NORWEGIAN BREAKFAST CLUB NEWSLETTER

Vol. I No.1 November, 1994

Historical and Modern Lichen Dyes: Some Ethical Considerations

by Karen Diadick Casselman

SUMMARY

The use of lichen dyes is an ancient craft. Archaeological evidence proves ancient textiles presumed to have been dyed with other products (such as cochineal or murex) were actually dyed with a combination of molluscs (Murex spp.) and lichens (Roccella spp.). The use of lichen dyes such as crottle, cudbear, korkje and orchil by many cultural groups in the ancient, medieval and post-Renaissance period, led to the eventual depletion of some European lichen species. Modern conservation warnings aimed at craft dyers are taken seriously; however, the ethical issue related to the use of lichens for textile dyes is obscured by confusion about dye names, dye ingredients, and dye methods. A modern lichen dye language has evolved, particular to specific species (see GLOSSARY). New dye methods use fewer lichens than did historical lichen dyes made on an industrial basis. Lichen dyes use can continue if dyers collect with conservation in mind, and if dye research, textile history and science education are included as discussion points within the ethical debate.

GLOSSARY

DYE NAME	DYE TYPE	LICHEN INGREDIENTS	ORIGIN AND PERIOD
crottle	BWM	Parmelia omphalodes and/or P. saxatilis	Gaelic: medieval & modern
cudbear	AM	Ochrolechia tartarea and Lasallia pustulata	Gaelic: ancient, medieval & modern
korkje	AM	Ochrolechia tartarea and Lasallia pustulata	Norse: ancient, medieval & modern
orchil	AM	Roccella spp.	Asian: ancient, medieval & modern
orsallia	AM	Actinogyra muehlenbergii, Lasallia papulosa & Umbilicaria spp.	North American: modern

SYMBOLS:
BWM = boiling water method lichen dyes
AM = ammonia method lichen dyes (also called AFM or ammonia fermentation method dyes - see TABLE 1, note #)

DYE METHODS

Lichens contain acids (chemical substances) that are extracted to make textile dyes by one of two methods: 1. the ammonia method (AM dyes); and 2. the boiling water method (BWM dyes).

1. Lichens that contain substances such as gyrophoric acid (for example: most species of Actinogyra, Lasallia, and Umbilicaria) are processed by the ammonia method. AM dyes constitute a vat process wherein lichen particles, water, ammonia and oxygen are combined, and set aside to decompose. During decomposition ingredients are first converted to orcein, and subsequently to orcinol, a purple dye precursor. The decomposition ("ageing" or "fermentation" period) varies from several weeks (to make cudbear, korkje and orchil), to three months or more (to make orsallia).

2. Some lichens contain substances that can be extracted in water (for example: the salazinic acid Parmelia omphalodes and P. saxatilis). Thus boiling water method dyes are a direct dye process; however, there are several steps in the extraction process.

AM DYES: In a large glass bottle with a lid (the vat), place 500ml (2 cups) of lichen particles (for species, see 5, 9, 10 13, 14, 26). Mix approximately 1 litre (1 quart) of a 1:1 solution of water and household ammonia: add this mixture to the lichens in the vat. Stir until the lichen particles are completely hydrated. Mix more solution if required, but leave sufficient space to incorporate oxygen by stirring the contents vigorously. Replace the vat lid. Stir (or otherwise aerate) vat contents several times daily for 1 week, and daily thereafter, for a total time of 3 weeks (for cudbear, korkje and orchil) or 3 months (orsallia). To prepare the dyebath: pour 125 ml (1/2 cup) of the vat liquor into a dye pot. Prepare a dye bath with a ratio of 20 parts water to 1 part dye liquor. Immerse one pre-soaked wool skein (28.5 grams, or 1 ounce) in the dye bath. Initial colourcontrol is achieved by varying the weight of fibre dyed - less fibre produces darker shades, more fibre results in lighter colours. Slowly heat the dye pot to just below a simmer (maximum of 88.5° C or 191° F). The wool is "dyed" when the desired shade has been obtained; longer processing (on heat 2 hours, fibre remaining in the dyebath overnight, off heat), followed by a cold water rinse the next day, results in improved fastness. Additional colour variation is achieved by adjusting dyebath pH with vinegar (14, 17).

BWM DYES. Place layers of torn lichens (for species, see 5, 9, 10, 13-20, 26; for amounts to use, see Table 1) and wool yarn in a large dye pot. Add water to cover the mass, replace the lid and set aside overnight. The next day, heat the dye pot to below a simmer (88.5 C, 191 F). Process for several hours. Remove pot from heat and allow the contents to cool. Reheat once more (or twice) to maximize pigment extraction. This is the traditional "contact" method; a preferred modern variation is the "triple extraction" process. Soak torn lichens in water to cover for 1 or more days. Alternately heat and cool lichen and water mixture three times (you can strain off extracted pigment and water each time, and add more fresh water; or simply reheat lichens in the same water. In the latter case, strain off the lichens after the third heating). This method maximizes pigment extraction without entangling lichens in the wool.

HISTORY

Lichen dye history spans 3,500 years (29, 36). The most famous of several ancient purple dyes was Phoenician murex. This purple was also known as Royal or Tyrian Purple, and it was made from various species of Murex, Purpura and Thais molluscs (29, 41). Dye historians now realise that ancient murex had a lichen component (16, 29, 36). AM lichen dyes modified Tyrian Purple in several ways: lichen dyes enhanced mollusc pigments (2) and also functioned as a mordant (6). Orchil provided a ground colour in multi-dipped purples (29), and a cost-effective way to extend precious murex dye baths (36). Alkaline lichen dyes also helped increased dye bath pH (29). Despite a lingering reputation as an inferior dye (24), orchil was a popular commercial dye improver for cochineal and madder (32, 48).

Although often mentioned as a dye lichen (1), it is doubtful that Roccella tinctoria was used in commercial dyeing: Roccella babingtonii, R. fuciformis, R. montagnei and R. patellata (30) were the principal ingredients in authentic orchil (see GLOSSARY). The economics of ancient murex and orchil were inexorably linked, as was the ecology of these two over-harvested organisms (36). By the second and third centuries AD, demand for purple dyes outstripped the supply of raw materials. Thus both molluscs and lichens suffered the first of several periods of historical depletion (36). Until recently (45,47), there was also a noticeable lack of lichen dye documentation dating from the fourth to the eleventh century. It is therefore understandable that many authorities (8, 24) conclude that AM lichen dyes literally "died out" in post-Roman Europe. Archaeologists now know this was not the case (45,47). Nonetheless, it is true that after the fall of Rome, lichen dye use dwindled. Whether due to a general decline in commerce (29), or Roccella depletion (36), the manufacture and trade in lichen-based dyes certainly did decline during the Dark Ages (29,36). However, lichen dye manufacture and commerce was by no means abandoned. Northern European archaeology supports this supposition (29, 47) with documentation of Iron Age AM lichen dyes (45). Norse and Saxon textile finds prove conclusively that lichen dyes were traded and used throughout northern Europe in the post-Roman period (47).

The medieval "discovery" of purple lichen dyes (8, 24) is rightfully attributed to a Florentine merchant family (29). The etymology of both the dye name (orchil), and the lichen genus (Roccella), clearly derive from Rucellai, which is a later version of the original name, Orcellarii (49). However, precisely because lichen dyes did survive the Dark Ages, the medieval Florentine orchil monopoly should be characterised as an economic and commercial dye revival (26,36) instead of a "discovery".

continued to page 9

upon the lichen used. It is significant that the eventual failure of cudbear as a commercial product (17, 21, 29, 36, 40) has never been described in terms of dye chemistry.

An important point in the ethical debate involves the distinction between early commercial lichen dyes, and modern lichen dyes created as a means of aesthetic expression. Comparisons between the volume of lichen required to maintain full production at a nineteenth century cudbear factory (21, 29, 34,36,40) and the amount of lichen gathered and used by the individual craft dyer, are inappropriate. A more apt comparison would involve figures that show the extent of the European lichen harvest that supplies the contemporary cosmetic industry (35, 39).

The crux of the ethical debate remains this: exactly how much lichen is required to make a dye? A fundamental misunderstanding about the precise lichen to fibre ratio in a lichen vat, or dye bath, characterises historical recipes (2, 22, 32, 48). Many modern dye recipes are likewise vague (4, 11, 25). The so-called historical (7) or traditional (5) "standard measure" (see TABLE 1) varies from one source to another. Therefore, in order to address ethical concerns, it is essential to establish a modern standard.

CONCLUSION

There are a number of solutions to the ethical issue. Some lichenolgists suggest using alternate dyes (7), while others (9, 10, 13) advise the adoption of conservative lichen to fibre ratios (see TABLE 1). It should be noted that warnings about over-collecting lichens may be found in many modern dye books (5, 14, 26). but in order to avoid rarities, dyers must learn to identify lichens correctly (1, 27, 31). The purchase and sale of dye lichens is actively discouraged (14, 17), and dyers are urged to gather lichens at sites where they will otherwise be destroyed (14, 17, 19).

The great danger to wild flora today is not the occasional craft dyer, but the modern cosmetic industry. In many parts of central and eastern Europe, a massive lichen harvest provides raw materials for an apparently insatiable cosmetic industry (35,39). These exported American products included after-shave, deodorant, henna, perfume, pot pourri, and shampoo (35, 39). While we may or may not wish to purchase lichen-based cosmetics, avoiding such products is not always possible, for labelling is notoriously vague. This situation is reminiscent of vague (and thus wasteful) lichen dye recipes - recipes that are amusing to read, but hardly practical in a shrinking world where environmental awareness, science education, and a professional craft ethic must guide our sensibilities.

continued from page 3

There is abundant documentation of ancient and medieval AM lichen dyes (24, 28, 36, 45, 47), but little corresponding evidence to show that BWM dyes were in use at this time. Late medieval European BWM lichen dye traditions are suggested (2, 26,42), but to date, no such textiles have been found. BWM recipes appear to date only from the late eighteenth century (3, 22, 48). It has been noted that BWM dyes produce colours available from a wide variety of herbaceous plants (46); possibly this explainswhy archaeological evidence of BWM dyes is lacking.

Similarly lacking is documentation of lichen dye use by native peoples of North America in the post-contact period; however, one mention in the journal of an early Hudson's Bay factor (12) may provide the first clue that such dyes were in use in the Canadian north. Despite many (likely apocryphal) mentions of early American lichen dyes in literature, documented lichen-dyed textiles of the colonial or post-colonial period are conspicuous by their absence in major American textile collections.

DISCUSSION

Lichens have been over-collected for many centuries, not only by dyers (13), but also by pharmacists (44) and even by lichenologists (37, 40). The depletion of dye lichens was not mentioned historically because dye promoters believed that lichen dyes could revive rural economies in northern Europe (32, 48). Only when conservation became a priority (30) was historical depletion, due to over-harvesting for dyes, noted in dye literature (36). Warnings aimed explicitly at craft dyers suggest modern craft usage may be reaching historical proportions (23, 44). This is clearly not the case (13, 16, 17, 20). Missing from critical discussions of the ethical issue (7, 26) is an important point: namely, the distinction between the amount of lichen used to make craft dyes today, and the volume required to manufacture historical and hence, industrial, dyes.

What volume of lichen was harvested to manufacture those lichen dyes that were economically significant in earlier times? Amounts projected (28, 32. 34, 36, 39, 40) indicate a truly staggering harvest, excessive by any measure. The first period of historical depletion likely was caused by Roman demand for purple (36). The second period of depletion was associated with the success of Florentine purple (36). Nineteenth century Scottish cudbear resulted in a third period of historical lichendepletion, and one that created ecological mayhem in the highlands (17, 29, 36, 40). The primary cudbear ingredient was Ochrolechia tartarea.when this lichen was no longer locally available in Scotland (28), tons of O. tartarea (30) were imported from Norway (32). Just as the shortage of molluscs may have necessitated the incorporation of Roccella in ancient murex, so the shortage of O. tartarea in the nineteenth century led to the discovery that another lichen made a red or purple AM dye. Lasallia pustulata (and likely various species of Umbilicaria) became integral to the cudbear process (17, 26, 29, 32). There is no corresponding documentation to show how dye manufacturers responded to inevitable problem: orcinol develops in dyes based on Ochrolechia in only three weeks (see AM DYE METHODS). Dyes made from Lasallia and Umbilicaria require three months to decompose (14, 17). Although many lichen substances produce successful AM dyes, the production time required to develop orcein and orcinol varies substantially depending

TABLE 1: LICHEN TO FIBRE RATIOS IN AMERICAN & EUROPEAN DYES

DYE NAME and/or DYE TYPE	LICHEN : FIBRE by weight and/or volume	REFERENCES and COUNTRY
AM and BWM dyes	unspecified	Bærentsen 1987 Faeroes, Denmark
AM and BWM dyes	various ratios inc. 4:1, 2:1 and 1:1	Bliss 1981, United States
crottle BWM	4:1 weight and/or volume not specified	Brightman and Laundon 1985, England
* AM dyes * BWM dyes	1:10 by weight 1:10 by weight	Brough 1994,1988 United States
AM and BWM dyes	unspecified	Buchanan 1990, United States
BWM dyes orsallia AM	#lichens by volume fibre by weight #lichens by volume fibre by weight	Casselman 1986-1994 Canada
cudbear AM	no ratio given weight/volume unspecified	Grierson 1986 Scotland
orselj (tuchlav) AM BWM dyes	3:1 by weight 4:1 and 2:1 by weight	Sandberg and Sisefsky 1980

* Brough devised "AFM & BWM". Fred Gerber suggested eliminating "fermentation" from my description of the orsallia method. The vat process to develop orcinol (Richardson 1975) is more accurately characterised as "decomposition".

\# 2 cups (0.5 l) of crushed, dry lichen particles (see Methods) weigh approximately 10 - 12 g.

ACKNOWLEDGEMENTS

This is one of a series of articles based on a paper presented on August 31, 1992, at IAL Symposium 2, at Båstad, Sweden. An award from the Mackay Foundation made it possible to present a slide presentation based on this research at CONVERGENCE '94, in Minneapolis.

Karen Diadick Casselman is Research Associate (Lichens) Nova Scotia Museum of Natural History, 1747 Summer Street, Halifax, Nova Scotia, Canada BON 1G0

BIBLIOGRAPHY

1. Alvin, K. 1977. Observer's Book of Lichens. Warne, London.
2. Bancroft, E. 1813. Experimental Researches Concerning Permanent Colours, Vol. 1, 2nd. ed. Cadell & Davies, London.
3. Bærentsen, G. 1987. Liting Vid Skónum. Forlag, Torshavn, Faeroes.
4. Bliss, A. 1981. Dyes From Natural Sources. Scribner's Sons, New York.
5. Bolton, E.M. 1991. Lichens for Vegetable Dyeing. 2nd. ed. Robin & Russ, McMinnville, Oregon; 1st. ed. Studio, London, 1960.
6. Born, W. 1937. Purple. CIBA Review 4, 106-123.
7. Brightman, F. and J. Laundon. 1985. Alternatives to lichen dyes. British Lichen Society, London, n.p.
8. Brunello, F. 1973. The Art of Dyeing. Neri Pozza, Venice.
9. Brough, S. 1988. Navajo lichen dyes. The Lichenologist, 20 (3), 279-290.
10. Brough, S. 1984. Dye characteristics of British Columbia forest lichens. Syesis. BC Provincial Museum, 81-94.
11. Buchanan, R. 1990. Dyes From Nature. Brooklyn Botanic Garden Record, 46 (2).
12. Burnham, D. 1992. Personal communication.
13. Casselman, K. 1994. Lichen dyes relevant to northeastern taxa. Part 1 & 2. Maine Naturalist (in press).
14. Casselman, K. 1993a. Craft Of The Dyer. 2nd ed. Dover, New York; 1st. ed. University of Toronto Press, 1980.
15. Casselman, K. 1993b. Scandinavian dye studies. Part 1 & 2. Ontario Handweavers & Spinners Bulletin, 36 (2) 10-13; 36 (3) 5-7.
16. Casselman, K. 1992a. Dyes: conservation, education, preservation. Nova Scotia Museum Magazine, 13 (1) 13-16.
17. Casselman, K. 1992b. Lichen dye primer, Spin-Off, 16 (1) 34-38.
18. Casselman, K. 1992c. Searching for Eileen Bolton. Journal for Weavers, Spinners & Dyers, 162 (June) 20-23.
19. Casselman, K. 1991. Cemetery lichen dyes. Shuttle, Spindle & Dyepot, 22 (3) 32-33.
20. Casselman, K. 1990. Lichen dyes. Heddle, 6 (4) 6-9.
21. Clow, A. and N. Clow. 1952. The Chemical Revolution. Batchworth, London.
22. Edmonston, T. 1844. Native dyes of the Shetland Islands Transactions of the Edinburgh Botanical Society Vol. 1 123-126.

23. Filson, R. and R. Rogers. 1979. Lichens of South Australia. Government Printing Department, Netley.
24. Forbes, R. 1955. Studies In Ancient Technology. Vol. 6. Brill, Leiden.
25. Fraser, J. 1983. Traditional Scottish Dyes. Canongate.
26. Grierson, S. 1986. Colour Cauldron. Mill Books, Perth.
27. Hale, M. 1979. How To Know The Lichens. Brown, Dubuque, Iowa.
28. H□iland, K. 1983. Laven korkje, Ochrolechia tartarea, som fargeprodusent. Blyttia (41) 17-21.
29. Kok, A. 1966. A short history of orchil dyes. The Lichenologist, 3 (2), 248-272.
30. Laundon, J. 1992. Personal communication.
31. Laundon, J. 1986. Lichens. Shire, Aylesbury, Bucks.
32. Lindsay, W. 1856. Popular History of British Lichens. Lovell & Reeve, London.
33. Llano, G. 1991. Personal communication.
34. Llano, G. 1951. Economic uses of lichens. Annual Report of the Smithsonian Institution 1950, 385-422.
35. Moxham, T. Lichens and perfume manufacture. British Lichen Society Bulletin 47, 1-2.
36. Perkins, P. 1986. Ecology, beauty, profits: trade in lichen-based dyestuffs. Journal Society Dyers & Colourists 102, 221-227.
37. Pittam, S. 1990. Personal communication.
38. Richardson, D. 1990. Lichens and man. In: D. Hawksworth, ed: Frontiers in Mycology. International Mycological Institute, Kew, 187-210.
39. Richardson, D. 1988. Medicinal and other economic aspects of lichens. In: M. Galun, ed: Handbook of Lichenology. Vol. 3. CRC Press, Boca Raton, Florida, 93-108.
40. Richardson, D. 1975. The Vanishing Lichen. David & Charles, Newton Abbot.
41. Robinson, J. 1971. Tyrian purple. Sea Frontiers, 17 (12) 77-82.
42. Sandberg, G. and J. Sisefsky. 1980. Växt Färgning. Norstedt, Stockholm.
43. Smith, A. 1921. Lichens. Cambridge University Press, Cambridge.
44. Starkey, B. 1977. Dyers threaten lichen flora. British lichen Society Bulletin 40. n.p.
45. Taylor, G. and P. Walton Rogers. 1983. Lichen purples. Dyes on Historical and Archaeological Textiles. York Archaeological Trust, York.
46. Walton Rogers, P. 1993. Personal communication.
47. Walton Rogers, P. 1989. Textiles, cordage and raw fibre from Coppergate. Archaeology of York 17, York.
48. Westring, J. 1805. Svenska Lafvarnas Färghistoria.
49. Woodward, C. 1949. Vernacular names for Roccella. Torreya 76, (4) 302-307.