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The role of Scottish native plants in natural dyeing and textiles

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ABSTRACT OF THESIS

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Dyes have traditionally come from a wide variety of Scottish native sources, including flowering plants, clubmosses, and lichens. Many Scottish plant sources produce a range of yellows, greens and browns, but few red and blue. These colours were to a large extent provided by introductions most notably madder, woad and latterly indigo. Several species of lichens, used to obtain purple and red shades, were used in the only documented commercialisation of native plant species for dyeing. Various native species were traditionally used for their mordant (fixative) properties.

Dyes were commonly used from early times. Tartan is believed to have developed as a consequence of the small dye-lots afforded by native plant material, the plaid wearer's locality discernible by colours obtained from local plants. During the 18th century the practice of dyeing with plants became more restricted in range, concentrating within the Highlands and Islands. Consequently most records of traditional uses originate from this area. Despite the introduction of chemical dyestuffs at the end of the 19th century which almost extinguished natural dyeing, traditional dyeing has continued in the Outer Isles to the present day. During the 1970s there was a resurgence of interest in natural dyeing, more typically as a hobby than a commercial activity. Fungal dyeing, a modern day discovery with no discernible tradition, was introduced to Scotland in the early 1990s.

The need for diligence in the collection of wild plants and the disposal of home dyeing effluent is well appreciated by today's dyers. Guidelines and home test kits could be produced to support dyers in their quest to follow good practice. It is likely that additional value add could be provided through support of dye-plant production and the provision of a sustainable-source mark for artefacts using Scottish native plant sources.

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1. Introduction

1.1 Background

A remarkably wide variety of native plant species have been used in Scotland for dyeing, both as the source of dyestuffs themselves, and as mordants, fixatives which assist the adhesion of dyestuffs to material. Dyestuffs and mordants have been obtained from a range of flowering plants (using flowers, leaves, stems, roots and bark), lichens, clubmosses, seaweed and, more recently, fungi.

Dyeing using native plants has been performed in Scotland from very early times. It is likely that the inhabitants of Scotland were familiar with dyes by the time of the Romans; in any case there is a degree of certainty that the Celts, with their love of colour, would have brought over the knowledge of dyeing when they arrived in Scotland in the 5th and 6th centuries. Native species would have been extensively used throughout the country until the advent of imported dyestuffs, which is reported from as early as the 15th century.

The means by which dyeing was performed had already diverged by this time with the emergence of professional dyers in towns. They tended to use natural dyestuffs imported or cultivated within the country, a practice that continued until the introduction of chemical dyes in the latter part of the 19th century. In rural areas the situation was somewhat different although by the end of the 18th century the hitherto widespread practice of dyeing using native plants had become largely restricted to the Highlands and Islands.

Traditionally dyeing using native plants was an aspect of subsistence living, and the art, passed down through the generations, continued in the Outer Isles until the first part of this century when chemical dyes, quicker and easier to use, reduced the levels of native plant dyeing almost to zero. However the resurgence of interest in 'nature' during the 1970s gave rise to a new generation of natural dyers including those craftspeople who choose to use native plant materials. These individuals are now taking the tradition forward, and experiment with a view to rediscovering lost secrets and making new discoveries.

Relatively few native plants have been used in the manufacture of materials. A long time introduction, flax, (*Linum usitatissimum*) historically provided a wide range of articles from clothing to ship sails. This industry was significant until the first half of the 19th century, declining with the introduction of cheaper imports of linen and of cotton. Nettles, *(Urtica dioica*) were also historically employed in Scotland, although to a lesser extent, in the manufacture of linen.

1.2 Aims and Objectives

The initial impetus for this research came from the *Flora Celtica* initiative, led by the Royal Botanic Garden, Edinburgh. This initiative aims to research and publicise the uses of the native flora in Celtic countries and regions, traditional, current and future.

The following set of aims and objectives were identified to provide a focus for the research undertaken for this study :

- Undertake a review of the historic and traditional sources of natural dyes in Scotland, and explore the uses of the dyes thus obtained.
- Perform a review of current day sources of natural dyes in Scotland, and of current day applications.
- Assess the economic contribution of Scottish native plant dyes, both historically and in the present day.
- Assess the environmental impacts of dyeing using native plants, in a historical and present day context.
- Appraise the development of textiles utilising native plant materials.

With a view to producing a report in which the use of native plants for dyeing was fully contextualised in developmental, social and environmental terms, the approach adopted was to research related topics in addition to those directly covering the subject matter.

It was considered necessary to identify all the dyestuffs traditionally and currently employed in the country, and to explore the rationale for and development of substitutions for native plant substances.

In view of the significant social role which dyeing using native plants played, the historical development of dyeing as a practice and industry was traced. For the same reason, a similar approach was employed to establish the social aspects of textile manufacture from Scottish native plants.

In consideration of the environmental consequences of dyeing, the environmental consequences of dyeing using native plants in the past and the present day. were researched, covering the perspectives of over-utilisation of natural resources, pollution and attendant impacts.

1.3 Acknowledgements

The author wishes to acknowledge the invaluable help and guidance received from staff at the Royal Botanic Garden Edinburgh (in particular Sam Bridgewater, Dr. William Milliken, Greg Kenicer, Dr. Brian Coppins and Professor Roy Watling) in informing the content of this research.

Grateful thanks are also due to the talented and enthusiastic individuals, dyers past and present, who took time out from busy schedules to spend time with the author sharing their expertise.

2. Methodology

Broadly speaking, the research for this study took place in two phases. The first phase was concerned with acquiring familiarity with the historical background and current day context of the subject, and building an initial list of contacts for subsequent interview. The second phase established the present day status of dyeing using native plants among past and present practitioners.

The first phase of research consisted largely of secondary research which entailed a broad review of the existing literature. This was carried out in tandem with a small amount of primary research. Contact was made with subject matter specialists at the Royal Botanic Garden Edinburgh and additional details of key interviewees (for example, details of the Secretary of the local Guild of Weavers, Spinners and Dyers) were obtained from personal contacts.

The second phase consisted largely of primary research, contacting interviewees forming a representative sample of the community of present day and ex-dyers. The research was designed to ascertain how the dyers use their plant dyed material, how they learned about natural dyeing, their motivations for practising dyeing with plants, the species they use and where they obtain them. In order to obtain further potential contacts, interviewees were also asked to supply details of others they knew to be using plant dyes.

In view of the disaggregated nature of the practice of natural dyeing, it was not possible to establish the extent and nature of the dyeing population in advance of commencing research. Accordingly, the approach followed was to use the initial contact list to identify suitable potential interviewees among practitioners. This approach was followed iteratively throughout the period of research, with the result that there is an outstanding list of some tens of people who could yet be contacted if time permitted.

2.1 Secondary research

The approach adopted for the literature review was to research those areas of specific relevance to the subject of study. The areas reviewed included historical accounts (covering the practice from the earliest times up to the present day),

historical and present day economic botany, dye chemistry, and the practitioner's perspective on the subject (by means of literature ranging in date from the early 18th century to the present day).

The material reviewed was obtained from a variety of sources, including the Royal Botanical Garden Edinburgh library; the National Library of Scotland; the National Museum of Scotland; the Main and the School of Scottish Studies libraries at the University of Edinburgh; and the Kingussie Folk Museum. Additional material was provided by some of the contacts made during the period of primary research.

The findings from the secondary research are presented in Chapters Three and Five.

2.2 Primary research

The literature review was complemented by primary research conducted with individuals selected on the basis of their knowledge and expertise in the subject of dyeing and textile manufacture using Scottish native plants.

In consideration of the type of information being sought, a variety of interview methods were employed. These included informal or qualitative methods (open-ended conversations and semi-structured interviews) and formal or quantitative methods (structured interactions) (Martin, 1995). Qualitative methods were employed during initial contact with a view to establishing the interviewee's knowledge and experience of the subject. These methods were also applied, in greater depth, during site visits and meetings at a neutral venue. Where it was considered appropriate, further in depth information was sought via quantitative methods, by means of a questionnaire.

Contact was initiated by a direct phone call or visit to the individual concerned. Depending on the information gathered during the course of this interaction, as deemed most appropriate one of the following outcomes resulted :

1. No further action. Sufficient information was obtained during the initial contact.

2. A structured questionnaire was sent to the respondent. See Appendix C. for a copy of the questionnaire sent to those currently dyeing using Scottish native plants. (See below for further details.)

3. A site visit was carried out either at the respondent's home or place of work.

4. A meeting was held at a neutral venue.

The questionnaire was tailored according to the respondent's situation, and variations were devised to cater for categories of respondent other than present day dyer (for example those who had dyed in the past, and those growing dye plants). The questionnaire was devised to leave scope for respondents to answer in their own words. Only one section, designed to solicit the nature of plant dye application, included pre-defined options.

The primary research findings regarding dyestuffs are discussed in Chapters Four and Five. Details of those contacted are provided in Section 4.1.

3. Plant Dyeing in Scotland from Past to Present : A Review

".. constant striving after an ever widening range of dyestuffs .. remaining unimpaired in all the conditions .." (Davenport, 1955)

3.1 Dye terminology

The following list contains terms with which it is helpful to be familiar in order to understand the dyeing process.

(Extracted from Dalby, 1992)

Term	***Description***
Adjective dye	Name given to a dye requiring mordant to fix it to the fibre
Bleeding	The loss of dye which occurs during washing
Dyebath	The liquor resulting from boiling dyestuff in water in the dye pan
Exhaust	After the initial dyeing of fibre has been carried out the left over dyebath is then known as 'exhaust'
Fast	Dyestuff on fibre will remain after washing and exposure to light
Fugitive	Fugitive dye will fade during the washing process or on exposure to light
Level	A term used to describe even dyeing
Mordant	A substance, usually a metal salt, which chemically fixes the dye to the fibre
Over-dyeing	Dyeing one colour on top of another to produce a third colour
Pre-mordanting	Mordanting fibre before dyeing
Scour	Wash fibre to remove dirt and grease
Top dyeing	As over-dyeing
Wetting out	Before dyeing process, wetting fibres by soaking beforehand. A wetting agent is sometime used to speed up the process

3.2 *Dye chemistry*

> *"All dyeing is chemical, in that without chemical action colour can't be permanent." (Davenport, 1955)*

The distinction commonly made between dyes made from plant materials, also referred to as 'natural' dyeing, and manufactured synthetic dyes, referred to as 'chemical' dyeing, is somewhat misleading. Chemistry is fundamental to the dyeing process, regardless of the source of dyestuff used.

The colouring matter responsible for the dye which a plant yields is not necessarily the same pigment which colours the plant itself, although in many cases they are the same. Dye pigments can be grouped according to their chemical structure. These groupings are considered here (Grierson, 1986; Rice and Beebee, 1980).

3.2.1 ANTHRAQUINONE GROUP

All of the major red dyes fall into this group, including the various species of the madder (*Rubia*), bedstraw (*Galium*) and *Dermocybe* genera. Alizarin is the most important pigment in this group.

3.2.2 FLAVONOID GROUP

These are the yellow dyes, which fall into two major categories : the flavones which include weld (*Reseda luteola*); and the flavonols, which include heather (*Calluna vulgaris*).

3.2.3 INDOLE GROUP

The indigo (obtained from several members of the *Indigofera* genus) and woad (*Isatis tinctoria*) dyes are contained in this group.

3.2.4 TANNIN GROUP

Tannins are obtained from tree species, such as oak (*Quercus* spp.) and alder, (*Alnus* spp.) Tannin produces brown and black dyes when used in combination with an iron mordant.

3.2.5 LICHEN ACIDS

The acids associated with dye colouring from lichens can be divided into two groups, those which produce colours in the range yellow to brown (boiling water lichen acids), and those which produce colours in the range purple to red (orchil acids).

In the orchil acid group the colourless acids represent only a precursors of the dye, and must be subject to a process of modification (via maceration in a solution of ammonia) prior to generating the final colour.

3.2.6 ANTHOCYANIN GROUP

These are the flower or plant pigments, closely related to the flavonoids. They are responsible for the actual plant colour, as well as, in some cases, creating dyes.

3.2.7 CINNAMIC ACIDS

Derivatives of this group are found in a wide range of fungi species, including *Gymnopilus* spp., and *Inonotus* spp.

3.2.8 TERPHENYLQUINONES

These acids occur in a range of species of fungi, including *Hydnellum* spp., *Paxillus atromentosus,* and *Hapalopilus* spp.

3.3 Colour Fastness, mordants and alterants

'mordre' - to bite (Fr.); 'mordere' - to bite (Lat.)

3.3.1 SUBSTANTIVE AND FUGITIVE DYES

In order to understand the process of dyeing, it is essential to appreciate what the dyer has historically tried to achieve. The ideal is to obtain dyed material of the desired colour, and for this colour to remain fast despite exposure to light and water (Davenport, 1955). However, the chemical compositions of dyestuffs are such that it may be difficult to achieve dyestuff adherence directly on the material to be dyed, and once dyed, the dyestuff on material may react adversely to light or washing (Dalby, 1985).

There are some natural dyestuffs which adhere well to material without any prior preparation of the material to be dyed, and which remain acceptably light and wash fast. Such dyes are called 'substantive'. Several plant and lichen dyes have this

quality. The dyes from many other species which do not remain fast are called 'fugitive'. It is possible to improve the fastness of fugitive dyes through the use of a chemical fixative, called a mordant. This is discussed in Section 3.3.4. below.

3.3.2 LIGHT FASTNESS

Exposure of dyes to light may result in fading of their colour. Fading can take effect either by lightening the colour (as is the case for most colours of dyes), or by darkening it (in the case of colours produced from tannins) (Tull, 1987).

In the UK fastness testing work started in 1934 when the Society of Dyers and Colourists published detailed instructions for carrying out tests to establish standards of fastness to light of dyestuffs applied to textile fibres. These tests are now recognised by the British Standards Institute (BSI), and are described below (Davenport, 1955).

A light fastness test can be performed by subjecting a sample of dyed material to light for a pre-defined interval, with one part of the sample exposed to the light, the other part covered up and protected from the light. The results between the two parts of the sample are then compared at the end of the interval. Home dyers can perform light fastness tests in the way described by putting the sample under test on a windowsill for a period of around 2 weeks.

The British Standard BSI light fastness ratings use a scale of 1 to 8 :
LF1 - very fugitive
LF4 - can be considered suitable for dyeing purposes
LF6 to LF8 - fast to light. (Dalby, 1992)

3.3.3 WASH FASTNESS

British standard tests for measuring wash fastness of textiles use a scale of 1 to 5 :
WF1 - very poor light fastness. Dye will bleed out.
WF5 - no bleeding takes place. Fast to washing.

The reaction of a particular dye to washing is related to the structure of the dye molecule. Washing is nearly always carried out in alkaline conditions caused by the addition of washing powder. Some dyes are alkaline sensitive, and may change

shade or hue. An example of this is the elderberry (*Sambucus nigra*) which can change from a pinky mauve to green (Dalby, 1992). Appendix D. Illustration 1 shows this effect.

There is much debate about the fastness of natural dyes relative to chemical dyes. Research performed by Grierson, Duff and Sinclair, (1985) demonstrated that the wash fastness of some of the native Scottish dyes (e.g. lichen brown (species not stated), and the red from tin-mordanted lady's bedstraw (*Galium verum*)) was as good as some of the currently available synthetic levelling acid dyes on wool. It was found to be difficult, however, with natural dyes to combine good fastness to washing with good fastness to light. The conclusions were reached that the light fastness of the dyes from native plants (of which the water lily (*Nymphea alba*) was the best, and the lichen purples worst) are probably on the whole lower than the modern synthetic dyes.

Hue	*Species & mordant used*	*Wash fastness*	*Light fastness*
Yellow	Heather tips (alum)	2	1 - 2
Red	Lady's bedstraw roots (tin)	4	5
Red / purple	Lichen purple	2 - 3	<1
Blue	Privet berries (alum / iron)	2 - 3	3
Green	Foxglove (alum / iron)	2	6
Brown	Crottle lichen	4 -5	4
Black	Water lily (iron)	3	7

Table 1. Fastness of native plant species

Source: Grierson et al, (1985).

3.3.4 MORDANTS

In order to attain greater levels of fastness, most natural dyestuffs require to be treated with a chemical fixative called a mordant. The existence of mordants has been known of since Egyptian times (Thompson, 1974), and in Scotland mordants obtained from plant materials or the earth (i.e. minerals) were used in locations where it was difficult (or too costly) to obtain mineral preparations. See Section 3.11 for details of traditional plant and mineral mordants.

Mordants can be applied at various stages during the dyeing process - either before the material is dyed, alongside the dyestuff material in the dye-bath, or applied

towards the end of the dyeing process in an afterbath. The choice of mordant(s) used can have a significant effect on resultant colour. The mordants which have been employed by present day hand dyers include alum, iron, copper, iron, chrome, tin, and, for vegetable fibres, tannic acid.

Before the chemical process of mordanting was fully understood, it appears that mordant proportions which had been found to be effective were recommended by those writing books earlier on in the century on the subject (Mairet, 1938; Thurstan, 1939). No consideration appears to have been given as to how much of the mordant would remain in the dye bath after the process or the attendant environmental impacts. Some latter day exponents of the art (e.g. Fraser, 1983) repeated the proportions and mordanting recipes provided in these earlier works, while others appear to have experimented and to have come up with more modest proportions (Dalby, 1985; Dean, 1996). The more toxic mordants, tin and chrome which were commonly used in the past are no longer in fashion, as awareness has grown of their effects on the environment and health.

3.3.4.1 ALUM

Also known as Potassium aluminium sulphate.

This substance has had a long history of usage in Scotland, with documentary evidence of imports as early as 1491 (Dunbar, 1962). It is the mordant most commonly used by present day dyers, being used to pre-mordant yarn prior to dyeing. Cream of Tartar added to an alum mordant helps to brighten colours (Mairet, 1938) and to increase the amount of alum fixed to the wool during the mordanting process (Dalby, 1985).

Alum is not poisonous, and is recommended as the only mordant to use when children are carrying out dyeing. It is recommended that the exhaust bath be diluted with water prior to draining away. (Dean, 1999)

3.3.4.2 IRON

Also known as Ferrous sulphate; previously known as copperas or green vitriol.

This is one of the oldest known mordants (Thompson, 1969). It is more usually added as an afterbath to 'sadden' i.e. darken, dull or 'green' colours (Mairet, 1938, Thurstan, 1939), although it can also be used as a pre-mordant for black dyes (Grierson, 1986). Iron has to be applied carefully, as it can stain, harden (Mairet, 1938) or rot (Dalby, 1985) the material being dyed; Cream of Tartar (15%) can be added to reduce these adverse effects.

3.3.4.3 COPPER

Also known as Copper sulphate. Previously known as verdigris, blue vitriol, blue copperas or bluestone.

This mordant can be used as a pre-mordant or afterbath (Mairet, 1938) to a yellow dye-bath to create a bright, colourfast green (Tull, 1987). It should be used sparingly as it can rot wool. (Fraser, 1983). In order to increase the uptake of the chemicals, it is recommended (Dalby, 1985) that 2% concentrated acetic acid be added to a bath with 2% copper.

3.3.4.4 CHROME

Also known as Potassium dichromate, Bichromate of Potash.

This mordant came into use relatively recently, with an introduction during the latter half of the 19th century. It has the effect of leaving wool soft and silky to the touch (Mairet, 1938). The addition of formic acid (2%), a common industrial practice, helps to increase the uptake of the chemicals by the dyed material (Dalby, 1985).

Chrome is a toxic substance which is an irritant to around 5% of the population (Dalby, 1985). Consequently present day dyers are moving away from using it and it is not mentioned at all in a recent publication on dyeing (Dean, 1999).

3.3.4.5 TIN

Also known as Stannous chloride, tin crystals, muriate of tin, tin salts.

This modifier is used to provide brighter, clearer and faster colours than other mordants (Mairet, 1938). It can be used as a pre-dyeing mordant, or more commonly

as an afterbath (at 8%). It is recommended that oxalic acid or Cream of Tartar (7%) be added to the solution in order to prevent superficial fixing (Dalby, 1985).

This substance is also toxic, and present day dyers are tending to use it less frequently than they did in the past. It is not mentioned at all in a recent publication on dyeing (Dean, 1999).

3.3.4.6 TANNIC ACID

It is acknowledged that the dyeing of vegetable fibres such as cotton or linen is more complex than that of animal fibres, although, unlike wool for instance, vegetable fibres can be boiled without harm. In order to prepare material made from vegetable fibres, it is necessary to pre-treat the material with a tannic acid, which makes it more receptive to subsequent treatment with mordants previously mentioned. Tannic acid is available as a mineral, or in the form of oak galls (*Quercus* spp.), sumac (*Rhus* spp.), cutch (*Acacia* spp.) and some barks. Some tannic acid sources (e.g. barks) may also be the source of dye. (Dalby, 1992).

A form of black (iron black) can be obtained by adding iron to cloth which has been treated with tannic acid (Dalby, 1992).

3.3.4.7 ADDITIVES AND MODIFIERS

Mordants are used in afterbaths to modify or enhance the resultant end colour. Other forms of modifiers or additives used in dyeing include :

- Ammonia, in the form of washing soda, which deepens or intensifies colours, lightens colours (Ross, 1974). or (in some instances) changes colours (Bolton, 1960). It is also used to release the dyes from the bracket fungus *Hapilopilus nidulans.* (Scottish Fungi Group, pers comm) ;
- Acetic acid, which can be used to neutralise alkaline water, or as a solvent for colouring matter (Fraser, 1983) ;
- Berries (e.g. Rowan berries), which bring out bright colours in material which has been dyed with madder or cochineal (Fraser, 1983) ;
- Citric acid, which can be added to some dye baths to modify (Wilkes, pers comm) or fix the colour (Dean, 1996) ;

Illustration 2 in Appendix D. shows a range of colours obtained from madder using different mordants and alterants.

3.4 The dyeing process

In order to carry out the dyeing, the following process should be followed :

- The dyer requires access to a water source with neutral pH - rainwater is cited by various sources as being ideal for this purpose, as water which is acid or alkali will affect the colours obtained.
- Scour (clean) the material to be dyed, and pre-mordant if necessary.
- Wet out the material to be dyed.
- Dyestuffs can either be fresh, or prepared. Many plant dye materials are best used fresh. Lichens and fungi, if carefully dried, can be used at a later date without any appreciable impairment to the colour obtained. Although proportions vary, fresh dyestuff materials are generally used in the same proportion as the material to be dyed Some plant and lichen dyes (for example woad, and orchil) require to go through a period of fermentation prior to usage (Shaw, 1955; Bolton, 1960).
- Ideally, dyeing is carried out in a location separate from the kitchen. Some practitioners do this in the open air, over a fire, some have separate dyeing facilities, and others carry it out in the kitchen. It is important to keep pans and other implements used for dyeing separate from those used for cooking. Unless specific effects are required from the pan (for example from an iron or aluminium pot), it is recommended that a stainless steel be used. Using an iron pot does not appear to affect the colour outcome appreciably if the pan is kept free from rust.
- The dyeing process followed varies depending on the dyestuffs being used, the material which is to be dyed, and whether the boiling water, solar (cold) dyeing or vat methods (for indigo and orchil producing lichens) are being used. Typically the dyeing process using berries or other plant parts requires a relatively short period of boiling (e.g. 15 - 30 minutes for brambles); while any recipe using the boiling water method for lichens or bark will take several hours. Dyeing by the solar method may take up to several weeks, as may the vat process.
- The colour of the dyed material can be altered using one of the modifiers mentioned above; or the material can be overdyed by another dyestuff - for example, indigo is commonly used as an overdye on yellow to produce greens.

- The dyed material is rinsed out in cold water, and hung up to dry.

3.5 The colours obtained from flora

> *"The natural dyer only requires sources of a few basic colours .. the most important are red, blue and yellow .." Dean, (1996).*

Using the modification techniques described above, the native plants, lichens and fungi of Scotland are capable of producing a wide range of colours. The types of colours obtained are listed in Appendices A. and B. The native plants provide for a wealth of yellows, browns and greens. The number of species which produce red is rather limited (to the *Galium* genus, and to a couple of members of the fungal *Cortinarius* genus). Although there are occasional reports in the literature of blue being produced by native species such as *Vaccinium myrtillus* (Gladstone,1981), historical references point to the use of woad from early times, and latterly indigo being used to produce a fast form of that colour (Ross, 1974).

Colours obtained from naturally occurring species can vary from location to location, the resultant dyestuff being dependent on the conditions in which the plant has grown such as the local geology, the plant's exposure to sun-light, and seasonal weather conditions (Dunbar, 1962; Fraser, 1983). There is evidence that colour producing substances appear to accumulate in strong sunshine (Kok, 1966), which is possibly one reason why there is a long tradition of importing dyestuffs into Scotland.

Colours can be obtained from a variety of plant parts, depending on the species used, for example leaves (e.g. *Betula nana* for a bright yellow), flower tips (e.g. *Calluna vulgaris*, to obtain yellow); flowers (e.g. *Filipendula ulmaria* to produce yellow), fruit (e.g. berries from *Vaccinium myrtillus*, a shade of violet), bark (e.g. *Alnus glutinosa* with iron to produce black), roots (e.g. *Galium verum* to obtain red); fungi caps (e.g. *Cortinarius semisangineus*), or the whole plant (e.g. *Senecio jacobaea* to produce mustard shades).

There is a long tradition of using imported plants and dyestuffs to improve the palette of colours available to the dyer. Appendix C. Illustration 3. shows the range of colours which can be obtained from a selection of native plant and imported dyestuff materials.

3.6 *The early history of natural dyeing*

Natural dyeing has its roots in antiquity. As early as 3000 BC the Chinese are reported to have been carrying out dyeing workshops (Tull, 1987), while around the same time mummies were being buried in cloths mordanted with alum and iron in Egypt (Thompson, 1969).

Caesar, on invading Britain reports that the inhabitants painted themselves a form of war paint which could have been woad. Many authors surmise that the name Pict derived from the Latin for 'painted ones', *Picti*, given to the Britons at this time (e.g. Pennant, 1774; Sowerby and Johnson, 1862).

It may be reasonable to assume that the Britons' neighbours to the north and west were also users of dyestuffs by that period. Early documentation of dyestuff usage in Ireland is to be found in the 11th century Senchus Mor (Thompson, 1969). This refers to a '*glaisin*' dye, which may have been green, or may have been blue, possibly being related to the Gaelic word '*glas*' meaning blue.

3.7 *Clothing*

Due to a lack of documentary evidence, there is considerable uncertainty about the exact form of clothing worn by Scottish Highlanders until around the 16th century. What is known is that the Celtic peoples were traditionally fond of bright colours, and that a form of tartan was in use by Continental Celts 2000 years ago (McLintock, 1949; Scarlett, 1994).

SAFFRON SHIRT

The first piece of clothing in the Highlands to be extensively documented is the so-called Saffron shirt (or '*Leine*' in Gaelic). Reputedly introduced from Ireland, this appears to have resembled a shirt or smock (often described as being hooded), and was worn to the knees by men, long by women. It and appears to have been worn in conjunction a plaid-type garment, known in Gaelic as '*Brat*'. The '*Brat*' has been referred to as being variegated and multi-coloured, but there is no indication of the colours used. It is possible that this clothing already in use by the end of the 11th century, but certainly by the 16th century there are frequent references to it. (McLintock, 1949). It is unlikely that saffron, an expensive ingredient obtained from

the crocus (*Crocus sativus*), would have been commonly used for the dyeing of this linen shirt, but rather that the colour would have been obtained from the wealth of native plants which produce yellow dyes (Grierson, 1986). The shirt was worn in combination with a plaid. Wearing of the Saffron shirt appears to have ceased around 1600. Martin, (1716) reports that the Hebridean islanders "have laid it aside about 100 years ago".

3.8 Wool

It is likely that woollen cloth played a major role in the clothing of Scotland from early times in the town and country. Dunbar, (1981) cites documentary evidence of woollen cloth manufacture in Scotland dating from the middle of the 12th century. In 1457 James II passed an Act encouraging the professions of weaver and tailor among the burgesses of towns (Pennant, 1774).

In order to protect the wool manufacturing industry in Scotland, laws were passed in the time of James VI which prohibited the wearing of any cloth manufactured outside the country (Pennant, 1774). It is perhaps reasonable to assume that this included a proscription of foreign dyestuffs. The industry appears to have enjoyed success beyond the border at this time, and in 1614 plaiding and cloth were said to be among the most important of Scottish exports (Gulvin, 1973).

The buoyant state of the woollen cloth manufacture was brought to an end by the passing of Acts in 1641 and 1645 which allowed free import of foreign wool, oil and dyestuffs. Disdaining the coarse home produced material, wealthier Scots turned to finer products imported from England and France. This led to a downturn in the Scottish wool industry, which was replaced as the main textile industry in the course of the 18th century by linen (Gulvin, 1973).

The manner of dress in Scotland developed along different lines in the north and west from the rest of the country. Some indications exist that by the mid 1700s people outside of Southern Scotland were attired in a similar manner to those in Southern Scotland e.g. in Shetland in 1769, "they...are dressed like the people of the South of Scotland, only every man wears a worsted or woollen cap" (Henderson and Dickson, 1994).

3.8.1 TARTAN

"The origins of Highland tartans are obscure to say the least". Mackay, (1976).

The origins of the word tartan are subject to much debate. There is a divide of opinion about whether the name originated from a description of the material used, or the patterns into which the material was woven. Some sources consider that it derives from the French '*tiretaine*', denoting coarse woollen cloth (Mackay, 1976), or light woollen cloth (Scarlett, 1994); others that it derives from the ancient Gaelic '*tuar tan*', meaning district colour (Campbell, 1993). What can be assumed is that the original tartan was likely some combination of the two, the colours used in woollen cloth being derived from locally available plant material. The modern day meaning of the word, denoting a specific pattern ascribed to a particular clan, most likely dates only from around 1820, when tartan started to become fashionable outside the Highlands (Campbell, 1993).

Hand collected dyestuffs, boiled in a pot, were not capable of producing either large dye batches, or being exactly replicated. This might go part way to explaining why checks, in which comparatively small quantities of different colours were used, were so usual from early times (Grant, 1961). Many early specimens of Highland clothing have a background of white or undyed wool of natural colours with lines of dyed wool, and McLintock, (1949) indicates that while it seems reasonable that the mass of clothing would have been made that way, those in a position to do so would have worn plaids of many colours.

Following on from the *Brat* and *Leine*, the distinctiveness of Highland dress continued into the 18th century. Martin, (1716) reports "Many of the people wear Trowis (trews) .. some are colour'd and others striped". He provides a detailed description of the plaid which "consists of divers colours". He observes the wearing of Highland dress throughout the Western Isles, and remarks that the pattern of plaids provides an indication of where the wearer comes from, possibly an indication of district tartans (Scarlett, 1994) : "Every Isle differs from each other in their Fancy of making Plaids, as to the Stripes in Breadth and Colours. This Humour is as different through the main Land of the Highlands insofar that they who have seen those Places, is able at the first view of a Man's Plaid to guess the place of his Residence." He refers to the "ancient Dress wore by the women, and which is yet

wore by some of the vulgar, called Arisad, is a white Plade, having a few small strips of black, blew and red". He provides further comment "but persons of distinction wear the Garb in Fashion in the South of Scotland" (coat, waistcoat and breeches).

Pennant, (1774), reports seeing Highlanders dressed (presumably in contravention of the Dress Act - see below) in the *breachcan feill* (plaid) "The colour of their dress was various .. being dyed with stripes of the most vivid hues; but they sometimes affected the duller colours, such as imitated those of the Heath in which they reposed; probably from a principle of security in time of war."

Prior to the 1745 Jacobite Rebellion, the colours employed in a tartan design would have been dependent on the weaver, and the availability of dyes from roots, leaves, bark and lichens in the locality. There are some indications of tartans being associated with specific clans (Richardson, 1975).

Following the 1745 Jacobite Rebellion, the Dress Act was introduced in 1747 proscribing the wearing of tartan (McLintock, 1949). Several sources conjecture that much knowledge of the traditional tartan patterns, and the sources and recipes of dyestuffs associated with them were lost during the period of proscription (Fraser, 1983; Dunbar, 1962). Naismith sums up the consequences of this period in 1790 as follows - "The law which prohibited the use of partly coloured dress gave a severe blow to this art" (Richardson, 1975).

By the time the Act was repealed in 1783, a wider range of foreign dyestuffs was readily available in Southern Scotland, providing greater strength and simpler application than home produced dyestuffs. This, coupled with the increased industrialisation of tartan manufacture, led to a decline in home weaving and the use of dyes from home grown sources. (Grant, 1961; Dunbar, 1962)

3.8.2 TWEED

Handloom weaving has been an important cottage industry in many parts of Scotland from the 16th century. The division between tartan and tweed began to appear during the course of the 19th century, the essential difference between the two practices resulting from the fact that tartan employs yarn with solid colours,

woven into variegated patterns called setts, whereas tweed is a plain weave using yarn which is blended using several different colours (Mackay, 1976).

The origin of the word 'tweed' is variously described as being due to the mistaken use of the word instead of the usual '*tweel*', which was used to describe the material woven in the traditional 'twill' pattern (Mackay, 1976); or bound up in the romanticism inspired by Sir Walter Scott's writings (Grant, 1961).

The Borders was well established as the main producer of tweed by 1830, using mechanised production methods and imported dyestuffs (Gulvin, 1973).

The manufacture of tweeds in the Highlands stems from the mid 19th century, a period when the populace were particularly beleaguered. They were suffering from the effects of over-population as a result of forced relocation, a series of poor fishing seasons, and the potato famine. In an effort to provide poor relief, various textile-related projects were initiated by the lairds, or more frequently, their wives. Most of these efforts failed when the founders were unable to provide continued supervision, but the initiative started by Lady Dunmore, the wife of the owner of Harris, in 1844 was a notable exception (Grant, 1961).

Lady Dunmore had noticed that the local population had a tradition of producing good quality plaiding, and introduced them to the making of the Murray tartan in the tweed style. She found a ready market among her friends for the material produced by the islanders, and the tweed from Harris soon found popularity among those involved with field sports. Scottish Home Industries was incorporated in 1896 to protect the weavers from unscrupulous buyers. The Harris Tweed Orb mark developed from this initiative in 1909 (Thompson, 1969), protecting only tweed hand woven by the islanders at their own homes ."in the islands of Lewis, Harris, Uist, Barra and their several purtenances" (Harris Tweed Authority, pers comm).

During the 19th century, tweed production made extensive use of naturally coloured wool, and white wool dyed with plant dyes. The colours obtained were orange from ragwort (*Senecio jacobaea*); green from heather (*Calluna vulgaris*) or flag iris (*Iris pseudacoris*); red from corcir (*Ochrolechia tartarea*), yellow from bracken roots (*Pteridium aquilinum*) or peat soot, and a reddish brown from crottle (*Parmelia* spp.)

(Harris Tweed Authority, pers comm). Bog myrtle (*Myrica gale*), which produces a yellow colour, also appears to have been used in the original manufacture of tweed (Manners, 1978). Once woven material was fulled by waulking (pummelling) of the cloth in a solution of soap and lye (in this case stale urine).

From around the start of this century, synthetic dyes began to be increasingly used by Harris Tweed weavers. The traditional mix of indigenous and imported dyestuffs, and naturally coloured wool is well exemplified by a list of St. Kilda tweed colours listed on a Post Card sent from the islands in 1930 (National Museum of Scotland - Scottish Life Archive) : "Indigo fixed by docken roots; Brown pure lichen crotal; Grey natural wool shade; Fixed by vegetable docken root fixing."

Claims that the use of lichen dyes in Harris tweed manufacture is no longer extant (Casselman, 1994), are possibly only premature. Although plant and lichen dyes continue to be employed in Harris Tweed to the present day the number of weavers using them is decreasing. In 1975 six people were reported to have been using lichen dyes (Richardson, 1975). When contacted as part of this study, the Harris Tweed Authority reported that they knew of two tweed weavers using plant dyes, but subsequent contact confirmed that only one of these was in fact doing so. See Section 4.4. for further details.

3.9 Linen

There is a wealth of knowledge and experience of linen manufacture in Scotland. It is debatable whether flax (*Linum usitatissimum*) is naturally indigenous (Lawson, 1852; Mabey, 1977) or an introduction of antiquity (Stace. 1999). However, due to the significant role which it has played in Scotland's past, it is considered here.

3.9.1 LINEN MANUFACTURING PROCESS

Flax produces a bast fibre (forming fibrous bundles or strands in the inner bark of the stems), from which linen is manufactured. The manufacture of linen is a several stage process : (Dalby, 1992)

- Retting, a fermentation process, which rots the unwanted inner woody core. This takes several weeks (Mabey, 1977);

- Breaking and scutching, in which the retted flax is passed through fluted rollers to break the woody core into pieces, without damaging the textile fibres running through the stem;
- Hacking which is carried out to separate the fibres from each other. The fibres are hackled (combed) through successively finer combs.

3.9.2 THE HISTORY OF LINEN

The antiquity of linen production is demonstrated by a report of a late Bronze age find near Dundee, in which a plug of woven cloth, made from fine flax fibres, was found (Coles Coutes and Ryder, 1964). It is possible that flax was used as extensively in Scotland as it was in England, where, describing its use in the manufacture of fish nets, sails, ropes, sacks, sheets and shirts, Bartholomaeus Anglicus wrote in the mid 13th century, "none herbe is so nedefull to so many dyurrse uses to mankynde as is the flexe" (Mabey, 1977). It is generally assumed that the Saffron shirt, previously referred to, was manufactured from linen (McLintock, 1949).

Whatever the level of production beforehand, increased use of home produced linen was encouraged by the 1686 Act which demanded that "no corpse of any person whatsoever be buried in any shirt, sheet, or anything else except in plain linen, the cost not exceeding 20/- (£1) Scottish ell" (Ross, 1974), "for encouragement of manufactories within this kingdom, and prevention of the exportation of the moneys thereof" (Scottish Parliament, 1686). Around this time, the growing and processing of flax became widespread throughout Scotland. The weaving of linen became increasingly important, and by the late 17th century was Scotland's most important export. After the Union in 1707, its growth was further encouraged by free trade with England, export bounties and the new Board of Manufacturers (National Museum of Scotland, Scottish Life Archive, Anon.).

Writing in 1767 J. Robertson describes experiments made in Caithness showing that flax would grow well there, and he takes the liberty of suggesting its cultivation there as an improvement measure (Henderson et al, 1994). Various sources from about this time, suggest that linen manufacture was introduced in various places throughout the country to provide a measure of poor relief in rural districts.

On his travels, Pennant (1774), makes references to linen manufacture throughout the country, with lint mills ranging in location from the Lothians to Caithness on the East coast, and from Dumfriesshire to Renfrewshire in the West. The wider spread growing of flax throughout the country, including the Inner Hebrides, would suggest that elsewhere linen was manufactured by hand. He is uncertain about when linen manufacture commenced, but states "there could not be a great call for the commodity a century and a half ago, when people of fashion scarcely changed their shirts above once a week in England". At the time of his writing, linen manufacture was booming, and he quotes figures which demonstrate a rapid rate of expansion during the course of the 18th century.

With the introduction of cheaper linen substitutes from Ireland and elsewhere, and the cotton imports from the U.S.A, Scottish linen manufacture went into a period of decline during the first half of the 19th century. Writing in 1895, Ross reports that "(growing of lint) came to an end some thirty to forty years ago, and, except as an experiment, it is never now grown." (Ross, 1974).

In the more recent past, the cultivation of flax was re-introduced in Scotland during the First and Second World Wars. Processing factories established were established in Turriff, Blairgowrie and Cupar during World War II (Livingstone, 1952).

3.9.3 NETTLES

Documentation of the manufacture of linen from nettles (*Urtica dioica*), another producer of bast fibres (Dalby, 1992), is much more scarce than that for flax. Given that it was more difficult to extract than flax (reported by C. A. Johnson in 1862), that its cultivation requires deep rich soil (Sowerby et al, 1862) and that it has much shorter fibres than flax (Mabey, 1977), it is possible that it was only manufactured occasionally as Henslow suggests, as a substitute for flax (Henslow, 1905). Therefore, on the basis of evidence surveyed, it is not possible to ascertain the historical extent of its usage.

Wilkinson, (1858) quotes the poet Campbell writing in "Letters from the South", "In Scotland I have eaten nettles, I have slept in nettle sheets and have dined off a nettle table cloth. The stalks of the old nettle are as good as flax for making cloth. I have heard my mother say, that she thought nettle cloth more durable than any other

species of linen". She also provides a report from the Dundee Advertiser "I enclose a small piece of cloth, a bit of the flag of the Tailor Incorporation, Arbroath, made in 1670, as recorded in the minute book of the craft, from the common nettle. The cloth, you will notice, is very fragile - a mere rag in fact - but this may be accounted for by age and exposure to the weather when the worthy craft celebrated gala days by processions &c".

Urtica dioica is reported "as affording a large proportion of fibre which has not only been made into ropes and cordage, but also into sewing thread and beautiful white linen-like cloth of very superior quality." (Lawson, 1852). Lawson goes on to report that there are no indications that it was ever cultivated in Scotland for the purpose of textile manufacture, although Mabey, (1977) indicates that nettle cloth is still manufactured in northern Europe, and that plants are cultivated for this purpose in some areas. He also reports that the Germans made extensive use of nettles during the First World War to make military clothing, employing something in the region of 2½ million kg of plant material. Around 40kg is required to make one shirt.

3.9.4 OTHER SPECIES

Several other native species are capable of yielding fibre which could be used in the manufacture of cloth including Common broom (*Cytisus scoparius*) (endorsed by Lightfoot, 1777 and Henslow, 1905), and marram (*Ammophila arenaria*) (Lawson, 1852). Both Lawson and Henslow suggest that members of the mallow family (*Malva* spp.) also yield excellent fibres, although too little for commercial production.

The introduced species *Cannabis sativa*, hemp, cultivated to a considerable extent in the South of England, is capable of being grown in warmer and more sheltered districts in Scotland (Lawson, 1852). Accounts exist of hemp being grown and manufactured in various locations in Scotland, including Farr in Caithness where it is reported as being used for herring nets (New Statistical Account, 1845), and Cromarty, where its utilisation for coarse cloth was reported by Wight in 1784.

3.10 Dyestuffs

> *"Each devotee of natural dyeing has her own secret. I reckon that, if all the secret processes were written down, they would make a book about the size of a family bible". Carmichael, (1974).*

"(Natural dyestuffs) have warmth, a lustre and delicacy of shading that appeals to the connoisseur of colour". Edlin, (1949)

3.10.1 NATIVE PLANTS

While it can be assumed that native plants, along with some ancient introductions such as madder (*Rubia tinctorum*) and woad (*Isatis tinctoria*), were employed at one time throughout the whole of Scotland, it appears that the use of native plant materials, collected from the wild, had decreased markedly in the southern part of the country by the 16th century. References from the southern part of the country indicate the establishment of dyeing as a profession, which was performed in towns by dyers utilising comparatively large volumes of imported or cultivated dyestuffs (Dunbar, 1962; Craigie and Aitken, 1963).

This leaves the practice of collection and use of native plants and lichens in the main to the inhabitants of the Highlands and Islands. As Kok writes "The dyes employed by the Highland women, with the exception of some obtained from lichens, were never capable of being adapted for commercial purposes, and this is perhaps one of the reasons there is little authoritative information about them" (Dunbar, 1962).

For the purposes of this study a wide ranging review was performed to obtain as comprehensive as possible a list of the species traditionally used in Scotland for dyeing. It is acknowledged that this review could be more comprehensive, were time available. The results are summarised in Appendices A.1., which covers the native flora employed, and Appendix A.2. which completes the picture, by listing the species which were introduced or naturalised in Scotland.

For the purposes of this study, published instances of dyeing results have been reported as they appear in the references, without verification. Dates of publication of the references used range from 1774 (Pennant) to 1986 (Grierson). Selection of species for inclusion has been based on the assumption that the majority of the Scottish flora would historically have been tried out for dye producing qualities. Accordingly, where a reported species has been determined to be native to Scotland, or a likely introduction to the country, it has been listed, although the

reference for its use as a dye plant may refer to another country. Such references are clearly indicated in Appendix A.1.

It is highly possible that the list of species provided in Appendices A.1. and A.2. is far from complete, given the amount of knowledge which appears to have been lost over the passage of time. In 1841, Edmonstone indicated that some beautiful dyes which had been known in the past, derived from different types of heather and many other species, especially among the *Rubiaceae* and *Rosaceae* were now lost (Edmonstone, 1841).

Many of the recipes reported are incomplete, and some appear to be contradictory of others. There is also evidence that some authors have copied recipes from previous publications verbatim. Dunbar, (1962) identifies the problem faced by those undertaking the compilation of dye plant colours thus : "Many factors contribute to the difficulty of neatly tabulating plant and mineral dyes, including the nature of the fibre to be dyed, the 'hand' or temperament of the dyer, and even the material of the dye vessel". Faced with this situation while researching for her book, Grierson, undertook the task of trying to replicate each of the traditional recipes which she lists. The findings have been reported in press (Grierson, 1986).

There are too many species listed to be able to discuss them individually in the text, but some points of interest are covered here. Some additional comments are furnished in the Appendix text.

Archaeological findings from medieval Perth found the remains of several plant and pteridophyte species in an assemblage which strongly suggests their use in dyeing (Page, 1982). Shoot fragments of *Diphasiastrum alpinum* (Alpine clubmoss) and *Lycopodium clavatum* (Stag's horn clubmoss) were found alongside the remains of several dye plants including *Calluna vulgaris*, heather, as shoot tips and flowers, *Reseda luteola*, weld, bark slivers of *Betula* sp., birch, *Potentilla erecta*, tormentil seeds, and *Pteridium aquilinum*, bracken, as frond fragments.

Galium verum, Ladies bedstraw, is frequently mentioned for the quality of the red dye which can be obtained from its roots. A relation of the much used madder (*Rubia tinctorum*), this is reported to produce dye of as good as, or even superior to that of

its relation, madder (*Rubia tinctorum*). Lawson, (1852) reports that the roots of other plants of the *Galium* genus, *G. mollugo* (Hedge bedstraw), *G. odoratum* (Woodruff), and *G. boreale* (Northern bedstraw) possess the same qualities as *G. verum*, although in lesser quantity.

Iris pseudacorus, yellow iris, is frequently mentioned for the black dye obtained from its roots when treated with mordants such as bog iron or copperas. *Alnus glutinosa* is reported by many for its black dye, obtained using similar methods.

Yellow dyes can be obtained from many of the species listed. The quality of the dye obtained from the leaves of *Betula nana*, the dwarf birch rates special mention from several respondents.

CULTIVATION

It is possible that some species of native plants could have been cultivated on a vegetable garden scale with a view to employing them for dyeing, but the records of this and of full scale cultivation are very sparse. Lightfoot, (1777), reports the cultivation, and extensive use of *Reseda luteola* as a dye plant, and its appearance in waste places in Fife and the Lothians. Lawson, (1852) noting the decrease in extent of cultivation of the species, observes that it yields the best dye when it is not grown to a large size.

Illustrations 4, and 5 in Appendix D. show a few of the native species commonly used in dyeing.

3.10.2 NATIVE LICHENS

Lichens traditionally used in Scotland for dyeing fall into two categories according to the method of obtaining the dye; the ammonia method, producing orchil-type dyes, and the boiling water method.

ORCHIL DYES

Orchil dyes are obtained by fermenting the lichen with ammonia, water and oxygen in a warm atmosphere, the period of fermentation lasting between three and four weeks. The traditional source of ammonia was stale urine, the use of which for this purpose continued until the recent past in the Highlands. (MacDonald, 1982). The

fermented liquid was either used immediately for dyeing (Martin, 1716), or thickened using chalk or lime, and formed into balls or cakes, which could be stored for long periods. When needed these dried dyestuffs were powdered and boiled with some alum prior to dyeing taking place (Fraser, 1983).

The use of lichens as an orchil dye source can be traced back into antiquity, to the time of the Phoenicians around 1500 BC (Casselmann, 1994). The purple dye, called orchil, obtained in these times was obtained from the lichen *Rocella tinctoria* and *Rocella fuciformis* which grow on rocks around the Mediterranean coast (Richardson, 1975, Bolton, 1960). The use of various species of shellfish for the manufacture of the regal Tyrian purple dye was similarly discovered in ancient times. It appears that the two types of dye were often used in conjunction, the cloth treated with the expensive Tyrian dye being first coloured with orchil dyes (Bolton, 1960). Orchil was also used to imitate the Tyrian dyes (Kok, 1966). The name orchil developed to mean any dye produced using the ammonia method.

The trade in orchil dyes appears to have remained significant until the decline in Roman trade in the Mediterranean. These dyes only reappear as an article of commerce in Europe in recordings from Florence during the early 14th century, with a likely re-introduction into England some time later. The English orchil trade initially developed using *Rocella* lichens imported from Africa, the Canary Islands and Cape Verde (Bolton, 1960). Later the use of *Rocella* species was replaced by *Umbelicaria pustulata* (Rock tripe) from Scandinavia, *Parmelia perlata* from the Canaries and quantities of indigenous British lichens including *Ochrolechia tartarea* and *Ochrolechia parella* (Bolton, 1960).

Orchil dyes impart a beautiful colour to cloth when first applied, possibly even surpassing that of Tyrian purple, but these dyes are fugitive, and with prolonged exposure to light they fade, turning a brown colour (Richardson, 1975).

It is possible that orchil dyes had a much earlier introduction in the Celtic lands, and that it was used from early times in Scotland. As Kok points out, the opportunity was certainly there, given the profusion of orchil-yielding lichens in the country (Kok, 1966). The export in the 14th century of lacmus, a red lichen dye, from Norway is well documented (Kok, 1966).

Indigenous orchil dyes are well documented from around the 16th century in Scotland, where the material is variously referred to under a variety of names including *orchard*, *orcheard*, *orchert*, or *orchat*, in reference to the type of dye produced, or *corcir-lit*, *corcolet*, *corkar litt*, or *korkalett* in reference to the type of lichens (variously referred to as *cork*, *arkill*; *corcir*, *korkir*) used in its production (Grierson, 1986).

Corcur was widely utilised in rural Scotland. Martin, (1716) reports its use in the production of a crimson colour. He reports that the process for obtaining the dye is steeping the dried lichen, ground to powder, in an air-tight container in urine for up to three weeks, followed by boiling with the yarn. A report from 1774 describes the process followed by the people of Foula in the production of balls of '*corcolet*'. That the manufacture of dyes from these lichens was not confined to the Highlands is confirmed by the report from Galloway that "In Monnygaffe there is ane excrescence ... which the country people make up into balls.. which they call they call cork-lit" (Craigie et al, 1963). Lightfoot, (1777) reports that the people of Taymouth export great quantities of corcur (*Lichen omphalodes*) (sic) for the use of dyers at a shilling or sixteen pence per stone (equivalent to 8p to 11p per 10kg). If, as is likely, he refers to the extraction of lichens for the Cudbear industry extant in Edinburgh at that time (see Section 3.10.3), he apparently misidentifies the lichen as *Parmelia omphalodes*, a species of boiling water lichen.

Lightfoot, (1777) considered the commercial potential of the lichens identified during his journeys, and was moved to write of one particular species (most probably *Ramalina siliquosa*) " .. (it) promises, in that intention to rival the famous *Lichen Rocella*, or *Argol*, which is brought from the Canary Islands, and sometimes sold at the price of £80 sterling per ton".

The previously mentioned fugitive nature of the dye led to it being called a 'false' dye, and there are examples of unscrupulous dyers using it in preference to more expensive, permanent dyes (Richardson, 1975). Packer, (1816) provides an example of how orchil was employed, noting that '*archil*' added to grape madder yielded a maroon colour. Kok, (1966) notes the discovery in France of a method of producing fast orchil purple and mauve dyes, made under the name 'French Purple',

in 1856. Surprisingly, this preparation does not appear to have been developed to any extent.

Some of the orchil producing dyes are natural pH indicators, the most well known being *Rocella montagnei*, which is used in the production of litmus paper (Fraser, 1983).

BOILING WATER LICHENS

Boiling water lichens do not require to be macerated in the same way as orchil-producing lichens, and produce their dye by boiling alongside the fleece (Bolton, 1960). Although it is asserted that the use of this lichen group developed later than the orchil-producing group, it is likely, in view of their simple application, and their substantive properties that these lichens were also employed in dyeing from early times.

The boiling method dyes were traditionally used to produce brown to red dyes. The name used for the lichens which are most commonly used to produce this dye (*Parmelia saxatilis* and *Parmelia omphalodes*) is crottle (Gaelic '*crotal*'). The word "crottle" is commonly used erroneously, both by those in the areas where it was a frequently employed dyestuff, and by some authors, to mean any lichen.

Other names traditionally used for crottle include (from Shetland) *skrottyie*, eloquently employed as follows : "A bliu kot an weskit oot o' da litt, and a pere o'skrottee breeks" (Grant and Murison, 1965). Martin, (1716) reports on seeing 'crostil', a dark scurf, which dyes a philamot colour.

The traditional method of crottle collection continues until the present day, although the level of present day activity in this area is only a small fraction of its one time extent. An evocative recollection from his childhood days is provided by MacDonald, (1982) : "The desultory scrape of the crotal spoons had etched itself on the memory. Finding a 'good rock' would be confirmed by the long peeling scratch of the spoon as a blister was eased off the stone." He also recalls that breaks were not determined by time, but by the amount of crottle which had been collected - "the half sack break".

Crottle was believed by the islanders to have both good and malignant properties. Wearing crottle dyed stockings was supposed to prevent the wearer's feet from becoming inflamed on long journeys (Thompson, 1969). Various sayings provide testimony of the strong superstition among sailors that they would come to harm at sea if they wore anything dyed with the lichen. "Anyone wearing crottle dyed garment sinks like a stone". "What comes from the rocks returns to the rocks" (Goodrich Freer, 1902). Bennett reports the belief that if a person drowned wearing crotal their body would never be recovered. (Pankhurst and Mullin, 1991)

An insight into the low esteem in which town dwellers held the use of lichens for dyeing is provided by a mocking little poem reported by Goodrich Freer, (1902) :

"'Tis not the indigo of Edinburgh
That would be for clothing to these kites
But lichen gathered by finger nails
Scratched off the rocks".

The value of lichens to the islanders was nevertheless manifest, its worth to them well summarised in an epithet from MacCodrum "Cattle on the hills and Gold on the stones" (Petch, 1984).

See Appendix D. Illustration 7 for a selection of lichen species traditionally used in dyeing, along with the colours obtained from them. Illustration 8 shows a fleece, dyed in the traditional manner using *Parmelia saxatilis.*

3.10.3 CUDBEAR

It is possible to regard Orchil as the English, Cudbear as the Scottish, and Litmus as the Dutch name for the local preparations of the same type of dyestuff (Lindsay, 1856). Fraser, (1983) reports that a purple colour is obtained from the Cudbear preparation, while acid modification results in a reddening, and alkaline modification results in the dye turning violet.

The manufacture in Scotland of 'Cudbear' a dyestuff prepared from orchil producing lichens, started in Edinburgh in 1758. While mending a dye-house boiler, George Gordon, a coppersmith from Banffshire, noticed the similarity between the orchil

dyes being produced there and those produced domestically in Scotland. His brother Cuthbert, a merchant from Leith, was already producing a purple dye from a "species of moss" he had discovered. In 1758 Cuthbert Gordon applied for a patent on a lichen dye called 'Cudbear' (Kok, 1966; Richardson, 1975), the name being derived from his Christian name (Gordon, 1785).

The chief ingredient used in the manufacture of Cudbear was *Ochrolechia tartarea* (Cudbear lichen); other ingredients used including *Lecanora calcarea* and *Cladonia pyxidata* (Cup lichen) (Kok, 1966; Richardson, 1975). The inclusion of *C. pyxidata* has since been disputed by Grierson, (1986) and it is possible that a similar species, *C. coccifera*, may have been used in its place. Other ingredients included "spirit of urine", "spirit of soot" and quicklime (Kok, 1966).

The Gordon brothers commenced Cudbear manufacturing operation in partnership with Messrs William Alexander and Co. at Leith. The business lasted there until 1778, when the Edinburgh operation failed. Production moved to Glasgow under the management of George MacIntosh, where another of Cuthbert Gordon's brothers was a partner. This venture proved to be successful, and the Glasgow operation continued until 1852. This success seems to be attributable to a number of factors, including the scientific production methods employed. Measures taken to ensure that the production process was kept secret included employing only Gaelic speakers, and surrounding the factory with a high fence (Kok, 1966; Richardson, 1975). These measures were not entirely successful however, as several companies in England were producing a cudbear type of product by 1785 (Gordon, 1785).

It appears that Cuthbert Gordon continued the quest for new products using native lichens after the failure of the Edinburgh operation. He "determined to dedicate his whole time, and the remainder of his fortune, to an investigation of the powers of the common indigenous plants in the production of colours". This move was endorsed by several users of Cudbear, including a couple in Paisley, who noted that its addition to an indigo dyevat produced colours "equally deep and much more beautiful (with) a finer lustre" (Gordon, 1785).

During the period of Cudbear production in Scotland, around 250 tons of lichen were used annually (Richardson, 1975). Initially the lichen was collected in the Highlands

and Islands by collectors working with iron hoops (Sowerby, 1862). The collectors earned around 3s 2d per 22lb. - possibly earning up to £3 10s per week - a substantial sum for the time. The volume of lichen extraction required to fulfil demand was such that sources in Scotland became rapidly exhausted, and subsequently supplies were imported from Norway, Sweden, the Canary Islands and Malta (Richardson, 1975).

The MacIntosh Cudbear works continued in operation until 1852. By 1867 the orchil manufacturers in London had absorbed the Cudbear industry and the two dyestuffs became analogous (Kok, 1966). Looking to Cudbear as the type of industry which could be revived in Scotland to help relieve the rural poor, in the 1840s and 1850s Dr. Lindsay carried out research into the commercial use of lichens in dye manufacture. This did not meet with success possibly due to the discovery of chemical dyestuffs around that time (Dunbar, 1962) or the logistical difficulties involved in obtaining them, and the resulting dyes' lack of permanency (Sowerby et al, 1862).

Small amounts of the material continued to be manufactured in England until recent times. Thurstan, (1939) reports the availability of Cudbear as a preparation, available for 1s 10d per lb (equivalent to 20p per kg.).

3.10.4 FUNGI

There does not appear to be any tradition of dyeing in Scotland using dyes obtained from fungi, although it appears that they were historically employed in scattered locations elsewhere in the world. Coppins and Watling, (1995) cite the usage of several species.

Pisolithus arhizus Raus. which produces an orange yellow dye, was employed for the dyeing of silk in Nice, where there was a trade for it with the Canary Islands. (These islands, and the canary, were named after a fungi produced yellow dye (Watling, pers comm)). The juice of *Inonotus hispidus* (Bull.:Fr.) Karst was used in the Middle Ages to dye the wood of finished furniture. *Fomes fomentarius*, the medieval 'tinder box fungus' was also used for dyeing. Other fungi were used by Native Americans and Australian aborigines for skin colouring and decoration.

3.10.5 SEAWEEDS

Few records exist of the use of seaweeds in dyeing in Scotland, but it is highly probable that some species were traditionally used for this purpose. A specific Scottish reference indicates the use of dulse (*Palmaria palmata*) in the Highlands to obtain a red / brown dye (Grierson, 1986). Other dye-yielding species which may have been used in Scotland include *Fucus nodosa* and *Fucus versiculosus* (bladderwracks) which produce brown shades, and *Cladophora rupestris* which produces a greyish green (Grierson, 1986).

3.10.6 IMPORTED AND NATURALISED PLANTS

In Scotland there is a long tradition of the introduction from elsewhere of plants used for dyeing. Some species, for example, *Juglans regia*, walnut, and *Convallaria majalis*, Lily of the Valley, have been reported as being used in dyeing, but it is most unlikely their introduction was primarily due to their dye-giving qualities.

This section considers those species for which there are records of cultivation in Scotland. Apart, possibly from *Reseda luteola*, weld, and *Genista tinctoria* which are classified by Stace, (1999) as a native to Scotland (*G. tinctoria* native to S. Scotland only), the 'classic' dye plants, listed in virtually every publication on dyeing are foreign to the country.

Lawson, (1852) notes that "dye plants cultivated in Scotland are very few, and the extent of cultivation very limited, arising no doubt from the facility with which vegetable dyes can be imported from countries still more favourable for their production." There are, however, indications that several species of dye plants were cultivated at various locations in Scotland, although it is not possible to ascertain the extent of cultivation.

Darwin, (1996) reports of the presence of fields of madder (*Rubia tinctorum*), the one-time standard source of red, in East Lothian, close to a cloth manufacturer, and Grierson, (pers comm) suggests that the village of Madderty in Perthshire may derive its name from the growing of madder in the area. Lawson, (1852) suggests that England is particularly suitable for growing the species, but notes that, in times of peace, it can be imported from Holland and other continental countries at a

cheaper rate than it can be grown in the UK. He concludes with an observation that its cultivation has been almost, if not entirely, abandoned in the UK.

In view of the difficulties in obtaining blue from the native flora, it is reasonable to assume that woad (*Isatis tinctoria*) was used in Scotland from early times. Page, (1982) reports that traces of woad plant were found at an archaeological site from 10th century York. Grierson, (1986) reports that the 12th century Merchant Guild of Edinburgh specifically excluded from membership those with dirty hands, or blue nails; most likely woad dyers. She continues by noting records of woad production in the Lothians, where it was cultivated in the latter part of the 17th century for New Mills cloth factory at Haddington, and during the 18th century where it was cultivated for individual dyers' use. The cultivation of woad in Clackmannanshire is noted in the 1845 Statistical Account of Scotland, Vol. VIII, where around an acre of the species is planted each year in Alva for dyeing woollens blue (Various authors, 1845). Sowerby et al, (1862) report that *Genista tinctoria* was formerly much used with woad in dyeing green. Lawson, (1852) relates that woad was formerly cultivated to a pretty considerable extent in Scotland, but that the cheapness and consequent general use of indigo has almost completely superseded it.

Lawson (1852), mentions several other species in the section 'Plants cultivated for their dye in Scotland', but it is unclear whether these species were actually ever cultivated in the country. Species mentioned include *Carthamus tinctorius*, safflower, used for the production of red shades; *Anthemis tinctoria*, yellow chamomile for yellow, *Phytolacca* sp., pokeweed, from which a red or purplish colour can be obtained.

3.10.7 IMPORTED DYESTUFF MATERIALS

To meet the demand for strong primary colours, the importation of dyestuffs into Scotland is likely to have occurred from relatively early times, complementing the material being cultivated and collected in the country. A list of dyestuffs known to have been imported to Scotland is provided in Appendix A.4.

Dunbar, (1962) suggests that woad could have been imported from the Netherlands by the 15th century. This would have been shipped in the form of a paste or in dehydrated form in hard balls which had to be ground down to a powder, being made

soluble by a process of fermentation using putrid urine. Ross, (1974) mentions that as far back as the 16th century buyers were sending consignments of wool to Holland to be dyed a particular scarlet.

While there are indications that dyestuffs were grown towards the end of the 17th century in East Lothian for the use of the New Mill clothing factory, a bill of materials, dated 1685, (Anon, 1905) shows that volume importation of dyestuffs was also taking place. Materials mentioned include five hundredweight of logwood, a hoghead of copperas and eight hundredweight of sumach. The New Mill order also enquires after the price of cochineal (a red dye from the Canary Islands and elsewhere, obtained from the dried bodies of insects), and '*Jameca*' indigo.

Indigo was first introduced into Holland from Italy in the 16th century and soon afterwards into England. By 1700 indigo was being shipped regularly into St. Kilda (Dunbar, 1962; Fraser, 1983). The consequent decline in woad use is noted by Ross, writing in 1895 (Ross, 1974), who states that indigo superseded woad over a hundred years ago. Shipped in a similar manner to woad, in balls, indigo was made soluble using a solution of stale urine, and made fast with a mordant such as *Rumex acetosa* (Shaw, 1955).

Pennant, (1774) notes the import of old iron and madder from the Netherlands into Dundee. Grant, 1961, observed the use of imported dyes in the manufacture of tartan towards the end of the 18th century, a trend which appears to have been common in this industry after the repeal of the Dress Act in 1783. The use of imported dyestuffs gradually became more commonplace in more remote areas. Edmonstone, (1841) reported the widespread usage in recent times of madder, indigo and logwood in Shetland.

The rapid development and uptake of synthetic dyes had a dramatic effect on the levels of usage of natural dyestuffs, both imported and home collected. Perhaps through the efforts of authors like Mairet who first published a treatise on vegetable dyes in 1913, (Mairet, 1936) and Thurstan, whose work was first published in 1930 (Thurstan, 1939), the practice of natural dyeing continued, and natural dyestuffs, including those listed in this section can still be obtained by today's natural dyers from specialist outlets.

3.10.8 CHEMICAL DYES

The first inorganic dyes were simple colourations produced from oxides of the traditional mordant metals (Grierson, 1986). The first mineral dyestuff to be manufactured and used on a wider scale was Prussian blue commercialised by Charles Macintosh (son of the Cudbear manufacturer George Macintosh) in 1785. Development of mineral dyestuffs characterised developments during the first half of the 19th century.

The first synthetic dye was discovered unexpectedly by the chemist Perkins. Instead of the synthetic quinine which he was hoping to produce, he obtained a fluid which stained everything a bright violet. He commercialised this preparation and commenced the first manufacture of an aniline dyestuff, 'Perkin's Mauve' (Thompson, 1969; Grierson, 1986).

Research in this field developed rapidly, and discoveries such as that of alizarine in 1868 and the diazo reaction in 1876, enabled the manufacture of a wide range of colours, by the end of the 19th century. (Thompson, 1969; Grierson, 1986).

The use of chemical dyes rapidly reached all of Scotland. Ross, (1974), reports in 1895 the use of diamond black instead of logwood for dark colours, and the use of alizarin in the dyeing of all other colours.

The introduction of chemical dyes did not appear to alter the esteem in which orchil dyes were held. In recognition of this, makers of chemical dyes brought out synthetic 'orchil' and 'cudbear' substitutes, and some crimson and claret azo dyes were misrepresented for sale as 'Orchil extract', 'Orchil Red' and 'Orsellin' (Henderson, 1984).

Although chemical dyes produced harsher colours than natural dyes, they were stronger, labour saving and cheap. Colour matching was easier, and more reliable (Fraser, 1983). They were colourfast and capable of being produced in the volumes required by industry (Tull, 1987). The wide spread availability of these dyes had an immediate effect on natural dyeing, almost bringing the practice to point of extinction.

3.11 Mordants

The application of mordants to improve the bond between dyestuff and material dates back to the time of the Egyptians (Thompson, 1969). Comprehensive treatment of the mordants historically used by dyers is provided by Grierson, 1986. This section considers the mordants traditionally employed by those who performed dyeing at an individual level.

The mordants listed here are those which would have been available in the dyer's local natural environment. It is likely that latterly these would have complemented the prepared mordants which were readily available for purchase (Grant, 1961).

3.11.1 CLUBMOSSES

Certain aluminium containing clubmosses were used as a vegetable substitute for alum from early times. An archaeological site of medieval Perth yielded species of clubmoss, accompanied by other plant species associated with dyeing. The species identified were *Diphasiastrum alpinum*, Alpine clubmoss, and *Lycopodium clavatum*, Stag's horn clubmoss. (Page, 1982).

Robertson reports seeing in 1767 "*Lycopodium alpinum* - mountain club moss" being used by Loch Broom instead of alum (Henderson et al, 1994). The editors note that *Huperzia selago* is quoted by Lightfoot, but it is possible that Robertson observed *Diphasiastrum alpinum*. Lightfoot, (1777) observed the use of *H. selago* as a substitute for alum in Raasay and some other places.

Modern experiments (Page, 1982) show clubmoss mordants to be less brilliant than alum, but more fast.

3.11.2 FLOWERING PLANTS

Some of the *Rumex* species contain oxalic acid, long known to have mordanting properties. The use of the root and stem of sorrel (*Rumex acetosa*) as a mordant, in solution is reported by Shaw, (1955) in a recipe for indigo. MacDonald, (1982) reports that a handful of sorrel added to the dyeing brew ensured colour fastness.

Docken (*Rumex obtusifolius*)as a mordant is mentioned on a post card from St. Kilda in 1930, where it was used to fix indigo. (National Museum for Scotland -Scottish Life Archive).

The tannin bearing bark of many tree species was employed as a form of dyeing mordant when dark colours were required. The alder (*Alnus glutinosa*) appears to have been a particularly popular species, yielding black when used in conjunction with bog iron or copperas. The New Mills Cloth Manufactory included elder bark (*Sambucus nigra*) among the mordants employed. Oak galls (called nut galls) were also added to darken or dull colour and for making it black (Dunbar, 1962).

Digitalis purpurea is reported by Wilkinson, (1858) as being used as a mordant by Welsh peasant dyers. It is possible that it may also have been employed in Scotland for that purpose.

3.11.3 MINERAL SOURCES

Alum has long been used in Scotland, with records of its importation dating from 1491, and alum mining commencing in the country around 1620 (Dunbar, 1962).

Another mineral mordant source was the iron found in black bogs (Fraser, 1983). The Statistical Account for Scotland, Vol. XIV, (Various authors, 1845) mentions the use in North Uist of an earth called '*dubhoch*', used in other mixtures for dyes. Pennant, (1774) relates the presence of a "deep circular hollow" in the vicinity of Loch Awe : "There is a tradition that this was one of the vatts frequent in the highland turberies, from which the old natives drew an unctious substance, used by them to dye their cloth black, before the introduction of copperas etc.". He reports that cloth or yarn boiled in this substance received a lasting colour. In Foula, mossy earth and water "much impregnated by bog iron" is reported to have been used to yield a black dye.

3.11.4 LIQUIDS

Urine

Putrid urine (Gaelic *fual* or *graith*) has long been used to scour wool, and as a mordanting ingredient. This pungent solution, which is reported to have the capacity

to bring "tears to the eyes of a seaman" (MacDonald, 1982), was employed in the Outer Isles until its replacement by bottled ammonia in recent times.

It was used extensively in the vat processes by which orchil producing lichen dyes and indigo dyes were obtained. These processes demanded long-term steeping at a stable temperature to bring about the required chemical reaction. The Statistical Account for Scotland, Vol. XII, mentions the disappearance of the 'lit-pig', common only 40 years before, from most households in the Parish of St. Fergus (Various authors, 1845). The lit-pig containing the dye liquor, was stored in a suitable warm location in a family's living quarters (Grant, 1961).

Venables, (1956) reports on the use of stale urine, at least three weeks old, being used as a mordant for yarn being dyed with indigo. The length of time which the dye bath was required to steep depended on the depth of colour required : a week for medium blue, a month for dark blue (Shaw, 1955). The temperature had to be kept steady at 85° - 90°F (29.5° - 32°C) (Shaw, 1955).

Orchil producing lichens were also macerated with urine, in a mixture with water and oxygen requiring a constant temperature between 56° and 75°F (13.5° and 24°C) throughout the period of fermentation, which lasted three to four weeks (Bolton, 1960). An essential ingredient in the commercially produced Cudbear, 2,000 to 3,000 gallons (approx. 9000 to 13500 litres) of urine were collected for this purpose each day in Glasgow and surrounding areas. In order to ensure the quality of the collected liquid, collectors were furnished with pocket hydrometers to ensure that they were not "being imposed upon by spurious and inferior products" (Richardson, 1975).

Bran water

The addition of bran to water was an alternative means of creating an alkali solution. Packer, (1816) recommends the use of this type of solution, particularly when dyeing delicate colours.

3.11.5 ASHES

The use of urine was replaced to some extent by the use of soda ash, made from burnt sea-weed or kelp (Dunbar, 1981).

3.12 The dyeing process

3.12.1 THE DYERS

An early reference in the Irish 11th Century Senchus Mor (Thompson, 1969) reported that spinning, weaving and dyeing was carried out by women. It is likely that this would also have been the case in early times in Scotland, with all dyeing being carried out in the home. The practice of dyeing developed in different ways in rural and urban areas. In rural areas the practice continued at a cottage industry level, with individuals meeting the needs of their immediate families, whereas in towns the practice developed as a specific skill, which was employed in larger scale operations.

In towns, development of the dyeing, weaving and tailoring professions were encouraged by laws such as that introduced by James II in 1457 forbidding any but burgesses "to buy wool, to lit (dye) nor mak claith nor cut claith" (Pennant, 1774). Those living in country areas were exempted from the law : "Bot it is to be otherwise said, gif ane man has woll of his awin sheip".

By the mid 16th century dyers (by this time male) were plying their trade in dye houses in towns throughout Scotland (Craigie et al, 1963). The common name for dyers in these times was *litster* or *lister*; dyes were referred to as *lits*, from the Old Norse *litr*, colour; *lita*, to dye (Grant et al, 1965). While this nomenclature has fallen into disuse in recent times, there is a report of a dyer in Victorian times in the Mearns being known as *Littie* (Grant et al, 1965). The name "Litmus" derived from the same source, referring to the reaction of certain lichen dyes to changes in acidity in water.

A report from the late 17th century (Anon, 1905) shows that dyers were financially recompensed at the same level as weavers, loom winders and dressers. Spinners and carders were paid less than half of this rate. Dyers were paid substantially less than those in administrative positions, indicating the relative importance attached to the role in these times. During the following century dyers began to assume a more influential role, with dyers being members of the Guildry, which was influential in business affairs, in 18th century Perth (Penny, 1986). In the Borders, dyers, who incorporated in a Dyer's Corporation in 1789, along with fullers were instrumental in organising the industry in the latter part of the 18th century. The advent of indigo dyeing required access to sufficient amounts of capital to enable the purchase of

materials, and these two disciplines joined forces to provide the required finances. Gradually, local spinners and weavers lost their independence and became bound up within the larger scale operations in their neighbourhood (Gulvin, 1973).

The discovery and rapid development of chemical dyes in the mid 19th century enabled industrial dyeing operations to obtain large quantities of reliably coloured dyestuffs at reasonable rates. Some natural dyes, in particular the orchil obtained from lichen, continued to be manufactured industrially until the 1940s (Henderson, 1984).

3.12.2 RECIPES

The difference in practice between the small scale individual dyers, and those who were dyeing in greater industrial volume, was reflected in differing approaches taken with regard to recipes.

Texts on dyeing from the 18th and 19th century (Anon, 1705; Packer, 1816) provide quite exact instructions for the industrial dyer, with precise volumes of each ingredient quoted for a specific colour.

Individual dyers using natural materials did not tend to follow recipes by this type of prescription. Information tended to be handed down through the generations by word of mouth and example, with the younger generation being involved in the collection of materials and the dyeing process itself - a practice which continued in the Outer Isles until the first half of this century (Fraser, 1983).

Keeping the dyeing process secret appears to have been common, with the women being able to express a degree of individualism through the colours they obtained from dyes (Fraser, 1983). The lengths to which some would go to preserve the secrecy were related by Fraser, (1983), who was told that the recipes in a chest in the Western Isles were to be burnt when the owner died and had not passed them on to the next generation.

3.12.3 THE DYEING PROCESS

Individual dyers and "industrial" dyers carried out dyeing by differing means. While litsters in the burghs carried out dyeing in their lit-houses, (dye-houses), individual

dyers traditionally carried out dyeing in the open air, a practice which is still continued in some isolated cases to the present.

The individual dyer traditionally used a large three legged iron pot, *Poit ghuirmein* or *Poit dhath* (as reported by Rev. Norman MacDonald of North Uist), heated by a peat fire.

Illustrations 9 and 10 in Appendix D. show a traditional three legged pot, and a pot used until today, which has the additional benefit of a plug hole.

One need which dyers of all sorts had was access to running water. This had consequences for where the lit-houses could be sited, (Packer, 1816) noting that the dye-house "should be as spacious as possible, for the proportion of work intended to be done in it and as near as possible to a clear, running stream". The individual dyer carried out her dyeing, in the open air, at a stream close to her house (MacIntyre, pers comm).

Once dyed, the fleece or yarn had to been hung up to dry. In rural areas this meant hanging it over the nearest dyke (MacLeod, pers comm), but this must have been a more vexed practice in Scotland's larger cities and towns. Packer, (1816), expressed concern about how drying should be carried out : "When the yellows are dyed and wrung as dry as possible, they should be taken into a close room or stove to dry, particularly in London, because of the smoke, and particularly in winter".

3.13 Developments during the 20th century

The use of native plants for dyeing probably reached its lowest ever ebb during the period from the end of World War II until the 1970s. In the Outer Hebrides, where the indigenous craft had lingered on for the longest, the inhabitants experienced a rise in the standard of living and disposable income (MacIntyre, pers comm) which enabled the purchase of factory made items of clothing. The use of plants for dyeing continued at a very low level, with only around six people reportedly using the traditional crottle for Harris Tweed production by the mid 70s (Richardson, 1975).

The optimistic and modernising mood prevalent in the country during this period probably acted as a disincentive to continue practices associated with austerity and

poverty (Wilkes, pers comm). While home knitting continued to be popular, makers tended to be satisfied with the chemically dyed products of industry.

The 1970s were witness to a growing interest in the environment and natural products, an interest which has been sustained to the present. The publication of books such as Mabey's "Food for Free", and Mackay's "Rural Crafts in Scotland" served to stimulate curiosity, and the practice of collecting for oneself or trying crafts out for oneself started to develop.

Around 12 of those interviewed during the course of research started to do their own spinning and experimenting with natural dyes in the 1970s and early 1980s. The significant growth in the number of workshops covering these subjects, coupled with the growth in availability of books on natural dyeing, for example the republication of Bolton, (1960) and of Thurstan, (1939) provided a growing number with the experience and knowledge to take up the art.

4. Survey Results : Present Day Use of Plants for Dyeing in Scotland

The primary research for this study was performed by means of a survey of present and previous dyeing practitioners. It should be noted that the results gained from this survey can not be considered to provide authoritative statistics due to the relatively low numbers of people interviewed and the sampling methods employed. If it can be assumed that the sample set of those surveyed covers a reasonable cross-section of the natural dyeing population, it can be inferred that the findings presented here are broadly in line with practice as a whole in Scotland at the present time.

The findings presented here combine the responses received from interviewees via semi-structured interview and from the questionnaire (see Chapter 2.). The presentation of findings in Sections 4.2 to 4.8 broadly follows the questions posed in the questionnaire.

Section 4.9 presents findings regarding the recently discovered use of fungi for dyeing. These comprise a combination of information gathered during semi-structured interviews with members of the Scottish Fungi Group and findings from the literature.

4.1 Primary research - Profile of respondents

Interviewees came from a variety of sources selected on the basis of the relevance of their knowledge and experience. Groupings contacted including The Guilds of Weavers, Spinners and Dyers throughout Scotland; the Scottish Fungi Group; International Feltmakers; Royal Botanic Garden Edinburgh staff; museums, key individuals, and personal contacts.

A total of 73 people were contacted during the course of primary research. Of these, 34 are actively dyeing at present, 7 are no longer actively dyeing, and 32 are not plant dyers. Those contacted can be categorised as follows :

Category	*No. of individuals contacted*
Academic / historians / museums	10
Dyers with a degree of commercial interest *	19
Workshop leaders / demonstrators *	8
Home dyers *	12
Suppliers of dyeing materials	2
Suppliers of dye plants	3 (includes 1 commercial dyer)
Those brought up in tradition *	2
Others	17
Total	73

* - numbers provided are inclusive of those who are no longer dyeing.

Note that although several respondents' activities fitted into more than one category, with the exception of those indicating commercial interest they were categorised according to the main aspect of their activity. As a key aim of this study was to ascertain the commercial potential for plant dyeing, those who indicated some level of commercial interest were counted in that category. It should, however, not be inferred that all these individuals are making (or have at one time) made a living from natural dyeing, as this is not the case.

The methodology employed to identify potential respondents among the dyeing community addressed the importance of obtaining a representative sample from across the country. Dyers (present and past) were contacted in the following regions:

Region of Scotland	*No. interviewed*
South East	5
South West	5
West	5
Central	4
Grampian	0
Highlands	8
The Hebrides	11
Orkney and Shetland	3
Total	41

Attempts made to obtain contact details for dyers using plant materials in the Grampian area were not successful.

After initial contact (as described in Section 2.2) the following actions were taken. The numbers in brackets indicate the number of interviewees falling in each category.

1. No further action was taken. (32)
2. A structured questionnaire was sent to the respondent. A total of 28 questionnaires were sent or given out. A total of 16 people returned the completed questionnaire.
3. A site visit was carried out either at the respondent's home or place of work. (See below for further details.) (11)
4. A meeting was held at a neutral venue. One of these was the monthly Edinburgh Guild of Weavers, Spinners and Dyers meetings. (2)

Several site visits were made in the vicinity of Edinburgh, and during the course of a field trip to the N. W. Highlands; the Western Isles and Skye. A range of people were contacted via this method, including present day dyers and those with extensive dye plant gardens (in Edinburgh, East Lothian, Beauly, Harris, North and South Uist and Skye), and dyers brought up in the tradition (in Lewis, Harris and South Uist). In each of these situations informal, semi-structured interview methods were employed. The means of recording varied according to the situation and included note taking; tape recording; and photography. A selection of photographs taken during these visits is included in this document.

It was originally envisaged that the research would uncover how many individuals are using native plants as dye sources. The findings in this area are somewhat vague, given that there is no prescribed pattern for peoples' usage of plant dyes. Some people are 'dabblers', carrying out the process for a while, perhaps after attending a workshop; others have been doing it for a long time, and intend to continue; and others fall somewhere in between. An informed estimate would be that there are between 100 and 200 people in Scotland actively involved in natural dyeing

using some element of native flora; whereas there are probably the same number again of those who would be classified as 'dabblers'.

4.2 How plant dyes are being used

Scottish native flora is used by most natural dyers in conjunction with natural dyeing materials from other sources. The majority of dyers surveyed use native plants for less than 50% of their dyeing requirements, although a few people use native plants more extensively. Several respondents reported that they use a combination of dyed wool and naturally coloured wool (e.g. brown, moorit, black etc.)

Several respondents are using or have used the dyed material in a commercial capacity, while others are using or have used it to manufacture items for home use or for gifts. The material most commonly utilised is wool, although some dyers also use silk and linen. The following tables show what the makers are producing, and how it is being utilised. Those who have a commercial interest also noted the means by which they sell their products.

What making (made)	*No.*
Yarn	12
Harris Tweed	3
Tartan	1
Knitted garments	13
Rugs / throws	6
Weaving, tapestries	5
Felt	2
Silk items	3
Other	4

Use(s)	*No.*
Personal & family	5
Non-commercial gifts	3
Commercial	20
- sold directly	18
- sold via mail order	3
- sold in local shops	4
- sold at craft fairs	2
- commissions	4
- other locations	4
Workshops / demonstrations	10
Experiment only	1

While a significant number of dyers reported some level of commercial activity, the situation requires clarification. One respondent stated that they didn't see plant dyeing as more than a hobby or semi-professional activity. This appeared to be borne out by the findings from other respondents. Several stated that they do not obtain an adequate return for the effort which goes into the production of artefacts,

and that were they to charge prices which realistically reflected the hours put in they would price their products beyond consumers' ability or willingness to pay. Some had previously sold what they made, but had given up, because of the poor economics involved.

A small number of respondents, however, appear to be performing well in their business. A couple have had several high profile commissions, while another has been successful in obtaining good publicity both sides of the Atlantic. All these respondents use a significant proportion of purchased natural dyestuffs in combination with a smaller proportion of those derived from native plants.

4.3 Species of plants being used

Several respondents indicated that they limit the wild species they collect to acknowledged weeds which no-one objects to being collected. In particular, the collection of *Senecio jacobaea*, (ragwort) a particularly popular source of yellows and greens was considered by at least one correspondent as "doing the farmer a favour". *Urtica dioica* (stinging nettle) was also a commonly used species, and *Rumex obtusifolius* (broad-leaved dock). *Calluna vulgaris* (heather) was another popular choice among respondents. The numbers of native species used varied considerably among respondents, ranging from 3 to 18 (not including any fungi species used).

Two respondents mentioned using species of seaweed. One listed *Fucus vesiculosus* (bladderwrack) producing red / brown, while the other listed dulse (*Palmaria palmata*) to obtain a mustard yellow.

A few of the species reported by dyers, for instance *Achillea millefolium* (yarrow), *Chenopodium album* (fat hen), and *Solidago* spp. (goldenrod) are not plants which appear to have traditionally been used for dyeing. These species are listed in modern day dyeing books such as Grierson, (1986).

The species used by today's dyers typically include a mixture of wild flowers, dye plants, vegetables and cultivars. One such species which appears to be a particular favourite is the onion (*Allium cepa*) which produces a range of strong colours, ranging from yellow to orange. Domestic *Asteraceae* (composites) including species within the genera *Tagetes*, *Coreopsis* and *Dahlia* are popular sources.

Details of the plant species used by respondents along with reported colours and are provided in Appendix B.1. to B.4. Appendix D. Illustrations 4, 5 and 6. show a selection of plant species used by present day dyers.

4.4 Means of learning about dyeing

Traditionally, knowledge of the dyeing process tended to be handed down through the generations by word of mouth and example. The younger generation were involved in the collection of materials and the dyeing process itself - a practice which continued to a reasonable extent in the Outer Isles until the first half of this century (MacLeod, pers comm; MacIntyre, pers comm). There are strong indications that this tradition, handed down from generation to generation, has all but ceased. Many respondents mentioned a high profile exponent from Harris, Marion Campbell, who died around three years ago, coupled with a statement to the effect that there aren't many others like her left on the islands now. During the survey, 4 people were contacted who had learnt dyeing from their mother. Only one of these individuals is still a practising dyer. Two of the respondents in this category were confirmed to be over 75 years of age.

The large majority of today's dyers have come to the practice through choice. Many have learnt extensively through reading, and through sharing results with other dyers. Workshops also play a role in helping people get started. International influences were reported by one respondent who indicated that she had gained skills in S. E. Europe and Africa. Most people had learned via a variety of means, for example from books and through sharing results. Several respondents indicated that they extended their knowledge by experimentation.

The following table provides an indication of the relative frequency of means by which today's dyers learned their art.

How learnt about dyeing	*No.*
From mother	4
From other older generation	2
From books	20
At workshops / courses	6

How learnt about dyeing	*No.*
From other dyers	9
Experimentation	8

A substantial number, but by no means all, of today's natural dyers are members of groups which enable them to network with other like minded individuals. Among the respondents were members of groups such as the Guild of Spinners, Weavers and Dyers, The Scottish Fungi Group, the International Feltmakers Association and the Association of Applied Arts.

4.5 Motivations for using plant dyes

> *"Knowing I produced these colours from plants fills me with wonder". Smillie, (pers comm)*

Those using plant dyes today are in general extremely enthusiastic about the practice. The quality of colours obtained, the natural "matching" between colours, and maintaining a long tradition were among the motivational aspects mentioned. Several respondents mentioned that they enjoyed being "a witch in the kitchen", attending to a bubbling brew. It is worth noting that only one respondent listed commercial advantage as a motivating factor. Among the disadvantages listed was the difficulty in obtaining exact replication of colours, the time required and the limited colour palette. Many Scottish native plants (and others) appear to produce yellows.

Motivations	*No.*
Quality of colours	8
Colours go well	6
Pleasure	6
Carrying on tradition	5
Free materials	5
Uniqueness	5
Interest to other people	5
Natural	4
Commercial advantage	1

Drawbacks	*No.*
Difficulties in replicating colours	10
Time consuming	7
Poor fastness	4
Restricted colours - yellows!	3
Only small dye-lots possible	2
Large quantities of materials required	2

4.6 Sources of plant materials

In the latter days of traditional dyeing in the Outer Hebrides, the plants and lichens used were collected from the surrounding area. Relatively large quantities of lichens were collected in this manner - McLeod, (pers comm) reports that when she was young the children collecting lichens from their surrounding area would have a race to see who could fill their sack first.

Today's dyers obtain their plant materials from a variety of sources. Most respondents reported collecting some species from the wild, mainly in their local area. Several dyers indicated that they consider local collection to be part of the ethic of using native plants for dyeing. Some species, in particular lichens, were reported to have been collected from areas further afield from areas where they are abundant.

Possibly in part due to the calls for restraint in collecting from the wild, and to relative accessibility, respondents reported significant use of species growing in the garden selecting from a combination of native wild flowers, introduced dye plants, domestic garden cultivars and vegetables.

Several respondents indicated that the dye plants (such as *Genista tinctoria*, (Dyer's Greenweed) *Isatis tinctoria* (woad) and *Rubia tinctorum* (madder)) which they grow in their garden were obtained as cuttings or seeds from friends, while others reported that they purchased dye plants from nurseries. One respondent indicated that she intends to shortly specialise in the supply of dye plants, for which she believes that there is a good market. A few respondents indicated that they had been unsuccessful in cultivating dye plants, citing poor performance from weld (*Reseda luteola*), madder and woad.

Most dyers supplement the collected materials with pre-prepared dyestuffs obtained from stockists.

Illustration 11 in Appendix D. provides an insight into the range of colours obtained from native plant species.

4.7 The dyeing process

Most present day dyers use specialist equipment in their kitchen, while a small number have their own dye houses. Several dye in the open air, using mainly old oil drums, but none appear to use the traditional three legged pot. Some of these pots are still to be found in the Western Isles, where they have become greatly prized for their service as garden plant-pots (Winterstein, pers comm).

It is interesting to note the trend of today's natural dyers to move over time from following written recipes to the letter to a greater degree of individualism. Several interviewees mentioned using imprecise amounts and 'feel' to guide them.

The method of dyeing used by today's dyers generally follows that outlined in Section 3.4. Those concerned about the effect of alkaline washing powders on dyed fabrics now have the choice of non-alkaline products such as 'Stergene' and 'Fairy Liquid' (Caddell, pers comm); and some choose to manufacture artefacts, such as wall hangings etc. which do not require to be washed.

Illustration 12 in Appendix D. shows dyes being obtained in the traditional manner, boiled in the open air over a peat fire.

4.8 Experimentation

A common theme to come through from respondents was the willingness and desire to experiment. Many respondents see experimentation as a means of taking the tradition forward.

In recognition of the fact that many recipes were written before dye chemistry was well understood, and out of concern over the adverse environmental effects of dyeing, current day practitioners are prepared to question traditional prescriptions such as the proportion of mordant material to yarn or fleece. This is shown in Section 3.11., where mordant proportions recommended in dyeing textbooks have been reduced in recent years.

As has been shown in Section 3.12.2., dye recipes which have been handed down through the tradition can be vague. In order to identify inaccuracies which have been passed down without verification by various authors, and to ratify that traditional

recipes had been accurately reported, S. Grierson (pers comm) undertook the task of trying out all the recipes listed in her book (Grierson, 1986). She was unable to reproduce the outcomes suggested by some recipes, and found that in some instances a critical 'little bit of something' which their mother had put into the dye pot had been omitted from the reported recipe. A ubiquitous example still waiting for a satisfactory solution is the magenta dye reportedly obtained from dandelion roots, listed in various texts e.g. Thompson, (1969) and Fraser, (1983) among others, and by one respondent (who was not a practising dyer). Several respondents, including Mrs. Grierson, have been unable to replicate this to date.

A few respondents reported that they have boiled up virtually any plant material which they come across, just to see what happens. From the reports on the success of this, it would appear that most unacknowledged dyeplants produce a murky yellow (e.g. Caddell, pers comm).

Continuing the tradition of home made mordants, a few respondents reported making their own copper or iron water at home. Several respondents had also experimented with urine as a mordant - reported by one as "a horrendous experience". Modern-day 'lore' among dyers is that the urine produced by pre-pubescent boys is the most effective. One respondent reported paying her young son £1 per gallon (approx. 22p / litre) of the product.

4.9 Fungi

4.9.1 HISTORY AND DEVELOPMENT

As was mentioned in Section 3.10.4., there is no tradition of dyeing in Scotland using fungi. Fungal dyeing is a relative newcomer, having only developed in the country during the 1990s.

Modern day fungal dyeing was discovered in 1971 by Miriam Rice, an artist and sculptress working at the Mendicino Arts Centre in California. A keen collector of edible fungi, she experimented by putting a pre-mordanted skein of yarn into a pot of boiled fungi (*Hypholoma fasciculare*) or Sulphur Tufts. The outcome was a range of spectacular yellows, greens and tans. Encouraged by this outcome, M. Rice went on to experiment with a wide range of species of fungi, discovering species producing

the full spectrum of colours, including strong reds and blues. She published the first book on the subject, Mushrooms for Color, in 1980 (Rice et al, 1980).

In Europe, fungal dyeing developed in Scandinavia, led by Hjørdis Hall Andersen, a Danish interior designer with an interest in natural dyes, mycology and M. Rice's work in the USA H. Hall Anderson presented a paper on fungal dyeing and led a workshop titled "The Use of Fungal Dyes in Making Garments" at the 1990 British Mycological Society Conference, hosted by the Royal Botanic Gardens Edinburgh. S. Grierson, author of The Colour Cauldron (1986), participated in the fungal dyeing workshop, and subsequently presented her dye samples at that year's Battleby gathering (the annual gathering of spinners and dyers, held at Scottish Natural Heritage Conference Centre, Battleby, Perthshire each September).

The delegates at the gathering were so impressed with the quality and colours of the samples that Mrs. Andersen was invited to present to the 1991 Battleby gathering. The range and quality of colours presented there was enthusiastically received, and led to makers in Scotland forming the Scottish Fungi Group that year. (Scottish Fungi Group, pers comm).

4.9.2 SCOTTISH FUNGI GROUP

Members of the newly formed group had previously been involved with plant dyeing. The group went through a period of rapid learning, as they discovered for themselves the best places to find good dye producing species. "We were inspired to forge ahead into this new world of colour and track down the habitats of these 'magic mushrooms' " (Scottish Fungi Group, pers comm). As the members were makers rather than mycologists, there was initially a struggle with the scientific names and identification of some species, but the natural enthusiasm for the art has led to members becoming knowledgeable in the field (King, pers comm).

The group were approached by Miriam Rice in the autumn of 1992 to host the 1993 International Fungi and Fibre Symposium in Scotland. Initially somewhat daunted by the request, they agreed, and a most successful event, attended by 80 people from across the world, was held at the Royal Botanic Garden. Because of the pioneering nature of this practice, events such as this symposium provide a focus for learning and sharing of ideas. The symposia, at which Scotland is well represented, take

place every two years at venues world-wide; the 1999 event being hosted by Norway.

The 1993 symposium has been followed by a series of local workshops, which included paper making from fungi (see below).

The Scottish Fungi Group has never formally constituted and remains as an informal grouping fungal dyers. The group reached a peak of around 43 members; the current membership is around 26. Originally the establishment of local groups was envisaged, but the problems finding some species locally mitigated against this. (Caddell, pers comm).

With due consideration of the possible environmental impact of their activities, the group developed a code of practice which states that members will collect fungi only for their own use, and will not collect to supply to others. More experienced members will help each other learn how to identify suitable dye fungi, by fungal forays, but each members is expected to identify their own local area rather than starting to collect in an area already being collected from by some else (Gow, pers comm). "The suggestion has been made that we should sell dried fungi. We thought about it, but have decided against picking to sell. At the moment we try to be sensible and pick in moderation for our own use, and to maybe keep a stock for dye workshops. It may be possible to buy from the Scandinavians when the CD-ROM is up and running this information would be available" - Scottish Fungi Group, (pers comm).

Collecting fungi is a somewhat complex process. Particular species have their own preference in terms of habitat, and this can lead to challenges in their collection. For example, *Cortinarius* spp., which provide a range of orange and red coloured dyes, can be found in areas where *Betula* spp. are in close conjunction with conifers. The collection of these fungi is carried out on hands and knees under the conifer canopy, with the result that needles and other debris find their way into every article of the wearer's clothing! Bracket fungi, such as *Hapalopilus nidulans* are usually to be found on tree trunks several feet above the forest floor, and in order to obtain them, collectors have had to become adept at climbing techniques. These and other difficulties are seen, however, by the dyers as merely part of the overall process. (King, pers comm). For future use, collected fungi can be cut up and carefully dried

(taking care to ensure that the insects resident in the fungi don't infest the airing cupboard!) (Gow, pers comm).

Appendix B.5 lists the fungi mentioned in the literature as being suitable for dyeing, and highlights those species reported by interviewees as having been used in Scotland. Appendix D. Illustration 13 shows the 'Magic mushroom' made by the Scottish Fungi Group.

Another innovation from Miriam Rice, first presented in Scotland at the 1993 Symposium, was the manufacture of paper from bracket fungi. The resulting paper is often high quality and attractive appearance. Bracket fungi can be classified by the hyphal structure; whether the hyphae are thin-walled (generative), thick-walled linear (skeletal) or thick-walled branched and the mixtures of two (dimitic) or three (trimitic) hyphal types. If only generative hyphae are present in the fungus, it is termed monomitic. The best papers appear to be obtained from trimitic polypores such as *Fomes fomentarius* and *Ganoderma applanatum*; while some dimitic species and even a couple of monomitic species can also produce paper (King and Watling, 1997)

5. Conservation - Context and Practice : An Appraisal

5.1 Historical perspective

5.1.1 OVER-EXTRACTION

The profile accorded to historical instances of over-extraction of species for dyeing in Scotland is such that it can be reasonably assumed that, in general, most species do not appear to have been used beyond their capacity for regeneration. This could have been either as a consequence of local abundance, or of careful stewardship of a limited resource.

The only recorded instance of large scale population depletion was that in the Highlands where lichen species such as *Ochrolechia tartarea*, *Ochrolechia parella*, and *Umbellicaria pustulata*, were extracted in volumes required to satisfy the needs for industrial Cudbear manufacture in the latter part of the 18th century (see Section 3.10.3). It has been conjectured that, at the peak of production, an efficient gatherer could have collected over 400lbs (approx. 180kg) of lichens in one week (Richardson, 1975). Depletions on a more localised level, again more specially of lichen species, seem to have been likely. MacDonald, (1982) reports having to walk quite some distance to find collectable amounts of crottle, a situation re-iterated by MacLeod, (pers comm).

Over-extraction of some species had a detrimental effect on the surrounding ecology. The extraction of *Galium verum* roots for a red dye, appears to have been the cause of environmental erosion in various locations in the country, despite the passing of the Soil Preservation Act in 1695 forbidding activities of this kind (Grierson, 1986). Robertson, writing in 1767, (Henderson et al, 1994) notes that the people in Sutherland are not allowed to dig out the species, as it grows among the sand. Heron, writing in 1794 reports that in North Uist the species is "Forbidden to be plucked because it is needed to stabilise the sand (of the machair)". Similar ecological damage took place on the islands of Tiree and Coll, where the people "tore up the pastures in the search for (*Potentilla erecta*) roots" (used in tanning) to such an extent that the landowners were compelled to forbid the search for them (Sowerby et al, 1862).

5.1.2 POLLUTION

As a practice which clearly has potential for environmental impact, there is little to be found about pollution caused by dyeing in the literature. It is possible that the requirement that dyeing be carried out by running water helped ensure that the problem was simply swept away "The dye-house should be ... as near as possible to a running stream; the floor should be .. sufficiently inclining that the water, spirit baths, old contents of blue vats etc. may run off freely when thrown down" (Packer, 1816). One instance where such a solution was clearly not achieved was in Aberdeen, where in 1632 the dyers' practice of washing the dyed cloth in the loch which formed the town's water supply left it "filthie, defyled and corrupted" (Grierson, 1986).

Another area where air quality may have been reduced in Scotland, although no records have been found indicating this, could have been in the production of woad. The preparation of woad for the dye vat required a two stage fermentation process, the first of which was to create a pulp which was made into cakes. Prior to dyeing, the cakes were broken up, moistened and fermented again (Mabey, 1977). Woad imported into Scotland would have required the second stage of fermentation in country (Grierson, 1986), and both stages would have been required for the home grown product. In England, Queen Elizabeth I banned woad production while she was passing through towns due to the stench caused by the fermentation process (Mabey, 1977).

5.2 Present day context

Those who carry out dyeing using plants or fungi in the present day live in an era of greatly increased awareness about issues of an environmental and conservation nature.

5.2.1 LEGISLATION

Wild flowers are protected under the 1981 Wildlife and Countryside Act, which prohibits the collection of roots of wild plants (including lichens and fungi), and the picking of flowers from wild plants without landowners' consent check. Under the Theft Act, 1968, it is an offence to uproot plants for commercial purposed without authorisation. Schedule 8 of the Wildlife and Countryside Act, listing endangered

plants, was first published in 1981. This list is updated every 5 years; the latest revision being published in 1998 (Palmer and Hearn, 1999).

The disposal of mordant solution and dyebath exhaust into the sewage system is covered by UK Consent levels (set in Scotland by the Scottish Environmental Protection Agency) which stipulate the maximum concentration levels of waste containing metals such as aluminium, tin, chrome or copper. The levels currently in force are : Aluminium : 2mg / litre; Chrome : 0.5mg / litre; Copper : 2mg / litre; and Iron 10mg / litre; with an overall total of any metal /litre not to exceed 10mg. Commercial dyeing operations have to operate within these consent levels, or face being fined. It is possible that home dyebaths could exceed these levels, especially if the mordant take up is not efficient (Glover, 1993).

Recent publications on natural dyeing have become increasingly concerned with addressing the issues around pollution. For example, Dean, (1999) provides explicit instructions as to how the mordant bath or dye bath should be neutralised and diluted prior to disposal, and of the disposal itself. She recommends the addition of solutions to the dyebath to help increase the uptake of the mordant e.g. acetic acid to a copper dyebath. The tin and chrome mordants formerly recommended for improved brightness and fabric softness respectively, are not mentioned at all in this publication. An alternative approach, accepting that fading will occur, is to dispense with mordants altogether (Mabey, 1977).

5.2.2 CODES OF CONDUCT

Dyers in Scotland are not covered by any formal Codes of Conduct regarding the collection of wild flowers or fungi.

A voluntary Code of Conduct on fungi collection, agreed by English Nature, British Mycological Society and Plantlife, was introduced in England in autumn 1998, stipulating that fungi in a certain location should only be collected on one day for the consumption of that person (Watling, pers comm). This Code of Conduct does not extend to Scotland, where the collection of fungi is covered in a similar manner to wild plants under the Wildlife and Countryside Act.

5.2.3 LICENSING SYSTEMS

There are currently no licensing systems in place for collections of flora or fungi in the UK. Several European countries have developed licensing systems for those collecting fungi for the table. In Finland, for example, commercial collectors have to prove their proficiency in correctly identifying 3 species, after which they obtain certification permitting them to collect only these 3 species; this can progressively be extended to 6 species, further to 10, and only then to all species (Watling, pers comm).

In Britain, there is a debate at present about whether fungi extraction is indeed a major problem, or whether loss of habitat and industrial pollution pose more of a threat (Rotheroe, 1998). There is as yet no evidence that collecting the fruiting bodies of fungi damages them (Watling, pers comm). Were, as does not seem likely at present, a regulatory system to be introduced for fungi collection in Britain, it is probable that any such system would have implications for those who collect fungi for dyeing.

5.2.4 GOOD PRACTICE FOR COLLECTING FROM THE WILD

Within the hand dyeing community, there have been moves in recent years to improve awareness of conservation issues, and to foster good practice in collections.

GENERAL PRINCIPLES

A good starting point for collecting practice is provided by Grierson, 1986, who recommends that any dyer considering collecting plants or lichens should :

- learn how to identify them by reading before going out into the field;
- seek the landowner's permission for collection;
- collect only a very small sample and try it out to see whether it is colour yielding, to avoid wasteful misidentification;
- collect only species which are really prolific, not just in the immediate vicinity, but also for a mile or so around the area;
- take small samples from many sources rather than clearing a stand, or, in the case of lichens, scraping a rock or tree clean.

She continues, that, wherever possible, it is ideal to gather plants or lichens which will be destroyed in any case by, for example,

- watching building sites and getting in ahead of the bulldozers;
- collecting from roadside verges before the grass cutters arrive;
- obtaining permission to collect from trees which are to be logged or felled as part of forestry operations;
- watching out for dredging operations in ditches and waterways.

Tull, (1987) recommends taking fallen branches or spring cuttings for recipes where bark is required.

LICHENS

Due to their slow growth habit, much discussed, but apparently little understood, the use of lichens for dyeing has been the sources of healthy debate in recent times. While some call for an outright cessation of collecting and use of alternative sources for similar colours (Brightman, 1983), others advocate a pragmatic approach based on local abundance and prudence.

Collecting windblown lichens, a common phenomenon in the west of Scotland (leaving rare species, as they can still spread spores); or harvesting lichens from a recently fallen tree species which quickly rots (such as *Betula spp.*) is also recommended (Grierson, 1986).

Dalby, (1992) cautions against the collection of lichens from the wild, recommending that dyers purchase from suppliers of lichens from managed sources. No literature surveyed during the course of this research made any reference to successful cultivation of the species; but the inability to cultivate the species does merit mention (Brightman, 1983).

Restraint in the volume of lichens used is recommended by Casselmann, (1994) who states that dyers should direct their attention towards abundant lichen species, and should experiment with lower volumes of the species than typically recommended in the literature. She adds to Grierson's list of 'rescue' situations, citing the removal of lichens from graveyards during restoration projects (this could be possibly be expanded to any restoration project); removal of lichens from popular climbing sites; and looking out for road building sites or other civil engineering projects. She also

states that there is a clear need for better instructions for dyers, particularly as regards unambiguous taxonomy.

CLUBMOSSES

Clubmosses are less plentiful today than historically, probably as a consequence of increased pollution and muirburn practices (Page, 1988). In view of their decreased availability, no book on dyeing advocates their collection, although few actively counsel against it.

5.2.5 ALTERNATIVE SOURCES

The approach to obtaining sufficient plant material for dyeing by growing your own, and using pervasive garden weeds (such as *Urtica dioica*, *Equisetum* sp., and *Rumex obtusifolius*) is promoted by Wilkes, (1999). Grierson, (1986) lists common 'weeds' which yield required colours.

5.3 Present day situation

The survey carried out among dyers for the purposes of this research showed that there is a high level of awareness of conservation and environmental issues among the group. Most of the respondents indicated, frequently without any prompting, concern about the use of species of wild plants or lichens; and similarly, concerns were raised about how to ensure safe disposal of dyebaths.

5.3.1 DOMESTIC SOURCES OF DYEING MATERIAL

As has previously been discussed, many of today's dyers collect a significant volume of the plant material for dyeing from their garden. Species used in this way include those naturally occurring in the wild (usually introduced to the garden through seed or plants purchased from nurseries), dye plants (obtained by cuttings, seed or plants from nurseries) and domestic cultivars.

5.3.2 COLLECTION FROM THE WILD

While significant numbers of respondents report collection from the wild, they appear to do so in moderation. Most report that they only collect species known to be common in their local area; and local conditions appear to inform the species collected. For instance, on Shetland mainland, there is reportedly only one stand of meadowsweet (*Filipendula ulmaria*), and no nettles (*Urtica dioica*) (Stuart, pers comm).

Collectors of species from the wild show a general awareness of the legislation covering their activities. Self regulating practices are followed, such as applying the '7 times rule' (i.e. leave at least 7 times the volume of plant material collected), and collecting only windblown lichen. Several respondents report using small quantities of lichens (in particular orchil-producing lichens) for dyeing.

In general, the usage of larger quantities (2 x textile weight or more) are reported in the case of abundant species, e.g. *Senecio jacobaea* and *Rubus fruticosus*.

Several respondents report the use of plants 'rescued' from the digger or the herbicide spray. Weld (*Reseda luteola*) in particular appears to be a frequent coloniser of vacant sites.

The Scottish Fungi Group's self regulating code of conduct means that members only pick for their own use. Given the 'spread-out' nature of fungi collections, it is possible that a major threat to stocks, namely trampling, is to a large extent avoided. There appears to be scope for greater levels of fungi collection for this purpose, the wild stocks being assessed to be capable of supporting double the present level of extraction (Watling, pers comm).

5.3.3 DYEBATH DISCHARGES

Today's dyers are concerned that their activities do not harm the environment. Consequently several reported that, much as they appreciated the results they had obtained from using tin or chrome, they had decided to stop using them. As one respondent put it, "We all have to sacrifice something for a better environment". The same respondent indicated that she had contacted the local environment protection agency office to obtain guidelines for disposals.

One area about which there appeared to be some confusion was how one would know when all the metallic mordant salts had been absorbed by the textile. This is one area which could warrant further consideration (see Section 6.3).

6. The Way Forward - A Discussion

All indications point to natural dyeing remaining a popular pursuit in Scotland, and to continued consumer demand for naturally dyed products ensuring the continuation of the practice at a commercial level. This raises questions as to means by which activity in Scotland can be taken forward in a positive way for the future.

6.1 Indigenous dye plant supply

In order to assess the suitability of Scotland for dye plant growing, it is necessary to both look to the past and the present, and to differentiate between small scale and 'industrial' scale operations.

6.1.1 SMALL SCALE

There appears to be some scope for increasing the volume of dyeplant production through nurseries in the country, with the output from existing general suppliers being augmented by small-scale specialist supplies (Bates, pers comm). Packaged natural dyestuffs sold in Scotland at present come from sources outside the country, such as Germany (Clarke, pers comm). There is likely potential for individuals to start up supplying dried materials obtained from Scottish sources. Achieving acceptable volumes, choice, and reliability of supply would be critical factors for any Scottish venture being successful in displacing current supply sources.

6.1.2 LARGE SCALE

As previously mentioned, records exist of the cultivation of madder and woad in Scotland the past. Locally cultivated material did not appear to displace imports of these species to a significant extent, and appears to have been discontinued when the cost of home production relative to cheaper imports made it uneconomical to do so (Lawson, 1852).

However, in today's unfavourable agricultural climate there could be some value in assessing the potential for dyeplant production as a diversified activity. Similar initiatives are already underway in other countries; France has been reviving woad production for several years, and the commercial growing of woad has recently recommenced in England, with the support of MAFF (Ministry of Agriculture, Food

and Fisheries), after a lapse of over 60 years. At Reading University research is on-going to replace the traditional lengthy method of fermentation by bacteriological means, via a process which will take minutes, rather than weeks. This accelerated process is undergoing pilot trials at sites of woad production in Southern England this summer (Daily Telegraph, 29th May 1999).

An informed appraisal of the suitability or otherwise of dyeplant production as a possibility for crop diversification in Scotland is beyond the scope of this study. However, any body undertaking such an appraisal would require to consider the following factors, among others, within the Scottish context :

- selection of species suitable for growth in Scotland. Weld, madder and woad have all been produced in the past. Other species with good dye yielding potential (for example certain *Asteraceae*) could also be considered;
- selection of strains of these species which are well adapted to Scottish weather and soil conditions;
- the likely markets for the crop and the competitive field. Other countries with more favourable growing conditions are already providing public sector support for dyeplant production;
- the environmental conditions required for acceptable performance, and the feasibility of assisted growth, for example, in polytunnels;
- the acreage and classification of land required to produce a viable commercial crop. The relative projected return from dyeplants would have to be compared versus that from other crops suitable for growing under similar conditions;
- the likely effect of subsidies in encouraging the establishment of dyeplant crops. This appears to be the practice in some other countries where dyeplant production is being encouraged (Clarke, pers comm).

6.2 *Scope for development of natural dyeing*

6.2.1 BRANDING

Consideration could be given to means by which textile products manufactured in an environmentally way using plant, lichen or fungal dyes and other materials obtained from sustainably managed or utilised sources within the country could be more effectively marketed. One possible means of achieving this could be the

establishment of a brand, or mark. Makers using dyeplants from Scottish sources are currently operating as individuals and do not currently enjoy the benefits which an umbrella 'mark' could confer. The Harris Tweed Industry is a good example of an industry which uses its mark - the Orb - in an effective way to guarantee consumers high quality textiles from accredited Western Isles sources (Harris Tweed Authority, pers comm).

In order for the 'Scottish source material' mark to be meaningful, it would be necessary to ensure that the plants etc. utilised by makers were collected and processed in accordance with accredited guidelines, such as those proposed in the following subsection. A modest level of funding would be required to establish a body responsible for accreditation and ensuring effective promotion of the mark.

This proposal would require the consideration of conditions under which a manufacturer would be eligible to enter the scheme. As has been previously mentioned, no-one currently making a living from naturally dyed materials uses exclusively Scottish materials. Although there is concern in the trade about the sustainability of collection practices in other (especially tropical) countries, as yet no schemes have been devised which guarantee that dyestuffs are produced in a sustainable manner. To bring this about, pressure could be applied to manufacturers, a move which would be envisaged through the supplier network rather than by individuals. In order for the Scottish scheme not to become discredited through association with unsustainable practice, it would be necessary to limit the percentage of material employing foreign dyestuffs to e.g. less than 25% (in the case of dyestuffs for which a sustainable source is not vouched); or to increase this percentage (to perhaps as high as 50%) in cases where the sustainability of source is guaranteed, for example through a similar local scheme.

6.2.2 EDUCATION

There appears to be potential for natural dyeing to play a two-fold role in education, both as a craft, and as an example of sustainable use natural resources. As previously mentioned, natural dyeing workshops are taking place all over the country at present, and there is every sign that this is likely to continue into the future. Perhaps the practice could become more widespread across the social strata of society, particularly in urban areas, if a greater number of workshops were to take

place in less affluent areas, perhaps with assistance being made available for the less wealthy to obtain access to the equipment required.

A couple of respondents reported that they had carried out natural dyeing in school art classes until the proscription of the use of metallic compounds in these classes. Natural dyeing could, therefore, be included in the educational curriculum for chemistry, as an eye- and mind-catching method of making chemical reactions relevant to the pupils.

Also in schools, the ethical and practical debate behind collection for the dye pot could help provide a different, thought provoking item for discussion under the sustainability agenda.

6.2.3 GUIDELINES AND PROCEDURES

6.2.3.1 DISCHARGES

There appears to definitely be a need for the development of guidelines, and possibly Code of Practice, for the use of mordants in home dyeing. Scientific research could be carried out (perhaps as a piece of postgraduate research) to identify means of achieving and monitoring discharge level compliant mordant and dyebath exhausts. It would be expected that this would result in the production of instructions covering the quantities of mordants employed, and the dilution requirements for exhaust baths prior to disposal. These instructions could be accompanied by the development and provision of 'home testing' kits, enabling home dyers to check the levels of the metallic residues in dyebaths before disposal. These could be made widely available to the home dyeing community, which would welcome the opportunity of following a process whereby environmental pollution would be avoided.

6.2.3.2 COLLECTIONS

The current situation with regard to collections from private ground is one requiring some attention. While some making collections undoubtedly seek permission for their collections, there remains a degree of confusion as to the situation with regard to the collection of e.g. lichens, and in view of the negative reaction anticipated from landowners or farmers, some collectors choose to take plant material (often farmland

weeds which would be sprayed in any case) without permission. In view of this, there are two areas which could be usefully addressed - namely the education of the collectors, and the encouragement of good collecting practice; and the advocacy of the acceptance of good practice among the land-owning sector.

It would be appropriate for relevant bodies (such as Scottish Natural Heritage, The Forestry Commission, local councils and representatives of local landowners, through the Scottish Landowners Federation and the National Farmers Union in Scotland) to work with the natural dyeing community towards setting up procedures facilitating the sustainable collection of plant, lichen and fungi materials. The procedures thus developed should be sensitive to the varying local conditions prevailing throughout the country, and not be overly proscriptive in areas of local abundance.

Emphasis could be placed on collection from areas where the flora and fungi would otherwise be destroyed, in particular civil engineering projects, forestry extractions and farming operations. Implementation of the procedures should include an awareness raising element among landowners, with a view to increasing their understanding of the practice, and to facilitating access for non-intrusive collections on private ground.

These procedures could be formalised into a Code of Practice for the dyeing community, and those wishing to be accredited for good practice could undergo a formal test of their identification skills and knowledge of procedures, backed up by evidence of good practice. The promotion of the Code of Practice would likely be most effectively achieved within the natural dyeing community by dissemination of publicity materials and other forms of promotion (e.g. training) through existing networks such as the Guilds of Weavers, Spinners and Dyers, the Scottish Fungi Group and the International Feltmakers Association.

7. Summary and Conclusions

7.1 Economic contribution

The 'intermediate' nature of dyeing using plants, and the high instance of combining with other dyestuffs for the end product; along with the fact that many products utilising plant dyes do not actually reach the open market, makes it virtually impossible to assess the economic contribution made by specifically native plant dyes in Scotland. An informed estimate would put present day contribution in the low tens of thousands of pounds per annum, but there is no straightforward way of determining how accurate this estimate is.

What can be inferred, however, is that the contribution of native plants to Scotland's economy through their use as dyes was relatively much greater in the past. If, as is likely, all early dyes came from native plants, there would have been a significant, though hidden, economic contribution at that time. As dyeing using plants continued through the home dyer tradition, the economic contribution would have remained significant, but again hidden.

There are only a couple of points in Scottish history where the economic value of flora for dyeing can be assessed to any extent. Lightfoot, (1777) reports "great quantities" of lichens being collected around Taymouth, collectors receiving 1s or 1s 4d per stone (equivalent to 8p or 11p per 10kg). The net contribution from this can only be conjectured. The Cudbear industry which initially used orchil producing lichens collected in the Highlands is reported to have required around 250 tons of lichens annum, with collectors reported to have earned 3s 2d (around 16p) per 22lbs (approx. 10kg) collected (Richardson, 1975). Although this seems an unlikely increase from Lightfoot's time, at this higher level of pay the activity would have produced a net annual contribution of around £400 to the local economy at that time. It is worth noting that this income stream did not last, catastrophic depletion of lichen supplies resulting in subsequent supplies being obtained from abroad. The returns from the manufactured Cudbear were reported by Gordon, (1785), to be £13 per ton, versus orchil which was imported at £200 per ton. It is probable that the Cudbear industry contributed several thousands of pounds per annum to the economy.

7.2 *The history of dyeing and textiles using native flora*

Evidence from elsewhere suggests that dyeing using the native flora is likely to have started in Scotland in early times. Historically, the practice of dyeing developed along different lines in urban and rural areas. Dyers in towns worked with volumes of textiles and dyestuffs, while individuals working in rural areas dyed in small lots to meet the needs of their immediate family.

Importation of dyestuffs started around the 15th century. These imports, along with home-grown cultivated crops of dyeplants, were used by commercial dyers. Individual dyers continued to use dyes obtained from the native flora until a significantly later date, although the practice throughout southern Scotland diminished after the 1783 repeal of the Dress Act in the face of readily available imports.

Flax (*Linum usitatissimum*) had likely been grown in Scotland from early times, and the linen textile produced from it was used in a wide range of applications. Linen obtained from nettles (*Urtica dioica*) was also produced in Scotland, but to a lesser extent. During the 1700s the indigenous linen industry went through a rapid period of expansion, but by the mid 1800s the linen industry had almost disappeared in the face of cheaper linen imports from abroad, and cotton from the USA Flax production recommenced in the country during the First and Second World Wars, but is presently in abeyance, with a limited amount of experimentation using continental varieties apparently the only activity in this field at present (Clarke, pers comm).

During the 1700s and 1800s, native flora augmented by imported indigo, continued to be used by dyeing individuals in the Highlands and Islands to a significant extent. In these areas, the rapid adoption of chemical dyes in the latter part of the 19th century and early part of the 20th century led to a sharp drop in the use of native plants in dyeing. The use of native plant dyes continued at a modest level in the Outer Hebrides to the present day, the practice being handed down through the generations, but the tradition has now almost completely died out.

7.3 *Dyeing using native plants in the present day*

The 1970s resurgence of interest in the environment and natural products has given rise to today's generation of natural dyers, many of whom use, or experiment with

native flora. Dyeing using fungi, first developed in the USA during the 1970s, was introduced to Scotland in the early 1990s, and is now a popular activity among some of the dyeing community.

Dyeing using native flora is now a matter of choice rather than that of necessity, as was historically the case. Today's dyers have generally learnt the practice through books, sharing with other dyers and attending workshops. Some are engaged in business using plant or fungi dyed materials, but those making a sustainable living typically augment Scottish natural sources with other natural dye sources.

7.4 Conservation and Environment

Today's dyers, to a large extent informed by sources from within the dyeing community, are in general highly aware of the potential environmental impacts of their activities, and tailor their collecting activities accordingly. They are also concerned about the impact of the dyeing process and many have reduced or eliminated completely harmful chemicals from their dyeing practices.

7.5 Development potential

There is some potential for the development of Scottish natural dyes in various areas. Following on in the footsteps of other nations, consideration could be given to carrying out research into the feasibility of re-establishing dyeplant crops within the country; while smaller scale production in nurseries and market gardens looks set to increase in volume. Guidelines could be established for the collection of plant and fungi material from the wild, and the safe disposal of dyebath solutions. These could form the basis for an accreditation scheme, publicised via a national 'mark', for products employing dyes obtained from sustainable sources. The 'mark' could possibly help raise the profile of such products and develop a more viable market for them.

Appendix A. Plants used in historical times

Appendix A.1. Scottish Native Plants traditionally used in Dyeing

Key to sources : 1 - Beveridge, (1911); 2 - Edmonstone, (1841); 3 - Ferguson, (1878); 4 - Fraser, (1983); 5 - Gladstone, (1981); 6 - Grierson, (1986); 7 - Henslow, (1905); 8 - Lawson, (1852); 9 - Lightfoot, (1777); 10 - Page, (1982); 11 - Pennant, (1774); 12 - Richardson, (1975); 13 - Henderson et al, (1994); 14 - Ross, (1974); 15 - Shaw, (1955); 16 - Sowerby et al, (1862); 17 - Thompson, (1969).

Comments are attributed to source by key. Where no key is given, the comment is attributed to the sole contributor.

Taxonomy and distribution according to Perring and Walters, (1990) and Stace, (1999).

Scientific name	Common name	Colour	Parts used	Reported by	Mordant (if known)	Comments
Agrimonia eupatoria	Agrimony	yellow	stems and leaves	6, 8, 16		16 - pale colour early in the season, deeping later
Alliaria petiolata	Garlic mustard	yellow		6		No specific Scottish reference
Alnus glutinosa	Alder	red / orange	bark (catkins - Sow)	16		
Alnus glutinosa	Alder	black	bark (catkins - Sow)	3; 4, 7, 9, 13, 14, 16, 17	FS	3, 13, 14 - with addition to copperas, bog mud or logwood; 17 - also grey
Angelica sylvestris	Angelica	black		2, 6		6 - possibly with addition of logwood
Angelica sylvestris	Angelica	yellow		6		
Anthriscus sylvestris	Cow parsley	yellow / green		11		
Anthyllis vulneraria	Kidney vetch	yellow	stems and leaves	7, 8, 16		
Arctostaphlyos uva-ursi	Bearberry	ash / bluish black		14, 16		16 - in Scandinavian countries
Artemisia vulgaris	Mugwort	yellow		6; 17		6 - greyish green
Betula nana	Dwarf birch	yellow	leaves	3, 9, 16		3 - bright yellow; 9, 16 - much superior to that obtained from other *Betula* spp.
Betula spp.	Downy and silver birch	yellow	leaves	9		
Betula spp.	Downy and silver birch	fawn	bark	14		

Scientific name	Common name	Colour	Parts used	Reported by	Mordant (if known)	Comments
Bidens tripartita	Trifid bur-marigold	yellow		9	Al	Stace, (1999) - v. scattered in the North of Britain.
Bidens cernua	Nodding bur-marigold	yellow		9		Stace, (1999) - v. scattered in the North of Britain.
Bromus secalinus	Rye brome	green	panicles	8		Stace, (1999) - v. scattered in British Isles.
Calluna vulgaris	Heather	yellow	tips	1, 7, 9, 11, 13, 14, 15		15 - plus indigo gives green; 16 - to orange with alum
Calluna vulgaris	Heather	green	tips	1, 6, 14, 16, 17	Al (17)	1, 6 - using FS; 14; 17 - from dark shady place; dark green
Caltha palustris	Marsh marigold	yellow	petal juice	6, 7, 16	Al	6 - possibly a stain; recorded as traditional dye in Ireland
Campanula rotundifolia	Harebell	fine blue	flowers	8		
Centaurea nigra	Common knapweed	yellow	whole young plant	4	Al+CoT	
Centaurea nigra	Common knapweed	bright green		6	Al	Reporting Mackay, 1924.
Chrysanthemum segetum	Corn marigold	yellow	flowers	15, 17	Al	
Corylus avellana	Hazel	dull brown / yellow	catkins	6		Reported from outside Scotland.
Crataegus monogyna	Hawthorn	black	bark	9; 16	FS	
Cytisus scoparius	Broom	yellow		6, 17		6 - possibly erroneous reference to *Genista tinctoria*
Cytisus scoparius	Broom	pale blue		5, 17	Al	"
Cytisus scoparius	Broom	dk. green		17		"
Daucus carota	Carrot	blue	leaves	16		
Digitalis purpurea	Foxglove	yellow	tops and leaves	6		19 - root reported as a mordant in Wales.
Diphasiastrum alpinum	Alpine club moss	mordant		10		
Dipsacus sp.	Teasel	yellow		14, 17		17 - bright yellow. Stace, (1999) - D. fullonum frequent in British Isles north to C. Scotland.
Dipsacus sp.	Teasel	dk. green		17		
Drosera rotundifolia	Round-leaved sundew	yellow		17	Ammonia	
Drosera rotundifolia	Round-leaved sundew	purple		14		
Drosera rotundifolia	Round-leaved sundew	bright yellow		14		
Dryopteris filix-mas	Common male fern	green		10		
Empetrum nigrum	Crowberry	purplish-blue	juice	2		To stain ribbons etc.
Empetrum nigrum	Crowberry	black	berries	9	Al	
Erica cinerea	Bell heather			6		Produces similar colours to *Calluna vulgaris*

Scientific name	Common name	Colour	Parts used	Reported by	Mordant (if known)	Comments
Erica tetralix	Cross-leaved heath			6		Produces similar colours to *Calluna vulgaris*
Equisetum spp.	Horsetail	yellow-green and green		10		Stace, (1999) - *E. arvense* abundant.
Euonymus europaeus	Spindle	purple		14	Sal ammonia	Stace, (1999) - frequent up to C. Scotland
Euonymus europaeus	Spindle	yellow	fruits	7		
Euonymus europaeus	Spindle	green	fruits	7	Al	
Filipendula ulmaria	Meadowsweet	black		2, 6, 17		2 - with bog-iron; 6 - bluish with Rumex acetosa mordant; 17 - black / grey
Fraxinus excelsior	Ash	black	root	6	FS	Quoting Maclagan, 1898.
Fraxinus excelsior	Ash	yellow	root	6, 14, 17		6 - used as an over-dye on woad / indigo
Fumaria officinalis	Common fumitory	green	flower, leaves and stems	6	Al	Reported Norwegian dye
Gallum aparine	Cleavers	red / yellow	roots	16		Not practically applied
Galium verum	Ladies bedstraw	red	roots	7; 8; 9, 11; 14; 15; 16; 17		9, 11 - not inferior to madder; 15 - orange red; 16, 17 - no parts mentioned
Galium verum	Ladies bedstraw	yellow	stems and leaves	7, 16	Al	16 - used to a great extent in Ireland
Genista tinctoria	Dyers greenweed	bright yellow	flowers	7, 8, 9, 16	Al	7 - young shoots. Stace, (1999) - native to S. Scotland;
Geranium sylvaticum	Wood crane's-bill	violet	flowers	9		Used by Icelanders.
Hedera helix	Ivy	black	leaves	16		
Hedera helix	Ivy	greenish grey	berries	4		
Huperzia selago	Fir clubmoss	red		10, 17		Also used as mordant
Hypericum perforatum	Perforate St. Johns Wort	yellow	tops	3, 9, 14, 16, 17	Al	9 - dried plant; 16, 17 - no mention of parts used
Hypericum perforatum	Perforate St. Johns Wort	yellow	stems and leaves	3, 8	Al	3 - plant part not indicated
Hypericum perforatum	Perforate St. Johns Wort	red	tops	7, 16	Al + Tin	
Hypericum pulchrum	Slender St. John's Wort			16		Similar dye to *H. perforatum*
Iris pseudacorus	Yellow iris	black	root	9; 11, 13, 14, 16, 17	FS	9; 11 - boiled with copperas to make ink; 13 - with addition to copperas or bog mud;
Iris pseudacorus	Yellow iris	black / grey	root	1, 15, 17		15 - also blue
Iris pseudacorus	Yellow iris	green	leaves	14, 16		16 - dark green

Scientific name	Common name	Colour	Parts used	Reported by	Mordant (if known)	Comments
Larixspp.	Larch	brown	needles in autumn	6		Not reported from Scotland
Lathtyrus pratensis	Meadow vetchling	yellow	leaves, stalks and flowers	6	Al	
Lotus corniculatus	Common Bird's-foot-trefoil	yellow		3		
Lycopodium clavatum	Stag's horn clubmoss	mordant		10		
Lycopus europaeus	Gypsywort	almost black		8		Stace, (1999) - scattered outside England and Wales
Lysimachia vulgaris	Yellow loosestrife	yellow	stems and leaves	8		Perring and Walters, (1990) - scattered S. of the Great Glen. No records further north.
Lythrum salicaria	Purple loosestrife	purple		6		Traditional Irish dyestuff
Malus sylvestris	Crab apple	yellow		14; 17		Perring et al, (1990) - often relict of cultivation. V. scattered in N. Scotland.
Malus sylvestris	Crab apple	citron	bark	9		
Menyanthus trifoliata	Bogbean	green		4	Al+CoT	With young heather tips
Menyanthus trifoliata	Bogbean	brown	roots	6		Traditional Irish recipe
Mercurialis perennis	Dog's Mercury	blue	leaves	16		16 - might provide valuable if any way could be found of fixing it. Perring et al, (1990) - v. scattered in N. Scotland.
Myrica gale	Bog-myrtle	yellow	tops	9, 14, 16, 17		9 - used to obtain dye in Sweden.17 - no mention of parts used
Myrica gale	Bog-myrtle	yellow	whole plant; seed's	15		
Narthecium ossifragum	Bog asphodel	yellow		6		Used as substitute for saffron in Shetland.
Nymphaea alba	White water-lily	dk. brown	roots	9; 11; 14		
Nymphaea alba	White water-lily	black	roots	15		Boiled with FS or Al
Origanum vulgare	Wild marjoram	red or purplish	tops	8, 9		9 - deep red colour. Stace, (1999) - locally common up to C. Scotland
Persicaria hydropiper	Water-pepper	yellow	stems and leaves	3, 8, 9		
Persicaria maculosa	Redshank	yellow	plant	3, 9	Al	
Phragmites australis	Common reed	green	panicles	8, 16	Al	16 - reported used by Swedish peasantry
Populus tremula	Aspen	yellow		14; 17		
Potentilla erecta	Tormentil	red	roots	7, 8, 13, 14, 16, 17		13 - as tanning agent in Skye and Orkney; 17 - no parts mentioned
Potentilla palustris	Marsh cinquefoil	reddish or dull yellow	roots	8, 9, 16		8 - red; 9 - roots used to dye wood and leather

Scientific name	Common name	Colour	Parts used	Reported by	Mordant (if known)	Comments
Potentilla palustris	Marsh cinquefoil	yellow	roots	7		Formerly used in tanning leather.
Prunus spinosa	Blackthorn	bright red	bark	3, 9		9 - the juice will make good ink with vitriol or copperas.
Prunus spinosa	Blackthorn	bluish black		14		
Pteridium aquilinum	Bracken	yellow	roots	12, 14; 17		
Quercus spp.	Oak	brown	bark	3, 9		3, 9 - black with FS
Quercus spp.	Oak	black / grey	bark and acorns	14, 17		
Reseda luteola	Weld	yellow	whole plant; seeds	7, 9, 16, 17	Al + CoT	7 - also reports green; 16 - tin to make more fade resistant; 17 - no mention of plant part. Perring et al, (1990) - throughout most of the British Isles except much of N. and W. Scotland.
Reseda luteola	Weld	lively green		14		With indigo.
Rorippa nasturtium-aquaticum	Water cress	voilet		14		
Rosa canina	Dog-rose	black	bark	3, 6, 9	FS	6 - reports Maclagan, 1898, stating use of root
Rosa pimpinellifoia	Burnet rose	violet		16	Al	16 - to silk. Stace, (1999) - round most coasts of British Isles.
Rubus fruticosus. agg.	Bramble	black	young shoots	9, 16	FS	9 - green twigs used
Rubus fruticosus. agg.	Bramble	red		6		Report from 19th century.
Rubus fruticosus. agg.	Bramble	orange		14, 17		
Rumex acetosa	Common sorrel	red	roots	8, 15		15 - mordant, making permanent blue with indigo.
Rumex obtusifolius	Broad-leaved dock	black / grey	roots	6, 14, 17		Also used as mordant. 6 - may also apply to *R. crispus* (curled dock).
Salix alba	White willow	cinnamon		9		Stace, (1999) - possibly native
Salix pentandra	Bay willow	yellow	leaves	9		Report from Sweden.
Salix spp.	Willow	black	bark	3		
Sambucus nigra	Elder	brown	berries	3, 9		Bark also used as a mordant.
Sambucus nigra	Elder	pale blue		5, 14, 17	Al	
Sambucus nigra	Elder	black	bark	9	FS	
Senecio jacobaea	Ragwort (Stinking Willie)	yellow	flowers	15, 16	Al	15 - "blackish yellow".
Senecio jacobaea	Ragwort (Stinking Willie)	green	leaves	8, 16		16 - dye is not v. permanent
Senecio jacobaea	Ragwort (Stinking Willie)	orange		14		16 - dye is not v. permanent
Serratula tinctoria	Saw-wort	yellow		8, 9	Al	9 - exceedingly fine colour, preferable to *Reseda luteola* or *Rubia tinctorum*. Stace, (1999) - local in Great Britain up to S. W. Scotland.

Scientific name	Common name	Colour	Parts used	Reported by	Mordant (if known)	Comments
Sinapsis arvensis	Charlock	yellow	flowering tops	6		
Sorbus aucuparia	Rowan		berries	4		Used as alterant (brightener), for e.g. madder
Stachys palustris	Marsh woundwort	black		2, 6		2 - logwood added; 6 - possibly used as a bottoming colour for logwood black.
Stachys sylvatica	Hedge woundwort	yellow	stems and leaves	8	Al	
Succisa pratensis	Devil's bit scabious	yellow / green		7, 16		16 - used on Continent
Succisa pratensis	Devil's bit scabious	yellow	stems and leaves	8		
Tanacetum vulgare	Tansy	green	young shoots	16		16 - used by Finlanders; Stace, (1999) - possibly native
Taraxacum spp.	Dandelion	magenta		14, 17		6 - colour unlikely, species possibly used as an additive.
Teucrium scorodania	Wood sage	yellow	leaves	6	Al	To linen. Not Scottish reference.
Thalictrum flavum	Common meadow-rue	yellow	roots	7, 8, 9		9 - roots and leaves. Stace, (1999) - very scattered, mostly in E. England. 6 - probably *T. minus*, lesser meadow rue or possible mis-identification with *Galium verum*, due to the similarity in Gaelic names for the two species.
Thalictrum flavum	Common meadow-rue	red	roots	17		
Tragopogon pratensis	Goat's beard	yellow	flowering tops	6		19th century reference from the Outer Hebrides.
Trifolium pratense	Red clover	green	heads	6, 16	Al or FS	6 - most likely escape from cultivation; 16 - gathered in N. Europe.
Tussilago farfara	Colt's-foot	green yellow	leaves	4	Al+CoT	
Ulex europaeus	Gorse	brown	bark; twigs	4, 6, 14, 17		6 - reports Maclagan, 1898, bark using Al; twigs with iron.
Ulex europaeus	Gorse	dk. green	bark	14; 17		
Ulex europaeus	Gorse	yellow	bark, flowers and young shoots	6		Irish recipe.
Ulmus glabra	Wych elm	yellow		14; 17		
Urtica dioica	(Stinging) nettle	dull green	juice	16		
Urtica dioica	(Stinging) nettle	yellow	roots	8, 9, 15, 16	Al	15 - greenish yellow from whole plant + Al.
Urtica dioica	(Stinging) nettle	black		6	FS	Quoting Maclagan, 1898.
Vaccinium myrtillus	Blaeberry	purple	juice	3, 9, 14, 16	Al	3, 9 - violet; 16 -dyeing linen
Vaccinium myrtillus	Blaeberry	blue		5, 12, 14	Al	14 - with copperas.
Vaccinium myrtillus	Blaeberry	brown		14		With nut galls.

Scientific name	Common name	Colour	Parts used	Reported by	Mordant (if known)	Comments
Vaccinium myrtillus	Blaeberry	red		14		With verdigris and sal ammonia.
	Peat soot	dk yellow		1		17 - also orange

Appendix A.2. Plants introduced to or naturalised in Scotland, historically used in dyeing

Key to sources : 1 - Ferguson, (1878); 2 - Fraser, (1983); 3 - Grierson, (1986); 4 - Henslow, (1905); 5 - Lawson, (1852); 6 - Lightfoot, (1777); 7 - Ross, (1974); 8 - Sowerby et al, (1862); 9 - Thompson, (1969).

Comments are attributed to source by key. Where no key is given, the comment is attributed to the sole contributor.

Taxonomy and distribution according to Perring and Walters, (1990) and Stace, (1999).

Scientific name	Common name	Colour	Parts used	Reported by	Mordant (if known)	Comments
Anthemis tinctoria	Yellow chamomile	yellow		5		Stace, (1999) - rare in N. British Isles.
Berberis vulgaris	Barberry	yellow	stem and root	4, 8	Al	
Berberis vulgaris	Barberry	orange	root	7, 9		
Carpinus betulus	Hornbeam	yellow	inner bark	6		
Convallaria majalis	Lily of the Valley	green	leaves	8	Lime water	Stace, (1999) - often naturalised.
Carthamus tinctorius	Safflower	red	flowers	5		Stace, (1999) - v. scattered outside S. British Isles.
Crocus sativus	Saffron	yellow	flowers	5		
Frangula alnus	Alder buckthorn	green, yellow	green berries	4, 5, 8		Perring and Walter, (1990) - status doubtful in Scotland. Stace, (1999) - v. scattered in Britain north to C. Scotland.
Frangula alnus	Alder buckthorn	bluish grey, blue and green	ripe berries	5, 8		
Frangula alnus	Alder buckthorn	black	bark	2	Al+CoT	
Humulus lupulus	Hop	yellow	juice	3, 8		3 - no dyes specifically recorded in Scotland.
Inula helenium	Elecampane	blue		1, 6		1, 6 - with whortleberries; 6 - bruised and macerated in urine with balls of ashes.
Isatis tinctoria	Woad	blue	foliage	4, 8		
Juglans regia	Walnut	dk. brown	root	7		Before sap rises
Ligustrum vulgare	Wild privet	green	ripe berries	5, 7, 8	Al	Ros - with salt; Perring at al, (1990) - probably not native in Scotland; Stace, (1999) - native throughout most of British Isles except N. Scotland.
Ligustrum vulgare	Wild privet	red		3		With salt
Myrrhis odorata	Sweet Cicely	yellow / green	tops	6		
Phytolacca sp.	Pokeweed	red /		5		

Scientific name	Common name	Colour	Parts used	Reported by	Mordant (if known)	Comments
		purplish				
Prunus domestica	Wild plum	yellow	bark	8		
Pyrus communis	Pear	yellow	leaves	8		
Rhamnus cathartica	Buckthorn	yellow	unripe berries	6	Al	Ripe berries provide green. Bark also dyes yellow.
Ribes rubrum	Red currant	dk. brown		7	Al	
Rubia tinctorum	Madder	red	root	5, 8		
Sambucus ebulus	Dwarf elder	fine blue	berries	5		Stace, (1999). Possibly native in England. Scattered.
Sambucus ebulus	Dwarf elder	violet	berries	4, 8		

Appendix A.3. Lichens historically used in Scotland for dyeing

Key to sources : 1 - Bolton, (1960); 2 - Fergusson, (1878); 3 - Grierson, (1986); 4 - Kok, (1966); 5 - Lightfoot, (1777); 6 - Lindsay, (1856); 7 - Ross, (1974); 8 - Shaw, (1955).

Taxonomy according to Coppins, (pers comm).

Scientific name	Common name	Colour	Reported by	Comments
Aspicilia calcarea		Red	4, 5, 6	4 - constituent of Cudbear. Coppins (pers comm) - dubious identification.
Cladonia coccifera agg.		Red	3	5 - "steeped in Alkaline Lixivium"
Cladonia pyxidata	Cup lichen		3, 4	4 - constituent of Cudbear; 3 - refutes 4's claim
Diploschistes spp.		Orchil	1	Orchil dye. *D. scruposus* - deep red dye
Evernia prunastri	Stag's horn or Ragged hoary lichen	Red	1, 5	Orchil dye. 1 - dark plum.
Ophioparma ventosa			5	No colour reported.
Haematomma ventosum		Chocolate brown	1	
Hypogymnia physodes	Puffed shield lichen	Brownish orange	6	Boiling water.
Lobaria pulmonaria	Lungwort	Brown	1, 6	Boiling water.
Ochrolechia parella		reddish / orangey	5, 6	Orchil dye.
Ochrolechia tartarea	Cudbear lichen, corcur	purple	6, 7	Orchil dye; main constituent of Cudbear.
Ophioparma ventosa		Chocolate brown	1, 5	5 - No colour reported
Parmelia caperata		Yellow	6	Boiling water. 6 - used by Isle of Man peasantry
Parmelia conspersa		Brown	1	Boiling water.
Parmelia omphalodes		deep brown	2, 5, 6	Boiling water. 2 - especially for hose.
Parmelia saxatilis		brown; brownish red	6, 7, 8	Boiling water. 6 - known as Staney Raw or Staney Rag
Peltigera canina		Yellow	1	Boiling water. No indications of tradition
Pseudevernia furfuracea	Tree moss	Red	6	In experiments
Platismatia glauca		Yellow	1	
Ramalina siliquosa	Sea ivory	Red	5, 6, 7	Probably *Lichen calicaris* reported by 5 (Coppins, pers comm).
Ramalina siliquosa	Sea ivory	Orange; yellow	8	

Scientific name	Common name	Colour	Reported by	Comments
		brown		
Ramilina subfarinacea		Orchil	1	
Tephromela atra		Orchil	1	
Umbilicaria pustulata		Red	1, 5, 6	Orchil dye. Coppins (pers comm) - Substitute for *Ochrolechia tartarea*, possibly imported from Norway.
Usnea spp.		yellow	1	Boiling water
Usnea subfloridana		Yellow	3	Boiling water. Also obtains copper and olive green with different treatments
Xanthoria parietina		Yellow or orange	5	Boiling water
Xanthoria parietina		Blue	1, 3, 7	

Appendix A.4. Natural dyestuffs historically imported into Scotland

List obtained from Thurstan, (1939) and Grierson, (1986).

Taxonomy according to Mabberley, (1997).

Dyestuff	*Description*
Brazilwood	Covers several redwood dyes originally from European species, later from American species. All produce red dyes.
Cochineal	Prepared from dried bodies of an insect which lives on cactus plants cultivated in Mexico, the Canary Islands and elsewhere for this purpose. Gives various shades of crimson, scarlet or rose.
Flavine	Commercial preparation of the U.S. Quercitron tree. (*Quercus tinctoria*). Produces yellows and oranges.
Fustic	Supplied in chips, prepared from the wood of *Maclura tinctoria*, which grows in Asia, Africa and America. Produces relatively fast yellow shades.
Cutch	Prepared from certain of the *Acacia* species, this has a special affinity with cotton. Produces brownish hues.
Indigo	Produced from various species of the *Indigofera* genus which grow in Egypt, India and elsewhere in Asia. It reaches the market as a dark blue powder, insoluble to water. Produces blue colours. Often used as an overdye on yellow to produce green.
Logwood	The heart-wood of *Haematoxylum campechianum*, a native of S. America, supplied to the market in chips or as a paste. Used in the preparation of darker colours, purple, grey and black.
Persian berries	Dried fruit of a blackthorn which grows in Greece and Turkey. Have to be pounded with a mortar before being used.
Sumach	Preparation of the ground-up leaves of certain species of *Rhus*, found in S. Europe, USA and S. E. Asia. Used extensively in cotton dyeing, providing a yellow brown colour.
Turmeric	Yellow powder obtained from the ground root of *Curcuma longa* found in India. Provides a range of orange to brown colours.

These and other products can be obtained at present from suppliers, as well as commercial preparations of species already mentioned as native or introduced species, namely :

Birch bark (*Betula spp.*), chamomile (*Anthemis tinctoria*), Dyer's Weed (*Genista tinctoria*), goldenrod (*Solidago* spp.), Heather flowers (*Calluna vulgaris*), madder (*Rubia tinctorum*), oak bark (*Quercus* spp.), poplar buds (*Populus* spp.), St. Johns Wort (*Hypericum perforatum*), Safflower (*Carthamus tinctorius*), Tansy (*Tanacetum vulgare*), Walnut husks and leaves (*Juglans regia*) and weld (*Reseda luteola*) (from Fibrecrafts catalogue – (Anon, 1999)).

Appendix B. Dyestuffs being used by today's natural dyers

Appendix B.1. Scottish native plants

The species listed here are those reported by respondents; other species may currently be in use.

Taxonomy according to Stace, (1999).

Abbreviations used : Al = alum; BP = chrome; CoT = cream of tartar; CS = copper; FS = iron; SC = tin.

Scientific name	Common name	Colour	Parts used	No. of respondents	Mordant (if known)	Comments
Achillea millefolium	Yarrow	pale lemon	stems, leaves and flower heads	1	Al+CoT	
Alnus glutinosa	Alder	goldish yellow		1	Al	
Alnus glutinosa	Alder	reddish orange	inner bark	1		Care not to boil
Alnus glutinosa	Alder	black	outer bark	1	FS	Care not to boil
Anthriscus sylvestris	Cow parsley	yellow		1	Al+CoT	
Anthriscus sylvestris	Cow parsley	green	buds and young leaves	1	Al+CS	
Anthriscus sylvestris	Cow parsley	vivid yellow / orange		1	SC	
Anthriscus sylvestris	Cow parsley	bronze		1	BP	
Artemisia vulgaris	Mugwort	green	flowering tops	1	Al+CS	
Betula pubescens	Downy birch	yellow	leaves		Al	
Betula spp.	Birch	greyish fawn	leaves	1	Al	*B. pendula* or *B. pubescens*
Betula spp.	Birch	light brown	bark	1	Al+CoT	Iron pot
Calluna vulgaris	Heather	yellow	tips	5	Al	One respondent reported gold with BP; another using the whole plant.

Scientific name	Common name	Colour	Parts used	No. of respondents	Mordant (if known)	Comments
Calluna vulgaris	Heather	green	tips	3	Al	On respondent obtained a greenish yellow.
Calluna vulgaris	Heather	ochre	tips	1	Al and BP	
Chelidonium majus	Greater celandine	corn yellow	flowering tops	1	Al+CoT	
Chenopodium album	Fat hen	blonde	flower tips	1	Al+CoT	Pale yellow using flowers and leaves.
Crataegus monogyna	Hawthorn	olive-brown	leaves	1	Al	
Cytisus scoparius	Broom	butter / yellow	flowering tops	2	Al+CoT	
Cytisus scoparius	Broom	yellow	flowering tops	2	SC	
Cytisus scoparius	Broom	golden	flowering tops	2	BP	
Digitalis purpurea	Foxglove	clear yellow	flowering tops and leaves	1	Al+CoT	
Equisetum spp.	Horsetail	pale yellow	sterile tops	1	Al+CoT	
Equisetum spp.	Horsetail	yellow - green		1	Al+CoT	
Equisetum spp.	Horsetail	olive green		1	BP	
Filipendula ulmaria	Meadowsweet	lime yellow	flowers	1	CS	
Filipendula ulmaria	Meadowsweet	yellow	flowers	1	Al	
Galium verum	Ladies bedstraw	orange / red	roots	3	Al+CoT	One respondent reported obtaining salmon (using root without bark) and orangey pink (using bark only).
Galium verum	Ladies bedstraw	golden brown	roots	1	Al+CoT	
Galium verum	Ladies bedstraw	yellow	root	1	Al	
Galium verum	Ladies bedstraw	flesh	whole plant	1		
Genista tinctoria	Dyers Greenweed	yellow	leaves and twigs	2	Al	
Hedera helix	Ivy	creamy yellow	leaves	1	Al	
Hypericum perforatum	Perforate St. Johns Wort	mustard brown	flowers	1	Al+CoT	Overgrazed but returning where sheep kept out.
Iris pseudacorus	Yellow iris	greeny brown	roots	1	Al+FS	One respondent reported obtaining light brown; another light beige.
Iris pseudacorus	Yellow iris	green	plant minus roots	1	iron pot	Grey green with CS.

Scientific name	Common name	Colour	Parts used	No. of respondents	Mordant (if known)	Comments
Iris pseudacorus	Yellow iris	orangey brown	root	1	Al	
Iris pseudacorus	Yellow iris	pale yellow	leaves	1	Al	Bright green with CS; dark grey green with FS.
Juncus sp.	Rush	apricot	flowers	1	Al+CoT	
Juniperus communis	Juniper	warm yellow	dried berries	1	Al+CoT	
Ligustrum vulgare	Wild privet	green	ripe berries	1	Al	
Lycopus europaeus	Gypsywort	yellow	flowers and leaves	1	Al	
Mercurialis perennis	Dog's Mercury	pinky beige	flower tips	1	Al	
Myrica gale	Bog-myrtle	yellow	leaves and twigs	2	Al	One respondent reported that the sp. left the wool smelling good; another using the whole plant.
Myrica gale	Bog-myrtle	dull gold		1	Al	Greyish green
Myrica gale	Bog-myrtle	green	whole plant	1	Al+CoT; iron pot	
Potentilla anserina	Silverweed	pale yellow		1	Al	
Potentilla erecta	Tormentil	reddish brown	roots	1	Al	
Prunus spinosa	Blackthorn	pink		1	Al+CoT	
Pteridium aquilinum	Bracken	greenish yellow / khaki	young fronds	1	Al	
Pteridium aquilinum	Bracken	fawn	buds	1	BP	
Pteridium aquilinum	Bracken	lime green	young fronds	2	Al or BP	One respondent reported also obtaining mustard yellow.
Ranunculus sp.	Buttercup	light fawn	flowers	1	Al	
Ranunculus sp.	Buttercup	green	flowers	1	BP	
Ranunculus sp.	Buttercup	yellow	flowers	1	SC	
Reseda luteola	Weld	yellow	whole plant; seeds	6	Al	Two respondents did not use roots; one respondent obtained gold using chrome mordant; and another respondent reported equally good results from fresh and dried material.
Reseda luteola	Weld	yellow green	whole plant; seeds	1	Al / FS	
Reseda luteola	Weld	green	whole plant	4	AL+FS; or BP+FS	Plus indigo yields green
Rubus fruticosus. agg.	Bramble	lavender	berries	2	Al	
Rubus fruticosus. agg.	Bramble	ginger	berries	1	Al+CoT	Small amounts

Scientific name	Common name	Colour	Parts used	No. of respondents	Mordant (if known)	Comments
Rubus fruticosus. agg.	Bramble	dusty pink	berries	3	Al(+CoT - 14)	
Rubus fruticosus. agg.	Bramble	green	berries	2	Ammonia	
Rubus fruticosus. agg.	Bramble	charcoal grey	young shoots	1	Al+FS	
Rubus idaeus	Raspberry	pale ginger	berries	1	Al+CoT	Small amounts
Rumex acetosa	Common sorrel	yellow		1	Al	
Rumex obtusifolius	Broad-leaved dock	greenish grey	leaves	1	Al+FS	Olive green from chrome and iron
Rumex obtusifolius	Broad-leaved dock	salmon pink	roots	1	Al+CoT	Respondent also experimented sp. with as mordant
Rumex obtusifolius	Broad-leaved dock	greenish brown	roots	1	Al+CoT	
Rumex obtusifolius	Broad-leaved dock	fawn	dried seeds	1	Al	
Rumex obtusifolius	Broad-leaved dock	yellow / green	leaves	1	Al+CoT	
Sambucus nigra	Elder	pink - deep purple	berries	3	Al+CoT	Purple using Al and SC; green or brown using Al and ammonia
Sambucus nigra	Elder	mid greens	leaves	1	Al+CoT	
Senecio jacobaea	Ragwort	yellow	flowers	10	Al	One respondent obtained bright yellow; two others, using chrome mordant obtained gold
Senecio jacobaea	Ragwort	green	flowers	1	Al+FS	
Senecio jacobaea	Ragwort	yellow brown	all	2	Al	
Senecio jacobaea	Ragwort	green	flowers and leaves	1	Al / FS	
Senecio jacobaea	Ragwort	mustard brown	all	1	Al / FS	
Silene sp.	Campion	lime yellow	dead flowers	1	Al	
Silene sp.	Campion	greens	dead flowers	1	CS and SC	
Solidago viraurea	Goldenrod	(pale) yellow	flowers	4	Al	One respondent reported colour even brighter with washing soda; and another that fresh and dried material was equally effective. Species used may be introduction from N. America - *S. canadensis.*
Solidago viraurea	Goldenrod	gold		1	BP	
Succisa pratensis	Devil's bit scabious	blue-green	flower heads	1	Al	
Tanecetum vulgare	Tansy	yellow	flower tips	2	Al	

Scientific name	Common name	Colour	Parts used	No. of respondents	Mordant (if known)	Comments
Tanecetum vulgare	Tansy	gold		2	Al+CoT	Sometimes gets light yellow
Taraxacum sp.	Dandelion	yellow		1	Al+CoT	Bright orange with tin and bronze with chrome
Taraxacum sp.	Dandelion	creamy lemon	flowers	1	Al	
Trifolium pratense	Red clover	bright orange	flowers	1	Al	
Trifolium pratense	Red clover	light brown	flowers	1	Ch	
Tussilago farfara	Colt's-foot	creamy yellow	leaves	1	Al	
Ulex europaeus	Gorse	yellow	flowers	2	Al+CoT	Gold with chrome
Ulex europaeus	Gorse	green	flowers	1	Al+FS	
Urtica dioica	(Stinging) nettle	soft grey green	young plant	1	Al	
Urtica dioica	(Stinging) nettle	dull yellow	young plant	1	Al	
Urtica dioica	(Stinging) nettle	green	young plant	3	Al+FS; Al+CS; Al+CoT	
Urtica dioica	(Stinging) nettle	(pale) yellow	tops	5	Al (+CoT)	One respondent reported obtaining greeny yellow
Urtica dioica	(Stinging) nettle	dark yellow	tops	1	BP	Olive green if use BP+FS.
Vaccinium myrtillus	Bilberry	pink - purple	berries	2	Al	One respondent reported obtaining green with ammonia rinse
Vaccinium myrtillus	Bilberry	slate blue	frozen berries	1	Al+CoT	
Vaccinium myrtillus	Bilberry	grey	berries	1	Al+FS	
	Peat soot	dk yellow		1		

Appendix B.2. Introduced plants used by present day dyers

The species listed here are those reported by respondents; other species may currently be in use.

Taxonomy according to Stace, (1999).

Abbreviations used : Al = alum; BP = chrome; CoT = cream of tartar; CS = copper; FS = iron; SC = tin.

Scientific name	Common name	Colour	Parts used	No. of respondents	Mordant (if known)	Comments
Aster spp.	Michaelmas daisy	yellow		1	Al+CoT	Gold with BP
Convallaria majalis	Lily of the Valley	green	leaves	1	Al	
Convallaria majalis	Lily of the Valley	pale yellow	flowers	1	Al	
Eucalytus spp.	Gum	orange	bark	1		
Frangula alnus	Alder buckthorn	yellow	bark	1	Al	Tangerine with addition of ammonia
Inula helenium	Elecampane	primrose yellow	flowers	1	Al	
Isatis tinctoria	Woad	blue	young leaves	5	Al (5)	One respondent reported fermenting leaves and stalks in urine; another adding ammonia or washing soda.
Isatis tinctoria	Woad	pink	young leaves	3	Al(+CoT)	One respondent reported obtaining salmon pink;another pinky fawn (with Al) and fawny pink (with Al+FS).
Larix spp.	Larch	sand	cones	1	Al+CoT	
Laurus nobilis	Bay	murky olive		1		
Myrrhis odorata	Sweet cicely	bright green-yellow		1	Al+CoT	Olive green with BP and FS
Polygonatum multiflorum	Solomon's-seal	cream	stems	1	Al	
Prunus lusitanica	Portugal laurel			1		
Rubia tinctora	Madder	red	root	3	Al	One respondent reported obtaining coral (using dyebath exhaust with Al); orange using unmordanted exhaust with citric acid, dk. brown using iron and purple using FS and washing soda
Silybum marianum	Milk thistle	pale grey green	flowering tops	1	Al+CoT+FS	
Symphoricarpos albus	Snowberry	yellow	berries	1		
Tanacetum parthenium	Feverfew	yellow	flowering tops	1	Al+CoT	

Scientific name	Common name	Colour	Parts used	No. of respondents	Mordant (if known)	Comments
Tanacetum parthenium	Feverfew	green	flowering tops	1	Al+FS	

Appendix B.3. Lichens used by present day dyers

The species listed here are those reported by respondents; other species may currently be in use.

Taxonomy according to Coppins, (pers comm).

Scientific name	Common name	Colour	No. respondents	Comments
Evernia prunastri	Stag's horn or Ragged hoary lichen	Yellow	1	Storm blown tufts - no mordant (boiled)
Evernia prunastri	Stag's horn or Ragged hoary lichen	pink purple	1	Macerated with ammonia
Evernia prunastri	Stag's horn or Ragged hoary lichen	coffee	1	Alum and tin mordants
Evernia prunastri	Stag's horn or Ragged hoary lichen	yellowish fawn	1	Chrome mordant
Hypogymnia physodes	Puffed shield lichen	ginger	1	Storm blown tufts
Lobaria pulmonaria	Lungwort	yellowish	1	Added ammonia
Lobaria pulmonaria	Lungwort	reddish brown; sienna	2	
Ochrolechia tartarea	Cudbear lichen	bright pink / purple	1	Soaked in ammonia for 6 weeks
Ochrolechia tartarea		purple	3	One respondent reported red purple (using soda) and blue purple (using vinegar). Another used *Vaccinium myrtillus* overdye
Parmelia omphalodes	Dark crottle	warm ginger / red brown	4	Gathered from rocks in Caithness and Harris.; One respondent used an iron pot.
Parmelia saxatilis	Light crottle	rich red browns / yellow brown	2	Used sparingly
Usnea subfloridana		pale yellow	1	pale yellow
Xanthoria parietina		clear yellow / ripe apricot	1	Storm blown tufts

Appendix B.4. Garden plants used by present day dyers

The species listed here are those reported by respondents; other species may currently be in use.

Scientific name	Common name	Colour	Parts used	No. of respondents	Mordant (if known)	Comments
Allium cepa	Onion	yellow	skins	4	Al	One respondent reported obtaining yellow to orange depending on quantity used.
Allium cepa	Onion	tan / gold	skins	5	Al or BP	One respondent reported obtaining dark gold with Al and tan with Al and FS.
Allium cepa	Onion	orange	skins	5	SC	One respondent reported obtaining orange brown using Al+CoT in an iron pot; another that the resultant colour was "like cognac"
Allium cepa	Onion	brown	skins	2	FS (1 resp. only)	
Allium cepa	Onion	gold / yellow	leaves	1	Al+CoT	
Aster spp.	Aster	yellow		1	Al+CoT	
Aster spp.	Aster	gold		1	BP	
Brassica oleracea	Red cabbage	bluey grey		2		Pink with addition of ammonia; green with the addition of washing soda.
Chrysanthemum spp.	Chrysanthemum	yellow		1	Al+CoT	
Chrysanthemum spp.	Chrysanthemum	gold		1	BP	
Coreopsis grandiflora	Coreopsis	bright yellow		1	Al+CoT	
Coreopsis grandiflora	Coreopsis	vivid yellow		1	SC	
Coreopsis grandiflora	Coreopsis	bronze		1	BP	
Dahlia spp.	Dahlia	yellow / gold to orange	dead flowers	3	Al	One respondent used flower heads.
Dahlia spp.	Dahlia	shrimp pink	flower heads	1	Al	Used a few days before the flowers passed.
Daucus carota	Carrots	bright yellow	leaves	1	Al	Ammonia afterbath.
Forsythia x intermedia	Forsythia	green		1	FS	
Fuchsia sp.	Fuchsia	pale yellow	leaves	1	Al	
Ligustrum spp.	Garden hedge	golden / brown	leaves	1	Al	
Lycopersicon esculenta	Tomato	yellow buff	whole plant excl. roots	1	Al	After fruiting
Lycopersicon esculenta	Tomato	olive green	leaves	1	BP+FS	
Narcissus sp.	Daffodil	pale lemon	flowers	1	Al	

Scientific name	Common name	Colour	Parts used	No. of respondents	Mordant (if known)	Comments
Narcissus sp.	Daffodil	butter	dead heads	1	Al+CoT	
Narcissus sp.	Daffodil	golden	dead heads	1	BP	
Petroselinum sp.	Parsley	pale green	leaves and stems	1	Al	
Prunus sp.	Damson	pale pink		1	Al+CoT	
Prunus sp.	Plum	pinky yellow	bark	1	Al	Creamy-fawn with iron
Rheum rhabarbarum	Rhubarb	yellow ochre	leaves	2	Al	One respondent reported obtaining a greenish / murky yellow. As the plant is toxic fumes have to be kept at bay
Rheum rhabarbarum	Rhubarb	bright yellow	flower	1	SC	
Rheum rhabarbarum	Rhubarb	dull gold	leaves	1	Al+CoT	Greeny gold with iron
Rubus idaeus	Raspberry	dark fawn	berries	1	Al+CoT	Iron pot used.
Tagetes spp.	Marigold	yellow	flowers	1	Al	
Tagetes spp.	Marigold	yellow / orange		1	Al+CoT	
Tagetes spp.	Marigold	gold		1	BP	
Tagetes spp.	Marigold	yellow / orange		1	Al+CoT	
Tagetes spp.	Marigold	gold		1	BP	
Vaccinium spp.	Cranberries	pale pink	berries	1	Al	*V. oxycoccos*; *V. microcarpum* or *V. macrocarpon*

Appendix B.5. Fungi used for dyeing – references and reports

Key to sources : 1 = Andersen, (1986); 2 = Lundgren, (1989); 3 = Rice and Beebee, (1980); 4 = Scottish Fungi Group, including present and ex-members, (pers comm).

The scientific names of species reported to have been used in Scotland are highlighted in bold.

Taxonomy according to Watling, (pers comm).

Scientific name	No mordant	Alum	Chrome	Tin	Copper	Iron	Reported by	Comments
Agaricus arvensis	beige	beige	tan	golden brown	tan	warm grey	3	
Agaricus augustus	pink tan / beige	tan	grey	dark brown	yellow brown	grey	3	Different colours obtained when dried whole.
Agaricus bisporus	tan	tan	tan	tan	tan	tan	3	
Agaricus campestris	tan	beige	tan	yellow brown	brown	tan	3	
Agaricus sylvaticus	tan	tan	brown	dark brown	brown	tan	3	
***Boletus* spp.**								4 - poor colours obtained from *Boletus* spp. in general.
Boletus aereus	none	lemon yellow	tan	orange	olive green	olive green	3	
Boletus appendiculatus		dark orange		red brown	yellow brown	dk. yellow	1	4 -using just tubes obtained red cracking / yellow
Boletus chysenteron		pale yellow		orange yellow			1	
Boletus edulis	yellow	greenish yellow	golden brown	orange	mustard brown	mustard	3	
Boletus erythropus		brown yellow		orange yellow	brown	brown	1	
Boletus submentosus		green yellow		orange yellow	brown yellow		1	
Bulgaria inquinans	red / golden brown	grey brown		chocolate brown	brown	grey brown	1; 3; 4	3 - all tests produce brown black
Cantharellus infundibuliformis		beige	grey	tan	grey	tannish grey	3	
Chroogomphus rutilus	beige	beige	tan	burnt orange	grey green	tan	3	
Collybia acervata	pink	tan	greenish tan	brown green	grey green	beige	3	
Cortinarius aureofolius	salmon pink	salmon pink	dusty rose	light cinnamon	burgundy	cinnamon	3	
Cortinarius cinnamomeus	orange	orange		muddy orange	red brown / cinnamon (4)	grey / red brown / orange	1; 2; 3; 4	3 - different colours if dried.
Cortinarius croceofolius	red	wine red	burgundy	red		purple black	3	3 - dried and powdered.
Cortinarius croceus	pale orange /	orange / yellow		orange yellow			1; 2; 3; 4	

Scientific name	No mordant	Alum	Chrome	Tin	Copper	Iron	Reported by	Comments
	yellow							
Cortinarius fervidus	yellow brown	red brown		terracotta			1; 2; 4	
Cortinarius malicorius	orange	orange red / yellow		orange yellow	red brown	grey brown / fawn (4)	1; 2; 4	
Cortinarius phoenicoeus var. *occidentalis*	apricot	wine red		blood red	grey burgundy	blue purple	3	3 - different colours if dried.
Cortinarius sanguineus	orange - rust red	red / red orange		scarlet	deep fox-red / cinnamon	purple / tan	1; 2; 3; 4	4 - best of the *Cortinarius* genus.
Cortinarius semisanguineus	orange - rust red / apricot (3)	orange red / red / apricot	cinnamon	orange yellow / salmon pink	red brown / tan	grey brown / tan	2; 3; 4	4 - best to separate caps and stalks and use separately.
Cortinarius violacenus	light grey	warm grey	tan	tan	grey-brown	warm grey	3	
Craterellus cornucopoides		beige	beige	greenish brown	tan	beige	3	
Daldinia concentrica	grey green	grey green	brown green	sage green	brown green	brown green	3	
Fomes fomentarius	beige	beige brown / mustard	yellow brown	yellow brown / mustard	yellow brown / light brown	dark brown / light brown	1; 3; 4	4 - may need a lot of soaking before use
Ganoderma applanatum				orange yellow	brown	yellow beige	1	
Gloephyllum sepiarium				olive			1	
Gomphidius glutinosus	brown / tan	brown	brown	brown (dark)	brown / grey	brown	1; 3	
Gymnopolis penetrans	gold	gold	mustard	gold / yellow	cinnamon	greenish yellow	1; 4	
Gymnopolis spectabilis				yellow			1; 4	
Gyromitra infula	beige	apricot	yellow orange	orange	yellow brown	dark brown	3	
Hapalopilus nidulans	none	red violet		blue violet	red brown	purple	1; 2; 4	4 - ammonia required to release dyestuff.
***Hydnellum* spp.**							4	4 - provides blue dye. Only found in small quantities.
Hydnellum aurantiacum		blue green	blue green	forest green	olive green	grey green	3	
Hydnellum caeruleum	tan	grey blue	grey green	light blue	brown green	dk. forest green	3	
Hydnellum ferrugineum		khaki		khaki		khaki	1	
Hydnellum peckii	tan	grey	forest	dark forest green	green brown	olive green	3	3 - slightly different when dried
Hydnellum scrobiculatum	dark brown	greenish brown	dark brown	black	dark brown	brown black	3	
Hydnellum zonatum	brown	brown	greenish brown	black	brown	brown	3	
Hygrophorus conicus	beige	beige	tan	mustard	brown green	beige	3	
Hygrophorus hypotheius	cinnamon	red brown	red brown		dark brown	brown	3	

Scientific name	No mordant	Alum	Chrome	Tin	Copper	Iron	Reported by	Comments
Hygrophorus miniatus	lemon yellow	lemon yellow	greenish yellow		greenish yellow	lemon yellow	3	
Hygrophorus psittacinus			greenish yellow	mustard			3	
Hygrophorus puniceus			greenish yellow	lemon yellow	greenish yellow	pale lemon yellow	3	
Hypholoma capnoides	lemon yellow	yellowish beige	tan	yellow orange	gold brown	greenish brown	3	
Hypholoma fasciculare	gold / yellow	yellowish beige / gold	cinnamon	ochre yellow / gold	yellow olive / yellow brown	grey green / greenish brown	1; 3; 4	
Inocybe maculata	beige	beige	dark tan	light gold brown	greenish tan	tan	3	
Inonotus hispidus		yellow			gold brown	green gold	4	
Inonotus radiatus	beige yellow	beige yellow		yellow	green yellow	grey brown	2	
Ischnoderma benzoinum				brown	blackish	dk. brown / blackish	1; 2	
Lactarius deliciosus	beige	beige		beige	beige	beige	3; 4	4 - may have been *L. deterrimus*
Laetiporus sulphureus			grey	pale greenish yellow		beige	3	
Merulius tremellosus	beige	blue green	grey green	blue green	green	blue green	3	
Mycena crocata		bright yellow		pale yellow			1	
Panus torulosus	grey brown	grey brown	brown green	blue green	purple black	brown green	3	
Paxillius atromentosus	beige brown	beige brown		yellow brown	olive, tawny	yellow / grey green	1; 2; 3; 4	3 - quotes purple, blue colours. Possible mid-identification. 4 - respondent quotes purple, green or navy blue
Paxillius involutus	beige	beige		orange	tan	greenish tan	3; 4	
Phaeolus schweinitzii	beige yellow	yellow		bright yellow	brown	moss green	1; 2; 3; 4	
Phellodon niger	grey blue	green grey	green grey	green grey	olive green	grey blue	3	
Pholiata incarnata				orange yellow			1; 4	4 - many species yield yellow.
Pisolithus tinctorius	red brown	dk. brown		dk. brown	red brown	red brown	1; 3	3 - obtains blacker colours, but mentions that colours are not so dark when dried material is used.
Polyporus melanopus	beige	yellow brown	beige	light brown	mustard	greenish tan	3	
***Ramaria* spp.**							4	4 - provides blue dye.
Ramaria aurea		lemon yellow	tan	orange	olive green	olive green	3	
Ramaria formosa						grey brown	1	
Rhizopogon sp.	yellow orange	yellow orange	yellow orange	yellow orange	yellow orange	yellow orange	3	All brown when dried.
Sarcodon imbricatus	warm grey	green blue	grey green	blue	forest green	greenish blue	3	

Scientific name	No mordant	Alum	Chrome	Tin	Copper	Iron	Reported by	Comments
Sarcodon scabrosus	beige	olive green	olive green	olive green	olive green	olive green	3	
Scleroderma sp.	brown	brown	brown	brown	brown	brown	3	
Shellodon tomentosus	gold brown	brown	green brown	green brown	dark brown	brownish green	3	
Suillus bovinus				orange yellow			1	
Suillus granulatus	beige	warm tan	tan	orange	tan	beige	3	
Suillus grevillei		yellow beige	olive green	dull gold	yellow green	brown green / tan	1; 3	
Suillus luteus		straw		orange yellow			1	
Suillus variegatus		pale yellow		orange yellow	yellow green		1	
Thelophora palmata	tan	tan	tan	olive green	tan	tan	3; 4	4 - provides blue dye.
Thelophora terrestris		yellow green		moss green	moss green	light green	3	
Trametes versicolor	warm grey	warm grey	silvery green grey	warm grey	greenish tan	grey blue	3	
Tricholonopsis rutilans	mustard	brown	brown	mustard	dark brown	brown black	3; 4	

Appendix C. Questionnaire sent to respondents

USE OF SCOTTISH NATIVE PLANTS IN DYEING

Research being performed as part of the "Flora Celtica" initiative, Royal Botanic Garden, Edinburgh.

Thank you for agreeing to participate in this survey. This questionnaire should take around 15 minutes for you to fill out. Could you please send the completed questionnaire to :

Doreen McKenzie, c/o Flora Celtica, Royal Botanic Garden, Edinburgh EH3 5LR.

Thank you.

A. About you and your business

A1. Please enter your name _____

and your company name (if appropriate) _____

A2. What do you produce (using both plant and non-plant) dyes? _____

_____

_____

A3. How much of what you produce uses dyes from Scottish native plants? _____

_____

A4. If you sell the products which you manufacture, where do you sell them? (Please indicate by ticking appropriate boxes)

❑ Sold directly, i.e. from home ❑ Sold in local shop

❑ Sold in other locations (please indicate where) _____

_____

❑ Sold at craft fairs ❑ Sold via mail order

❑ Other. Please indicate _____

_____

_____

_____

A5. For how many years have you produced products made from plant dyes? _____

_____

B. Dye plants used

For the plant dyes which you use, which species do you use, what colours do you obtain from them and what is the quality of light and wash fastness? *(Please indicate fastness quality as follows : V. poor, Poor, Average, Good, V. good)*

Species used	Colour(s) obtained	Mordant(s) used	Part(s) of plant Used	When plant part(s) collected	Quantities of plant parts used	Fastness quality Light	Wash
Example: Heather	*Yellow* *Green*	*Alum* *Alum + Iron*	*Flower tips* *Flower tips*	*Summer* *Summer*	*Small amounts* *Around 1lb / collection.*	*Good* *Good*	*Average* *Average*

Species used	Colour(s) obtained	Mordant(s) used	Part(s) of plant Used	When plant part(s) collected	Quantities of plant parts used	Fastness quality Light	Wash
Example: Heather	*Yellow* *Green*	*Alum* *Alum + Iron*	*Flower tips* *Flower tips*	*Summer* *Summer*	*Small amounts* *Around 1lb / collection.*	*Good* *Good*	*Average* *Average*

C. The dyeing process

C1. How did you learn about the dye recipes which you use? _____

C2. What other (if any) plant and non-plant dye sources do you use? _____

C3. What process do you follow to carry out the dyeing? _____

D. Dye plant sources

D1. Please indicate where you obtain the dye plants listed in Section B. - e.g. from the garden, collected locally, purchased from stockist etc.

D2. Have you ever experienced any difficulties in maintaining stocks of wild plants for dyeing? YES / NO.

If you answered YES, please explain what caused the difficulties _____

E. Plant dyes - pros and cons

E1. What do you see as being the advantages of using plant dyes? _____

E2. What do you see as being the disadvantages of using plant dyes? ___

E3. How do you consider that your use of plant dyes adds value to the items which you produce? ___

F. Association with other Dyers

F1. Do you work in any form of partnership with other people in the course of producing dyed items? YES / NO.

If you answered YES, please explain how the partnership works / worked.

F2. Please indicate present or past membership of any associations, guilds etc. in conjunction with your dyeing interests.

Body	*Presently member /Formerly member?*

F3. How many other people are you aware of who use natural dyes? ___

F4. Could you please provide the names and contact details of other dyers who we could contact as part of this survey ?

Thank you very much for taking the time to complete this questionnaire. Your help is greatly appreciated.

E2. What do you see as being the disadvantages of using plant dyes? ___

E3. How do you consider that your use of plant dyes adds value to the items which you produce? ___

F. Association with other Dyers

F1. Do you work in any form of partnership with other people in the course of producing dyed items? YES / NO.

If you answered YES, please explain how the partnership works / worked.

F2. Please indicate present or past membership of any associations, guilds etc. in conjunction with your dyeing interests.

Body	*Presently member /Formerly member?*

F3. How many other people are you aware of who use natural dyes? ___

F4. Could you please provide the names and contact details of other dyers who we could contact as part of this survey ?

Thank you very much for taking the time to complete this questionnaire. Your help is greatly appreciated.

Appendix D. Illustrations

Note : The colour reproduction of these illustrations may vary somewhat from the original

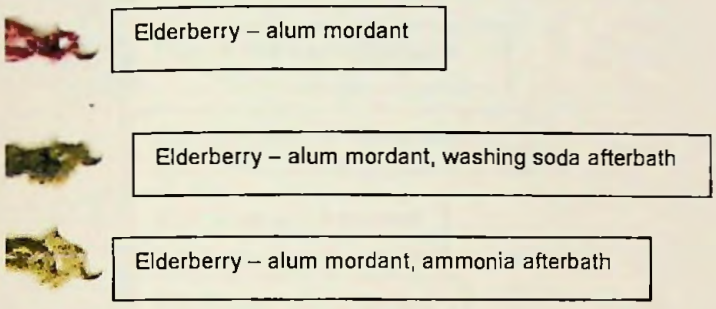

Illustration 1. *The effect of alkalis on elderberry dyes*
(Courtesy of M. Campbell, by Glasgow)

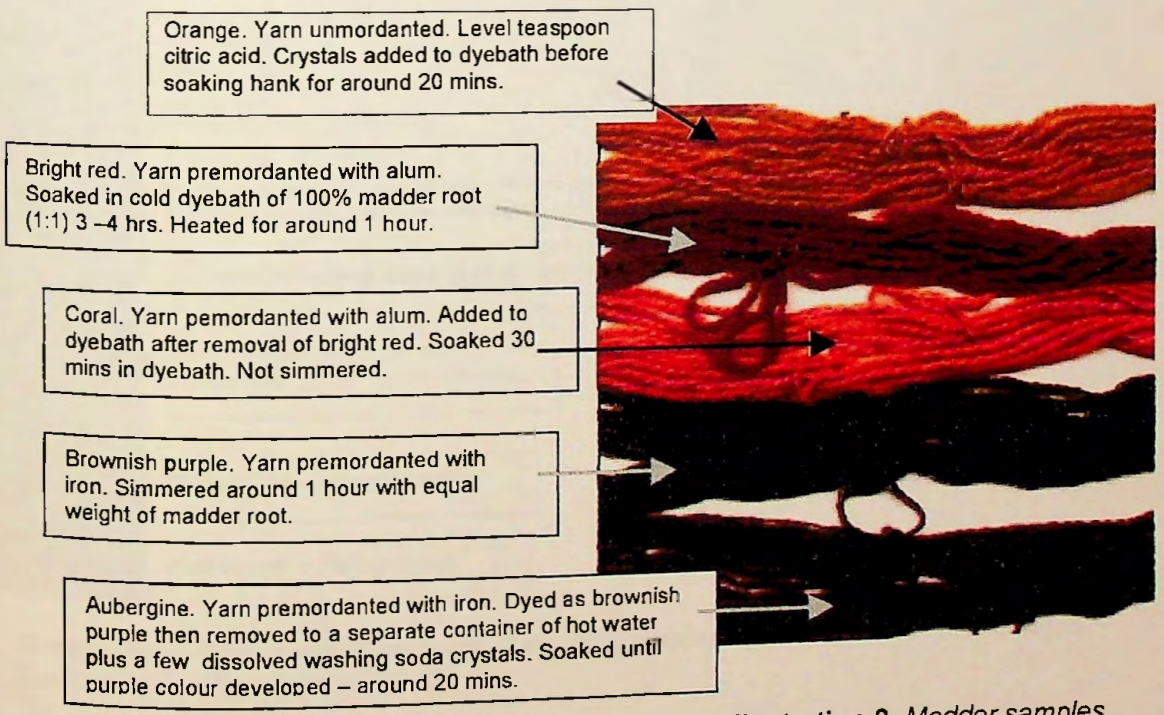

Illustration 2. *Madder samples*
(Courtesy of R. Wilkes, E. Lothian)

Illustration 3. *Wool samples showing the variety of colours available from natural dyes*
(Courtesy of R. Wilkes, East Lothian)

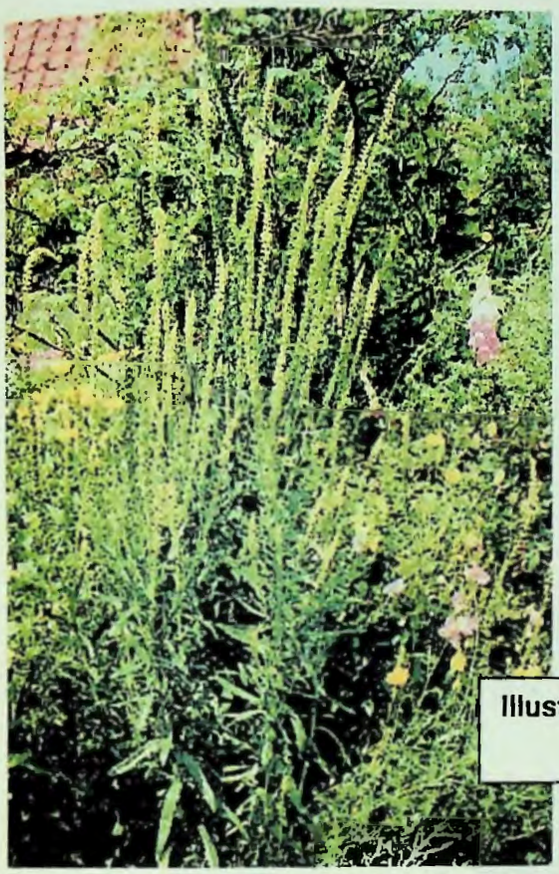

Illustration 4. *Reseda luteola* in flower. July 1999.
(Courtesy of R. Wilkes, East Lothian)

Illustration 5. *'The dyer's garden'. Iris pseudacorus, Rumex acetosa and Lysimachia vulgaris in foreground; Soay Studio in background.*
(Courtesy M. Mackay, Harris)

Illustration 6. *Potentilla anserina, July 1999.*
(Courtesy of M. Mackay, Harris)

Illustration 7. *Lichens used for dyeing.*
(Courtesy of M. Mackay, Harris.)

Illustration 8. *Sheepskin fleece, dyed in the traditional way with crottle.*
(Courtesy of Mr. MacLeod, Harris)

Illustration 9. *Traditional 3-legged 'Poit dhath'*
(Courtesy of the Kildonan Museum, S. Uist)

Illustration 10. *Pot still in use, N. Uist.*
(Courtesy of L. MacDonald, N. Uist)

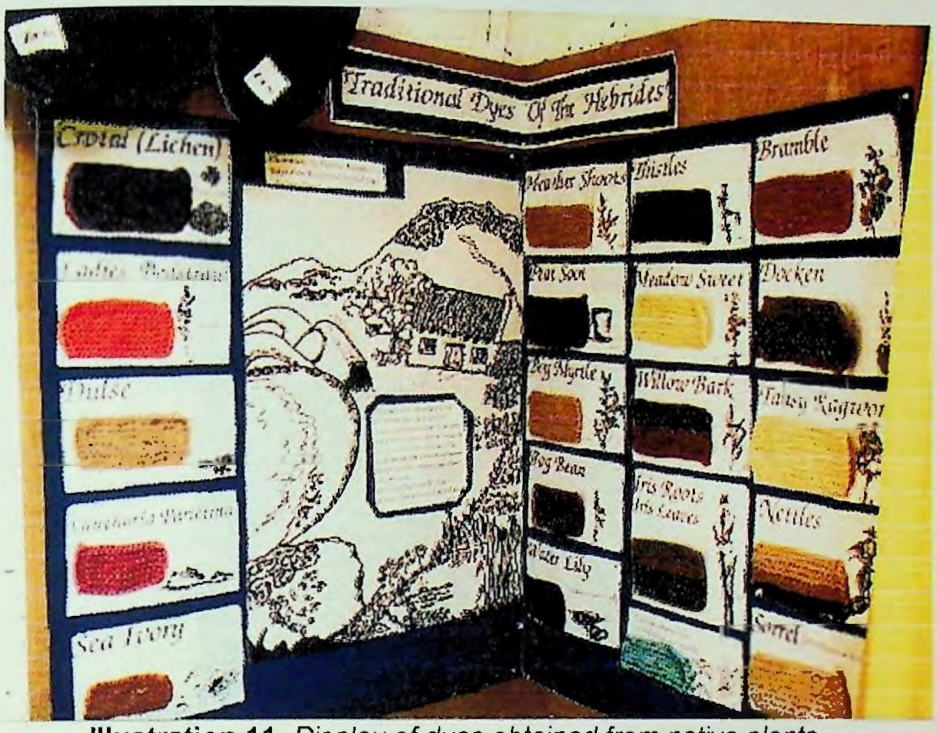

Illustration 11. *Display of dyes obtained from native plants.*
(Courtesy of M. Mackay, Harris)

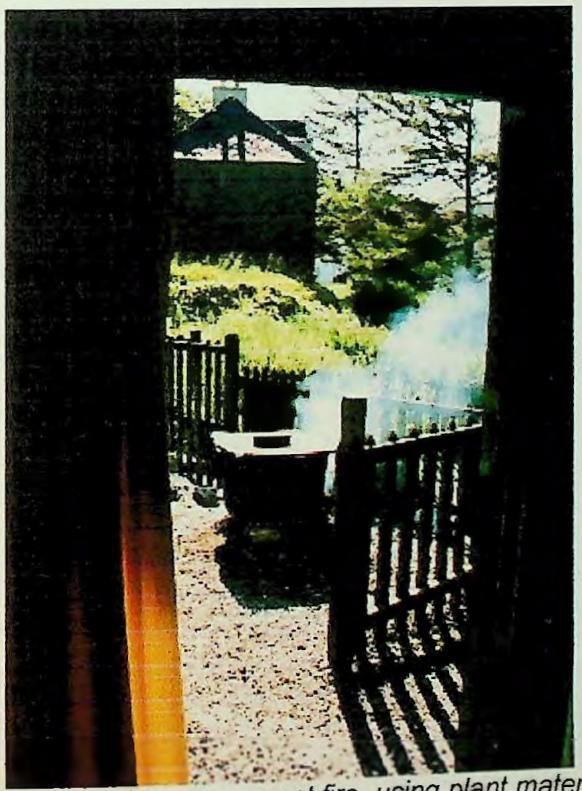

Illustration 12. *Dyeing over a peat fire, using plant materials obtained from the garden in the background. (Viewed from workshop).*
(Courtesy M. Mackay, Harris)

Illustration 13. *'Magic mushroom', made exclusively with fungal dyes.*
(Courtesy of The Scottish Fungi Group.)

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