

Compiled Key to *Xanthoparmelia* in Southern Africa

by H. Sipman, 25 Nov. 2017

The key is based on the keys for the genera *Karoowia*, *Paraparmelia*, *Xanthoparmelia* and the *Neofuscelia* group published by Hale (1989), Elix (201), Hale (1990) and Esslinger (1977), respectively. The species not known from Southern Africa are omitted, some rearrangements are made, and added are all additional species reported by Fryday (2015) in the Checklist for South Africa. For the added species a reference to a description is given; for the other species descriptions can be found in the above publications.

The delimitation of the genus *Xanthoparmelia* follows Blanco et al. (2004). Genus abbreviations: K = *Karoowia*; N = *Neofuscelia*; P = *Parmelia*; Par = *Paraparmelia*; X = *Xanthoparmelia*. For the currently accepted name of the species, see the websites of Index Fungorum or Mycobank.

Key to main groups (coinciding largely with former genera)

1. Thallus loosely adnate, attached by central umbilicus..... **F. Xanthomaculina**
Thallus loosely or tightly adnate, attached by rhizines or scattered hapters2
2. Thallus upper surface with pseudocyphellae **C. Namakwa**
Thallus upper surface without pseudocyphellae3
3. Thallus upper cortex with atranorin or usnic acid, colour whitish-, yellowish- or greenish grey4
Thallus upper cortex without atranorin or usnic acid; thallus colour dark brownish grey6
4. Thallus upper cortex with atranorin, upper surface whitish grey, K + pale yellow **E. Paraparmelia**
Thallus upper cortex with usnic acid, upper surface yellowish to greenish grey, K -5
5. Thallus tightly adnate, subcrustose, often with immersed (aspicilioid) apothecia, with dull upper surface without or with thin epicortex **B. Karoowia**
Thallus tightly or loosely adnate, subcrustose or foliose to pulvinate, with sessile apothecia with constricted base, usually with glossy upper surface at least near the lobe tips, occasionally pruinose to scabrose..... (Xanthoparmelia) 7
6. Thallus subfruticose, with linear, erect to spreading, not adnate lobes..... **A. Almbornia**
Thallus foliose to subcrustose, with shorter, subirregular to sublinear, loosely to tightly adnate lobes **D. Neofuscelia**
7. Thallus upper surface dull, at the lobe tips coarse-pruinose **M. Pruinose Xanthoparmelia**
Thallus upper surface shiny, at least at the lobe tips, rarely thinly white-pruinose.....8
8. Thallus sorediate **G. Sorediate Xanthoparmelia**
Thallus not sorediate9
10. Thallus terricolous (on soil, humus or pebbles, attached or vagrant) **H. Terricolous Xanthoparmelia**
Thallus saxicolous, rarely on other substrate9
9. Thallus isidiate10
Thallus not isidiate11
10. Thallus with pale brown to brown lower surface, darkest at the tips
..... **I. Isidiate Xanthoparmelia pale below**
Thallus with black lower surface, paler at the tips **J. Isidiate Xanthoparmelia black below**
11. Thallus with pale brown to brown lower surface, darkest at the tips
..... **K. Nonisidiate, Nonsorediate Xanthoparmelia pale below**
Thallus with black lower surface, paler at the tips
..... **L. Nonisidiate, Nonsorediate Xanthoparmelia black below**

A. Almbornia group

1. Thallus lobes linear-elongate, irregularly arranged; norstictic acid present **Almbornia cafferensis** Essl., Nordic J Bot. 1(1): 125 (1981) (*Xanthoparmelia ovealmbornii* A. Thell et al.)
Thallus lobes shorter, gradually attenuated, appanate; no substances present.... **Almbornia azaniensis** Brusse, Mycotaxon 40: 265 (1991)

B. Karoowia group

1. Thallus coarsely sorediate; evernic acid present; Transvaal, Cape **K. ganymedeae**
Thallus not sorediate 2
- 2(1). Thallus isidiate; lower surface black 3
Thallus not isidiate; lower surface black or paler 5
- 3(2). Lobes broad, to 1 mm wide; medulla K + yellow to orange (stictic or hypostictic acid agg.) 4
Lobes narrower, less than 0.6 mm wide; medulla K - (norlobaridone); Transvaal, Natal
..... **K. microscopica**
- 4(3). Medulla K + yellow (stictic acid present); widespread, Namibia, Transvaal, Natal, Lesotho, Cape
..... **K. saxeti**
Idem, but hypostictic acid agg. without stictic acid present; Cape **K. lyrigera** (Brusse), Mycotaxon 35:
24.
- 5(2). Lower surface black 6
Lower surface tan to brown 10
- 6(5). Apothecia persistently aspicilioid; salazinic acid present; Cape **K. leptoplaca**
Apothecia aspicilioid to sessile; salazinic acid absent 7
- 7(6). Psoromic acid present; Transvaal **K. arquata**
Stictic acid agg. and traces of hypostictic acid present 8
- 8(7). Thallus effigurate-crustose, with black prothallus visible between the lobes; Cape **K. supposita** (Brusse),
Mycotaxon 50; 294.
Thallus foliose but strongly appressed, without black prothallus 9
- 9(8). Lobes flat and appressed; apothecia persistently aspicilioid; cortex with additional atranorin; Transvaal,
N Cape **K. adligans**
Lobes flattish to convex; apothecia sessile at maturity; Cape, Natal, Transvaal **K. adhaerens**
- 10(5). Medulla P+ yellow to orange-red 11
Medulla P- 14
- 11(10). Medulla K + yellow turning orange to red 12
Medulla K - (or brownish, not yellow); protocetraric acid present; lobes flat and appressed; apothecia
persistently aspicilioid; Cape **K. protocetrarica**
- 12(11). Salazinic acid present; apothecia sessile; lobes flattish to convex 13
Stictic, constictic, menegazziaic acids present **K. diutina** (Brusse), Mycotaxon 49: 2.
- 13(12). Thallus areolate-cracked at the center; chalybaeizanic acid absent; Cape **K. salazinic**
Thallus lobate at the center; chalybaeizanic acid present; Cape **K. subchalybaeizans**

- 14(10). Medulla C + red (lecanoric acid present as major substance): Namibia, Cape, Natal, OFS, Lesotho **K. scitula**
 Medulla C - (lecanoric acid if present minor) 15
- 15(14). Squamatic acid present; Cape **K. squamatica** (Brusse) (syn. *Xanthoparmelia mucinae* G. Amo et al.; *Parmelia princeps* Brusse, Bothalia 17: 27)
 Squamatic acid absent 16
- 16(15). Norlobaridone present; Australia, Transvaal, Natal, OFS, Cape, Lesotho **K. ralla**
 Norlobaridone absent 17
- 17(16). Hypoprotocetraric acid present; apothecia large, adnate; Cape **K. perspersa**
 Hypoprotocetraric acid absent; apothecia small, initially aspicilioid 18
- 18(17). Lobes flat and appressed; evernic acid present (major); OFS, Natal, Cape **K. insipida**
 Lobes convex; evernic and lecanoric acids present; Lesotho, Natal, OFS, eastern Cape **K. spissa**

C. Namakwa group

1. Thallus upper cortex with usnic acid, thallus surface greenish to yellowish grey 2
 Thallus upper cortex without usnic acid, thallus surface brownish grey; soredia or isidia absent; lower surface pale tan to pale brown; no medullary substances; cortex HNO₃ + blue-green; Cape
 **Namakwa pseudepheboides** Essl., Bryologist 103: 577.
2. Medulla K + yellow turning red; chalybeizanic acid and salazinic acid present **X.F exornata** (Zahlbr.)
 Brusse & M.D.E. Knox = *Namakwa exornata* (Zahlbr.) Hale, Mycotaxon 32:169.
 Medulla K -; constipatic acid agg. present *Namakwa aliphatica* Elix, Mycotaxon 63: 336 (1997)
 = **X. aliphaticella** A. Thell et al.

D. Neofuscelia group

- 1(1). Medulla redbrown to violet (pigment anhydrofusarubin agg.); isidia and soredia absent; lower surface pale brown 2
 Medulla white (no pigment); lower surface pale or black 4
- 2(1). Thallus loosely adnate; protocetraric acid present; lower surface with many rhizines; like *X. endomiltodes* but without usnic acid; Cape **X. parilis** (Brusse), Mycotaxon 40: 383.
 Thallus adnate to tightly adnate 3
- 3(2). Divaricatic acid present; lobes congested, imbricate, subirregular to sublinear, 1-2 mm wide; Cape **N. quinonella** Elix, Mycotaxon 83: 338.
 Fumarprotocetraric acid present; lobes imbricate or not, sublinear, 1-3 mm wide; Cape
 **N. vernicosa** (syn. *Paraparmelia violacea*, see Elix, Bibl. Lichenol. 80: 198)
- 4(1). Thallus with isidia 5
 Thallus without isidia 13
- 5(4). Medulla K + yellow turning red-orange or red (hypostictic acid agg.) 6
 Medulla K - 7
- 6(5). Isidia cylindrical; mountains of Kenya **P. kenya** Essl.
 Isidia pustular; widespread, Lesotho, Namibia, Cape **P. subhosseana** Essl.
- 7(5). Medulla C + rose or reddish; lobes mostly 1 mm broad or more; isidia distinctive, ± pustular; olivetoric acid; Cape, Lesotho, Namibia **P. caliginosa** Essl.

Medulla C -	8
8(7). Medulla KC + rose, or red; alecronic acid present.....	9
Medulla KC -; isidia cylindric; divaricatic or lobaric acid present	10
9(8). Lower surface dark brown to black; divaricatic acid present; Australasia, Cape.....	P. verrucella Essl.
Lower surface black; lobaric acid present; isidia short-cylindrical; Cape. N. lobarica Elix, Mycotaxon 71: 442.	
10(8). Medulla UV+ bright blue-white fluorescent; alecronic acid with or without a-collatolic acid present	11
Medulla UV - or faint whitish, other compounds present	12
11(10). Lower surface black; Australasia, Lesotho, Namibia, Cape, OFS, Natal, Transvaal	P. verisidiosa Essl.
Lower surface pale to dark brown; OFS	P. brandwagensis Elix, Mycotaxon 71: 434.
12(10). Physodic acid present; Australia, Lesotho	P. incantata Essl.
Glomelliferonic acid present; Australia, Lesotho, Caoe, OFS	P. subincerta Essl.
13(4). Upper cortex HN03 + blue-green to dark blue-green.....	14
Upper cortex HN03 - or slight reddish to (rarely) violet, never blue-green	61
14(13). Medulla PD + very pale orange to orange-yellow or red-orange, usually K + yellow to dingy orange or turning red.....	15
Medulla PD -, K -	41
15(14). Lower surface erhizinate, without organs of attachment or with loboid holdfasts.....	16
Lower surface sparsely to moderately rhizinate	21
16(15). Thallus closely appressed, moderately adnate to tightly adnate to subcrustose	17
Thallus loosely appressed and loosely or not at all adnate.....	19
17(16). Lower surface black	18
Lower surface pale tan to brown; stictic acid agg. inc. hypostictic and tr. lusitanic acid; Cape	N. polystictica Elix, Mycotaxon 71: 448.
18(17). Medulla K + yellow turning red ; norstictic acid without caperatic acid present; lobes tightly adnate throughout, short and rounded; Cape	P. squamariata Nyl. ex Cromb.
Medulla K -; fumarprotocetraric acid present; lobes rarely imbricate, irregular to sublinear, 0.2-0.8 mm wide; Cape.....	N. brussei Elix, Mycotaxon 63: 338.
19(16). Lower surface black; lobes 0.5-1.5 mm broad; without special organs of attachment, lying virtually loose on sandy rock surfaces or sandy soil; norstictic acid; Cape.....	P. loriloba Essl.
Lower surface pale tan to brown	20
20(19). Lobes mostly 0.1-0.5 mm broad; lower surface pale tan to pale brown; with one to several, subcentral umbilicoid holdfasts anchoring it to the rock; norstictic acid; Cape	P. foveolata Essl.
Lobes 0.3-1.2 mm wide; lower surface pale brown to brown; hypostictic, stictic and hypoconstictic acids present; Cape.....	P. adamantea Brusse, Mycotaxon 40:378
21(15). Thallus very tightly adnate and subcrustose, distinctly lobed only at the periphery	22
Thallus plainly foliose, not subcrustose, tightly adnate but often with convex lobes (namaensis-group)	29
22(21). Lower surface dark brown or black; major substance norstictic acid	23
Lower surface pale tan to pale brown; major substance norstictic acid or another depsidone.....	24

- 23(22). Lobes thin, 80-160 μm thick; apothecia immersed when young, remaining \pm immersed (between areoles) or becoming sessile, to 0.8 mm in diameter, \pm flat; spores 10-13 x 4-5 μm ; Cape, Transvaal, Australia *P. squamariata* Nyl. ex Cromb. (syn. *N. albornii* Henssen)
Lobes thicker, 150-210 μm thick ; apothecia sessile, to 1.5 mm in diameter, becoming convex; spores 13-16 x 5-6 μm ; Kenya *P. nakuruensis* Essl.
- 24(22). Medulla K + yellow turning orange or red, PD + pale orange; hypostictic or salazinic acid present
Medulla K -, P+ brick red; fumarprotocetraric and protocetraric acids present; Australia, Cape
..... *P. parviloba* Essl. (syn. *P. manina* Brusse, Mycotaxon 49: 6.
- 25(24). Hypostictic acid agg. present; Cape *P. crustulosa* Essl.
Salazinic or norstictic acid present 26
- 26(25). Salazinic acid present 27
Norstictic acid present 28
- 27(26). Salazinic acid alone present; Cape *P. melancholica* Zahlbr.
Salazinic acid and norlobaridone present; lobes discrete to slightly imbricate, sublinear to linear, 0.3-0.8(-1) mm wide; lower surface pale tan to brown; Namibia *N. namibiensis* Elix, Mycotaxon 71: 444.
- 28(26). Norstictic acid and caperatic acid present; thallus small foliose to subcrustose, tightly adnate; apothecia immersed when young, becoming sessile; ascospores 7-9 x 4-6 μm ; Cape, Natal
..... *N. subsquamariata* Elix, Mycotaxon 71: 450.
Norstictic acid alone present; thallus subcrustose, foliose-placodioid, tightly adnate; lobes 100-160(-200) μm thick; apothecia immersed when young, becoming sessile; ascospores subglobose, 5-5.5 μm in diameter; Cape *N. substygioides* Essl., Bryologist 103: 585.
- 29(21). Lower surface dark brown or black 30
Lower surface pale tan to pale brown 31
- 30(29). Medulla PD + very pale orange; hypostictic acid agg. present; widespread, Cape, OFS, Lesotho
..... *P. squamans* Stizenb.
Medulla PD + distinctly yellow-orange to orange; norstictic acid present; Tanzania?
..... *P. erythrocardia* (Müll. Arg.) Vain.
- 31(29). Lobes flat, \pm imbricate to contiguous, not particularly elongate or sinuous; thallus pulvinate; lower surface \pm flat, not channeled; upper cortex not minutely roughened; unknown depsidones; Cape, Lesotho *P. fissurina* Zahlbr.
Lobes rather distinctly convex, especially inward, \pm discrete and elongate, often somewhat sinuous; lower surface often slightly channeled; upper cortex very minutely roughened and porous (epicortical pores?) 32
- 32(31). Medulla CK + yellow or yellow-orange; diffractaic acid and protocetraric acid present; Namibia
..... *P. serpulina* Essl.
Medulla CK -, K + yellow turning red; other substances present 33
- 33(32). Medulla PD + very pale orange; hypostictic acid agg. present 34
Medulla PD + distinctly yellow-orange or orange; other substances present 35
- 34(33). Lobes flat, often with isidioid lobules; Namibia *P. tentaculina* Essl.
Lobes more shiny, convex; Cape *N. quintarioides* Essl., Bryologist 103: 582.
- 35(33). Medulla UV + bright blue-white fluorescent, KC + rose-red (done quickly before the K reaction interferes) 36
Medulla UV - or faint, KC -; other substances present 37
- 36(35). Salazinic acid with or without alectoronic acid present; Namibia *P. incomposita* Essl.
Norstictic acid and alectoronic acid present; Namibia *N. norincomposita* Elix & Nash, Mycotaxon 71: 447.

37(35). Norstictic acid present as major substance.....	38
Cryptostictic acid or salazinic acid present, sometimes with minor quantities of norstictic acid	39
38(37). Lobes elongate and ± sinuous, discrete; norstictic acid and traces present; Cape, Namibia	
..... <i>P. dregeana</i> Hampe (syn. <i>P. namaensis</i> J. Stein. & Zahlbr.	
Thallus moderately adnate; lobes 0.7-1 mm wide, convex, with anticlinal upper cortex like <i>N.</i>	
<i>adamantea</i> (see Brusse 1991); norstictic acid present; Cape	<i>N. waboombergensis</i> Essl.,
Bryologist 103: 588.	
39(37). Cryptostictic acid and variable quantities of norstictic and stictic acids present; lobes linear-elongate,	
discrete, Namibia, Cape	<i>N. lapidula</i> Essl., Bryologist 103: 574.
Salazinic acid present.....	40
40(39). Morphology like <i>N. pulla</i> ; salazinic and variable quantities of norstictic acid present; Cape	
.....	<i>N. mehalei</i> Essl., Bryologist 103: 575.
Morphology like <i>P. namaensis</i> ; salazinic acid and a trace of norstictic acid present; Namibia	
.....	<i>P. incomposita</i> Essl.
41(14). Medulla C - and KC -	42
Medulla C + rose or red or orange, and/or KC + rose, red, or orange.....	44
42(41). divaricatic or stenosporic acid present, with or without gyrophoric acid; lower surface pale tan to pale	
brown; widespread, Cape	<i>P. luteonotata</i> J. Stein.
Fatty acids or scabrosins present.....	43
43(42). Indet. fatty acids (bourgeanic acid) present; lower surface pale tan; Namibia.....	<i>N. follmannii</i> Krug,
Flechten Follmann 264.	
Scabrosin derivatives present; lower surface black; Cape	<i>N. ceresella</i> Elix, Mycotaxon 71: 434.
44(41). Lower surface dark brown to black.....	45
Lower surface pale tan to pale brown	53
45(44). Lobes narrow, 0.1-0.6 mm wide	46
Lobes broader, mostly (0.5-) 1-3 mm or more broad, not distinctly convex, more or less flat (the <i>P.</i>	
<i>pulla</i> group, sensu stricto)	48
46(45). Thallus pulvinate; lobes linear-elongate, very narrow, mostly 0.1-0.6 mm broad; thallus very loosely	
or not at all adnate, ± pulvinate; medulla C -, KC + rose-red; physodic acid present; Cape	
.....	<i>P. lineella</i> Essl.
Thallus subcrustose, tightly adnate	47
47(46). Thallus subcrustose; lobes 0.25-0.6 mm wide; gyrophoric acid present; Australasia, Cape?	
.....	<i>P. minuta</i> Essl. (= <i>X. minutella</i> O. Blanco et al.)
Thallus small-foliose to subcrustose, tightly adnate; lobes imbricate or not, irregular to sublinear, 0.1-	
0.5 mm wide; lower surface dull, black, erhizinate; 4-O-methylphysodic, lividic, alectoronic acids;	
Cape	<i>N. wesselsii</i> Elix, Mycotaxon 71: 454 (= <i>X. beckeri</i> O. Blanco et al.)
48(45). Medulla C + red; olivetoric acid present; Cape, Transvaal, Lesotho	<i>P. cafferensis</i> Essl.
Medulla C - or uncommonly C + rose to rose-red (accessory gyrophoric acid)	49
49(48). Medulla UV + bright blue-white fluorescent ; alectoronic acid present, with or without a-collatolic	
acid; widespread, Lesotho, Cape.....	<i>P. glabrans</i> Nyl.
Medulla UV - or faint whitish; other compounds present.....	50
50(49). Medulla KC + red.....	51
Medulla KC + rose or rose-red and fading rapidly, or KC -; divaricatic or stenosporic acid present,	
with or without gyrophoric acid; widespread, Cape.....	<i>P. pulla</i> Ach.

- 51(50). Physodic acid present; Lesotho, Cape, OFS..... *P. imitatrix* Tayl.
Glomelliferonic present.....52
- 52(51). Lower surface pale tan to brown; Mediterranean, Lesotho, Cape..... *P. pyrenaica* Essl.
Lower surface black; OFS, Transvaal *N. glomelliferonica* Elix, Mycotaxon 71: 440.
- 53(44). Lobes mostly less than 1 mm broad54
Lobes (0.8-) 1-3 mm broad59
- 54(53). Norlobaridone present55
Norlobaridone absent, hypoprotocetraric acid or barbatic acid agg. present58
- 55(54). Thallus loosely or not at all adnate, ± subfruticose; lobes flat to convex or almost terete, entangled;
Cape *P. lichinoidea* Nyl.
Thallus tightly adnate to appressed56
- 56(55). Thallus foliose, appressed to pulvinate; lobes 0.4-1 mm wide, flat, linear-elongate; lower surface pale
tan to pale brown, erhizinate; Cape *N. esterhuyseniae* Essl., Nordic J B 6: 88 (*X. neoesterhuyseniae* O.
Blanco et al.)
Thallus tightly adnate, ± subcrustose57
- 57(56). Thallus tightly adnate, ± subcrustose; lobes 0.5-2 mm wide, ± flat, subdiscrete to contiguous; lower
surface pale tan to pale brown; apothecia adnate to substipitate; Cape..... *X. esslingeri* O. Blanco et al.
(syn. *P. applicata* (Stizenb.) Essl.)
idem, thallus thinner, lobes 0.1-0.5 mm wide; lower surface tan to brown, dull; apothecia
subimmersed; Cape *N. applicatella* Elix, Mycotaxon 71: 432.
- 58(54). Medulla C - and KC -; lower surface tan to pale brown; hypoprotocetraric acid present; Cape
..... *N. arrecta* Essl., Bryol. 103: 569.
Thallus loosely adnate; barbatic, 4-O-methylbarbatic, alectoronic acids; Namibia
..... *N. lagunebergensis* Krug, Flechten Follmann 267.
- 59(53). Lobes becoming distinctly convex, 0.8-1.5 mm broad, 200-320 µm thick ; unknown substances
present; Namibia, Cape *P. conturbata* Müll. Arg.
Lobes ± flat, 0.5-2 (-3) mm broad, 80-160 (-200) µm thick ; other substances present.....60
- 60(59). Medulla KC + rose-red or red; physodic acid present; Lesotho, Cape, Natal *P. subimitatrix* Essl.
Medulla KC - or KC + rose, rarely C + rose; divaricatic or stenosporic acid present, with or without
gyrophoric acid; widespread, Cape *P. luteonotata* J. Stein.
- 61(13). Medulla PD + very pale orange to yellow-orange or orange, K + yellow turning orange-red or red62
Medulla PD -, K - or faint yellowish to faint violet66
- 62(61). Cortex dark olive-green to greenish-black, K + violet and HN03 + violet ; medulla PD + very pale
orange; hypostictic acid agg. present; Cape *P. atroviridis* Essl.
Cortex some shade of brown, K -, HN03 -; medulla PD + distinctly orange-yellow to orange.....63
- 63(61). Thallus ± subcrustose; upper surface dark brown to blackish-brown, the cortex minutely roughened;
norstictic acid, sometimes salazinic acid, and a trace of connorstictic acid present; Cape
..... *P. trachythallina* Essl.
Thallus more loosely adnate.....64
- 64(63). Thallus moderately to tightly adnate but not subcrustose; upper surface yellowish-brown or darkening
somewhat, the cortex ± smooth; norstictic acid and a trace of salazinic acid present; Cape (=Xanthop.)
..... *P. prolixula* Nyl. ex Cromb.
Thallus less closely adnate65

- 65(64). Thallus appressed to weakly pulvinate; lobes 0.5-1.5 mm wide; lower surface black; physodic acid and traces of norstictic and salazinic acids present; Cape.... **N. nonreagens** Essl., Nordic J B 6: 89 (X. *neonreagens* O. Blanco et al.)
Thallus loosely appressed; lobes 0.5-1 mm wide, linear-elongate, slightly channeled; norstictic acid; Cape **N. pseudoloriloba** Essl., Nordic J B 6: 90.
- 66(61). Upper cortex becoming distinctly scabrous; lower surface pale tan or unevenly darkened; scabrosin-derivatives present; Cape (=Xanthop.)..... **P. scabrella** Essl.
Upper cortex not scabrous.....67
- 67(66). Lower surface pale brown to brown, occasionally black68
Lower side black; lobes 1-2.5 mm wide69
- 68(67). Lower surface pale tan, brown or black but usually consistent throughout; lobes 0.1-0.4 mm wide; medulla CK + pale yellow to yellow (sometimes difficult to see in the very thin medulla); diffractaic acid present; Cape (=Xanthop.)..... **P. spesica** Essl.
Lower surface pale tan to pale brown, with scarce or without rhizines; lobes 1-2.5 mm wide; olivetoric acid present (C + red); upper cortex HNO₃ -; Cape... **N. pseudocafferensis** Essl., Bryologist 103: 579.
- 69(67). Medulla KC + rose-red, UV + bright blue-white fluorescent; alectoronic acid, a-collatolic acid present or absent; Cape **P. pseudoglabrans** Essl., Bryologist 103: 580.
Medulla KC + rose or rose-red and fading rapidly, UV-; divaricatic acid present; Cape **P. pseudopulla** Essl., Bryologist 103: 581.

E. Paraparmelia group

1. Thallus isidiate2
Thallus not isidiate9
- 2(1). Lower surface pale brown to dark brown; thallus distinctly foliose3
Lower surface black, ±brown-black at lobe margins6
- 3(2). Thallus loosely to moderately adnate; isidia globose, inflated at apices, ±becoming short-cylindrical; medulla KC + rose; norlobaridone present; Kenya, Uganda, Zimbabwe..... **Par. subtortula**
Thallus tightly adnate to adnate; isidia cylindrical, not inflated at apices.....4
- 4(3). Medulla C + red; lecanoric acid present; Réunion, Namibia, Transvaal..... **Par. usitata**
Medulla C -; lecanoric acid absent.....5
- 5(4). Lobes narrow, 0.3-1.0 mm wide; fatty acids present; Angola, Lesotho **Par. arcana**
Lobes broad, 1.5-3.0 mm wide; scabrosins present; Natal. Transvaal **Par. basutoensis**
- 6(2). Medulla C + red; lecanoric acid present; thallus foliose; Cape, Transvaal, Zimbabwe **Par. annexa**
Medulla C -; lecanoric acid absent; isidia cylindrical, not inflated at apices; medulla K + intense yellow or yellow then pale red; stictic acid and/or hypostictic acid major7
- 7(6). Lobes narrow, 0.2-1.0 mm wide; medulla K + intense yellow; stictic acid present, hypostictic acid absent; Cape **Par. ischnoides**
Lobes broad, 0.5-4.0 mm wide; medulla K + yellow then pale red; hypostictic acid present.....8
- 8(7). Thallus lobulate at centre; bourgeanic acid present; Cape **Par. oveana**
Thallus elobulate; bourgeanic acid absent, stictic acid and hypostictic acid present; lobes broad, 1.0-4.0 mm wide; Cape **Par. agamalis**
- 9(1). Lower surface pale brown to dark brown, darkest at lobe tips10
Lower surface black, ±brown-black at lobe tips23

10(9). Thallus subcrustose to minutely foliose	11
Thallus distinctly foliose	15
11(10). Thallus densely lobulate; Cape.....	Par. gemmulifera
Thallus lacking lobules	12
12(11). Medulla K + intense yellow, or yellow then red; salazinic, stictic or baeomycesic acid present.....	13
Medulla K - or K + yellow-brown; fumarprotocetraric, lobaric or fatty acids present	14
13(12). Medulla K + yellow then red; salazinic acid present; Cape	Par. fynbosiana
Medulla K + intense yellow; salazinic acid absent; baeomycesic acid present; apothecia black, immersed; Cape.....	Par. pristiloba
14(12). Medulla P+ brick red; fumarprotocetraric acid present; Cape	Par. nimbicola
Medulla P- ; fumarprotocetraric acid absent; medulla KC + pale red; lobaric acid present; Cape	Par. barda
15(10). Thallus loosely to moderately adnate; medulla P- ; lobes and/or laciniae contorted; lobes broad, 1-3 mm wide; scabrosins present; Cape.....	Par. prolata
Thallus tightly adnate to adnate	16
16(15). Medulla intense violet-purple (pigment anhydrofusarubin agg.) with or without fumarprotocetraric acid; Cape N. violacea = <i>Pararparmelia vernicosa</i> (Brusse) Essl., <i>Parmelia vernicosa</i> Brusse, <i>Bothalia</i> 15: 320.	
Medulla white	18
18(16). Medulla P+ orange, K + pale red; salazinic and chalybaeizanic acid present; Cape..	Par. condyloides
Medulla P-; chalybaeizanic and salazinic acids absent.....	19
19(18). Medulla C + intense red; lecanoric acid present; Cape, Transvaal, Saudi-Arabia	Par. perfissa
Medulla C + pale pink or C -; lecanoric acid absent.....	20
20(19). Medulla KC + pink or red; norlobaridone, lobaric, stenosporonic or hydroxystenosporonic acids present	21
Medulla KC - ; Thallus ±with contorted laciniae; scabrosins present; Cape	Par. scabrosinita
21(20). Thallus with contorted laciniae; norlobaridone present; Cape, OFS	Par. tortula
Thallus lacking contorted laciniae; norlobaridone absent; medulla KC + pale pink; lobaric acid and scabrosins absent.....	22
22(21). Stenosporonic acid present; Cape.....	Par. erebea
Hydroxystenosporonic acid present; Cape.....	Par. vanderbylii
23(9). Thallus subcrustose to minutely foliose	24
Thallus distinctly foliose	35
24(23). Medulla P+ orange or red; fumarprotocetraric, stictic or salazinic acid present	25
Medulla P- ; hypostictic, stenosporic, alectoronic, gyrophoric, 4-O-methylphysodic acids present...29	
25(24). Medulla K - or K + yellow-brown; fumarprotocetraric acid present; Cape	Par. maritima
Medulla K + intense yellow or yellow then red; fumarprotocetraric acid absent	26
26(25). Medulla K + intense yellow; stictic acid present; Cape	X. xanthomelanelle Elix (<i>Paraparmelia xanthomelanoides</i> Elix & Nash, non <i>Xanthoparmelia xanthomelanoides</i> Elix & J. Johnst.)
Medulla K + yellow then dark red; salazinic acid present	27
27(26). Lobes 0.1-0.5 mm wide, discrete, linear to sublinear; Cape	Par. pudens
Lobes 0.2-1.0 mm wide, contiguous, irregular to sublinear.....	28

- 28(27). Upper surface brown; rhizines vestigial or absent; chalybaeizanic acid absent; Transvaal
..... *Par. tzaneensis*
Upper surface grey; rhizines dense; chalybaeizanic acid present; Cape *Par. sitiens*
- 29(23). Medulla K + yellow then pale red; hypostictic acid present; Cape *Par. inops*
Medulla K -; hypostictic acid absent.....30
- 30(29). Medulla C - ; stenoporonic acid present; Australia, Transvaal to Cape..... *Par. mongaensis*
Medulla C + rose or red; stenoporonic acid present or absent.....31
- 31(30). Medulla UV+ blue-white; alectoronic and α -collatolic acids present; Transvaal *Par. wirthii*
Medulla UV-; alectoronic and α -collatolic acids absent32
- 32(31). Medulla orange; pigmentosin B, D present; gyrophoric acid major; Cape - mountains *Par. fausta*
Medulla white; pigmentosin absent33
- 33(32). Lobes 0.1-0.2 mm wide; 4-0-methylphysodic and lividic acids present; Cape *Par. lividica*
Lobes 0.1-0.8 mm wide; 4-0-methylphysodic and lividic acids absent34
- 34(33). Rhizines dense; stenoporonic and gyrophoric acids present; Australia, Transvaal to Cape
..... *Par. mongaensis*
Rhizines sparse; olivetoric and 4-0-demethylmicrophyllinic acids present; Cape *Par. stricta*
- 35(22). Thallus loosely to moderately adnate; medulla K + yellow then pale red; hypostictic acid present;
Cape *Par. dwaasbergensis*
Thallus adnate to tightly adnate36
- 36(35). Medulla P- ; lecanoric acid or norlobaridone present.....37
Medulla P+ orange or red; K + intense yellow; stictic acid and butlerins present; lobes 0.5-3.5 mm
wide; Cape..... *Par. asilaris*
- 37(36). Medulla C + red; lecanoric acid present; Uganda, Madagascar, Cape *Par. molybdiza*
Medulla C - ; norlobaridone present; Cape *Par. norlobaridonica*

F. Xanthomaculina group

1. Thallus surface yellowish or greenish grey; usnic acid present in cortex2
Thallus surface dark brownish grey; usnic acid absent.....4
2. Thallus strongly convolute, fragmented and vagrant, loose on sandy soil, umbilicus rarely visible; stictic
and norstictic acids present; Namibia..... *Xanthomaculina convoluta* (Hue) Hale, Lichenol. 17: 263
Thallus attached to rock with a central umbilicus3
3. Thallus more or less monophyllous; lobes little branched, 10-20 μ wide, ciliate; norstictic acid with or
without stictic acid present; Namibia, Lesotho, Cape *Xanthomaculina hottentotta* (Ach.) Hale,
Lichenol. 17: 264
Thallus divided into subascending lobes; lobes somewhat convoluted at the tips, eciliate, 5-10 mm
wide; stictic acid; Cape *Xanthomaculina frondosa* (Hale) Hale, Lichenol. 17: 263
4. Lobes sublinear, ascending; not isidiate, not sorediate, lower surface brown; no rhizines, attached by
central umbilicus; gyrophoric acid present *Xanthoparmelia nautilomontana* (Brusse) O. Blanco et al. =
Neofuscelia nautilomontana (Brusse) Elix, *Parmelia nautilomontana* Brusse, Mycotaxon 49: 7.
Lobes sublinear to linear, loosely appressed to elevated; not isidiate, not sorediate; lower side pale tan
to pale brown, attached by one or several central umbilicoid holdfasts; norstictic acid present; Cape:
..... *P. foveolata* Essl. 1977, p. 111.

G. Sorediate Species of Xanthoparmelia

1. Lower surface black.....2
 Lower surface pale brown to brown.....5
- 2(1). Stictic acid agg. present; K + yellow turning orange3
 Stictic acid agg. absent; K -.....4
- 3(2). Soralia sorediate, capitate; thallus very tightly adnate with an areolate center; lobes 0.2-0.5 mm wide
 **X. mougeotii**
 Soralia with coarse soredia, arising from pustular isidia; thallus tightly to loosely adnate; lobes 0.5-4
 mm wide; Cape **X. pustulifera**
- 4(2). Gyrophoric, protoconstipatic and constipatic acids present; rhizocarpic acid in the cortex; soralia green,
 capitate; Cape **X. festiva** (Brusse), Mycotaxon 36: 305.
 Protocetraric acid present; soralia pustular; South America, Transvaal. **X. sipmanii** T.H. Nash & Elix,
 Bibl. Lich. 56: 96.
- 5(1). Medulla K - (fumarprotocetraric acid); soredia coarse, arising from pustular isidia; Lesotho **X. granulata**
 Medulla K + yellow or yellow turning red (stictic acid agg.); pustulate-sorediate, the soredia coarse;
 Cape, Namibia..... **X. pustulosorediata**

H. Terricolous Species of Xanthoparmelia (on soil, humus or pebbles, attached or vagrant)

1. Thallus free growing, often breaking apart into separate lobes or remaining intact; lobes moderately to
 strongly convoluted, sometimes forming tubes.....2
 Thallus forming intact, usually orbicular colonies or rosettes loosely attached on pebbles or compacted
 soil, in part becoming free-growing; lobes plane below, canaliculate (with a raised yellowish rim
 below), or weakly convoluted9/8
- 2(1). Medulla K - (fatty, fumarprotocetraric, hypoprotocetraric, or protocetraric acids)3
 Medulla K + yellow or yellow turning red (salazinic or stictic acid); surface emaculate7
- 3(2). Medulla P+ orange-red (fumarprotocetraric or protocetraric acids)4
 Medulla P- (fatty acid or hypoprotocetraric acid)5
- 4(3). Lobes strongly convoluted in tubes; thallus vagrant and scattered; upper surface emaculate, dull but not
 pruinose; protocetraric acid present; lower surface ?; Cape..... **X. beatricea**
 Lobes weakly convoluted; surface weakly white-maculate; fumarprotocetraric acid present; lower
 surface pale brown to darker brown; Cape..... **X. leonora**
- 5(3). Hypoprotocetraric acid present6
 Fatty acids present; thallus forming intact colonies; lobes weakly convoluted; lower surface pale
 brown; Cape **X. epigaea**
- 6(5). Lower medulla orange-red (skyrin); lobes weakly convoluted, open below; lower surface pale brown;
 Cape **X. neocongruens**
 Lower medulla white; lobes strongly convoluted as tubes; vagrant; lower surface pale brown; Cape
 **X. pachyclada**
- 7(2). Salazinic acid present.....8
 norstictic and stictic acids present; thallus free-growing on soil and humus, strongly fragmenting; lobes
 strongly convoluted; lower surface black without rhizines; Namibia **Xanthomaculina convoluta** (Hue)
 Hale, Lichenologist 17: 263.

8(7). Thallus free-growing on soil and humus, often scattered; lobes strongly convoluted, elongate, less than 2 mm wide; lower surface dark brown with dense, long dark rhizines; salazinic acid present; Lesotho	X. kotisephola
Thallus mostly loosely attached on soil or pebbles, remaining intact; lobes weakly convoluted; thallus expanded; salazinic acid present; lower surface brown with dense, dark brown rhizines; Cape	X. subconvoluta
9(1). Lobes canaliculate; lower surface pale yellow to brown (blackening only in <i>X. salamphixantha</i>) with sparse long brown to black rhizines	10
Lobes plane, flattened to weakly convoluted; lower surface pale brown to black with sparse to moderate concolorous rhizines.....	16
10(9). Upper surface white-maculate	11
Upper surface continuous, emaculate.....	12
11(10). Medulla K - (fumarprotocetraric acid); Lobes with terete laciniae at the center; Cape ..	X. neoreptans
Medulla K + yellow or yellow turning red (salazinic acid); Cape	X. salamphixantha
12(10). Medulla K - (evernic acid); upper surface dull, not pruinose; Cape	X. aggregata
Medulla K + yellow or yellow turning red (salazinic or stictic acids)	13
13(12). Stictic acid present	14
Salazinic acid and chalybaeizanic acid present; Cape.....	X. amphixanthoides
14(13). Lobes becoming terete, narrow, 0.2-0.6 mm wide; Madagascar.....	X. benyovszkyana
Main lobes flattened, only the secondary laciniae terete, 1-2 mm wide	15
15(14). Center of thallus becoming densely terete-laciniate.....	X. molliuscula
Terete laciniae absent; lower surface mostly dark brown; Cape, Madagascar.....	X. subflabellata
16(9). Thallus pale brown to brown below; lobes flat and plane to subconvolute, in a few species convoluted or terete	17
Thallus black below; lobes flat and plane or rarely canaliculate, weakly convoluted or subterete.....	31
17(16). Medulla K - (4-0-demethyldiffractaic, fatty, fumarprotocetraric, hypoprotocetraric, or protocetraric acids)	18
Medulla K + yellow or yellow turning red (hypostictic, norstictic, salazinic, or stictic acids).....	25
18(17). Medulla P+ orange-red (fumarprotocetraric or protocetraric acids)	19
Medulla P-.....	24
19(18). 4-0-Methyldiffractaic acid present; Cape.....	X. duplicata
4-0-Methyldiffractaic acid absent	20
20(19). Surface emaculate	21
Surface white-maculate.....	22
21(20). Lobes moderately convoluted, to 4 mm wide; Cape	X. leonora
Lobes plane, barely convoluted, to 2 mm wide; Venda	X. vendensis
22(20). Lower medulla orange-red; Cape	X. skyrinifera
Lower medulla white.....	23
23(22). Surface strongly white-maculate; lobes flat, with large bare areas on the lower surface.....	X. phaeophana
Surface weakly to moderately white-maculate; lobes moderately convoluted, uniformly rhizinate below; Cape.....	X. leonora
24(18). Lower part of medulla orange-red; hypoprotocetraric acid present	X. neocongruens

Lower part of medulla white; fatty acids present; lobes mostly weakly to moderately convoluted; Cape	X. epigaea
25(17). Stictic acid present; norstictic acid absent or present as traces	26
Salazinic and/or norstictic acids present (stictic acid absent); upper surface emaculate.....	27
26(25). Lobes separate, flat, sublinear and sparsely dichotomously branched; upper surcae emaculate or weakly maculate; Cape, Madagascar	X. subflabellata
Stictic acid agg. and norstictic acid present; upper surface emaculate; Andes, Cape?	X. standaertii
27(25). Lobes large and rotund, to 7 mm wide; Cape.....	X. crassilobata
Lobes smaller, elongate, 0.5-4 mm wide; thallus expanded, not pulvinate.....	28
28(27). Lobes becoming moderately convoluted; thallus expanded; lobes elongate, less than 2 mm wide; rhizines dense, dark brown; Cape	X. subconvoluta
Lobes flat and plane to barely convoluted; rhizines sparse to moderate	29
29(28). Lobes elongate, stringy, less than 1 mm wide.....	30
Lobes shorter, narrow, 1-1.5 mm wide; lower surface dark brown; Transvaal, OFS, Natal, Zimbabwe	X. terricola
30(29). Lobes almost entirely terete; lower surface mottled brown and black; East Africa.....	X. cylindriloba
Lobes flat, only secondary laciniae terete; lower surface mottled yellow-brown; Transvaal.....	X. wesselsii
31(16). Salazinic acid present	32
Stictic acid present	40
32(31). Lobes almost all terete, stringy; East Africa	X. cylindriloba
Lobes flattened, not stringy.....	33
33(32). Lower surface strongly rugose, very sparsely rhizinate; lobes curling upward	34
Lower surface not rugose, sparsely to moderately rhizinate; lobes not curling upward	35
34(33). Lobes rather narrow, to 1.5 mm wide; chalybaeizanic acid absent; Namibia	X. walteri
Lobes broader, to 4 mm wide; chalybaeizanic acid present; Cape.....	X. hyporhytida
35(33). Lower part of medulla deep orange-red (skyrin); Cape	X. rubromedulla
Medulla white	36
36(35). Lobes very broad and rotund, 3-8 mm wide; Cape	X. latilobata
Lobes narrower, obtuse, to 6 mm wide	37
37(36). Upper surface white-maculate	38
Upper surface continuous, emaculate; lobes very narrow, less than 0.5 mm wide; Cape... ..	X. eradicata
38(37). Lobes narrow and elongated, constricted, 0.5-1.5 mm wide; Cape, Australia	X. constrictans
Lobes broader, 2-6 mm wide, not constricted.....	39
39(38). Lower surface canaliculate, blackening only at the center; Cape.....	X. salamphixantha
Lower surface plane, black nearly to the margin; Cape	X. neotasmanica
40(31). Lobes very narrow, less than 1 mm wide.....	41
Lobes broader, 1-2.5 mm wide	42
41(40). Lobes linear, 0.5-1 mm wide; Madagascar, Australasia.....	X. suberadicata
Lobes almost thread-like, 0.1-0.3 mm wide; Cape.....	X. esterhuyseniae
42(40). Lobes sublinear-elongate, separate, somewhat constricted, black rimmed; Cape.....	X. simulans
Lobes shorter, imbricate, not black-rimmed or constricted.....	43

- 43(42). Lower surface plane; Cape **X. austrocapensis**
 Lower surface with a yellowish rim toward the tips; Cape and South America **X. hypopsila**

I. Isidiate Species of Xanthoparmelia with a Pale Lower Surface

1. Medulla K - (to slowly K + faint yellow) (containing 3- α -hydroxybarbatic, 4-0-methylhypoprotocetraric, barbatic, colensoic, diffractaic, evernic, fatty, fumarprotocetraric, hypoprotocetraric, lecanoric, lobaric, protocetraric, psoromic, succinprotocetraric acids or norlobaridone or scabrosin derivatives)2
 Medulla distinctly and quickly K + yellow or yellow turning red (hypostictic, norstictic, salazinic, or stictic acids).....22
- 2(1). Isidia globose, short and usually unbranched, less than 0.2-0.3 mm high, usually hollow and often erumpent with pale tips3
 Isidia subglobose (when immature) to cylindrical, relatively tall and becoming branched, usually more than 0.2 mm high, the tips often darkening, solid (pustulate or erumpent in *X. constipata*, *X. remanens*, *X. scabrosa*, and *X. spargens*); medulla C - 11
- 3(2). Thallus very tightly adnate to tightly adnate; lobes less than 1 mm wide on the average4
 Thallus adnate to loosely adnate; lobes more than 1 mm wide 10
- 4(3). Medulla C + red (lecanoric acid); upper surface shiny to dull and white-pruinose (at the tips?); Cape **X. coneruptens**
 Medulla C -5
- 5(4). Barbatic acid present; isidia coarse, bullate, 0.2-0.3 mm in diameter; Cape, Transvaal, Namibia **X. areolata**
 Barbatic acid absent6
- 6(5). Hypoprotocetraric acid present; Namibia..... **X. khomasiana**
 Hypoprotocetraric acid absent.....7
- 7(6). Evernic acid and a trace of lecanoric acid present8
 Evernic and lecanoric acids absent.....9
- 8(7). Isidia moderate to dense, 0.15-0.25 mm in diameter; upper surface shiny to white-pruinose; Namibia **X. evernica**
 Isidia sparse, bloated, to 0.3 mm in diameter; Cape..... **X. eruptens**
- 9(7). 4-0-methylhypoprotocetraric acid present; lobes 0.5-2 mm wide; Cape..... **X. calvinia**
 Norlobaridone and an unknown substance present; lobes 0.2-1.0 mm wide; Transvaal..... **X. infausta**
 (Brusse), Mycotaxon 36: 307.
- 10(3). Medulla P+ red (fumarprotocetraric acid); isidia coarse and pustular, subsorediate; upper surface dull to faintly white-pruinose; Lesotho **X. granulata**
 Medulla P- (hypoprotocetraric acid); America, Australia, Cape, Natal, Namibia **X. weberi**
- 11(2). Medulla P+ red or P+ yellow 12
 Medulla P-..... 16
- 12(11). Medulla P+ persistent yellow (psoromic acid); isidia cylindrical, branched, not erumpent; Natal, Namibia..... **X. afrolavicola**
 Medulla P+ red or orange red (protocetraric or fumarprotocetraric acids) 13
- 13(12). Protocetraric acid present; isidia tall and cylindrical, branching; Zimbabwe, Namibia..... **X. fucina**
 Fumarprotocetraric acid present..... 14

14(13). Diffractaic acid present; Natal.....	X. natalensis	
Diffractaic acid absent.....		15
15(14). Medulla white; widespread	X. subramigera	
Medulla pale yellow-orange; Kenya	X. krogiae	
16(11). Norlobaridone present		17
Norlobaridone absent		19
17(16). Norlobaridone and scabrosins present; thallus loosely adnate to adnate, lobes 1.5-4 mm wide; widespread, Cape?	X. scabrosa	
Norlobaridone without scabrosins present		18
18(17). Thallus very tightly adnate, lobate at the center; lobes 0.4-1.3 mm wide; Namibia	X. subamplexuloides	
Thallus adnate; lobes 1-4 mm wide; isidia subglobose to cylindrical, pale-tipped and in part erumpent to pustulate; Cape, Natal, Transvaal.....	X. amplexuloides	
19(16). Hypoprotocetraric acid present		20
Hypoprotocetraric acid absent; unknown spargens fatty acids present; all South Africa, Swaziland	X. spargens	
20(19). Skyrin present in lower medulla; Natal, Transvaal	X. neoweberi	
Skyrin absent.....		21
21(20). Thallus adnate; lobes 2-3 mm wide; Natal, Transvaal, Namibia, widespread	X. weberi	
Thallus tightly adnate; lobes 0.7-1.3 mm wide; Kenya, Zaire	X. endochrysea	
22(1). Medulla entirely pigmented reddish purple; isidia rugose-pustulate; Cape	X. rubropustulata	
Medulla white (lower medulla red-orange in <i>X. saniensis</i>)		23
23(22). Medulla pigmented orange-red in lower part; Lesotho, Cape	X. saniensis	
Medulla entirely white		24
24(23). Isidia globose, mostly unbranched, 0.2-0.3 mm high, often hollow and erumpent.....		25
Isidia cylindrical, branching, to 2 mm high, entire and often black-tipped.....		31
25(24). Stictic acid present		26
Stictic acid absent; salazinic acid present (norstictic acid if present only in traces); thallus tightly adnate; lobes 0.6-1.8 mm wide; isidia moderate to dense, globose to subcylindrical, mostly erumpent; Namibia.....	X. tenacea	
26(25). Thallus very tightly to tightly adnate; lobes 0.2-0.8 mm wide.....		27
Thallus adnate; lobes 0.7-3 mm wide.....		29
27(26). Stictic and barbatic acid present; Natal	X. umtamvuna	
Stictic acid present, barbatic acid absent.....		28
28(27). Isidia dense, globose to cylindrical-distorted; stictic acid present without hypostictic acid; Australia, Natal, Transvaal	X. victoriana	
Isidia mostly clustered; stictic acid agg. and hypostictic acid agg. present; Cape ..	X. tyrreha (Brusse), Mycotaxon 49: 10.	
29(26). Isidia erupting into large capitate, subsorediate masses; upper surface shiny to dull white-pruinose; Namibia, Cape.....	X. pustulosorediata	
Isidia not in capitate, subsorediate masses; upper surface shiny, not pruinose		30
30(29). Isidia erumpent to diffuse subsorediate; rhizines very sparse; Cape.....	X. globisidiosa	
Isidia globose to subcylindrical, basally constricted; rhizines moderate; Neotropics, Cape? X. subplittii		

31(24). Stictic acid present	32
Salazinic acid present with or without chalybaeizanic acid or traces of norstictic acid.....	35
32(31). Thallus tightly adnate; lobes 0.4-1 mm wide	33
Thallus adnate; lobes 1-2 mm wide; widespread, Transvaal, Natal	X. plittii
33/30(32/29). Isidia in tall masses to 2 mm high; Kenya, Tanzania.....	X. glomerulata
Isidia short, to 0.4 mm high	34
34(33). Rhizines stout; isidia darkening at tips; Transvaal, Natal, Namibia, widespread tropical	X. neopropaguloides nom sup. = X. neopropagulifera
Rhizines delicate, translucent; isidia pale; Cape	X. subpallida
35(31). Isidia bullate, more than 0.3 mm in diameter; chalybaeizanic acid present; Cape, Lesotho	X. subbullata
Isidia cylindrical, less than 0.2-0.3 mm in diameter; chalybaeizanic acid absent.....	35
36(35). Thallus adnate to loosely adnate; lobes 1.5-4 mm wide; isidia becoming black-tipped, entire; lower surface pale brown; widespread, Kenya.....	X. mexicana
Thallus more tightly adnate; lobes 0.3-1.5 mm wide; center of thallus lobate; isidia becoming tall, densely branched; Cape, Australia, Argentina	X. antleriformis

J. Isidiate Species of Xanthoparmelia with a Black Lower Surface

1. Medulla K - (alectoronic, barbatic, diffractaic, echinocarpic, evernic, fatty, fumarprotocetraric, hypoprotocetraric, lecanoric, or stenosporonic acids).....	2
Medulla K + yellow or K + yellow turning red (hypothamnolic, norstictic, salazinic, or stictic acids)9	
2(1). Medulla C + red (lecanoric acid); Cape	X. clivorum
Medulla C -	3
3(2). Medulla P+ (fumarprotocetraric acid or echinocarpic acid).....	4
Medulla P-.....	5
4(3). Medulla P+ red (fumarprotocetraric acid); thallus loosely adnate; isidia cylindrical; Natal, Swaziland	X. mbabanensis
Medulla P+ yellow (echinocarpic, conechinocarpic, hypothamnolic acids); thallus adnate; isidia globose to subcylindrical, mixed with lobules; Cape... X. banskloofensis Elix & T.H. Nash, Lichenol. 34: 283	
5(3). Thallus very tightly adnate; lobes 0.2-1 mm wide	6
Thallus adnate to loosely adnate; lobes 1-4 mm wide.....	7
6(5). Hypoprotocetraric and 4-O-demethylnotatic acids present; lobes 0.5-1 mm wide; isidia subglobose to cylindrical, 0.1-0.2 mm thick; Zimbabwe, Transvaal, Natal. X. neocongensis , syn. <i>X. patula</i> (Brusse), Bothalia 15: 317.	
Stenosporonic acid present; lobes 0.2-0.5 mm wide; Natal, India	X. keralensis
7(5). Medulla in part orange-red in lower part; Natal.....	X. oribensis
Medulla white; fatty acids present	8
8(7). Constipatic acid series present; Transvaal.....	X. transvaalensis
Unknown fatty acids present; upper surface dull, not pruinose; Kenya, Tanzania	X. meruensis
9(1). Thallus very tightly adnate, often appearing areolate at the center; lobes 0.2-0.8 mm wide	10
Thallus adnate to loosely adnate, lobate at the center; lobes 0.5-5 mm wide	15

10(9). Stictic acid present	11
Salazinic and/or norstictic acid present	13
11(10). Isidia globose, unbranched, in part erumpent; Zaire, Uganda, Natal, Transvaal, widespread	X. congensis
Isidia cylindrical, branched or unbranched, not erumpent	12
12(11). Lobes short and blunt, margins black-rimmed; isidia dark-tipped; Transvaal, OFS, Venda, Natal	X. pseudocongensis
Lobe relatively elongate, the tips acute, margins and isidia pale; OFS, Venda, tropical America	X. substenophylloides
13(10). Salazinic acid present without chalybaeizanic acid (norstictic if present only in traces); Africa..... 14 Norstictic acid present as major metabolite (with salazinic acid present in equal concentration); Transvaal, Natal	X. minuta
14(13). Isidia globose, erumpent; Transvaal.....	X. geesterani
Isidia cylindrical, not erumpent; Kenya, Uganda, Transvaal, Natal, Cape	X. diadeta
15(9). Isidia globose, unbranched, less than 0.2-0.3 mm high, often hollow and erumpent; stictic acid present; lobes narrow, 0.5-1.2 mm wide; Cape	X. pustulifera
Isidia cylindrical, usually branched, up to 2 mm high, solid, the tips often darkening	16
16(15). Stictic acid present	17
Stictic acid absent.....	19
17(16). Rhizines absent; upper surface patchy white-maculate in older parts; norstictic acid (minor) present; lusitanic acid absent; Transvaal, Kenya	X. treurenensis
Rhizines present, sparsely to moderately developed; upper surface emaculate; norstictic acid (minor) or lusitanic acid present.....	18
18(17). Lobes 1-3 mm wide, subirregular; norstictic acid (minor) present; lusitanic acid absent; northern temperate widespread, in South Africa?	X. conspersa
Lobes 1-5 mm wide, subirregular to sublinear, generally short; norstictic acid absent; lusitanic acid present; S. Europe and all South Africa	X. verrucigera
19(16). Salazinic acid present (norstictic acid if present in traces).....	20
Hypothamnolic acid present; Cape	X. thamnolica
20(19). Chalybaeizanic acid present; Cape.....	X. capensis
Chalybaeizanic acid absent	21
21(20). Thallus tightly adnate; lobes 0.7-1.3 mm wide; Kenya, Uganda, Transvaal, Natal, Cape ...	X. diadeta
Thallus adnate to loosely adnate; lobes 1-5 mm wide.....	22
22(21). Thallus usually loosely attached; isidia relatively thick, 0.1-0.2 mm in diameter; widespread, Australasia, Kenya, Tanzania, Cape.....	X. australasica
Thallus adnate; isidia relatively thin, less than 0.1 mm in diameter; Australasia, Peru, Cape	X. isidiigera

K. Nonisidiate, Nonsorediate Species of Xanthoparmelia with a Pale Lower Surface

1. Medulla containing yellow, orange-red, or reddish purple pigments (for dull red caused by discoloration by decomposed norstictic or salazinic acids see under medulla white)	2
Medulla white	23

- 2(1). Medulla pigmented deep purple-red throughout (pigment anhydrofusarubin agg.).....3
 Medulla pigmented yellow or yellow-orange throughout, purple-red in patches, or orange-red in the lower part4
- 3(2). Salazinic acid present (if no usnic acid, see *X. parilis*); Cape..... **X. endomiltodes**
 Colorless substances absent; Cape **X. ianthina**
- 4(2). Purple and/or red pigments in the medulla.....5
 Yellow to orange-red pigments located in the medulla.....8
- 5(4). Thallus very tightly adnate; lobes 0.3-0.6 mm wide; hypostictic acid agg. present; upper surface ???; lower medulla rusty red (unknown pigment); Cape **X. inconspicua**
 Thallus adnate to loosely adnate; lobes 1-4 mm wide; protocetraric acid present; pigment deep purple (anhydrofusarubin agg.) in scattered patches in white medulla6
- 6(5). Abundant black, convex spots present on the upper surface, inside dark reddish; lobes 1.2-3 mm wide; Transvaal, OFS, Cape **X. marroninipuncta**
 No black spots containing red pigment present.....7
- 7(6). Lobes 1.5-4 mm wide; OFS, Cape, Lesotho **X. dichromatica**
 Lobes 0.6-1.5 mm wide; Cape **X. kleinswartbergensis** Elix, Lichenol. 34: 286
- 8(4). Medulla pigmented throughout pale yellowish orange (sekalonic acid agg.); fumarprotocetraric acid; Cape **X. mutabilis**
 Medulla pigmented orange-red in the lower part (mostly skyrin).....9
- 9(8). Medulla (white areas) K - (barbatic, 4-0-demethyldiffractaic, hypoprotocetraric, or protocetraric acids)10
 Medulla (white areas) K + yellow or yellow turning red (hypostictic, norstictic, or salazinic acids).16
- 10(9). Medulla P+ orange-red (protocetraric acid)11
 Medulla P-.....13
- 11(10). Thallus adnate with subirregular lobes; surface emaculate; Cape..... **X. subochracea**
 Thallus loosely adnate with sublinear lobes; surface maculate12
- 12(11). Lobes suberect, dark, rugose, and sparsely rhizinate toward the tips below; Cape..... **X. subcolorata**
 Lobes not suberect, pale brown, smooth, and moderately rhizinate below; Cape **X. skyrinifera**
- 13(10). 4-O-methyldiffractaic acid or evernic acid present14
 Hypoprotocetraric acid present15
- 14(13). 4-0-Methyldiffractaic acid present; (pigment endocrocin + indet. anthraquinone); Cape **X. ochropulchra**
 Evernic acid present; medulla reddish yellow in the lower half (pigment skyrin); thallus tightly adnate with an areolate center; lobes sublinear, 0.6-1 mm wide; surface roughened; Cape..... **X. lecanoracea** (Müll. Arg.) Hale, Hale 1976: 35; syn. *Paraparmelia lecanoracea*.
- 15(13). Thallus adnate to loosely adnate, reasonable parts separable from rock; lobes 2-4 mm wide; Lesotho, Transvaal, Natal, OFS, Cape..... **X. subdomokosii**
 Thallus tightly adnate, not collected without rock; lobes 0.8-1.5 mm wide; Cape **X. karoensis**
- 16(9). Hypostictic acid present17
 Norstictic or salazinic acids present18
- 17(16). Hypostictic acid and stenosporonic acid present; Cape..... **X. naudesnekia**
 Hypostictic acid without stenosporonic acid present; Cape, Lesotho **X. brevilobata**
- 18(16). Norstictic and salazinic acids present in equal concentration; thallus adnate; Cape... **X. probarbellata**

Salazinic acid present (norstictic acid only as traces if present)	19
19(18). Stenosporonic acid present; Lesotho.....	X. tsekensis
Stenosporonic acid absent	20
20(19). Surface distinctly white-maculate	21
Surface continuous, emaculate; thallus loosely adnate with sublinear lobes 2-5 mm wide; Lesotho, Cape, Australia.....	X. subpigmentosa
21(20). Thallus loosely adnate; lobes sparsely rhizinate, rugose below, and dark below at the tips; Cape	X. denudata
Thallus adnate; lobes moderately rhizinate and smooth, pale below at the tips.....	22
22(21). Upper surface smooth; thallus yellow green; chalybaeizanic acid absent; Cape ...	X. cirrhomedullosa
Upper surface wrinkled and rugose, shiny; thallus dark greenish yellow; chalybaeizanic acid present; Cape	X. springbokensis
23(1). Medulla C + rose or red (gyrophoric or lecanoric acids)	24
Medulla C - (or C + pale orange in a few species with barbatic acid)	28
24(23). Surface effigurate-maculate; Cape	X. leucostigma
Surface continuous, emaculate.....	25
25(24). Thallus adnate to loosely adnate; gyrophoric acid present; upper surface dull; Cape, Natal, Lesotho	X. gyrophorica
Thallus tightly adnate to adnate; lecanoric acid present.....	26
26(25). Lecanoric and evernic acids present; thallus tightly adnate, appearing areolate in the center; lobes 0.2- 1.0 mm wide; Cape	X. lucrosa (Brusse), Mycotaxon 40: 380.
Lecanoric acid alone in the medulla.....	27
27(26). Thallus tightly adnate, appearing areolate at the center; Cape, Namibia	X. worcesteri
Thallus adnate, lobate at the center; Cape, N. America	X. arida
28(23). Medulla K + yellow or yellow turning red (echinocarpic, hypostictic, norstictic, salazinic, stictic, or unknown acids)	29
Medulla K - (4-0-demethylnotatic, 4-0-methylhypoprotocetraric, barbatic, diffractaic, echinocarpic, evernic, fatty acids, fumarprotocetraric, hypoprotocetraric, protocetraric, or psoromic acids, or norlobaridone or scabrosins)	58
29(28). Surface white-maculate or effigurate-maculate.....	30
Surface continuous, emaculate.....	33
30(29). Thallus surface effigurate-maculate	31
Thallus surface white-maculate.....	32
31(30). Thallus adnate; surface effigurate-maculate; salazinic acid with or without chalybeizanic acid present; Cape	X. namakwa
Idem; stictic acid agg. with hypostictic acid present; Cape... X. micromaculata Elix, Lichenologist 34: 289	
32(30). Lobes narrow, 0.6-1.2 mm wide, separate; salazinic acid present; Cape	X. affinis
Lobes broader, 1-5 mm wide, mostly imbricated; thallus darkish yellow-green; salazinic acid and chalybaeizanic acid present; Cape.....	X. neosynestia
33(29) Thallus loosely adnate to nearly free growing on pebbles and soil;.....	34
Thallus very tightly to loosely adnate on rock, rarely on soil; lobes plane, not convoluted	36
34(33). Lobes almost thread-like, 0.1-0.3 mm wide; stictic acid agg.; Cape.....	X. esterhuyseniae

Lobes not threadlike; salazinic acid present.....	35
35(34). Thallus loosely attached to nearly free growing on pebbles and soil; lobes more or less convoluted; lobes elongate, separate; lower surface dark brown; Cape.....	X. subconvoluta
Thallus loosely attached to nearly free growing on pebbles and soil, not convolute; high elevation in Transvaal, OFS, Natal, Zimbabwe	X. terricola
36(33). Echinocarpic acid present; Lesotho.....	X. putsoa
Echinocarpic acid absent.....	37
37(36). Hypostictic acid present	38
Norstictic, salazinic, stictic, or pseudostictic acid present	39
38(37). Fumarprotocetraric acid present; Cape.....	X. paradoxa
Fumarprotocetraric acid absent; thallus adnate; lobes sublinear, 0.6-1 mm wide; lower surface dark brown; Cape	X. quintaria
39(37). Stictic acid or pseudostictic acid present.....	40
Salazinic and/or norstictic acid present.....	47
40(39). protocetraric acid and pseudostictic acid present; lobes sublinear, contiguous to subimbricate, lacking lacinae; thallus adnate; surface deeply fissured; Transvaal.....	X. hybrida
Stictic acid agg. present.....	41
41(40). Thallus adnate to loosely adnate; lobes 1-2 mm wide.....	42
Thallus very tightly to tightly adnate; lobes 0.4-1 mm wide.....	44
42(41). Lusitanic acid present as additional substance; Malawi.....	X. malawiensis Elix, Lichenol. 34: 287.
Lusitanic acid absent.....	43
43(42). Lobes subirregular, crowded, imbricate, often becoming lacinate; Americas, Cape	X. cumberlandia
Thallus appressed, not imbricate or lacinate; neotropical lowlands, Cape....	X. neocumberlandia T.H. Nash & Elix, Bibl. Lich. 56: 79
44(41). Thallus very tightly adnate, areolate at the center; rhizines 0.1-0.2 mm long.....	45
Thallus tightly adnate, lobate at the center; lobes short and subirregular; Uganda, Socotra	X. convexula
45(44). Rhizines stout; lobes black-rimmed; Australia (and South Africa?).....	X. xanthomelanoides
Rhizines delicate, 0.03-0.06 mm wide at base; lobes pale-rimmed	46
46(45). Yellow pigments and menegazziaic acid absent; Cape.....	X. greytonensis
2 yellow pigments and menegazziaic acid present; Cape	X. diutina (Brusse), Mycotaxon 49: 2.
47(39). Norstictic acid present as major metabolite or in equal concentration with salazinic acid; lobes small, 0.6-2 mm wide; thallus tightly adnate to adnate; lacinae absent; Namibia	X. ausiana
Salazinic acid present; norstictic acid if present only in trace amounts	48
48(47). Salazinic acid and diffractaic acid present	49
Diffractaic acid absent.....	50
49(48). Lobes broad and rotund, 2-3.5 mm wide; Cape	X. diffractaica
Lobes narrow, dissected, sublinear, 0.7-2 mm wide; Lesotho	X. lesothoensis
50(48). Salazinic acid and stenosporonic acid present; Lesotho.....	X. tsekensis
Stenosporonic acid absent.....	51
51(50). Salazinic acid and chalybaeizanic acid present.....	52
Chalybaeizanic acid absent	55

- 52(51). Thallus loosely adnate, usually collected without rock substrate; Cape **X. concolor** (syn.: *X. laxchalybaeizans* Hale)
Thallus very tightly adnate to adnate on rock substrate53
- 53(51). Thallus very tightly adnate, areolate at the center; lobes 0.4-0.8 mm wide; Cape..... **X. perplexa**
Thallus adnate, the center lobate; lobes 1-3 mm wide54
- 54(53). Surface covered with bullate-isidial structures; Cape, Lesotho **X. subbullata**
Surface smooth; Cape, Ciskei **X. chalybaeizans**
- 55(51). Lobes very broad, 3-7 mm wide; Cape **X. crassilobata**
Lobes narrower, 0.6-3 mm wide56
- 56(55). Thallus adnate to loosely adnate; lobes 1.5-3 mm wide, subirregular to sublinear; SW Europe, Cape?
..... **X. sublaevis**
Lobes narrower, 0.6-3 mm wide; thallus tightly adnate, collected with rock substrate57
- 57(56). Thallus centrally not areolate; Australasia, USA, North America, Cape **X. lineola**
Thallus centrally areolate; Australia, Cape? **X. neorimalis**
- 58(28). Medulla P+ orange-red or yellow (fumarprotocetraric, protocetraric, or psoromic acids).....59
Medulla P- (barbatic, diffractaic, evernic, fatty acids, hypoprotocetraric, or 4-0-methylhypoprotocetraric acids or norlobaridone or scabrosins)73
- 59(58). Medulla P+ yellow (psoromic acid or echinocarpic acid present)60
Medulla P+ orange-red (fumarprotocetraric or protocetraric acids present)61
- 60(59). Medulla P+ yellow; psoromic acid present; Cape, western N. America (when lower surface black, see *X. nigropsoromifera*)..... **X. psoromifera**
Medulla P+ yellow (echinocarpic, 4-0-methylhypoprotocetraric acids); OFS..... **X. multiacida** Elix, Mycotaxon 73: 59.
- 61(59). Fumarprotocetraric acid present (often with much succinprotocetraric acid resembling protocetraric acid).....62
Fumarprotocetraric acid absent, only protocetraric acid present.....69
- 62(61). Surface white maculate63
Surface continuous, emaculate.....64
- 63(62). Lobes weakly convoluted; Cape..... **X. leonora**
Lobes plane or subascending; lower surface with large bare areas; Southern Africa from Cape to Mauritius **X. phaeophana**
- 64(62). Thallus pulvinate, the lobes narrow and stringy, 0.4-1 mm wide, black-rimmed; Cape.. **X. alborni**
Thallus not pulvinate, the lobes not stringy, 0.5-2.5 mm wide, pale to black-rimmed65
- 65(64). Thallus adnate, not separable from the substrate, imbricate, the lobes 0.8-2 mm wide, subirregular; rhizines 0.3-0.8 mm long; Cape **X. ceresina**
Thallus loosely adnate.....66
- 66(65). Thallus lobes 2-10 mm wide67
Thallus lobes 1-2.5 mm wide68
- 67(66). Thallus lobes 2-10 mm wide, sublinear to subirregular, with large rhizine-free areas; rhizines 0.5-1 mm long; lobe tips often with extensive black parts; Cape to Mauritius **X. phaeophana**
Thallus lobes 3-10 mm wide, without rhizine-free areas; thallus leathery; rhizines 0.5-1.5 mm long; Cape **X. fumaraficana** Elix, Mycotaxon 73: 54.
- 68(66). Rhizines 0.2-0.5 mm long; northern temperate, Cape? **X. protomatrae**

Rhizines 0.4-1 mm long; Australia, Cape	X. iniquita
69(61). Thallus loosely adnate with broad lobes 2-6 mm wide; Cape, Transvaal, Zimbabwe	X. austroafricana
Thallus tightly adnate to adnate; lobes 0.5-3 mm wide.....	70
70(69). 4-0-Methyldiffractaic acid present; Cape.....	X. neotumidosa
4-0-Methyldiffractaic acid absent	71
71(70). Lobes narrow and sublinear, 0.5-1 mm wide; upper surface dull, not pruinose; Namibia	
.....	X. lagunebergensis
Lobes broader, subirregular, 1.5-3 mm wide	72
72(71). Lobes convex; fatty acids present; Cape	X. tumidosa
Lobes plane; fatty acids absent; Transvaal and Australia	X. verruciformis
73(58). Norlobaridone present	74
Norlobaridone absent	77
74(73). Thallus loosely adnate with linear to sublinear lobes, usually collected free of the rock substrate;	
surface emaculate, dull, not pruinose?; lobes pale-rimmed; loxodin absent; Cape.....	X. tenuiloba
Thallus very tightly adnate to adnate with sublinear to subirregular lobes, usually collected with the	
rock substrate	75
75(74). Thallus densely covered with small short lobules; Cape, Lesotho.....	X. microlobulata
Lobules absent (elongate laciniae may be present); center of thallus lobate; lobes 0.6-3 mm wide...76	
76(75). Thallus dark brown at the center; lobes tips yellow-green; Cape.....	X. obscurata
Thallus uniformly yellow-green; loxodin absent; Cape	X. norlobaronica
77(73). Hypoprotocetraric acid present	78
Hypoprotocetraric acid absent.....	82
78(77). Thallus tightly adnate; lobes 0.7-1.5 mm wide; Australia, Cape	X. laxencrustans
Thallus adnate to loosely adnate; lobes 1.5-4 mm wide.....	79
79(78). Lobes inflated and puffy, convex; upper surface dull, not pruinose; Lesotho	X. inflata
Lobes plane, not inflated.....	80
80(79). Lobes 1.5-2.5 mm wide, rather crowded, at most weakly rugose; thallus adnate; hypoprotocetraric	
acid, 4-O-demethylnotatic acid and scabrosins present; Australia, Cape.....	X. prodomokosii
Lobes 2-5 mm wide; scabrosins absent.....	81
81(80). Thallus adnate; lobes 2-5 mm wide, not becoming rugulose; hypoprotocetraric acid and 4-O-	
demethylnotatic acid present; Mexico, Cape X. domokosioides Elix & T.H. Nash, Mycotaxon 73: 52	
Thallus adnate to loosely adnate; lobes 2-4 mm wide, becoming heavily rugose at age;	
hypoprotocetraric acid, 4-O-demethylnotatic acid and indet. fatty acid present; Cape.....	X. perrugosa
82(77). 4-0-Methylhypoprotocetraric acid present; Cape.....	X. competitiva
4-0-Methylhypoprotocetraric acid absent	83
83(82). Barbatic acid present; thallus very tightly adnate, areolate at the center; lobes 0.7-1.5 wide; Cape,	
OFS, Lesotho	X. applicata
Barbatic acid absent (or present only as a trace).....	84
84(83). Diffractaic acid present.	85
Diffractaic acid absent.....	86
85(84). Major metabolite 4-0-Demethyldiffractaic acid; Lesotho	X. conjuncta

4-0-Demethyldiffractaic acid present only as traces; thallus tightly adnate; lobes 0.7-1.5 mm wide; Cape	X. rugulosa
86(84). Evernic acid present	87
Evernic acid absent	88
87(86). Thallus tightly adnate with an areolate center; lobes sublinear, 1-2 mm wide; surface epruinose; Cape	X. sigillata
Thallus adnate, the center lobate; lobes sublinear, 0.5-1.1 mm wide; surface shiny to dull and white-pruinose; Namibia	X. equalis
88(86). Scabrosin derivatives present	89
Fatty or exuviatic acids present (scabrosin derivatives absent).....	90
89(88). Lobes 0.9-3 mm wide; thallus very tightly adnate with an areolate center; scabrosin unknown Rrc 12 present; Cape, Namibia, Australia	X. brunthaleri
Idem, without Rrc12, with additional fatties; lobes 0.8-1 mm wide; Australia, Cape	X. cravenii
90(88). Thallus very tightly adnate with an areolate center; lobes 0.5-1 mm wide; Cape.....	X. unctula
Thallus tightly to loosely adnate; lobes 0.7-5 mm wide.....	91
91(90). Fatty acid unknowns 33 and 37 as major metabolites	92
Constipatic acid group present; thallus adnate to loosely adnate	93
92(91). Thallus adnate to loosely adnate with large rotund lobes 2.5-5 mm wide; OFS, Cape..	X. barklyensis
Thallus adnate to more rarely loosely adnate with subirregular lobes 1.5-2.5 mm wide; thallus surface emaculate; Cape, Natal, OFS, Lesotho, North America	X. subdecipiens
93(91). Lobes 1-2 mm wide; dehydroconstipatic and protodehydroconstipatis acid present, in the cortex additionally atranorin; thallus surface strongly maculate to effigurate-maculate; Cape	X. maculodecipiens Elix, Mycotaxon 73; 56.(= X. triebeliae Elix, Mycotaxon 63: 339???)
Protoconstipatic and constipatic acids present	94
94(93). Lobes 0.2-1.0 mm wide, with constrictions; Cape	X. assimilis (Brusse), Mycotaxon 40: 379.
Lobes linear, 0.2-2.0 mm wide, without constrictions; Cape	X. oreophila (Brusse), Mycotaxon 40: 382.

L. Nonisidiate, Nonsorediate Species of Xanthoparmelia with a Black Lower Surface

1. Medulla containing yellow, orange-red, or reddish purple pigments (for dull red caused by discoloration by decomposed norstictic or salazinic acids see under medulla white)	2
Medulla white	10
2(1). Medulla entirely orange-red (sekalonic acid derivatives present).....	3
Medulla uniformly pale salmon-colored, or the upper part white and the lower part orange-red.....	4
3(2). Lobes opuntiooid-constricted, strongly black-rimmed; Cape	X. endochromatica
Lobes sublinear, not constricted, weakly black-rimmed; Cape.....	X. verecunda
4(2). Medulla pale yellow-orange throughout; salazinic acid present; Cape	X. enteroxantha
Medulla pigmented orange-red to dull reddish in lower part (skyrin or schenckiana unknown).....	5
5(4). Medulla K - (fatty acid or hypoprotocetraric acid present)	6
Medulla K + yellow turning red (salazinic acid present)	7
6(5). Thallus loosely adnate; hypoprotocetraric acid present; Cape	X. contrasta
Thallus adnate; fatty acids present; Cape	X. coriacea

7(5). Surface white-maculate; lobes in part constricted; Cape.....	X. rubromedulla	
Surface continuous, emaculate; lobes not constricted.....		8
8(7). Lobes broad, 2-5 mm wide; Australia, Cape.....	X. luminosa	
Lobes narrower, 0.2-2 mm wide		8
9(8). Lobes narrower, 1-2 mm wide; Cape	X. surrogata	
Lobes very narrow, less than 0.5 mm wide; Cape.....	X. eradicata	
10. Surface effigurate-maculate		11
Surface continuous, emaculate or white-maculate		22
11(10). Medulla C + red (lecanoric acid); Cape	X. protodysprosa	
Medulla C -		12
12(11). Medulla K + yellow or yellow turning red (salazinic or thamnolic acids).....		13
Medulla K - (barbatic, evernic, fumarprotocetraric, hypoprotocetraric or protocetraric acids).....		15
13(12). Thamnolic acid and squamatic acid present; Cape.....	X. cedrus-montana ("cedrimontana")	
Thamnolic acid absent.....		14
14(13). Salazinic and chalybeizanic acid present; thallus adnate; lobes 1.5-4 mm wide; Cape ...	X. effigurata	
Salazinic and norstictic acids present; lobes 0.5-0.8 mm wide; Cape	X. knoxii Elix, Mycotaxon 73: 55	
15(12). Thallus adnate with subirregular lobes.....		16
Thallus loosely adnate with narrow, elongate lobes.....		17
16(15). Lobes 1.2-2 mm wide; medulla P- (hypoprotocetraric acid); Cape.....	X. karoo	
Lobes 0.5-1.5(-3) mm wide; medulla P+ red (protocetraric acid); rhizines black, robust; SW Australia,		
Cape	X. hypoleiella Elix, Mycotaxon 65: 488	
17(15). Medulla P+ orange-red.....		18
Medulla P-.....		20
18(17). Fumarprotocetraric acid present; lobes 0.5-1 mm wide, sublinear to linear; Australia, Cape		
.....	X. pseudohypoleia	
Protocetraric acid present.....		19
19(18). Lobes 0.6-2 mm wide, sublinear to linear, stiff; rhizines sparse to moderate; Australia, Uganda, Cape		
.....	X. hypoleia	
Lobes 0.5-0.7 mm wide, linear-elongate, soft; rhizines nearly absent to very sparse; surface weakly		
effigurate-maculate to white-maculate; Natal	X. mollis	
20(17). Evemic acid present; Cape	X. dysprosa (in Hale key <i>X. neodysprosa</i> nom.nud.)	
Evemic acid absent.....		21
21(20). Barbatic acid present; Australia, Cape	X. burmeisteri	
Barbatic acid absent, hypoprotocetraric acid present; Australia, Cape	X. hypoprotocetrarica	
22(10). Medulla C + red (gyrophoric, lecanoric, microphyllinic or olivetoric acids).....		23
Medulla C -		29
23(22). Thallus very tightly adnate; lobes 0.2-0.9 mm wide		24
Thallus adnate to loosely adnate; lobes 0.5-5 mm wide.....		26
24(23). Olivetoric acid present; Transvaal.....	X. heterodoxa	
Gyrophoric acid present		25

25(24). Gyrophoric acid without schenckiana pigments in the medulla, usnic acid in the cortex; Cape	<i>X. olivetorica</i>
.....	
Gyrophoric acid and 2 schenckiana pigments in the medulla, isousnic acid in the cortex; strongly black-rimmed; Cape	<i>X. ponderosa</i> (Brusse), Mycotaxon 36: 307.
26(23). Lobes convex, appearing inflated; surface shiny or dull, white-pruinose; Namibia	<i>X. serusiauxii</i>
Lobes flat, epruinose	.....27
27(26). Microphyllinic acid present; thallus forming compact mats; surface faintly reticulate-maculate; Cape	<i>X. ceresensis</i>
.....	
Lecanoric acid present; surface continuous	.....28
28(27). Thallus adnate; lobes subirregular, 1-2 mm wide; upper surface shiny to dull, not pruinose; Cape	<i>X. lecanorica</i>
.....	
Thallus loosely attached; Lobes sublinear, 2-5 mm wide; Cape	<i>X. namaquensis</i>
29(22). Thallus very tightly adnate to tightly adnate, the center often appearing areolate at the center, always collected with the rock substrate; lobes 0.2-0.8 mm wide	.....30
Thallus adnate to loosely adnate, the center lobate, collected with or without the rock substrate; lobes usually more than 1 mm wide near the thallus margin (except in <i>X. indumenica</i> and <i>X. lobulifera</i> and a few stringy loosely adnate species)	.....49
30(29). Medulla K - (to slowly K + yellowish) (barbatic, colensoic, fatty, fumarprotocetraric, hypoprotocetraric, or stenosporonic acids or norlobaridone)	.....31
Medulla K + yellow or yellow turning orange (constictic, hypostictic, norstictic, salazinic, or stictic acids)	.....38
31(30). Medulla P+ red-orange (fumarprotocetraric acid); lobes 0.3-0.6 mm wide; Cape	<i>X. swartbergensis</i>
Medulla P-	.....32
32(31). Stenosporonic acid present	.....33
Stenosporonic acid absent (or present only as traces)	.....35
33(32). Usnic acid in the cortex	.....34
Isousnic acid present in the cortex; stenoporic acid present in the medulla; Cape	<i>X. lurida</i> (Brusse), Mycotaxon 31: 157, 36: 309.
34(33). Lobes elongate, black-rimmed; surface emaculate; Cape	<i>X. stenosporonica</i>
Lobes short, blunt, pale-rimmed; surface faintly reticulate-maculate; Transvaal	<i>X. shebaiensis</i>
35(31). Hypoprotocetraric acid present; lobes subirregular, 0.6-1.5 mm wide; Cape	<i>X. domokosii</i>
Hypoprotocetraric acid absent; lobes sublinear, 0.2-1 mm wide	.....36
36(35). Fatty acids present; Cape	<i>X. inuncta</i>
Fatty acids absent	.....37
37(36). Colensoic acid present; Cape	<i>X. colensoica</i>
Norlobaridone present; Cape	<i>X. dubitella</i> Elix, Lichenol. 34: 285
38(30). Stictic acid present	.....39
Stictic acid absent	.....44
39(38). Stictic acid present with additionally minors stenoporic acid and fatties; lobes 0.2-0.5 mm wide, sublinear to subirregular; thallus lobulate, not areolate; Cape	<i>X. lobuliferella</i> Elix, Lichenol. 34: 287
Stictic acid aggregate alone present	.....40
40(39). Isousnic acid instead of usnic acid present in the cortex	.....41
Usnic acid present in the cortex	.....42

41(40). Lobes 0.2-0.8 mm wide, sublinear; rhizines simple; Cape....	X. putida (Brusse), Mycotaxon 40: 384.	
Lobes 0.1-0.8 mm wide, sublinear to linear; rhizines often fused in pairs or flattened; Cape		
.....	X. epacridea (Brusse), Mycotaxon 49: 3.	
42(40). Thallus lobulate, not areolate, lobules 0.4-0.6 mm; lobes 0.6-1.0 mm wide, sublinear; upper surface dull to shiny, not pruinose; Cape.....	X. lobulifera	
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43(42). Thallus emaculate, with contiguous lobes; lobes 0.2-0.6 mm wide, sublinear; Australasia, Cape		
.....	X. xanthomelaena	
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Elix, Lichenol. 34: 289		
44(38). Hypostictic acid present		45
Salazinic acid present (norstictic absent or present as a minor metabolite or in traces)		46
45(44). Lobes 0.4-0.9 mm wide, subirregular to sublinear; upper surface shiny, transversely cracked at the center; Cape.....	X. protoquintaria	
Lobes 0.3-2 mm wide; upper surface matt to scabrous; Cape	X. mesmerizans (Brusse), Mycotaxon 50: 294.	
46(44). Lobes to 1 mm wide; center of thallus not areolate; Transvaal.....	X. proximata	
Lobes narrower, 0.3-0.6 mm wide; thallus center usually appearing areolate		47
47(46). Chalybaeizanic acid present; Cape.....	X. conspersula	
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48(47). Lobes elongate, little branched; norstictic acid present as a minor metabolite; Cape ...	X. olifantensis	
Lobes short, dichotomously branched; norstictic acid absent; Australia, Transvaal, Cape		
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49(29). Medulla K - (diffractaic, fatty, fumarprotocetraric, hypoprotocetraric, protocetraric, or psoromic acids, norlobaridone or scabrosin)		50
Medulla K + yellow or yellow turning red (hypostictic, norstictic, salazinic, or stictic acids).....		65
50(49). Medulla P+ orange-red or yellow (fumarprotocetraric, protocetraric, or psoromic acids; if echinocarpic acid present, see <i>X. squamatica</i>)		51
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51(50). Fumarprotocetraric acid present; thallus loosely adnate		52
Fumarprotocetraric acid absent (protocetraric acid or psoromic acid present)		54
52(51). Lobes broad, 2-4 mm wide, sublinear; upper surface emaculate; Australia, Kenya	X. rogersii	
Lobes narrower, 1.2-3 mm wide; upper surface in part slightly maculate		53
53(52). Revolute to convolute, di- to trichotomously branched laciniae present in thallus center; lobes 1.5-3 mm wide, sublinear to linear; Cape.....	X. magnificans Elix, Mycotaxon 73: 57.	
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55(54). Surface emaculate to very sparsely maculate; lobes linear, soft; Natal.....	X. mollis	
Surface maculate; lobes sublinear, stiff; Australia, Uganda, Cape	X. hypoleia	
56(50). Fatty acids present.....		57
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57(56). Lobes broad and rotund, 3-6 mm wide; Cape	X. aliphatica	
Lobes narrower, 1-2.5 mm wide, the tips obtuse or acute.....		58
58(57). Thallus pulvinate; lobes black-rimmed; unknown fatty present; Lesotho.....	X. atroventralis	
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59(58). Thallus loosely adnate; lobes digitate or elongate-laciniate; subdeciapiens 33 and 37 fatty acids present		60
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61(56). Hypoprotocetraric acid present;		62
Hypoprotocetraric acid absent.....		63
62(61). Thallus loosely adnate; lobes sublinear; Cape.....	X. tablensis	
Thallus tightly adnate with an areolate center; lobes 0.6-1.5 mm wide; upper surface glossy, at least near the lobe tips; Cape	X. domokosii	
63(61). Squamatic acid present with a trace of echinocarpic acid, diffractaic acid absent; Cape.....	X. squamatica	
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64(63). Lobes sublinear to linear, 0.1-0.7 mm wide, with mainly marginal rhizines; Cape.....	X. abraxas (Brusse), Mycotaxon 40: 377.	
Lobes sublinear, 1-2 mm wide; thallus loosely adnate, suberect; rhizines sparse; Namibia	X. luderitziana	
65(49). Stictic acid present as the major metabolite		66
Norstictic or salazinic acids present		77
66(65). Diffractaic acid present additionally; Natal.....	X. indumenica	
Diffractaic acid absent.....		67
67(66). Rhizines absent; lobes sublinear		68
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68(67). Thallus tightly adnate, congested; Cape, Transvaal	X. lobulifera	
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69(67). Lobes linear.....		70
Lobes sublinear to subirregular		71
70(69). Rhizines absent or very sparse; lobes linear, 0.5-1 mm wide; lower surface rugose; stictic acid agg. present incl. a trace of hypostictic acid; Australasia, Madagascar	X. suberadicata	
Rhizines sparse; lobes linear, 0.2-1.2 mm wide, slightly convex; more hypostictic acid present; Cape	X. musculina (Brusse), Mycotaxon 40:381.	
71(69). Lobes broad, 2-4 mm wide, short and rotund; surface white-maculate; rhizines very sparse; Transvaal, Natal	X. albomaculata	
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72(71). Lusitanic acid present; norstictic acid absent; Lesotho	X. protolusitana	
Lusitanic acid absent; norstictic acid usually present		73

73(72). Thallus tightly adnate	74
Thallus adnate to loosely adnate; lobes 0.6-2.5 mm wide.....	75
74(73). Lobes 0.6-1.5 mm wide; thallus lobate at the center with contiguous lobes; Australia, Transvaal	X. bicontinens
Lobes 0.6-1.2 mm wide; thallus center becoming rugose-bullate with age; USA, Cape?	X. neoconspersa
75(73). Lobes mostly less than 1 mm wide	76
Lobes mostly more than 1 mm wide; lower surface of lobes faintly canaliculate with a raised yellowish rim at the tips; very sparsely rhizinate at the tips; South America, Cape.....	X. hypopsila
76(75). Lobes black-rimmed; Australia, Cape.....	X. tegeta
Lobes pale-rimmed; Cape	X. austrocapensis
77(65). Norstictic acid present as a major metabolite or with salazinic acid in equal concentration	78
Salazinic acid present; norstictic acid if present as minor metabolite or in traces only	81
78(77). Psoromic acid present additionally; upper surface dull, not pruinose; Cape.....	X. psornorstictica
No additional major substance	79
79(78). Thallus loosely adnate to suberect; surface white-maculate; Namibia.....	X. norwalteri
Thallus adnate; surface continuous, emaculate	80
80(79). Lobes black-rimmed, rugose below; Tanzania.....	X. kiboensis
Lobes pale-rimmed, smooth below; upper surface dull; Namibia	X. norcolorata
81(77). Upper surface white-maculate	82
Upper surface continuous, emaculate.....	85
82(81). Lobes narrow and constricted, 0.5-1.5 mm wide; Australia, Cape.....	X. constrictans
Lobes broader, not constricted, 1-6 mm wide	83
83(82). Thallus dark yellowish green; lobes rather short, subirregular to sublinear; Cape.....	X. synestia
Thallus light yellowish green; lobes, sublinear	84
84(83). Thallus leathery, pulvinate; rhizines dense, dark, long and branching; Kenya, Uganda.....	X. africana
Thallus membranaceous, not pulvinate; rhizines moderate, brown, unbranched; Cape.....	X. neotasmanica
85(81). Lobes sublinear to linear, 0.2-4 mm wide; collected on rocks or on pebbles on soil or among moss.....	86
Lobes subirregular to sublinear, smooth and shiny below, sparsely to densely rhizinate	88
86(85). Lobes 0.2-0.5 mm wide, linear-elongate, smooth below; Cape	X. eradicata
Lobes 0.5-4 mm wide, sublinear to linear, rugose below with very sparse rhizines	87
87(86). Chalybaeizanic acid present; lobes 1.5-4 mm wide; Cape	X. hyporhytida
Chalybaeizanic acid absent; lobes 0.5-1.5 mm wide; Namibia.....	X. walteri
88(85). Thallus tightly adnate to adnate, usually collected with rock substrate	89
Thallus loosely adnate, rarely collected with rock substrate	93
89(88). Thallus very tightly adnate; lobes less than 1 mm wide; Australia, Transvaal, Cape ..	X. parvoincerta
Thallus adnate; lobes 0.8-2.5 mm wide.....	90
90(89). Protocetraric acid present in high concentration equalling salazinic acid; lobes 0.8-2 mm wide, sublinear; Lesotho	X. mapholanengensis
Protocetraric acid absent or present in traces	91

- 91(90). Thallus with convex laciniae with canaliculate lower surface at the center; lobes 0.8-2 mm wide, sublinear to subirregular; Natal, OFS..... **X. afroincerta** Elix, Mycotaxon 73: 51.
Thallus without canaliculate laciniae92
- 92(91). Norstictic acid absent; lobes 1-2.5 mm wide, subirregular; upper surface dull, not pruinose; Australasia, Cape **X. incerta**
Norstictic acid present; lobes 1-3 mm wide, sublinear to subirregular; rhizines tufted and sparsely furcate; Kenya **X. boyeri** Elix; Lichenol. 34: 285
- 93(88). Lobes large and rotund, 3-8 mm wide; Cape **X. latilobata**
Lobes narrower, apices obtuse or acute, 1-5 mm wide; lower surface moderately to densely rhizinate94/
- 94(93). Thallus with short, laciniate, black-rimmed lobes; Kenya, Tanzania **X. salkiboensis**
Thallus with elongate, sublinear, pale or black-rimmed lobes95
- 95(94). Thallus pulvinate; rhizines dense, becoming branched; Kenya, Uganda **X. africana**
Thallus not pulvinate; rhizines sparse to moderate, unbranched.....96
- 96(95). Protocetraric acid present in high concentration; lobes 0.8-2 mm wide, convex; Lesotho **X. mapholanengensis**
Protocetraric acid absent or if present in traces; lobes 2-5 mm wide, flat; pantemperate, incl. Kenya, Natal, Cape **X. tasmanica**

M. Species of *Xanthoparmelia* with a Dull Thallus and Coarse-pruinose Lobe Tips

Note. This may concern a natural group which shares the absence of an epicortex (cf. Brusse 1986 on *Parmelia bibax*) and the presence of black apothecium discs. Most species in the key are included tentatively. In case of doubt they are also keyed out as non-pruinose species.

1. Isidia or soredia present2
Isidia and soredia absent6
- 2(1). Pustulate-isidiate to sorediate3
Cylindrical isidia present; hypostictic acid agg. present; lower surface pale brown; thallus turning brown at maturity; upper surface dull and light pruinose; tiny, tightly adnate species; Namibia **X. harrisii**
- 3(2). Medulla C + red (lecanoric acid present); pustulate-isidiate to sorediate; lecanoric acid present; lower surface pale brown; upper surface shiny but turning dull and white-pruinose at age; small, tightly adnate species; Cape **X. coneruptens**
Medulla C - (lecanoric acid absent)4
- 4(3). Medulla K + yellow soon turning orange to red (stictic or salazinic acids present)5
Medulla K - (stictic and salazinic acid absent; fumarprotocetraric acid present; isidia coarse and pustular, subsorediate (pustular soralia); fumarprotocetraric, succinprotocetraric acids; lower surface pale brown; upper surface dull to faintly white-pruinose; Lesotho **X. granulata**
- 5(4). Isidia erupting into large capitate subsorediate masses; stictic acid agg., lusitanic; lower surface pale brown or darkening; upper surface shiny to dull white-pruinose; Namibia, Cape... **X. pustulosorediata**
Isidia sparse, globose-pustulate; salazinic, chalybaeizanic; lower surface pale brown; upper surface dull, white pruinose; Cape..... **X. saleruptens**, syn. *P. geckonalis* Brusse Mycotaxon 34: 400.
- 6(1). Lobes small, 0.2-2 mm wide7
Lobes large, 2-9 mm wide (*schlenckiana*-group of Hale 1990)17
- 7(6). Medulla K + yellow turning orange or red (stictic, hypostictic, norstictic or salazinic acid present)8

Medulla K - (evernic, lecanoric or hypoprotocetraric acid present).....	14
8(7). Salazinic, chalybaeizanic; lower surface pale brown; Lobes 0.5-2 mm wide; light yellow, dull and white-pruinose at the tips, darkening at the center; Cape.....	X. bibax
Salazinic acid absent	9
9(8). Lower surface pale brown to brown, darker at the lobe tips; stictic, hypostictic or salazinic acid present	10
Lower surface black, dark brown at the lobe tips; norstictic acid or hypostictic acid present	12
10(9). Hypostictic acid agg. present	11
Stictic agg. present; lower surface pale brown; lobes 0.2-1.5 mm wide, upper surface matt to pruinose near the lobe tips; apothecium discs black; Cape.....	X. emolumenta (Brusse), Mycotaxon 50: 292.
11(10). Lobes subirregular, 1-2 mm wide, upper surface coarse-pruinose towards the tips; apothecium discs black; Cape.....	X. chionophila (Brusse), Mycotaxon 50: 292.
Lobes sublinear, 0.3-0.6 mm wide; upper surface ???; lower medulla rusty red in older parts (unknown pigment); Cape.....	X. inconspicua
12(9). Norstictic acid present.....	13
Hypostictic acid present; lobes 0.3-2 mm wide; upper surface matt to scabrous; Cape.....	X. mesmerizans (Brusse), Mycotaxon 50: 294.
13(11). Norstictic acid present; lobes 1-2 mm wide, pale-rimmed, smooth below; upper surface dull, not pruinose?; lower surface black, sparsely rhizinate; Namibia	X. norcolorata
Psoromic acid and norstictic acid present; lobes 1.5-3 mm wide; upper surface dull, not pruinose; lower side black, brown at the tips; Cape.....	X. psornorstictica
14(7). Hypoprotocetraric, 4-O-demethylnotatic acid present, evernic acid and lecanoric acid absent; lower surface dark brown to black; thallus adnate with a lobate center, lobes 1-2 mm wide; lobes thick and strongly convex; upper surface shiny, dull, becoming densely pruinose; apothecium discs black; Cape	X. toninioides
Hypoprotocetraric acid absent, evernic and/or lecanoric acid present	15
15(12). Medulla C + red, lecanoric acid major substance; lower surface black; lobes 1-2 mm wide, convex, appearing inflated; surface shiny or dull, white-pruinose; Namibia	X. serusiauxii
Medulla C - or weakly C +, evernic acid major substance with a trace of lecanoric acid; lower surface pale.....	16
16(13). Thallus center lobate, lobes 0.5-1,1 mm wide; medulla white throughout; surface shiny to dull and white-pruinose; Namibia.....	X. equalis
Thallus center areolate; lobes sublinear, 0.6-1 mm wide; skyrin present in lower medulla; upper surface pruinose whitish; Cape	X. lecanoracea (Müll. Arg.) Hale, syn. <i>Paraparmelia lecanoracea</i> , <i>Pseudoparmelia lecanoraceae</i> Hale 1976: 35.
17(6). Medulla K + yellow turning red (salazinic or norstictic acid present)	18
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18(15). Salazinic acid, norstictic acid and often schenckiana pigments present; lower surface black; lobes broad and rotund, 2-6 mm wide; upper surface dull, white-pruinose at the tips; pigment dull rusty red (schenckiana pigment); apothecium discs black; Cape, Namibia	X. colorata
Norstictic and salazinic acids present; lower surface light brown; lobes very large, broad and rotund, 3-9 mm wide; upper surface dull and in part white-pruinose; Cape.....	X. maxima
19(15). Protocetraric acid absent: lobes broad and apically rotund, 3-7 mm wide; upper surface dull, at the tips sometimes weakly pruinose; OFS, Cape, Lesotho, Namibia.....	X. psoromica
Protocetraric acid present.....	20

- 20(19). Protocetraric acid and schenckiana pigments present; lower surface black; lobes broad and subirregular, 2-7 mm wide, upper surface at tips dull, white-pruinose; apothecium discs black; Lesotho, Cape..... **X. schenckiana**
 Protocetraric acid, psoromic acid and schenckiana pigment present; lower surface black; lobes 3-7 mm wide; upper surface shiny or rarely white-pruinose at the tips; Cape **X. diacida**

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