small and regular or occasionally

as much as 0.7 mm. broad with crenulate margin and rather distinctly podicellate.

C. albidella was formerly recorded only from Oahu, on lava, by Mann (according to Tuckerman); in a comprehensive manuscript of Zahlbruckner, now in my hands, it is recorded from a beach near Honolulu, on lava, Faurie no. 482. Probably an exclusively maritime species, it is not present in Dr. C. Skottsberg's collections which mainly came from the interior.

10. *Caloplaca capitulata*, new species.

Thallus effusus, tenuis, fusciscenti- vel violascenti-cinereus, minutissime areolatus, areolis irregulariter convexis, subgranuliformibus, contiguis, reagentibus immutatus, ambitu hypothallo obscuro indistincto cincto. Apothecia crebra, minutissima, sessilia, disco fuscorufo plano, margine thallode tenui haud prominente cincto. Thecium tenue, sordide fulvum, KOH—, apicibus paraphysorum distincte capitulatis. Sporae minutae, ellipsoideae.

Thallus forming small, irregular areas among other lichens, rarely \pm expanded, circumference not distinctly limited. Areoles 0.15-0.3(0.5) mm. large, about 0.2 mm. thick, very irregular in shape, the separating fissures often indistinct, surface opaque, uneven, often dotted by the darker, prominent mouths of pycnidia, KOH—, CaCl—, Pd—. Apothecia 0.2-0.35 mm. wide, circular, disk at first concave and paler, soon plane and darker, margin colorous with the thallus.

Thallus cortex 8-12 μ , cellular, uppermost cell-row olive with globose 4-6 μ large lumina. Thallus tissue cellular, cells 3-4.5 μ globose, thin walled. Gonidia 6-8 μ , dense. Apothecia about 200 μ thick, in water 0.45 mm. broad, margin depressed and disk very convex by swelling. Gonidial stratum almost horizontal under the apothecium 50-70 μ thick. Cortex of lower side 15-20 μ , transparent, cellular, cells 3-4 μ , very thin-walled, extenuated at the very margin. Exciple distinct, laterally about 15 μ , at center 30 μ , cellular, cells 2-3 μ . Hypothecium 20-30 μ , with minute, 1-1.5 μ large cells. Thecium 55-60 (65) μ , I+ violet blue; upper 25 μ sordid yellow to brownish yellow, in KOH more yellowish, in HNO₃ brighter yellow brown. Hypothecium and exciple I+ pale blue. Paraphyses 1.5-1.8 μ , \pm distinct, apices \pm discrete with 2(3) constricted, clavate or subglobose cells, tips usually 4-6 μ , with a gelatinous cover. Spores 8, (8)10-12 \times 5.5-6(7) μ , ellipsoid, polarilocular, isthmus 5(6) μ .

Pycnidia numerous, very minute, with pale olive mouth. Conidia very plentiful, 2-3 \times 0.6 μ , bacilliform.

Nihoa and Necker: on hard basalt, often associated with *Caloplaca pallescens* and *C. albidella*, *Lecanora Christophersenii* and *Buellia Nihoae*; type no. 75b.

The species is distinguished by its gray thallus, its very small apothecia and its unsensibility to reagents.

11. *Caloplaca pallescens*, new species.

Thallus effusus, continuus, pallidus, flavescenti-albescens, tenuis, inaequalis, indistincte areolatus, reagentibus immutatus. Apothecia crebra, lecanorina,

minuta, sessilia, basi constricta, orbicularia, disco lividoflavescente plano, margine thallino crassiusculo leviter prominente cincto. Epithecium sordidum, granulatum KOH immutatum. Sporae minutae, ellipsoideae, septo crasso.

Thallus forming 1-4 cm. large areas, very thin and effuse at the circumference, sometimes with a narrow, blackish, very thin hypothallus, surface rarely \pm smooth, generally indistinctly cracky, forming irregular, 0.2-0.4 mm., indistinctly limited areoles with uneven surface, only about 0.2 mm. thick, KOH—, CaCl—, Pd—. Apothecia uniformly dispersed, dense, constricted at the base, 0.25-0.4(0.5) mm. wide, disk opaque, slightly darker than the thallus, margin smooth, at length indistinctly crenulate, concolorous with the thallus.

Thallus 0.1-0.2 mm. thick, cortex about 10 μ , pale yellowish gray, granular, cellular all through, cells 3-4.5 μ , thin walled; medulla not granular. Gonidial layer about 20 μ , gonidia 6-10 μ . Apothecia 0.2-0.3 mm. thick, sections very convex because of the turgid thecium. Margin with a 12-15 μ thick, sordid yellowish gray, granular cortex, in KOH pale bright brownish yellow without granules, cells distinct in Pd, 3-4.5 μ , globular, thin walled. Gonidial stratum 45-55 μ up to the edge; gonidia yellowish green, 7-9 μ . Exciple sometimes distinct, 8-10 μ , under the hypothecium refracting, gelatinous, I—. Hypothecium 35-70 μ , colorless to opaque, hyphae mainly perpendicular, cells 1.5-2 μ , I+ dark blue. Thecium 70-75 μ high, colorless, I+ blackish blue; upper 10-14 μ pale sordid yellowish with dense minute granules, separating and gradually dissolving in KOH without coloring. Paraphyses 1.5 μ , apices 3.5-4.5 μ , the apical and subapical cells clavate. Asci 45-50 \times 10-12 μ , clavate. Spores 8, 10-13 \times 6-7 μ , colorless, ellipsoid, polarilocular, isthmus 3.5-4 μ .

Pycnidia common as minute, darker, hardly prominent dots on the surface, immersed, globular, about 70 μ diameter. Conidia 3.5-4 \times 0.7 μ , bacilliform.

Nihoa and Necker: on rather numerous rock specimens, associated with *Caloplaca capitulata* and *C. albidella*, *Rinodina intercedens*, etc.; type no. 70 from Nihoa.

At first sight, *C. pallescens* resembles a *Lecanora* species or a minute *Ochrolechia pallescens*, but it belongs to the *C. diplacia* group. It is distinguished from *C. diplacia* by the much paler apothecia, the negative KOH reaction of the thallus, the thicker spores and the simple (not "zeorine") apothecial margin.

12. *Caloplaca* (*Gasparrinia*) *Crosbyi* Zahlbruckner, in manuscript.

"Thallus crustaceus, placodimorphus, luteo-aurantiacus, nitidulus, KOH purpureus, suborbicularis (in speciminibus visis usque 3 cm. latus), lobis marginalibus brevibus, 0.6-1 mm. longis et fere totidem latis, \pm convexis vel planiusculis, subdigitato-divisis, lobulis subcrenatis, in centro subsquamuloso-verruculosis, squamulis \pm angustis, convexulis, sorediis et isidiis destitutus, superne corticatus, cortice pseudoparenchymatico, minute et subrotundato cellulosus, cellululis membranibus parum incrassatis cinctis, superne insperso et ochraceo-fuscescente, inferne non corticato, cum hyphis fuscescentibus medullae substrato affixus, gonidiis palmellaceis, laete viridibus, globosis, 7.5-13 μ

latis, stratum crassiusculum subcortinum formantibus, hyphis strati gonidiali ad 3.5μ latis, valde leptodermaticis, crebre septatis.

"Apothecia sessilia, lecanorina, rotunda, 0.5-1 mm. lata, dispersa vel approximata, plana, planiuscula, rarius leviter convexa, disco croceo-aurantico, epruinoso, margine thallino thallo concolore, tenui, integro, persistente, leviter prominulo, corticato, gonidia sat copiose includente, perithecio integro, crassiusculo, minute pseudoparenchymatico, cellulis satis leptodermaticis, subangulosis vel subrotundatis, ad verticem hymenii cum cortice marginis thalli confluyente, inferne in centro in thallo \pm elongato, strato gonidiifero superposito, epithecio dense insperso ochraceo-fusco, KOH purpureo, hypothecio decolore, ex hyphis intricatis formato, angusto, hymenio decolore, guttulis oleosis non impleto, 70-76 μ alto, I persistenter violaceo-caeruleo, paraphysibus simplicibus vel apicem versus 2-3-ramosulis, filiformibus, ad 1.4μ crassis, in parte inferiori esseptatis, ad apicem clavatis vel increbre moniliformibus septatisque, ascis ovalibus, in ipso apice late rotundatis vel fere retusis et membrana calyptriformi incrassato cinctis, 8-sporis; sporis 2-serialibus, decoloribus, late ellipsoideis vel late ovalibus, rarius ellipsoideis, subacutatis utrinque, polari-dyblastis, loculis vix $\frac{1}{3}$ -longitudinis sporarum occupantibus, siphone distincto, fere latiusculo hinc inde, junctis, 9-10(12.5) \times 7-8 μ .

"Conceptacula pycnoconidiorum in lobis marginalibus sita, gibbosa, cortice leviter prominentia, subsemiglobosa, aurantiaca, fulcris endobasidialibus, basidiis crebre septatis, ad septa leviter constrictis, usque 26 μ longis et \pm 3.5 μ crassis; pycnoconidiis oblongis vel fere cylindricis, rectis, 3.5 μ longis, 1.5 μ crassis.

"Oahu: ad saxa vulcanica (Crosby no. 145); Kauai: (Faurie no. 219)."

The Nihoa specimens agree very well with the description above.

Thallus lobes 0.2-0.25 mm. thick. Upper cortex variously thick, 20-55 μ with depressions into the gonidial stratum, colorless, with 5-6.5 μ thin walled cells, surface 5-7 μ , dark fulvous. Thecium only 55-60 μ high.

Nihoa: a few specimens associated with *Heppia nitida*.

The species is distinguished by the indistinctly radiating, squamulose-lobate, non-continuous thallus, by the dense, sessile, relatively large apothecia, the concolorous disk being surrounded by a thick, paler, regular margin, and the relatively broad spores.

13. *Buellia neckerensis*, new species.

Thallus effusus, continuus, sordide albescens, rimoso-subareolatus, areolis tenuibus irregularibus inaequalibus, iteratim subrimosis, reagentibus immutatus. Apothecia atra, minutissima, saepe punctiformia, interdum dilatata, plana, margine proprio atro tenui cincta. Thecium tenue, epithecio nigricante. Hypothecium incolor. Sporae mediocres, obtusae. Conidia longa, falcata.

Thallus continuous for a few cm. square, areoles 0.2-0.4(0.6) mm. wide, about 0.2 mm. thick, often indistinctly limited or separated by distinct, irregular cracks, surface plane or uneven, opaque, KOH—, CaCl—, I—. Apothecia 0.1-0.25(0.4) mm. wide, \pm sessile, apparently convex, verruciform, but

with developed thecium and spores. Older ones plane, orbicular, indistinctly marginate.

Thallus filled with yellowish green gonidia; cortex indistinct. One apothecium $200 \times 70 \mu$, sessile upon a 100μ thick thallus. Exciple about 50μ thick, without gonidia, outer $10-12 \mu$ blackish, the interior \pm pale to yellowish brown, I—, KOH—. Hypothecium $20-25 \mu$, colorless. Thecium 50μ , colorless, I+ dark blue. Paraphyses 1.7μ , capitate, $3-4.5 \mu$, blackish, in HNO_3 brownish green. Spores $8, 12-14 \times 6.5-7.5 \mu$, greenish brown, 2-celled, slightly constricted at the septum. Conidia $20-25 \times 0.5 \mu$, arcuate to falcate.

Nihoa: One small specimen with thinner, smoother and hardly continuous thallus and more plane, better developed apothecia than in the Necker specimens. Necker: scarce; type, no. 110b.

Distinguished by the very small apothecia with colorless hypothecium, low thecium with blackish capitate paraphyses and by the thin white thallus.

14. *Buellia Nihoa*, new species.

Thallus late expansus, indeterminatus, caesioalbescens, continuus, tenuis, rimoso-areolatus, areolis subregularibus planis vel leviter convexis, laevigatis, KOH flavus, I—, CaCl—, hypothallo indistincto. Apothecia dispersa perminuta, immersa, disco atro plano non prominente, margine proprio cinerascete haud prominente cincto. Thecium tenuissimum, epithecio obscure fusco. Hypothecium \pm fulvum. Sporae perminutae, septo haud constricto.

Thallus several cm. across but \pm interrupted by spots of naked stone, without distinct edge, areoles $0.3-0.5$ mm. wide, about 150μ thick, smooth but not shiny, exterior ones thinner but not larger. Apothecia $0.1-0.25$ mm. broad, their disk level with the thallus, the often distinct proper margin pale blackish gray, separated from the thallus surface by a thin crack.

Thallus cortex $8-15(20) \mu$ thick, yellowish gray with a thin, indistinct, amorphous stratum, in KOH transparent with $3-3.5 \mu$ wide, intricate hyphae, surface pale bluish green. Medulla opaque, mostly filled with gonidia, in KOH faintly yellowish, transparent, with oil-drops. A fully developed apothecium 280μ broad, and 110μ deep. No distinct exciple, or 30μ broad at surface of the "ring", dark greenish brown $12-14 \mu$ deep. Hypothecium triangular, sordid to pale brownish yellow, apparently cellular. Thecium $40-45 \mu$, I+ dark blue, upper $8-10 \mu$ greenish brown. Paraphyses in KOH 1.3μ , apices capitate, 3.5μ , dark brown with a violet shade. Asci about $35 \times 12 \mu$. Spores $8, 8-9 \times 4-5 \mu$, brown, 2-celled, not constricted, easily free.

Pycnidia immersed, urceolate, 100μ deep, 60μ broad, wall pale. Conidia $3.5-4.5 \times 1 \mu$, bacilliform.

Nihoa: abundant on hard rock, associated with other species, especially *Caloplaca palleescens* and *C. albidella*; type, no. 2.

15. *Buellia pacifica*, new species.

Thallus \pm late expansus, albidus vel cinerascenti-albidus, effusus vel maculas formans, rimoso-areolatus, areolis subplanis, irregularibus, subtenui-

bus, reagentibus immutatis, hypothallo indistincto. Apothecia numerosa, subimmersa, minuta, disco atro plano vel convexo prominulo, margine indistincto. Hypothecium fuscum, thecium subtenuae, epithecio viridi-fusco. Sporae subminutae, pariete uniformi.

Thallus covering \pm large areas but partly interrupted by naked stone, the white color with a tinge of bluish gray, areolae 0.5-1 mm. wide, about 0.3 mm. thick, very irregular in shape, separated by narrow cracks, surface opaque, subfarinose, KOH—, CaCl—, I—, Pd—. Apothecia 0.3-0.5 mm. wide, disk at first in level with the thallus surface and with indistinct black margin, later slightly convex and moderately prominent.

Thallus covered by an obscurely limited, 25-40 μ thick, whitish gray, indistinctly cellular stratum, almost unchanged in KOH, with intricate hyphae, indistinct surface and much air in the lower part. Below it is a 5 μ thick yellowish brown line (cortex). Gonidial stratum 35-40 μ , continuous, dense. Medulla opaque, whitish from granules and oil. Hyphae distinct, mainly perpendicular, 3.5 μ thick, \pm thin walled in and under the gonidial stratum, thick walled in the medulla, lumina hardly 1 μ . Granules dissolving in Pd or HNO₃. Apothecia about 250 μ thick. Exciple only lateral, 25(35) μ , mainly dark brown, ending abruptly beside the hypothecium. Hypothecium dark yellowish brown, when conical as much as 150 μ deep. Thecium 75 μ , colorless, I+ violet blue, upper 9-12 μ dark greenish brown. Paraphyses 1.5 μ , tips 3.5-5 μ , capitate, brown. Asci about 50 \times 14 μ , clavate. Spores 8, 13-15 \times 7.5-8 μ , dark greenish brown, often shrunk, 1-septate, not constricted.

Necker: on a single sample (no. 94b) of light gray basalt, probably the "medium gray andesine basalt" mentioned by Palmer (B. P. Bishop Mus., Bull. 35: 25, 1927) as forming dikes. It shows agate-like fillings as described on p. 26.

The new species is distinguished by the whitish, subfarinose thallus without reactions, by the small, slightly prominent apothecia, the dark, not brown hypothecium and the small spores.

16. *Buellia paupera*, new species.

Thallus ut videtur cum saxo confusus, indistinctus, cinereus. Apothecia dispersa, sessilia, atra, minuta, disco plano vel convexo, margine proprio concolore indistincto cincto. Thecium tenue, superne fulvo-fuscum. Excipulum cum hypothecio confluens, fuscoatrum. Sporae minutae.

Thallus uneven, slightly granular, hardly distinguishable from the gray stone surface. Apothecia 0.3-0.5 mm. wide, often irregular in shape, young ones urceolate, older ones with hardly perceptible, \pm excluded margin. No pycnidia found. No reaction in thallus or apothecia with KOH.

A thallus, consisting of yellowish green gonidia and hyphae among particles of stone observed to a thickness of 150 μ below the 150-200 μ thick apothecium. Exciple blackish brown, at the very margin 18-20 μ , laterally below up to 35 μ and confluent with the concolorous, 50-100 μ thick hypothecium unchanged in KOH, in thinner sections sordid orange brown. Thecium 50-60 μ , \pm colorless, I+ dark blue; upper 5-7 μ fulvous brown. Paraphyses contiguous, 1-1.5 μ , apices clavate to capitate, 3.5-5 μ , dark fulvous brown, in KOH dark (greenish) brown. Asci about 40 \times 13 μ . Spores 8, 8.5-12(13.5) \times

4-5(6) μ , 2-celled, greenish brown, wall thin, older ones longer and slightly constricted at septum, one side sometimes concave.

Nihoa: scarce, on hard basalt, exposed by weathering of part of a specimen of *Buellia Nihoae*; type, no. 16.

B. paupera resembles in appearance and structure *B. punctata* (Hoffmann) Mass. very much but has no perceptible thallus and at length [?] convex apothecia.

17. *Rinodina intercedens*, new species.

Thalli minuti, inter alios lichenes evoluti, pallide violaceo-cinerei vel subluridi vel partim caesiopruinosi, tenues, rimoso-areolati, areolis leviter convexis, rimis tenuibus indistincte separatis, hypothallo indistincto, reagentibus immutati. Apothecia immersa, minuta, disco atrofusco plano, margine indistincto thallo subaequali. Hypothecium pallidum. Thecium tenue, superne fulvescens. Sporae mediocres, pariete inaequaliter incrassato.

Thalli 0.5-1.5 cm. large, growing between other lichens and not distinctly limited, even free margin without fixed border; color of specimens exposed to full light dark gray with a violet tinge, of specimens growing in shade pale, yellowish gray, areoles 0.5-1 mm. wide, 0.1-0.2(0.35) mm. thick, opaque, KOH—, I—, CaCl—, Pd—. Apothecia \pm numerous, 0.25-0.35 mm. wide, in level with the thallus or slightly prominent; proper or thalline margin absent.

Thallus cortex up to 17 μ thick, colorless, cells distinct in HNO₃, 2-3 μ , thin walled like those in the rest of the thallus. Hypothecium colorless, 50 μ deep in the middle with \pm perpendicular hyphae; below is a thick layer of 6-8 μ large, yellowish green gonidia, filling also the largest part of the thallus. No exciple developed; hypothecium I+ dark blue down to the gonidial layer. Thecium 55-60 μ , colorless, I+ dark blue, surface pale (brownish) yellow. Paraphyses 1.7(2) μ , apices 3-4 μ , yellowish brown. Asci 40-45 \times 15-17 μ , clavate. Spores 8, 2-septate, 12-17 \times 7-7.5 μ , pale brownish green, wall irregularly thickened.

Pycnidia visible as darker, not prominent dots, several in the areole, diameter 50-70 μ , wall pale. Conidia 3.5-4.5 \times 1 μ , bacilliform.

Nihoa: small specimens associated with *Caloplaca albidella*, *C. pallescens*, and *Buellia Nihoae*; type, no. 4a.

Distinguished by its smallness and thinness, the immarginate, immersed apothecia and irregularly thickened spore wall.

18. *Rinodina* cf. *antarctica* Müller-Argau, Mission Scientif. du Cap Horn 5: 1631, 1889.

Thallus small, grayish white, effuse, areolate, areoles very uneven, partly non-contiguous, 0.5-1 mm. large, 0.2-0.4 mm. thick, I—, KOH—, Pd—. Apothecia immersed, solitary, disk 0.3-0.5 mm., black, plane, the areole surface prominent, \pm margin-like.

Cortex about 15 μ , mostly gray to brownish gray with indistinct cells, in KOH \pm transparent, only 6-8 μ broad, cells 3-4 μ , rounded, thin walled. Gonidia 12-16 μ in a 60-70 μ thick, continuous layer, approaching the thallus

surface. Medulla \pm transparent, cellular, cells 3-4 μ , irregular. Apothecia about 150 μ deep. Exciple indistinct or \pm visible in iodine, 10-12 μ thick, I—, Hypothecium colorless to pale gray, I+ pale blue. Thecium 100 μ , I+ dark blue, upper 10-12 μ yellowish brown. Paraphyses distinct, about 2 μ , tips 3.5-4 μ , contiguous also in KOH. Asci about 65 \times 20 μ , clavate. Spores 8, 17-22 \times 9-10 μ , dark greenish brown, wall irregularly thickened, cells \pm heart-shaped, center of spores often swelling in KOH.

There is a specimen on lava from Nihoa (no. 36), associated with *Caloplaca Crosbyi*, *C. capitulata*, *C. pallescens* and *Blastenia sandwicensis*, which agrees in many respects with Müller's description. The latter, however, lacks some essential characteristics. Not clear are his words, "sporae fuscae, hinc simul rinodinaceae, illinc quasi fusco-polariblastae." The specimen should also be compared with *R. Perousii* Zahlbruckner from Easter Island.

19. *Physcia* cf. *crispa* (Persoon) Nylander, Synops. lich. 1:423, 1860. Zahlbruckner, Cat. lich. 7:611, 1931.

The chalky white lobes are 2-4 mm. long and 1-1.5 mm. broad, loosely attached to ascending, fragile, with raised, coarsely sorediate margin and partly with soredia also on the upper surface. Thallus cortex and medulla K+ yellow.

Nihoa.

A few specimens mixed with other lichens but sterile and hardly determinable. It resembles *Ph. crispa* but is smaller and more coarsely sorediate. In one of these specimens (no. 67) there are also some traces of a brownish indeterminate *Physcia*. Other species present are *Ph. Fregatarum*, *Caloplaca pallescens*, *C. capitulata* and *Candelaria* species, a typically nitrophilous association.

20. *Physcia Fregatarum*, new species.

Thallus albescens, ambitu lobatus, centro versus crustosus et verrucosus, lobis brevibus, modice angustis, convexis, ramosis, contiguus vel \pm separatis, irregularibus, superne soraliis subrotundatis concoloribus, applanatis munitis, subtus pallidus, KOH extus et intus flavus. Apothecia in verrucis orta, appressa, mediocria, disco fuscoatro plano, margine tumido subcrenato vel sulcato cincto. Hypothecium incolor. Sporae mediocres.

Thallus covering several square cm. or \pm dissolved in patches, circumference usually not distinct, marginal lobes 1.5-2 mm. long, 0.5(1) mm. broad, irregularly branched, only a few contiguous, crenate to incised, \pm convex, surface smooth, white with a slight tinge of yellow, soralia 0.4-0.8 mm. large, sessile or slightly immersed, rounded or irregular, \pm coarsely granular, flattened, center with semiglobose or irregular, 0.3-0.5 mm. large warts, somewhat rough but usually not sorediate, forming a granular crust. Apothecia formed only among the warts, at first immersed, soon \pm sessile, reaching 1-1.5 mm.

in width (including margin), rarely fully developed. Margin at first inflexed above the disk, then \pm depressed or prominent, with shallow furrows or uneven surface.

Upper thallus cortex 20-25 μ , gray, opaque, cells indistinct, 4-6 μ , walls thin, distinct in KOH which dissolves the granules producing an intense yellow color. Gonidia 5-11 μ , in a layer 50-65 μ thick. Medulla thin, gray from granules, in KOH intensely yellow and transparent, hyphae lax 3-4 μ , thin walled, long-celled. Lower side non-corticate or marginal cortex overlapping, its cells 2-3 μ , globose. No crystals formed in H_2SO_4 . Apothecia about 0.4 mm. thick by 0.9 mm. wide. Margin 110 μ thick at edge, farther down 130 μ . Cortex 25-30 μ , colorless, but \pm grayish toward surface, unchanged in Pd, cells distinct, 4-6.5 μ , rounded or subangular, thin walled; gonidial layer 65-85 μ thick, continuous all around. Exciple indistinct in water, confluent with the colorless hypothecium which is 85 μ thick, with intricate hyphae, and I+ blue; exciple I— for 20-25 μ at base, laterally only for 10-15 μ . Thecium 85-100 μ , I+ dark blue; upper 15-19 μ \pm brownish yellow. Paraphyses discrete, 1.7-2 μ , tips contiguous, clavate, 3.5-5 μ . Asci 75-80 \times 17-20 μ . Spores 8, 17-19 \times 8-9 μ , pale brownish green, 2-celled, with rather uniform thick wall, ripe spores sometimes with prolonged ends as if germinating.

Pycnidia immersed, subglobose, about 200 μ diameter, chambered by deep folding of the light-colored wall. Conidia 3.5-4 \times 0.7 μ , bacilliform or apparently slightly thicker at the ends.

Nihoa: not uncommon on hard basalt and associated with *Physcia* cf. *crispa*, *Buellia Nihoae*, *Caloplaca pallescens*, *C. capitulata*, and *Candelaria* species; type, no. 76.

Ph. Fregatarum, named after the well-known bird breeding there, seems to be nearly akin to *Ph. Metraxii* B. de Lesdain, described from Easter Island, but has narrower lobes and is sorediate.

21. *Physcia picta* (Swartz) Nylander, *Essai nouv. classif. lich.* 2: 175, 1855. *Zahlbruckner, Cat. lich.* 7: 582, 1931.

Nihoa and Necker, several samples; one specimen 5 \times 2 cm., most others much smaller.

Always sterile, determination not quite certain. Seems rather typical with cortex KOH+ yellow and medulla KOH—, but soralia often less distinctly limited and less prominent, sometimes confluent toward the center as in no. 93b from Necker.

