

# The genera *Canomaculina* and *Parmotrema* (Parmeliaceae, Lichenized Ascomycota) in Curitiba, Paraná State, Brazil

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**ABSTRACT** – (The genera *Canomaculina* and *Parmotrema* (Parmeliaceae, Lichenized Ascomycota) in Curitiba, Paraná State, Brazil). The present study describes the species of *Canomaculina* Elix & Hale and *Parmotrema* A. Massal. occurring in Curitiba, Paraná. Identification keys, descriptions of the species, and comments are presented. *Canomaculina conferenda* (Hale) Elix, *Canomaculina pilosa* (Stizemb.) Elix & Hale, *Parmotrema catarinae* Hale and *Parmotrema eciliatum* (Nyl.) Hale are reported for the first time to Paraná State.

Key words - Brazil, Curitiba, lichens, Paraná, Parmeliaceae

**RESUMO** – (Os gêneros *Canomaculina* e *Parmotrema* (Parmeliaceae, Ascomycota Liquenizados) em Curitiba, Estado do Paraná, Brasil). Este estudo descreve as espécies dos gêneros *Canomaculina* Elix & Hale e *Parmotrema* A. Massal. ocorrentes em Curitiba, Paraná. São apresentadas chaves de identificação, descrições e comentários sobre as espécies. *Canomaculina conferenda* (Hale) Elix, *Canomaculina pilosa* (Stizemb.) Elix & Hale, *Parmotrema catarinae* Hale e *Parmotrema eciliatum* (Nyl.) Hale são citadas pela primeira vez para o Estado do Paraná.

Palavras-chave - Brasil, Curitiba, líquens, Paraná, Parmeliaceae

## Introduction

The lichen flora of Curitiba, a city that has 21 million m<sup>2</sup> of parkland maintained within the urban perimeter (Curitiba 2002), although abundant and diversified, has not yet been systematically surveyed. It is mainly constituted by Parmeliaceae, a family with more than 60 genera and approximate 1000 species (Elix 1994). In Curitiba, the Parmeliaceae are represented by the following 13 genera: *Bulbothrix* Hale, *Canomaculina* Elix & Hale, *Canoparmelia* Elix & Hale, *Flavoparmelia* Hale, *Hypotrachyna* (Vain.) Hale, *Myelochroa* (Asahina) Elix & Hale, *Parmelinella* Elix & Hale, *Parmelinopsis* Elix & Hale, *Parmotrema* A. Massal., *Punctelia* Krog, *Relicina* (Hale & Kurok.) Hale, *Rimelia* Hale & A. Fletcher and *Xanthoparmelia* (Vain.) Hale (Eliasaro & Donha, unpublished data).

The genera *Canomaculina* Elix & Hale and *Parmotrema* A. Massal. are richly represented in Curitiba. *Canomaculina* is a corticolous, rarely saxicolous genus, comprising 18 species (Crespo & Cubero 1998), with the major centres of distribution in South America and Africa (Elix 1993). It is characterised by effigurate maculate upper surface and

dimorphous rhizines, that are absent in the closely related genera *Parmotrema* and *Rimelia*. *Parmotrema* is a genus characterised by large thalli with broad lobes, commonly with a broad erhizinate marginal zone on the lower surface and the upper surface usually emaculate or if maculatae, the maculae neither effigurate nor reticulate (Elix 1993). It is best developed in tropical regions where over 300 species are known (Elix 1993).

The objective of this work was to survey the species of the genera *Canomaculina* and *Parmotrema* in Curitiba, to characterise them and provide means for their identification.

## Material and methods

Curitiba, the capital of Paraná is located in the south Brazil (25°25'48" S and 49°16'15" W) and has an area of 432 km<sup>2</sup> (Curitiba 2002). Its climate has been characterised as subtropical with fresh summers, frequent freezing weather during the winter, a mean annual precipitation between 1300 and 1500 mm, without dry season (Maack 1981).

The specimens studied were mostly collected by the authors from a variety of places as parks, woodland, avenues and streets in Curitiba, and are deposited in the Herbarium of the Federal University of Paraná (UPCB). Herbarium specimens were examined with a dissecting microscope for morphological characterisation. Apothecia and pycnidia were cut by hand with a razor blade and observed under light microscope. Spot tests on upper cortex and medulla were

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carried out with reagents K (10% KOH), C (30% Potassium hypochlorite) and K followed by C (KC), occasionally the medulla were examined under UV light. Lichen substances were identified by thin layer chromatography according to the methods standardized for lichen products (Culberson & Ammann 1979, Elix & Ernst-Russel 1993). Merck's silica gel 60 F<sub>254</sub> aluminium plates were developed in solvent C (Culberson & Ammann 1979).

## Results and Discussion

*Canomaculina* Elix & Hale, Mycotaxon 29:239. 1987.

The genera *Canomaculina* is represented by seven species in Curitiba. Excluding *C. conferenda*, a locally rare species, they are found on barks in well lit places, including trees used in arborization near downtown.

### Key to the species of *Canomaculina* occurring in Curitiba

1. Thallus lacking soredia
  2. Lower surface mostly black ..... *C. consors*
  2. Lower surface pale tan to brown
    3. Medulla K+ yellow then red (salazinic acid) ..... *C. subcaperata*
    3. Medulla K-, KC+ rose (norlobaridone and loxodin) ..... *C. recipienda*
1. Thallus sorediate
  4. Lower surface mostly black
    5. Medulla K+ yellow (stictic acid) ..... *C. muelleri*
    5. Medulla K- ..... *C. pilosa*
  4. Lower surface pale tan to brown
    6. Medulla K+ yellow then red (salazinic acid) ..... *C. subsumpta*
    6. Medulla K- ..... *C. conferenda*

*Canomaculina conferenda* (Hale) Elix, Mycotaxon 65:477. 1997.

*Parmotrema conferendum* Hale, Mycotaxon 5:433. 1977.

Thallus adnate, 3-6 cm wide. Lobes subirregular, apically rounded, 5-10 mm wide, densely ciliate; cilia simple. Upper surface greenish-grey, white effigurate-maculate, submarginally sorediate; soralia at first punctiform, then orbicular, confluent at maturity. Medulla white. Lower surface pale tan to brown, moderate to densely rhizinate; rhizines brown to black, of two types, either thick and up to 5 mm long or thin and less than 1 mm long, simple or rarely branched. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C-, KC+ rose (norlobaridone and loxodine).

Specimens studied: BRASIL: PARANÁ: Curitiba, Cidade Industrial de Curitiba, Parque dos Tropeiros, 23-III-1999, *C.G. Donha* 388, 390 (UPCB).

*Canomaculina conferenda* is here recorded for the first time for Paraná. It is an apparently rare species in Curitiba, where it was collected on a tree trunk in the most industrialized region of the city. It is characterised by the laminal soredia and the presence of norlobaridone and loxodine in the medulla.

*Canomaculina consors* (Nyl.) Elix & Hale, Mycotaxon 29:239. 1987.

*Parmelia consors* Nyl., Flora 68:613. 1885.

Thallus adnate, 4-10 cm wide. Lobes subirregular, 5-10 mm wide, margins densely ciliate; cilia simple or commonly furcate. Upper surface greenish-grey with white, effigurate macules; vegetative propagules lacking. Medulla white. Lower surface mostly black, moderately rhizinate; rhizines of two types, either thick and up to 5 mm long, or thin, less than 1mm long, intermixed, simple, furcate or rarely squarrosely branched. Apothecia substipitate, 2-5 mm diameter, disc brown, imperforate or perforate; ascospores ellipsoid to subglobose, 14-16 × 8-10 μm. Pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C-, KC- (aliphatic acids).

Specimens studied: BRASIL: PARANÁ: Curitiba, UFPR, Centro Politécnico, 8-IV-1999, *C.G. Donha* 476 (UPCB); Parque General Iberê de Mattos, 8-XI-1998, *S. Eliasaro* 2100 (UPCB); Cidade Industrial de Curitiba, Parque dos Tropeiros, 23-III-1999, *C.G. Donha* 434 (UPCB).

*Canomaculina consors* is a locally common corticolous species found in well lit places. It is characterised by the absence of vegetative propagules

and the negative results for medullary tests (presence of aliphatic acids).

*Canomaculina muelleri* (Vain.) Elix & Hale, Mycotaxon 29:240. 1987.

*Parmelia muelleri* Vain., Acta Soc. Fauna et Fl. Fenn. 7:49. 1890.

Thallus adnate, 5-10 cm wide. Lobes subirregular, apically rounded, 5-10 mm wide, densely ciliate; cilia tapered, simple or commonly furcate. Upper surface greenish-grey, white effigurate-maculate, submarginally sorediate; soralia at first punctiform, then orbicular, confluent at maturity. Medulla white. Lower surface mostly black, moderate to densely rhizinate to the margins, or with a brown, bare or papillate marginal zone under the lobe apices; rhizines black, of two types, either thick and up to 5 mm long or thin and less than 1 mm long, simple, furcate or rarely squarrosely branched. Apothecia and pycnidia not seen. Chemistry: Cortex K<sup>+</sup> yellow (atranorin); medulla K<sup>+</sup> yellow, C-, KC- (stictic acid).

Specimens studied: BRASIL: PARANÁ: Curitiba, Cidade Industrial de Curitiba, Bosque do Trabalhador, 24-III-1999, *C.G. Donha 458* (UPCB); Bairro São Francisco, 29-X-1998, *C.G. Donha 256* (UPCB).

*Canomaculina muelleri* is a scattered corticolous species in parks and streets. It is characterised by the sorediate upper cortex and the presence of stictic acid in the medulla. It is morphologically similar to *C. pilosa*, and differs only in the medullary chemistry (aliphatic acids in *C. pilosa*).

*Canomaculina pilosa* (Stiz.) Elix & Hale, Mycotaxon 29:240. 1987.

*Parmelia pilosa* Stiz., Ber. Tätigk. St. Gallischen Naturwiss. Ges. 1888:165. 1890.

Thallus adnate to loosely adnate, 5-10 cm wide. Lobes subirregular, apically rounded, 5-10 mm wide, densely ciliate; cilia tapered, simple or commonly furcate. Upper surface greenish-grey, white effigurate-maculate, submarginally sorediate; soralia orbicular, confluent at maturity. Medulla white. Lower surface mostly black, moderate to densely rhizinate; rhizines black, of two types, either thick and up to 5 mm long or thin and less than 1 mm long, simple or furcate. Apothecia and pycnidia not seen. Chemistry: Cortex K<sup>+</sup> yellow (atranorin); medulla K-, C-, KC- (aliphatic acids).

Selected specimens studied: BRASIL: PARANÁ: Curitiba, Bosque Alemão, 15-X-1998, *C.G. Donha 155* (UPCB); UFPR, Centro Politécnico, 1-II-1994, *S. Eliasaro 1160* (UPCB); Parque General Iberê de Mattos, 8-XI-1998, *S. Eliasaro 2099* (UPCB); Cidade Industrial de Curitiba, Parque dos Tropeiros, 23-III-1999, *C.G. Donha 427* (UPCB).

*Canomaculina pilosa*, the most common species of *Canomaculina* in Curitiba, is here cited for the first time for Paraná State. It is found on trunks and branches of trees in open woodland, streets, avenues and parks. The sorediate upper cortex and the negative results for medullary tests characterise this species.

*Canomaculina recipienda* (Nyl.) Elix, Mycotaxon 65:477. 1997.

*Parmelia recipienda* Nyl., Flora 68:609. 1885.

Thallus loosely adnate, 6-10 cm wide. Lobes subirregular, apically rounded, 5-20 mm wide, moderate to densely ciliate; cilia simple or rarely branched. Upper surface greenish-grey, white effigurate-maculate; vegetative propagules lacking. Medulla white. Lower surface pale tan to brown near centre, densely rhizinate; rhizines black, of two types, either thick and up to 5 mm long or thin and less than 1 mm long, simple. Apothecia and pycnidia not seen. Chemistry: Cortex K<sup>+</sup> yellow (atranorin); medulla K-, C-, KC<sup>+</sup> rose (norlobaridone and loxodine).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Regional do Iguaçu Zoológico, 16-XII-1998, *S. Eliasaro & C.G. Donha 282* (UPCB); Bosque Alemão, 15-X-1998, *C.G. Donha 143* (UPCB); UFPR, Centro Politécnico, 8-IV-1999, *C.G. Donha 474* (UPCB); Cidade Industrial de Curitiba, Parque dos Tropeiros, 23-III-1999, *C.G. Donha 391* (UPCB).

*Canomaculina recipienda* is a locally common corticolous species on barks in open woodland, parks and streets. It is characterised by the absence of vegetative propagules and the presence of loxodine and norlobaridone in the medulla.

*Canomaculina subcaperata* (Kremp.) Elix, Mycotaxon 65:477. 1997.

*Parmelia subcaperata* Kremp., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 25:10. 1874.

Thallus loosely adnate, 8-12 cm wide. Lobes subirregular, apically rounded, 5-20 mm wide, densely ciliate; cilia simple or branched. Upper surface greenish-

grey, white effigurate-maculate; vegetative propagules lacking. Medulla white. Lower surface pale brown to dark brown near centre, densely rhizinate; rhizines black, of two types, either thick and up to 5 mm long or thin and up to 0.5 mm long, simple. Apothecia and pycnidia not seen. Chemistry: Cortex K<sup>+</sup> yellow (atranorin), medulla K<sup>+</sup> yellow then red, C<sup>-</sup>, KC<sup>-</sup> (salazinic acid).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Regional do Iguaçu Zoológico, 16-XII-1998, *S. Eliasaro & C.G. Donha 333* (UPCB); Bairro Cristo Rei, 23-VI-1998, *S. Eliasaro 1987* (UPCB).

*Canomaculina subcaperata* is an uncommon species on barks in open woodland, streets and parks. The absence of vegetative propagules and the presence of salazinic acid in the medulla characterise this species.

*Canomaculina subsumpta* (Nyl.) Elix, Mycotaxon 65:477. 1997.

*Parmelia subsumpta* Nyl., Flora 52:117. 1869.

Thallus loosely adnate, 5-10 cm wide. Lobes subirregular, apically rounded, 5-18 mm wide, moderate to densely ciliate; cilia simple or branched. Upper surface greenish-grey, white effigurate-maculate; sorediate; soralia marginal or submarginal, linear to subcapitate, coalescing at maturity. Medulla white.

Lower surface pale tan to brown near centre, densely rhizinate; rhizines black, of two types, either thick and up to 5 mm long or thin and less than 1 mm long, simple. Apothecia and pycnidia not seen. Chemistry: Cortex K<sup>+</sup> yellow (atranorin); medulla K<sup>+</sup> yellow then red, C<sup>-</sup> (salazinic acid).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Regional do Iguaçu Zoológico, 16-XII-1998, *S. Eliasaro & C.G. Donha 331* (UPCB); Bairro Bacacheri, Conjunto Solar, 29-VI-1998, *C.G. Donha 85* (UPCB); Bairro Cristo Rei, 23-VI-1998, *S. Eliasaro 1989* (UPCB).

*Canomaculina subsumpta* is a scattered species growing on barks in open woodland, streets and parks. It is characterised by the pale brown lower surface, the submarginal or marginal soralia and the presence of salazinic acid in the medulla.

*Parmotrema* A. Massal., Atti Reale Ist. Veneto Sci. Lett. Arti, ser. 3, 5:248. 1860.

The genera *Parmotrema* is represented by 14 species in Curitiba. *P. austrosinense*, *P. permutatum* and *P. tinctorum* were found near downtown and on trees along avenues, while the commonest species *P. chinense* and *P. internexum* are limited to less urbanized places. *P. flavomedulosum*, *P. robustum*, *P. schindleri* and *P. xanthinum* occurs only in parks with native vegetation.

#### Key to the species of *Parmotrema* occurring in Curitiba

1. Thallus without soredia and isidia
  2. Medulla C<sup>+</sup> rose (gyrophoric acid) ..... *P. catarinae*
  2. Medulla C<sup>-</sup>
    3. Medulla K<sup>+</sup> yellow (stictic acid) ..... *P. eciliatum*
    3. Medulla K<sup>-</sup> ..... *P. melanothrix*
1. Thallus sorediate or isidiate
  4. Thallus sorediate
    5. Medulla mostly orange or pale yellow
      6. Eciliate to rarely sparingly ciliate ..... *P. flavomedulosum*
      6. Moderately to densely ciliate ..... *P. permutatum*
    5. Medulla white
      7. Medulla C<sup>+</sup> red or rose
        8. Marginal cilia absent, lecanoric acid present ..... *P. austrosinense*
        8. Marginal cilia present, gyrophoric acid present ..... *P. sancti-angeli*
      7. Medulla C<sup>-</sup>
        9. Medulla K<sup>+</sup> yellow (stictic acid) ..... *P. chinense*
        9. Medulla K<sup>-</sup>
          10. Densely ciliate; cilia 1-3 mm long, soralia submarginal to rarely laminal ..... *P. schindleri*
          10. Eciliate to sparingly ciliate; cilia up to 1 mm long; soralia marginal and linear along margins to subcapitate on marginal lacinae ..... *P. robustum*

## 4. Thallus isidiate

11. Upper cortex yellow-green, K- (usnic acid) ..... *P. xanthinum*  
 11. Upper cortex pale grey to grey-green, K+ yellow (atranorin)  
 12. Medulla C+ red (lecanoric acid)..... *P. tinctorum*  
 12. Medulla C-  
 13. Medulla K+ yellow, UV- (stictic acid)..... *P. internexum*  
 13. Medulla K-, UV+ white-blue (alectoronic acid)..... *P. mellissii*

*Parmotrema austrosinense* (Zahlbr.) Hale, Phytologia 28(4):335. 1974.

*Parmelia austrosinensis* Zahlbr., Symb. Sin. :192. 1930.

Thallus loosely adnate, 5-8 cm wide. Lobes rounded, 10-30 mm wide, margins often ascending, eciliate. Upper surface pale grey to grey-green, emaculate to faintly maculate; sorediate; soralia marginal to submarginal, linear. Medulla white. Lower surface black in the centre, with a brown erhizinate marginal zone, sparsely rhizinate; rhizines simple, black. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C+ red, KC+ red (lecanoric acid).

Specimens studied: BRASIL: PARANÁ: Curitiba, Bosque Alemão, 15-XI-1998, *C.G. Donha 165* (UPCB); UFPR, Centro Politécnico, 8-IV-1999, *C.G. Donha 478* (UPCB); Cidade Industrial de Curitiba, Parque dos Tropeiros, 23-III-1999, *C.G. Donha 401* (UPCB).

*Parmotrema austrosinense* is relatively common in Curitiba. It occurs on tree trunks in well lit sites. It is characterised by the eciliate lobes, often with ascending margins, marginal to submarginal soralia and the presence of lecanoric acid in the medulla.

*Parmotrema catarinae* Hale, Mycotaxon 25:87. 1986.

Thallus loosely adnate, 5-8 cm wide. Lobes rounded, 10-30 mm wide, margins ascending, moderately ciliate; cilia 2-4 mm long, simple or branched. Upper surface pale grey to grey-green, emaculate to faintly maculate; vegetative propagules lacking. Medulla white. Lower surface black in the centre, with a white to brown erhizinate marginal zone, sparsely rhizinate; rhizines simple to sparsely branched, black. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C+ rose, KC+ rose (gyrophoric acid).

Specimens studied: BRASIL: PARANÁ: Curitiba, UFPR, Centro Politécnico, 8-IV-1999, *S. Eliasaro 1173* (UPCB); Cidade Industrial de Curitiba, Parque dos Tropeiros, 23-III-1999, *C.G. Donha 406* (UPCB).

This is the first report of *Parmotrema catarinae* for Paraná State. It is an uncommon species on tree trunks in parks. The absence of vegetative propagules and the presence of gyrophoric acid in the medulla characterise this species.

*Parmotrema chinense* (Osbeck) Hale & Ahti, Taxon 35:133. 1986.

*Lichen chinensis* Osbeck, Dagb. Ostind. resa:221. 1757.

Thallus loosely to moderately adnate, 4-10 cm wide. Lobes rounded to irregularly incised, 6-15 mm wide, margins crenate, sparsely to moderately ciliate; cilia 1-2 mm long, simple or branched. Upper surface pale grey to grey-green, emaculate; sorediate; soralia marginal to submarginal, linear to subcapitate, sorediate lobes becoming revolute, soredia granular. Medulla white. Lower surface black in the centre, with a brown erhizinate marginal zone, moderately rhizinate; rhizines simple to sparsely branched, black. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K+ yellow, C-, KC- (stictic acid, constictic acid, menegazziaic acid).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Regional do Iguaçu Zoológico, 16-XII-1998, *S. Eliasaro & C.G. Donha 312* (UPCB); Bosque Alemão, 15-X-1998, *C.G. Donha 149* (UPCB); UFPR, Centro Politécnico, 15-IX-1993, *S. Eliasaro 1069* (UPCB); Parque Passaúna, 1-VII-1998, *C.G. Donha 108* (UPCB); Parque Tanguá, 1-VII-1998, *C.G. Donha 94* (UPCB).

It is a very common species on bark in open woodlands and parks. The presence of stictic acid in the medulla distinguish *Parmotrema chinense* from all other sorediate species of *Parmotrema* in Curitiba.

*Parmotrema eciliatum* (Nyl.) Hale, Phytologia 28:336. 1974.

*Parmelia crinita* Ach. var. *eciliata* Nyl., Flora 52:291. 1869.

Thallus loosely adnate, 5-8 cm wide. Lobes

irregular, 5-15 mm wide, margins crenate, sparsely ciliate; cilia up to 1mm long, simple. Upper surface pale grey to grey-green, emaculate; vegetative propagules lacking. Medulla white. Lower surface black in the centre, with a brown erhizinate marginal zone, densely rhizinate; rhizines simple to branched, black. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K+ yellow, C-, KC- (stictic acid, constictic acid, unidentified compounds).

Specimens studied: BRASIL: PARANÁ: Bosque Alemão, 15-X-1998, *C.G. Donha 151* (UPCB); UFPR, Centro Politécnico, 2-X-1995, *M. Bündchen 123* (UPCB); Parque Tanguá, 1-VII-1998, *C.G. Donha 103* (UPCB).

*Parmotrema eciliatum* is here recorded for the first time to Paraná. It is a scattered species found on trunks and branches in parks. It is characterised by the absence of vegetative propagules and the presence of stictic acid in the medulla.

*Parmotrema flavomedullosum* Hale, Mycotaxon 1:110. 1974.

Thallus adnate, 6-12 cm wide. Lobes rounded, 10-20 mm wide, margins entire to crenate, eciliate to rarely sparingly ciliate; cilia in lobe axils, less than 1 mm long, simple. Upper surface pale grey to grey-green, emaculate, cortex fragile near lobe margins; sorediate; soralia marginal to submarginal, pustular and punctiform or spreading and becoming confluent, soredia granular. Medulla yellow to orange. Lower surface black in the centre, with a brown erhizinate marginal zone, sparsely rhizinate; rhizines simple, black. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C+ rose, KC+ rose (gyrophoric acid, unidentified compounds).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Regional do Iguaçu Zoológico, 16-XII-1998, *S. Eliasaro & C.G. Donha 289, 295* (UPCB).

*Parmotrema flavomedullosum* is a locally rare species found only on bark of trees in a coppice of Araucaria Forests. It is characterised by the yellow to orange medulla, eciliate to rarely ciliate lobes and by the fragile upper cortex. *P. permutatum* is superficially similar, but has ciliate margins and marginal and linear soralia.

*Parmotrema internexum* (Nyl.) Hale ex De Priest & B. Hale, Mycotaxon 67:204. 1998.

*Parmelia internexa* Nyl., Flora 68:609. 1885.

Thallus adnate, 7-10 cm wide. Lobes rounded, 5-15 mm wide, margins entire to crenate, eciliate or with

short cilia in lobe axils. Upper surface grey-green, emaculate, densely isidiate; isidia laminal and marginal, simple to rarely branched, brown-tipped, eciliate. Medulla white. Lower surface black in the centre, with a brown to ivory erhizinate marginal zone, moderate to densely rhizinate; rhizines simple to rarely branched, black. Apothecia rare, 2-4 mm wide, disc imperforate, thalline exciple isidiate; ascospores 22-26 × 10-15 µm. Pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K+ yellow, C-, KC- or KC+ lilac, UV- (stictic acid, constictic acid, sometimes norlobaridone and loxodin).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Regional do Iguaçu Zoológico, 16-XII-1998, *S. Eliasaro & C.G. Donha 270, 328* (UPCB); Bosque Alemão, 15-X-1998, *C.G. Donha 104b* (UPCB); UFPR, Centro Politécnico, 27-I-1999, *C.G. Donha 337* (UPCB); Parque dos Tropeiros, 23-III-1999, *C.G. Donha 336, 404* (UPCB); Bairro Umbará, 10-I-1999, *L.T. Maranhão s.n.* (UPCB).

*Parmotrema internexum* is one of the commonest Parmeliaceae in Curitiba, occurring on barks in woodland, parks and streets in less urbanized areas. The presence of stictic acid in the medulla distinguish this species from all other isidiate *Parmotrema* in Curitiba.

*Parmotrema melanothrix* (Mont.) Hale, Phytologia 28(4):337. 1974.

*Parmelia urceolata* Eschw. var. *melanothrix* Mont., Ann. Sci. Nat., Bot. ser. 2, 2:372. 1834.

Thallus loosely adnate, 4-7 cm wide. Lobes rounded, 5-10 mm wide, margins entire to crenate, ascending, densely ciliate; cilia simple, 2-4 mm long. Upper surface pale grey to grey-green, emaculate; vegetative propagules lacking. Medulla white. Lower surface black in the centre, with a white to ivory erhizinate marginal zone, moderately rhizinate; rhizines simple to rarely branched, black. Apothecia common, 3-8 mm wide, disc imperforate, thalline exciple ciliate; ascospores 19-26 × 8-13 µm. Pycnidia common, conidia filiform, 7-11 µm long. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C-, KC- (protoliqueterinic acid, unidentified fatty acids).

Specimens studied: BRASIL: PARANÁ: Curitiba, UFPR, Centro Politécnico, 8-IV-1999, *C. Morales 3* (UPCB); Ópera de Arame, 7-IX-1994, *M. Schatzmann 34* (UPCB); Bairro Bacacheri, 29-VI-1998, *C.G. Donha 82* (UPCB).

*Parmotrema melanothrix* is a scattered species found on tree trunks in parks. The absence of vegetative propagules and the negative results for medullary tests characterise this species.

*Parmotrema mellissii* (C.W. Dodge) Hale, *Phytologia* 28:337. 1974.

*Parmelia mellissii* C. W. Dodge, *Ann. Missouri Bot. Gard.* 46:134. 1959.

Thallus loosely adnate, 5-9 cm wide. Lobes rounded, 6-15 mm wide, margins crenate, ascending, densely ciliate; cilia simple or rarely branched, 1-3 mm long. Upper surface pale grey to grey-green, emaculate, cortex fragile, isidiate; isidia marginal to submarginal, simple to branched, sometimes becoming granular and soresiate. Medulla white. Lower surface black in the centre, with a pale brown to brown erhizinate marginal zone, sparsely rhizinate; rhizines simple to rarely branched, black. Apothecia not seen. Pycnidia rare, conidia filiform, 7-10  $\mu$ m long. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C-, KC- or KC+ rose, UV+ white blue (alectoronic acid, unidentified compounds).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Regional do Iguaçu Zoológico, 16-XII-1998, *S. Eliasaro & C.G. Donha 286* (UPCB); UFPR, Centro Politécnico, 25-VI-1998, *S. Eliasaro 2005* (UPCB).

*Parmotrema melissii* is an uncommon species on tree trunks in parks and woodland. The densely ciliate lobes margins, the isidia that becoming soresiate and the presence of alectoronic acid in the medulla characterise this species.

*Parmotrema permutatum* (Stirt.) Hale, *Phytologia* 28(4):338. 1974.

*Parmelia permutata* Stirt., *Scott. Naturalist* (Perth) 4:252. 1878.

Thallus loosely adnate, 6-10 cm wide. Lobes rounded, 5-18 mm wide, margins entire to crenate, moderately to densely ciliate; cilia simple to furcate, up to 1.5 mm long. Upper surface pale grey to grey-green, emaculate; soresiate; soralia marginal, linear, soresidia granular, often grey brown. Medulla yellow to orange-yellow or white in the upper half and yellow in the lower half. Lower surface black in the centre, with a dark brown erhizinate marginal zone, moderately rhizinate; rhizines simple to rarely branched, black. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C+ rose, KC+ rose

(gyrophoric acid, unidentified compounds).

Specimens studied: BRASIL: PARANÁ: Curitiba, UFPR, Centro Politécnico, 8-IV-1999, *M. Bündchen 198* (UPCB); Parque General Iberê de Mattos, 8-XI-1998, *S. Eliasaro 2098* (UPCB); Centro Cívico, 15-IX-1998, *C.G. Donha 182a* (UPCB); Bairro Umbará, 22-IX-1998, *L.T. Maranhão 46* (UPCB); Parque Barigüi, 8-III-1994, *S. Eliasaro 1217* (UPCB).

*Parmotrema permutatum* is a relatively common species in Curitiba. It occurs on trunks and branches in well lit sites, including trees near downtown. It is a soresiate species characterised by the ciliate lobes and the pigmented medulla.

*Parmotrema robustum* (Degel.) Hale, *Phytologia* 28(4):338. 1974.

*Parmelia robusta* Degel., *Göteborgs Kungl. Vetensk. Samhälles Handl., Ser. B, Mat. Naturvetensk. Skr., ser. 6*, 1:33. 1941.

Thallus loosely adnate, 5-8 cm wide. Lobes rounded, 10-18 mm wide, margins entire to lacinate, eciliate to sparingly ciliate; cilia simple, up to 1 mm long. Upper surface pale grey to grey-green, emaculate; soresiate; soralia marginal, linear along margins to subcapitate on short marginal laciniae. Medulla white. Lower surface black in the centre, with a white to ivory erhizinate marginal zone, sparsely rhizinate; rhizines in scattered groups, simple to rarely branched, black. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C-, KC- (protocetraric acid).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Regional do Iguaçu Zoológico, 16-XII-1998, *S. Eliasaro & C.G. Donha 319* (UPCB).

*Parmotrema robustum* was found only on bark of trees in a coppice of Araucaria Forests. It is characterised by the eciliate to rarely ciliate lobes, soralia marginal and linear along margins to subcapitate on marginal laciniae and by the presence of protocetraric acid in the medulla. *P. schindleri* is superficially similar, but has densely ciliate margins and submarginal to laminal soralia.

*Parmotrema sancti-angeli* (Lyngé) Hale, *Phytologia* 28(4):339. 1974.

*Parmelia sancti-angeli* Lyngé, *Ark. Bot.* 13:35. 1914.

Thallus loosely to moderately adnate, 4-12 cm wide. Lobes rounded to irregular, 5-15 mm wide,

margins entire to crenate, ascending, ciliate; cilia simple to branched, 2-3 mm long. Upper surface pale grey, emaculate; sorediate; soralia marginal, linear, soredia farinose. Medulla white. Lower surface black in the centre, with a brown to dark brown erhizinate marginal zone, sparsely to moderately rhizinate; rhizines simple to rarely branched, black. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C+ rose, KC+ rose (gyrophoric acid).

Specimens studied: BRASIL: PARANÁ: Parque Passaúna, 1-VII-1998, *C.G. Donha 109* (UPCB); UFPR, Centro Politécnico, 9-VII-1993, *S. Eliasaro 1017* (UPCB); Parque dos Tropeiros, 23-III-1999, *C.G. Donha 425* (UPCB); Bairro Umbará, 12-X-1998, *L.T. Maranhão 6b* (UPCB).

*Parmotrema sancti-angeli* is a scattered species growing on bark in open woodland, parks and streets in less urbanized areas. It is characterised by the marginal and linear soralia and the presence of gyrophoric acid in the medulla.

*Parmotrema schindleri* Hale, Mycotaxon 21(1):89. 1986.

Thallus loosely adnate, 8-12 cm wide. Lobes rounded, 5-10 mm wide, margins entire to crenate, ascending, densely ciliate; cilia simple to branched, 1-3 mm long. Upper surface grey-green, emaculate or faintly maculate, becoming reticulate-cracked centrally; sorediate; soralia submarginal to rarely laminal, subcapitate, pustular, soredia granular. Medulla white. Lower surface black in the centre, with a brown erhizinate marginal zone, sparsely rhizinate; rhizines simple to branched, black. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C-, KC- (protocetraric acid, unidentified compounds).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Regional do Iguaçu Zoológico, 16-XII-1998, *S. Eliasaro & C.G. Donha 288* (UPCB).

*Parmotrema schindleri*, such as *P. flavomedulosum* and *P. robustum*, is a locally rare species only found in a coppice of Araucaria Forests. It grows on rock in shaded places. It is characterised by the densely ciliate lobes, the soralia submarginal to laminal and by the presence of protocetraric acid in the medulla.

*Parmotrema tinctorum* (Nyl.) Hale, Phytologia 28(4):339. 1974.

*Parmelia tinctorum* Nyl., Flora 55:547. 1872.

Thallus loosely adnate, 7-15 cm wide. Lobes rounded, 10-20 mm wide, margins entire, eciliate. Upper surface pale grey, emaculate, becoming cracked centrally; moderate to densely isidiate; isidia laminal to rarely marginal, confluent or in scattered groups, sometimes brown-tipped, simple to branched. Medulla white. Lower surface black in the centre, with a dark brown erhizinate marginal zone, sparsely rhizinate; rhizines simple to branched, black. Apothecia and pycnidia not seen. Chemistry: Cortex K+ yellow (atranorin); medulla K-, C+ red, KC+ red (lecanoric acid).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Regional do Iguaçu Zoológico, 29-XI-1998, *C.G. Donha 258* (UPCB); Centro Cívico, 15-XI-1998, *C.G. Donha 168a* (UPCB); Bairro Cristo Rei, 23-IV-1998, *S. Eliasaro 1993* (UPCB); Bosque da Fazendinha, 24-III-1999, *C.G. Donha 439* (UPCB); Bairro Umbará, 22-IX-1998, *L.T. Maranhão 39* (UPCB); Parque Barigüi, 8-III-1994, *S. Eliasaro 1227* (UPCB).

*Parmotrema tinctorum* is a locally very common species, found on trunks and branches of trees in open woodland, streets, avenues and parks. It is easily recognised by the eciliate lobes margins, the isidiate upper surface and by the presence of lecanoric acid in the medulla.

*Parmotrema xanthinum* (Müll. Arg.) Hale, Phytologia 28(4):339. 1974.

*Parmelia proboscidea* Taylor var. *xanthina* Müll. Arg., Lichen. bei. 20:7. 1884.

Thallus loosely adnate, 7-12 cm wide. Lobes rounded, 10-15 mm wide, margins entire to crenate, ciliate; cilia 1-3 mm long, simple to furcate. Upper surface yellow-green, emaculate, becoming reticulate-cracked centrally; isidiate; isidia marginal to submarginal, simple to coralloid-branched, brown-tipped, often ciliate. Medulla white. Lower surface black in the centre, with a dark brown erhizinate marginal zone, moderately rhizinate; rhizines simple to branched, black. Apothecia and pycnidia not seen. Chemistry: Cortex K- (usnic acid); medulla K-, C+, KC+ (gyrophoric acid, unidentified compounds).

Specimens studied: BRASIL: PARANÁ: Curitiba, Parque Tanguá, 1-VII-1998, *C.G. Donha 91* (UPCB).

*Parmotrema xanthinum* is an apparently rare species in Curitiba, where it was collected on exposed rock in a park. The presence of usnic acid in the upper surface distinguish *P. xanthinum* from all other species of *Parmotrema* in Curitiba.



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