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#### SUMMARY

Twenty-eight algal samples were collected in September-October, 1984, from two distinct habitats in the state of Acre, Brazil. Eleven were from the Moa River, and 17 were from a sulfur water spring which flows into the Moa River. A total of 74 species, representing 48 genera of algae, were identified from these samples. Forty-nine species were found in the Moa River and 67 in the sulfur water spring. Both collection sites had rich assemblages of cyanophycean algae, chlorophycean algae, and diatoms. Chlorophycean species dominated the algae flora at both sites, but were more numerous at the sulfur water spring. There was also a definite difference in the relative proportions of desmids to filamentous chlorophycean algae at the two sites.

#### INTRODUCTION

During September and October of 1984, four scientists from the United States of America participated in a botanical expedition into the state of Acre, Brazil, as part of "Projeto Flora Amazonica", an on-going botanical survey of Brazil co-sponsored by the Instituto Nacional de Pesquisas da Amazonia (Brazil) and the New York Botanical Garden (U.S.A.). The primary objective of the expedition was to collect fungi and edaphic algae for taxonomic studies and to conduct an inventory of overstory vegetation in an undisturbed terra firme forest. In addition to this, the senior author collected water samples along the upper reaches of the várzea floodplain of the Moa River. Most studies of riverine algae in Brazil have focused on the Amazon River and its major tributaries (Sioli, 1975), thus these samples provided the opportunity to identify the algal flora in remote Amazonian waters. A list of the taxa identified from the two sites is presented in Table 1.

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## MATERIALS AND METHODS

The state of Acre is situated in the Andean foreland of Brazil. According to Rżóska (1978), this region has intertropical temperatures and abundant rainfall. Vegetation consists primarily of climax tropical rainforests on nutrient poor soils, except in the várzea where soils are nutrient rich due to sediment deposition during annual floods. Conditions for growth of vegetation are thus more optimal in the várzea than in the terra firme.

The Moa River, located in the northwestern most part of Acre (7°30'S longitude; 73°45'W latitude), originates near the Peruvian border and flows easterly for approximately 100 km before its confluence with the Juruá River. The Moa River receives humic acids through runoff and seepage from podsol soils and is classified as an acidic blackwater river (Marlier, 1973). Such rivers typically have low mineral contents (Rżóska, 1978). The current in the Moa River is swift and water depth along its length ranges from 0.3 to 2.0 m during the dry season.

A total of 28 algal samples were collected from the two sites on the Moa River. Eleven samples collected from the river on September 21, 1984, downstream of Plantation Arizona, consisted of river water, bottom sands from the river, scraping from submerged logs and tree limbs in the river, and soils from seepage zones along the river bank. Seventeen samples were collected on October 1, 1984, from a sulfur spring which flows into the Moa River. This man-made spring was formed when an oil drilling operation in 1936, struck sulfur rich water. The well was not capped and the water has continued to flow as a swiftly moving stream across the floodplain and into the river. The spring is at the entrance of the serra section of the river just short of the Peruvian border. Algae were scraped from rocks in this spring and from drip areas and small, shallow pools along the margins of the spring.

Samples from both sites were placed in screw cap tubes which contained sterile liquid Bold's Basal Medium with triple the original concentration of nitrogen (3N BBM) (Archibald and Bold, 1970). Aliquots of the samples were also spread across the surface of agarized 3N BBM in plastic Petri dishes. The inoculated plates and tubes were kept under natural light while in the field in order to stimulate algal growth. Preservatives were not used because they distort taxonomic features needed for identification of some chlorophycean algae. The cultures were transported to a laboratory in the U.S.A. where they were maintained at 25°C and 2,000 lux of illumination on a 12-hr light, 12-hr dark cycle. Species identification were begun within one week after arrival of the cultures in the laboratory. Cultures studied, preserved by filtering onto glass fiber filters and drying, are on deposit in the herbarium at the INPA (Instituto Nacional de Pesquisas da Amazonia) headquarters in Manaus, Amazonas (BRAZIL). Specific taxonomic references used are cited in the bibliography.

## RESULTS AND DISCUSSION

A total of 74 species representing 48 genera of algae were identified in this study (Table 1). Total species composition consisted of 51.4% Chlorophyta (green algae), while 18.9, 25.7 and 4.0% were Cyanochloronta (blue-green algae), Bacillariophyceae (diatoms) and Euglenophyta (euglenoids), respectively. *Oscillatoria acuminata*, *O. lacustris*, *Cosmarium hammeri*, *Mougeotia* sp., *Pediastrum duplex*, *Coleochaete orbicularis*, and *Pithophora* sp. were found in less than 1% of the 27 samples. Species found in at least 50% of the samples were *Anacystis rupestris*, *Oscillatoria tenuis*, *Phormidium foveolarum*, *Chlorella* sp. *Cosmarium granatum*, *Klebsormidium* sp. *Oedogonium* sp., *Scenedesmus acuminatus*, *Cymbella affinis*, *Gomphonema apicatum*, and *Nitzschia palea*. Forty-two species were common to both sites, while 6 species were found only in the Moa River and 25 only in the sulfur water spring.

A total of 49 species were identified from the Moa River and 67 from the sulfur water spring (Table 2). Chlorophycean algae dominated the algal flora at both sites, but were more numerous at the sulfur water spring. This is to be expected since the pH of the sulfur water site is more acidic than that of the main channel of the river. Chlorophycean algae in the Moa River consisted of 54.5% desmids and 13.7% filamentous forms, while the sulfur spring had a species composition consisting of 38.9% desmids and 33.3% filamentous forms. Other chlorophycean algae at both sites were non-motile unicellular, motile unicellular, and non-motile coenobitic species. The increased relative abundance of filamentous chlorophycean algae at the sulfur spring may have been related to the lower pH of the water. The senior author has observed a similar response to pH in small streams in Pennsylvania.

The numbers of cyanochlorontes, diatoms and euglenoids were essentially the same at each site but species composition within each of these groups varied between sites. The euglenoids were the least represented of the algae at both sites and, with the exception of *Anacystis rupestris*, the cyanochlorontes were all filamentous species. Diatoms were the major sub-dominant group at both sites and were represented primarily by species reported (Patrick and Reimer, 1966, 1975) as occurring in acid waters or in a wide variety of habitats. However, three species seemed to have been habitat specific. *Gyrosigma scalproides* was found only in flowing water at both sites and *Cocconeis pediculus* occurred only in small pools which contained decomposing vegetation. *Navicula pusilla* was found only in seepage zones at both sites which received litter runoff high in mineral content (Meggers, 1973). These zones were easily recognized by their obvious growths of algae. Patrick and Reimer (1966, 1975) have reported that *G. scalproides* is found almost exclusively in flowing waters, that *C. pediculus* inhabits organically enriched aquatic habitats, and that *N. pusilla* is an aerophil found in areas with a high mineral content. Our observations of these species were thus in agreement with those of other authors.

The majority of algae identified in this study were found on the surface of some substrate. Phytoplankton populations in the Moa River were poorly developed because

of the high turbidity and swift current. High flow rates in the sulfur water also limited development of a phytoplanktonic community. However, the small pools alongside the spring were conducive to the growth of chlorophycean algae and this attributed to the larger number of species identified at this site.

This study indicated that the algal flora in the Moa River region was rich in cyanochlorontes, chlorophytes, desmids and diatoms. Similar assemblages have been reported also as occurring in other Amazonian waters (Sioli, 1975). However, this study was of a cursory nature and provided only a small sampling of the algae of this region. Additional studies are needed to more fully characterize the algal flora in the várzea of the Moa River.

#### RESUMO

Vinte e oito amostras de algas foram coletadas nos meses de setembro e outubro de 1984, provenientes de dois habitats distintos no Estado do Acre: o Rio Moa (11 amostras) e uma fonte de água sulfurosa afluente do Rio Moa (17 amostras). Ao todo foram identificadas 74 espécies, representando 48 gêneros de algas. Quarenta e nove espécies foram isoladas do Rio Moa e sessenta e sete da fonte sulfurosa. Ambas as localidades de coleta revelaram ricos conjuntos de algas clorófitas, algas cianofíceas e diatomas. Espécies clorófitas dominaram a flora algal de ambas as localidades, embora mais numerosas na fonte sulfurosa. Também foi observada uma diferença significativa entre as duas localidades nas suas respectivas proporções de desmidiáceas: algas clorófitas filamentosas.

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Table 1. Algae identified from the Moa River and a sulfur spring in the state of Acre, Brazil.

TAXA	COLLECTION SITES	
	MOA RIVER	SULFUR SPRING
CYANOPHYTA		
<i>Anabaena</i> sp. Bory	+	-
<i>Anacystis rupestris</i> (Lyngb.) Drouet & Daily	+	+
<i>Lyngbya spirulinoides</i> Gom.	-	+
<i>L. Taylorii</i> Drouet & Strickland	-	+
<i>Oscillatoria acuminata</i> Gom.	+	-
<i>O. chlorina</i> Kutz.	-	+
<i>O. geminata</i> Meneghini	+	+
<i>O. lacustris</i> (Kleb.) Geit.	-	+
<i>O. ornata</i> Kutz.	-	+
<i>O. subbrevis</i> Schmidle	+	+
<i>O. tenuis</i> Ag.	+	+
<i>Phormidium foveolarum</i> (Montagne) Gom.	+	+
<i>P. retzii</i> (Ag.) Gom.	+	+
<i>P. tenue</i> (Meneghini) Gom.	+	+
CHLOROPHYTA		
<i>Ankistrodesmus falcatus</i> (Corda) Ralfs	+	+
<i>Characium</i> sp. A. Braun	+	+
<i>Chlamydomonas concinna</i> Geit.	-	+
<i>C. parvula</i> Geit	+	+
<i>Chlorella</i> sp. Beyerinck	+	+
<i>Cladophora</i> sp. Kuetzing	-	+
<i>Closterium littorale</i> Gay	+	+
<i>Coleochaete orbicularis</i> Pring	-	+
<i>Cosmarium botrytis</i> Meneghini	+	+
<i>C. granatum</i> Breb.	+	+
<i>C. hammeri</i> Reinsch.	-	+
<i>C. norimbergense</i> Reinsch.	+	+
<i>C. notabile</i> Breb.	-	+
<i>C. subcrenatum</i> Hantz.	+	+
<i>C. turgidum</i> Breb.	+	+
<i>Euastrum denticulatum</i> (Kirch.) Gay	+	+
<i>E. sinuosum</i> Lenor.	+	+
<i>Hyalotheca dissilans</i> var. <i>tatrica</i> Racib.	+	-
<i>Klebsormidium</i> sp. Silva, Mattox, Blackwell	-	+
<i>Mougeotia</i> sp. C.A. Agardh	-	+
<i>Oedogonium</i> sp. Link.	+	+
<i>Pediastrum duplex</i> Meyen	-	+
<i>Penium margaritaceum</i> Ralfs	+	+
<i>Pithophora</i> sp. Wittrock	-	+
<i>Rhizoclonium</i> sp. Kutz.	-	+
<i>Scenedesmus acuminatus</i> (Lag.) Chod.	+	+
<i>S. dimorphus</i> (Turp.) Kutz.	-	+

TAXA	COLLECTION SITES	
	MOA RIVER	SULFUR SPRING
<i>S. quadricauda</i> (Trup.) Breb.	+	-
<i>Selenastrum Westii</i> G.M. Smith	+	+
<i>Sirogonium</i> sp. Kutz.	-	+
<i>Spirogyra</i> sp. Link	-	+
<i>Staurostrum hexaceruum</i> (Ehr.) Wittr.	+	+
<i>S. loeve</i> Ralfs	+	+
<i>Stichococcus bacillaris</i> Nag.	-	+
<i>Stigeoclonium</i> sp. Kutz.	+	+
<i>Tetraedron minimum</i> (A.Br.) Hansg.	-	+
<i>Ulothrix</i> sp. Kutz.	-	+
BACILLARIOPHYTA		
<i>Caloneis Wardii</i> Cl.	+	-
<i>Cocconeis pediculus</i> Ehr.	-	+
<i>Cymatopleura solea</i> (Breb.) Wm. Smith	+	+
<i>C. solea</i> var. <i>apiculata</i> (Wm. Smith) Ralfs	+	+
<i>Cymbella affinis</i> Kutz.	+	+
<i>Eunotia elegans</i> Ostr.	-	+
<i>Fragillaria pinnata</i> Ehr.	+	+
<i>Frustulia rhomboides</i> Ehr.	+	+
<i>Gomphonema affine</i> Kutz.	-	+
<i>G. apicatum</i> Ehr.	+	+
<i>Gyrosigma scalproides</i> (Rabh.) Cl.	+	+
<i>Navicula confervocea</i> (Kutz.) Grun.	+	-
<i>N. pusilla</i> Wm. Smith	+	+
<i>Nitzschia palea</i> (Kutz.) Wm. Smith	+	+
<i>Pinnularia biceps</i> Greg.	+	+
<i>P. termes</i> Ehr.	+	+
<i>Surirella elegans</i> Ehr.	+	+
<i>S. linearis</i> var. <i>constricta</i> (Ehr.) Grun.	+	+
<i>Synedra ulna</i> (Nitz.) Ehr.	+	+
EUGLENOPHYTA		
<i>Euglena</i> sp. Ehr.	+	+
<i>Trachleomonas lacustris</i> Drez.	+	-
<i>T. volvocina</i> Ehr.	-	+

+ Denotes presence of alga.

Table 2. Summary of the number of algal species identified in each algal division from the Moa River and sulfur spring.

Division	Moa River	Sulfur Spring
Cyanophyta	9	12
Chlorophyta	22	36
Bacillariophyta	16	17
Euglenophyta	2	2
Total	49	67

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