Lichen purple—an annotated bibliography

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This bibliography lists and contains comments on publications describing the textile dyeing applications and organic chemistry of purple dyes derived from lichens. Elsewhere in this issue such colorants are termed orcein; the usage “lichen purple” reflects the historical emphasis of the work described. Note that commentary by CJC is placed after the bibliographic information in italics.


Berthollet CL, Berthollet AB (1841) Elements of the Art of Dyeing and Bleaching. Thomas Tegg, London. pp. 365–369. A chapter on archil describes the manufacture from lichen Roccella (Canaries) or lichen Parellus (also called Perelle from Auvergne) using urine and lime to give a product with an odor of violets. A solution of the dye in ethanol was used for filling spirit of wine thermometers, but the color faded with time. “The contact of air renews the colour, which is destroyed anew in vacuo in process of time”. The same lichen is used for turnsole (litmus), “this preparation is made in Holland.”


Brightman FH, Laundon JR (1985) Alternatives to Lichen Dyes. British Lichen Society, London. A two page leaflet from the British Lichen Society (London) describes lichens used to produce the dyes orchil and cudbear which contain orcein and the indicator, litmus. Illustrations of the orchil lichen are reproduced from Dillenius’s Historia Muscorum tab. XVII Fig. 39 (1742).


Brunello F (1973) The Art of Dyeing in the History of Mankind. N. Pozza, Vicenza. Below, the numbers in parentheses are page numbers. Archil (Roccella tinctoria) was in common use in classical times (26), especially in the Greek islands of Amorgos (93) and is mentioned by Dioscoridis, Pliny and Celsus (96). The histories of the Papyrus Leydensis and Papyrus Holmiensis are related (97) and dyeing using woad then archil to obtain a violet tone on a blue base is discussed (99). The first recipe (no. 32) in Papyrus Holmiensis for an imitation purple using sasfflower (sic) and archil is reproduced (plate 57). There is speculation that the Roman garments vestes fucatae could have used archil (Greek: phikos, Latin: fucus; 108). The dye was forgotten during Medieval
times and reintroduced about 1300 to artisans in Florence by Federigo from the Levant (132). Tornexel (archil) is mentioned in Plictho de l’arte de Tentori, G. Rosetti, Venice, 1540 (191) and a chapter in Nuovo Plico d’ogni de tincture by G. Tallier, Venice, 1704, has the title “To make an archil dye which dyes everything brown” (207). Hellot, L’Art de la teinture des laines, 1750, quotes Rosetti’s Plictho, reproducing the formula, and quotes from “a fine description of this process” in Novum Plantarum Genera, PA Micheli, Florence, 1729, where it is called “raspa” (230). In the dictionary section of the book there is a description of dyeing lichens (350) and their location and an entry under Roccella tinctoria (383), with drawings of Lecanora tartarea and Lecidea geografica (plate 54).


**Casselman KL** (1994) Lichens: orseille de l’herbe. Herbarist 60: 42–49. The history, uses and folklore of lichens, including those used as purple and brown dyes. Several documentary sources quoted.


**Dambourney LA** (1794) Recueil de Proce´de´se t’Expe´riences sur les Teintures Solides: que nos Vége´taux Indigeˆnes Communiquent aux Laines & aux Lainages. 18th century details of improving fastness using silver birch bark (see Cardon and du Chatenet1990, p. 317).

**Dambourney LA** (1794) Histoire des Plantes qui Servent a la Teinture. Paris. p. 167. After dyeing woolen cloth with orchil, the fastness was improved by treatment in a bath of vinegar or of cold water and oil of vitriol.

**Diderot** (1788) La Grande Encyclopedie. pp. c. 484–666. “Lichen de Grece” (lichen Graceus, lichen Polypoides, lichen Tinctorius), found on Mediterranean coasts and used for dyeing is described; orchil of the sea and orchil of the earth are described. The use of a solution of tin “par l’esprit de nitre regalise” to make the color faster, in
the same way as for cochineal, is mentioned, but the color is affected. The use of orchil for dyeing marble red and blue is mentioned.

**Dorvault** (1889) L’Officine, ou Repertoire General de Pharmacie Pratique. p. 623.
A single paragraph describes use of lichens to obtain brown, yellow, purple and blue colours. Rocella and Variolaria species are mentioned and the color precursors, lecanorine, erythrine and orceine. The blue lacmus is obtained from Lecanora tartarea.

A large number of species of lichen were tested and examples are given of the different ways of dyeing using different species, soda, lime, urine. There is much detail about lichen Tartareux, the orchil of Auvergne, and the economy linked with this lichen.

Organic chemistry of orcein.

**Dumas JB** (1844) Traite de Chimie Applique aux Arts, Paris 8: 40–56.
Organic chemistry of orcein and litmus.


Separations were achieved using paper chromatography as well as alumina columns. Visible spectra are reported. Each of the four fractions had very different staining characteristics on tissue sections, and only the blue-purple fraction stained elastic fibers.

Litmus is obtained from Lecanora tartarea or Roccella tinctoria, and archil is similar although obtained from other species.

Mention is made of Rocella, Variolaria, lichen Corallinus (Pertusaria corallina), lichen Tartareus and a

A chapter on lichen dyes gives brief descriptions of the habitat and use of Ochrolechia (Leconora) tartarea, Parmelia saxatilis and Rocella tinctoria.

The production of cudbear is described from a mixture of Archelia or Spanish weed, Muscus rupibus admiscens or coroloides and Muscus pyxidatus, spirit of urine, spirit of soot and quick lime. “Digest them together for fourteen days, and they will produce the cudbear fitt for dyers’ use.”

Includes a description of the history of harvesting and processing cudbear, and a survey of orchil lichen species with recipes.

A commercial method for making solid orseille called “Pourpre Francaise” (see Cardon and du Chatenet 1990, pp. 317).

A very short summary of the use of orchil lichens, referring to Bolton (1960,1972) and Solberg; plus a little organic chemistry.

The Greek text of these 3rd century papyri found in a Theban tomb in 1828 is given, together with a French translation, with many footnotes. Of the 70 dye recipes, many are for imitation mollusc purple, and one includes a woad plus lichen-purple recipe.

A one page summary on orchil, cork and litmus with 4 references (1612–1674).


Hofenk-de Graaff JH (1969) Natural Dyestuffs – Origin, Chemical Constitution, Identification. International Council of Museums, Amsterdam. Plenary meeting 15–19 September 1969, Amsterdam. A brief history from ancient Rome, where the main use may have been as a ground color before dyeing with Tyrian purple, and the later use in Holland, France and Scotland. Although not usually mordanted, silk can be dyed red using alum + gallnuts followed by warm wine vinegar. Infrared spectra and TLC details (Figs. 32, 33) are given for orchil and orcein.


Hoiland K (1983) Laven korkje, ochrolechia tartarea, som fargeprodusent. Med spesiell omtale av bruken på Lista og i Farsund. Blyttia 41: 17–21. The lichen cork (korkje), Ochrolechia tartarea, as dye-stuff producer, with a special mention of the use on Lista and in Farsund. Details are given of the history of use in Norway since 1316, the chemistry of the color production, and the trade in the 18th century centered around Flekkefjord. Illustrations are given of wool dyed with cork, lichen-picks and the lichen; 11 references.


Hunt R (1875) Ure’s Dictionary of Arts, Manufactures, and Mines. Longmans, Green & Co., London. Volume 1, p. 1013. Article: cudbear, whose name derives from Dr. Cuthbert Gordon and “it was originally manufactured on a great scale by Mr. G Mackintosh, at Glasgow, nearly 80 years ago.”


Knecht E, Rawson C, Loewenthal R (1910) A Manual of Dyeing: for the Use of Practical Dyers, Manufacturers, Students, and all those Interested in the Art of Dyeing. 2nd ed. Charles Griffin, London. Volume 1, pp. 363–365. First published in 1893, 9th edition 1945. A section on orchil and cudbear describes the manufacture of orchil from Roccella tinctoria (Valparaiso weed), R. fuciformia (Lima weed), Varioariar orchina (from Auergue) or Lecanora tinctoria (from Sweden) by fermentation with urine and subsequent addition of slaked lime or by fermentation with dilute ammonia at 35–45°C for 5–6 days. Cudbear is usually made from L. tartarea. Wool is dyed without a mordant and is frequently used for “bottoming” indigo.

Kok A (1966) A short history of the orchil dyes. Lichenologist 3: 248–272. A complete historical review with 68 references, plus a further 11 of more general interest. In a section on the history of lichen purple, the early use in combination with and as a substitute for shellfish purple was mentioned by Theophrastus, Pliny the Elder and in the Stockholm Papyrus, and was a possible constituent of Gaetulian purple. The domestic use probably continued until the re-establishment of commercial trade by Federigo, ca. 1300. The expansion of the use continued
in the 16th and 17th centuries with mention by Roseto (1540), Guicciardini (1560), Imperato (1599), Ray (1686) and Pitton de Tournefort (1717). In the 18th century, some amounts and prices are given for lichen from the Cape Verde Islands and the Canaries. Much detail is given on the perelle industry in France and the cudbear industry in Scotland. In the 19th century, more sources were located in Ceylon, Mozambique, Peru, Madagascar and Zanzibar, and in the second half of the 20th century, the major sources were the Cape Verde Islands and Madagascar. In a section on the preparation of dyes, recipes are quoted for orchil, French purple, Perelle, cudbear and Litmus. In a final section, the dyeing of silk and wool with orchil alone and with other dyes is given in detail.

Le Pileur D’Appligny (1770) Essai sur la Teinture, pp. 129 – 135. The fugitive nature of orchil dyes is described, with experiments directed toward greater light fastness.

Leggett WF (1944) Ancient and Medieval Dyes. Chemical Publishing, Brooklyn. pp. 56 – 60. A brief history of orseille, with mention of Theophrastus and Dioscorides, Pliny (use as a ground for Tyrian purple), and Federigo (1300). Florence was the main source prior to that of the Canary Islands (1703). Norway and the Mediterranean islands are a source of Roccella fuciformis and Variolaria oricina. Attempts have been made to develop an industry in Lower California.

Leuchs JC (1829) Traité Complet des Propriétés, de la Préparation et de l’Emploi des Matières Tintoriales et des Couleurs. De Malher, Paris. pp. 399 – 415. A survey of 73 species of lichen and their ability to yield a red color. The recipe of P Vestring of Stockholm using lime and ammonia to obtain red or violet colours is described, with other processes using salt, salpeter, ammonia, urine, copper sulfate. The orchil lichens described are lichen tartareus, Variolaria oricina, lichen Calcareus, Roccella, lichen Farineux, lichen Lacteus.


Llano GA (1956) Economic Uses of Lichens. Washington. pp. 32 – 37. The current use of lichens for dyeing in western and northern Europe is mentioned. There is a short history of the use of lichens for purple dyeing from the 13th century onwards, with a chart showing the geographical origin of commercially used lichens, classified into two groups: orchil of the earth and orchil of the sea. Recipes are given for orchil paste, orchil cake, orchil liquor and the recipe of Coq (1813).


Mairet EM (1931) Vegetable Dyes, Being a Book of Recipes and Other Information Useful to the Dyer (5th ed.). St Dominic’s Press, Ditchling, Hassocks, Sussex. This little book was first published in 1916, with a 5th ed. in 1931, and another in 1939. In a chapter on lichen dyes, the processing of Lecanora tartarea in Scotland is described: “...is steeped in stale urine for about 3 weeks, wrapped in dock leaves and hung up to dry in peat smoke.” A general method of processing lichens is quoted from “Experiments on Lichens for Dyeing Wools and Silks” by Dr Westring of Sweden. The use of stale urine and slaked lime for orchil and cudbear (from L. tartarea or Urceolaria calcarea in Scotland) is mentioned and purple colors obtainable from Evernia prunastri, U. pustulata and Parmelia perlata. A recipe is given for red-purple dyeing of wool using equal amounts of cudbear and logwood. A list of lichens “used by the peasantry of different countries for wool dyeing” is reproduced from “The Dyeing Properties of Lichens” by Dr. Lauder Lindsay, Lecanora pallescens, Umbellaticaria vellea, Edinburgh Philosoph. J., July – October, 1855.

McGrath JW (1977) Dyes from Lichens & Plants. Van Nostrand Reinhold, Toronto. Based on 6 years’ experience of craft dyeing at Spence Bay in the Canadian Arctic, this book describes 63 plant...
species (including 22 lichens) with botanical details, including Inuit name and recipes for dyeing. Purple/blue producers are Alectoria ochroleuca, Cetraria delisei, Haematoma lapponicum, Umbilicaria vellea and Xanthoria elegans, the last of which only gives a blue color on exposure to sunlight. The lichens are illustrated in color with examples of dyeing results, some with unusual substrates like wolf fur and polar bear fur.


The structure of purple compounds isolated from the reaction of air and ammonia on orcinol suggested by Liebermann (Ber. 1875, 8: 1649) or Henrich (Sitzungsber. Physik.-Med. Soz. Erlangen 1939, 71: 199) are shown to be more likely of the oxazine type than the suggested indophenol type.


Ring paper chromatography of orcein, eluting with 0.5 M phosphate buffer at pH 11.0 in butanol; or column chromatography using cellulose–butanol–0.5M phosphate buffer at pH 11.75 separates 13 colored components.


Following a brief history of orcein from 1835 (H. Robiquet) onwards, paper chromatography and cellulose powder chromatography are used to separate 14 components, of which 5 are obtained as crystalline compounds. Spectral data obtained in methanol, 0.2 N HCl, 0.2 N NH₃, and 0.2 N KOH is given.


The major components of orcein were separated using cellulose powder chromatography with formamide–chloroform–pyridine for α-amino-orcein and butanol–phosphate buffer for other amino and hydroxyorceins.


The synthesis is used to support the proposed structure of α-amino-orcein.


IR and UV data are given for α-, β- and γ-hydroxy- and amino-orceine, and for γ-amino-orceimine.


Visible region spectral data are given for α-, β- and γ-hydroxyorceins and for litmus.


The Rf values and structures of 12 of the components of orcein separated by cellulose powder chromatography using butanol–phosphate buffer, pH 11.75, are given.


pK and redox potentials were determined for orcein components and phenoxazone models.

with an introduction by J. de L. Mann, and technical notes by K. G. Ponting.
A brief recipe for dyeing silk with cudbear to give a mazarine blue.


Ploss EE (1962) Ein Buch von alten Farben. Impuls Verlag Heinz Moos, Heidelberg and Berlin. Technologie der Textilfarben im Mittelalter mit einem Ausblick auf die festen Farben. Recipe 32 from Papyrus Graecus Holmiensis using safflower and orseille is described (pp 25) and the original MS reproduced (pp 36).


Roret (1898) Origine des Materieres Tinctoriales. pp. 252–255. In one chapter about orseille the author describes how to recognize the orchil lichen and different ways to obtain the dye. The recipe from Cocq (1812) for preparing orchil is given.

Rutty J (1772) An Essay towards a Natural History of the County of Dublin. Dublin. pp. 138–140. One chapter of the book is devoted to “Indigenous Vegetables Useful in Dying and Painting.” This work was reprinted and published by the Department of

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continuing education, university of bristol, 1990, and describes cork, corker or arcel. “in the co. of kerry they steep it in stale urine, and make it up into balls with lime”.

schunck e (1842) on some of the substances contained in the lichens employed for the preparations of archil and cudbear. chem. soc. mem. 1: 71–77.

schunck e (1842) vorläufige notiz über einige farbstoffgebende substanzen der flechten. ann. chem. pharm. 41: 157–162.

schunck e (1845) ueber die bestandtheile der lecanora parella. ann. chem. pharm. 54: 257–284.

schunck e (1847) ueber die in rocella tinctoria enthalteren stoffe. ann. chem. pharm. 61: 64–80.

a chapter about lichen dyes.

a comprehensive coverage of lichen purple including (page numbers in parentheses) an historical summary (530), reference to papyrus holmiensis (25, 53, 56, 310), pliny’s historia naturalis (52, 56), theophrastus’s geschichte der pflanzen, iv. buch, kapitel 6, 5 (53), the finds at vindolanda (58, 67), plictho (82, 84) and colbert (89). in the 18th century, orseille (orchil) from rocella tinctoria was obtained from crete and the greek islands and persio (cudbear) from lecanora species was obtained from scotland and scandinavia. orseille used on silk to obtain a violet color (140), and on parchment (318). the constitution and structures of dyes and precursors is covered (517), recipes for persio (cudbear), französischer purpur (pourpre français) and lackmus (litmus) are given (528). different colors are obtained with mordants, al, cu, fe, mg, zn (530); and 3 pictures of examples of aluminium mordanted wool dyeing are given (569). qualitative analysis is by dithionite reduction and oxidation to regenerate the color (no regeneration with azo dyes and shellfish purple under uv irradiation becomes blue) (530).


brief descriptions, local names, and recipes are given for 28 plant dyes in shetland including ochrolechia tartarea (korkalit). a typical recipe involved three weeks fermentation with urine followed by making into cakes with lime and drying in peat smoke (this was done on foula). parmelia parientina gives a lilac dye by urine fermentation, purple when used with chrome mordanted wool.

tassart cl (1890) les matières colorantes. in a chapter about orseille, the different species are described, the chemical studies of robiquet (1829) and others (frezon, stenhouse), and the recipe for french purple of guinon, marnas and bonnet given.

taylor gw (1990) ancient textile dyes. chem. brit. pp. 1155–1158. visible spectra (in methanol) were determined of lichen purple samples from the vindolanda site, 19th century orchil, and 20th century ochrolechia tartarea.


tievant p (1979) historique, usages des teintures aux lichens. université de paris i, uer d’art plastique, thèse de doctorat de 3ème cycle. a description of the history, the lichens and dyeing methods for orchil, cudbear, persio, tournesol, litmus and parelle. 88 references.

wallert a (1986) fluorescent assay of quinone, lichen and redwood dyestuffs. studies conserv. 31: 145–155.
a brief section describes lichen dyes, mainly orcein, with 3 references.

westring dm (1792) essais sur la propriété tinctoriale de plusieurs espèces de lichen qui croissent naturellement en suède, et sur les couleurs qu’ils communiquent aux lainages et à la soie. ann. chim. paris 15: 267–297.
see mairet (1931).

acknowledgments

an earlier version of this bibliography was published in dyes in history and archaeology (1996), volume 15, pp. 103–110, with assistance from hayo de boer, michèlle dallon, witold nowik and karen diadick casselman and penelope walton rodgers.

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