



Establishing a New International Standard for Natural Dyed Textile Goods [Natural Organic Dye Standard (NODS)]

Recep Karadag

To cite this article: Recep Karadag (2023) Establishing a New International Standard for Natural Dyed Textile Goods [Natural Organic Dye Standard (NODS)], Journal of Natural Fibers, 20:1, 2162187, DOI: [10.1080/15440478.2022.2162187](https://doi.org/10.1080/15440478.2022.2162187)

To link to this article: <https://doi.org/10.1080/15440478.2022.2162187>



© 2023 The Author(s). Published with license by Taylor & Francis Group, LLC.



Published online: 10 Jan 2023.



Submit your article to this journal [↗](#)



Article views: 4285



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 8 View citing articles [↗](#)

Establishing a New International Standard for Natural Dyed Textile Goods [Natural Organic Dye Standard (NODS)]



Recep Karadag^{a,b}

^aTCF, DATU Cultural Heritage Preservation and Natural Dye Laboratory, Umraniye, Istanbul, Turkey; ^bFaculty of Fine Arts, Department of Fashion and Textile Design, Istanbul Aydin University, Istanbul, Turkey

ABSTRACT

Environmental awareness has become more important among individuals and societies in recent years. The increasing awareness and sensitivity to the environment have made the reintroduction of natural dyes in the textile industries even more important. To date, natural dyes have been employed in the textile industries for years, and their use is now increasing rapidly. However, there is no standard or no criteria for textiles colored with natural dyes despite the fact that individual and institutional customers, textile brands, and other bodies have been advocating for such as standards. For this reason, NODS (Natural Organic Dye Standard) is required like GOTS (Global Organic Textile Standard), OEKO-TEX (International Association for Research and Testing in the Field of Textile and Leather Ecology), and other certificates. The NODS includes a list of natural dye resources (dye plants, dye insects, dye mollusks, dye lichens, and dye fungi), natural coloring compounds, mordant materials, auxiliary substances, and index of fastness properties of dyes used in textiles, and list of prohibited, and restricted substances. The standards also specify test and analysis methods.

摘要

近年来,环境意识在个人和社会中变得越来越重要。随着人们对环境的认识和敏感性的提高,天然染料在纺织行业的重新引入变得更加重要。迄今为止,天然染料已在纺织工业中使用多年,其使用量正在迅速增加。然而,尽管个人和机构客户、纺织品牌和其他机构一直在提倡使用天然染料染色的纺织品,但没有标准或标准。因此,需要NODS(天然有机染料标准),如GOTS

KEYWORDS

Standard; natural dyes; parameter; prohibited; restricted; dyestuff

关键词

标准;天然染料;参数;禁止;受限制的;染料

(全球有机纺织品标准)、OEKO-TEX (国际纺织品和皮革生态研究与测试协会) 和其他证书。NODS包括天然染料资源清单 (染料植物、染料昆虫、染料软体动物、染料地衣和染料真菌)、天然色素化合物、媒染剂材料、辅助物质、纺织品中使用的染料的牢度指数, 以及禁止和限制物质清单。标准还规定了测试和分析方法。

Introduction

In the past textile goods (such as a garment or home textiles), have been demanded on the market based on their price. The principal purpose of the textile companies producing fabrics and goods was to manufacture at low cost. Nowadays, when purchasing textile goods consumers demand not only specific designs, functionalities, and quality levels but also safety and consideration for ecology, with concern for the protection of the environment and producers in developing countries. Sustainability is becoming more of a marketing tool in the fashion supply chain, forcing textile producers to respect high environmental standards in their production methods (Caniato et al. 2012). Textile production is extremely complex and involves a multitude of mechanical, chemical, and physicochemical processes. These processes can include some harmful and toxic substances such as heavy metals, pesticides, etc. However, the processes are strictly controlled by ZDCH (Zero Discharge of Hazardous Chemicals), OEKO-TEX (International Association for Research and Testing in the Field of Textile and Leather Ecology), and GOTS (Global Organic Textile Standard), etc. standards.

One of the most important issues of recent years is the ZDHC concept in textile dyeing and goods (<https://chem-map.com/zdhc-mrsl/>; Ozdemir & Karadag 2023). It is known that natural dyes are the most suitable method for the criteria of ZDCH and this dyeing is encouraged in textile dyeings by important textile companies. But since there is no natural dye criteria and standards, the end consumer is misled. This is due to fact that instead of natural dye products, synthetic dyed products are sold. This obtains unfair gains and the ZDHC criteria are being eroded.

OEKO-TEX, the subject of ecological textiles, was brought up in the 1990s with this standard. Production by the environment and human health is based. Production of textile products starts from the raw material to the final product and even to the waste state. Every substance and chemical used in the process, including sewing thread, and zipper buttons, obliges to certify that it does not contain dangerous substances. In addition, wastewater, flue gas, and human health issues are also covered by the standard. The standard focused on the development of methods for testing pH, dangerous substances, heavy metals, toxic dyes, crop protection substances, and carcinogenic substances like formaldehyde, phenols, or pesticide in testing articles.

GOTS minimum textile of products must be produced from 70% organic, in all processes. Processing, samples, import, packaging, and inspection are always reviewed. GOTS-certified products must contain at least 70% organic fiber in all chemical products and international conditions should be suitable. Organic Standardization of Fibers International Standards systems such as EEC 834/2007 should be suitable. Quality Assurance System (ISO 9001) Compliance with all requirements of the standard in the training of a company working with GOTS should be met. GOTS aims to define requirements to ensure the organic status of textiles, from harvesting raw materials, through environmentally and socially responsible manufacturing up to labeling to provide a credible assurance to the end consumer. The controlling of the production, processing, manufacturing, packaging, labeling, quality and certification, export, and import of all products from natural fibers (<https://global-standard.org>).

CE (European Conformity Quality) certificate is the product passport for textiles. A requirement to be complied with for products covered by EU countries. The non-EU country is a requirement for them to sell their products in this market.

RCS (Recycled Claim Standard) and GRS (Global Recycled Standard) are international, voluntary standards that set requirements for third-party certification of recycled input and chain of custody. The shared goal of the standards is to increase the use of recycled materials. The GRS includes additional criteria for social and environmental processing requirements and chemical restrictions (<https://textileexchange.org/standards/recycled>).

The desire to control bacteria, fungi, mold, and algae and eliminate some human health problems, damage, stains, smells, and some materials that have been antimicrobial modified increased considerably in recent years. Biocidal products used to treat various textile materials are designed to neutralize and prevent the action or to exercise effective control on the development of any harmful organism in chemical or biological ways. At the same time, biocides may manifest harmful effects on humans, and animals. Biocides are used to maintain textiles in good hygienic conditions to avoid mold formation and deterioration. Biocidal products are regulated and the use of biocides is restricted. Residue tests are analyzed according to ISO 17,025. Pesticides, fertilizers used during the cultivation of natural fibers (e.g. cotton), and pesticides do not decompose until final use in humans. They increase toxic substances. This harms the reproductive, hormonal, and immune systems of humans.

Heavy metals such as arsenic, lead, cadmium, cobalt, chromium, nickel, copper, and mercury can be found in dyestuffs used in coloring.

PFOA (perfluorooctanoic acid), PFOA (perfluorooctanoic acid), and Teflon (Fluoro Carbon) have been used because of their heat-resistant, water, and oil-repellent properties in textile, leather, and paper coating, dyeing (Hou et al. 2022). But these substances have carcinogenic effects and their use was restricted or prohibited.

There are many academic studies on using natural dyes in the textile industry. The number of these studies has been increasing rapidly in recent years (Alkan, Torgan, and Karadag 2017; Baaka 2020; Guzel and Karadag 2021; Guzel, Karadag, and Alkan 2020). There are many methods and many different recipe studies in the dyeing of protein and cellulose-based fibers with natural dyes (Karadag 2022, 2023; Ozdemir and Karadag 2023; Karadag and Yildiz 2022; Karadag, Buyukakinci, and Guzel 2022).

Sustainability, awareness, and properties of natural dyes are especially important to environmentally sensitive and conscious consumers, as interest in textile products dyed with natural dyes has grown in recent years. Many textile industries are using natural dyes in some of their production to meet the demands of their customers. Some textile companies continue their R&D studies for mass production with natural dyeing. Yet, there is no standard to check that a textile product has been dyed with natural dye. Thus, it is necessary to establish the NODS (Natural Organic Dye Standard) The NODS aims to define particular requirements to ensure the natural dye status of textiles, from raw materials to environmentally and sustainably responsible manufacturing to provide credible assurance to the end consumer.

Natural dye raw materials

The NODS include 1686 main natural biological dye resources (dye plants, dye insects, dye mollusks, dye lichens, and dye fungi) and 228 main coloring compounds (dyestuffs) contained in these biological dyestuff resources books (Böhmer et al. 2002; Cardon 2007; Karadag 2007; Schweppe 1992) and in many publications (Amin et al. 2020; Ammayappan and Shakyawar 2016; Baliarsingh et al. 2012; Cooksey 2019; Karapanagiotis et al. 2007; Petrovicua et al. 2012; Shahid, Islam, and Mohammad 2013; Venil et al. 2020).

Dye plants

The vast majority of natural dye raw materials are dye plants. The roots, stems, branches, and flowers or whole parts of certain plants are utilized in natural dyeings. The main coloring compounds (dyestuffs) of the dye plants are anthraquinones, flavonoids, anthocyanins, carotenoids, indigoids, and tannins, as outlined in these dyestuffs resources books (Böhmer et al.



Table 1. List of dye plants.

Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name
<i>Abatia rugosa</i>	<i>Caesalpinia brevifolia</i>	<i>Daemonorops scipionum</i>	<i>Haematoxylon campe-chianum</i>	<i>Monnina salicifolia</i>	<i>Quercus alba</i>	<i>Schinopsis quebracho colorado</i>
<i>Acacia catechu</i>	<i>Caesalpinia coriaria</i>	<i>Dahlia coccinea</i>	<i>Haematoxylon brasiletto</i>	<i>Morinda angustifolia</i>	<i>Quercus cerris</i>	<i>Schinopsis quebracho colorado</i>
<i>Acacia catechu</i> WILLD	<i>Caesalpinia crista</i>	<i>Dahlia pinnata</i>	<i>Haematoxylon brazilletto</i>	<i>Morinda bracteata</i>	<i>Quercus coccifera</i>	<i>Schinus molle</i>
<i>Acacia crabica</i>	<i>Caesalpinia cristo</i> L.	<i>Dahlia rosea</i>	<i>Haematoxylon campechianum</i> KARST	<i>Morinda citrifolia</i>	<i>Quercus conferta</i>	<i>Schinus molle</i> L.
<i>Acacia decurrens</i>	<i>Caesalpinia echinata</i>	<i>Dahlia variabilis</i>	<i>Haematoxylon campechianum</i> L.	<i>Morinda citrifolia</i> L.	<i>Quercus dentata</i>	<i>Schleichera trijuga</i>
<i>Acacia farnesiana</i>	<i>Caesalpinia echinata</i>	<i>Dammacanthus indicus</i> var. <i>microphyllus</i>	<i>Hamamelis virginiana</i> L.	<i>Morinda corea</i>	<i>Quercus discolor</i>	<i>Scopolia aculeata</i>
<i>Acacia greggii</i>	<i>Caesalpinia echinata</i> Lam	<i>Dammacanthus major</i>	<i>Hapalopilus nidulans</i>	<i>Morinda geminata</i>	<i>Quercus frainetto</i>	<i>Scutellaria baicalensis</i>
<i>Acacia harpophylla</i>	<i>Caesalpinia paipai</i>	<i>Dammacanthus major</i> var. <i>parvifolius</i>	<i>Haronga madagascariensis</i>	<i>Morinda geminata</i> DC and spp.	<i>Quercus fructipendula</i>	<i>Scutellaria baicalensis</i> GEORGI
<i>Acacia mearnsii</i>	<i>Caesalpinia sapan</i> L.	<i>Danais fragrans</i>	<i>Haronga paniculata</i>	<i>Morinda jasminoides</i>	<i>Quercus germanica</i>	<i>Scutellaria lanceolaria</i>
<i>Acacia mollissima</i>	<i>Caesalpinia sappan</i>	<i>Daphne gnidium</i>	<i>Harrisonia perforata</i>	<i>Morinda longiflora</i>	<i>Quercus flex</i>	<i>Scutellaria macrantha</i>
<i>Acacia nilotica</i> L.	<i>Caesalpinia sappan</i> L.	<i>Daphne mezereum</i>	<i>Harungana madagas-carriensis</i>	<i>Morinda lucida</i>	<i>Quercus infectoria</i> Olivier	<i>Semecarpus anacardium</i>
<i>Acacia subcoerulea</i>	<i>Caesalpinia spinosa</i>	<i>Daphne oleoides</i> Schreber	<i>Hedyotis auricularia</i>	<i>Morinda macrophylla</i>	<i>Quercus intercedens</i>	<i>Semecarpus australasicus</i>
<i>Acacia suma</i>	<i>Caesalpinia spinosa</i> and spp	<i>Dapne gnidium</i> L.	<i>Hedyotis indica</i>	<i>Morinda persicaefolia</i>	<i>Quercus ithaburensis</i>	<i>Senecio jacobaea</i>
<i>Acacia vera</i>	<i>Caesalpinia tinctoria</i>	<i>Datisca cannabina</i>	<i>Heliantbus annuus</i>	<i>Morinda tinctoria</i>	<i>Decaisne</i>	<i>Senecio jacobaea</i> L. var. <i>gypicus</i>
<i>Acanthococcus uvaeursi</i>	<i>Caglio bianco</i>	<i>Datisca cannabina</i> L.	<i>Helichrysum</i> sp.	<i>Morinda umbellata</i>	<i>Quercus macrolepis</i>	<i>Senecio praecox</i>
<i>Acer campestre</i>	<i>Caglio giallo</i>	<i>Daucus carota</i>	<i>Heliotropium caeruleum</i>	<i>Moringa oleifera</i>	<i>Quercus malacophylla</i>	<i>Sepia officinalis</i>
<i>Acer palmatum</i>	<i>Cajanus indicus</i>	<i>Delphinium consolida</i>	<i>Heliotropium Lividum</i> (ostrum), <i>helleres</i>	<i>Moringa pterygospermo</i>	<i>Quercus palustris</i>	<i>Sepia succus</i>
<i>Acer rubrum</i>	<i>Calamus draco</i>	<i>Delphinium semibarbatum</i>	<i>Herba lutea</i>	<i>Moronobea coccinea</i>	<i>Quercus pedunculata</i>	<i>Serratula tinctoria</i>
<i>Acer tataricum</i>	<i>Calamus rotang</i> var. <i>Bien</i>	<i>Delphinium semibarbatum</i>	<i>Herba Scutellariae</i>	<i>Moronobea globulifera</i>	<i>Quercus petraea</i>	<i>Serratula tinctoria</i> L.
<i>Achillea millefolium</i>	<i>Calceolaria thyrsiflora</i>	<i>Delphinium</i> sp.	<i>Hibiscus sabdariffa</i>	<i>Morus alba</i>	<i>Quercus petraea</i> and spp	<i>Sherardia arvensis</i>
<i>Achillea myrtillophylli</i>	<i>Calendula arvensis</i>	<i>Delphinium sulphureum</i>	<i>Hieracum pilosella</i>	<i>Morus alba-Benzophenon</i>	<i>Quercus prinus</i>	<i>Shorea talura</i>
<i>Achillea setacea</i>	<i>Calendula officinalis</i>	<i>Delphinium zalli</i>	<i>Huperzia selago</i>	<i>Morus tinctoria</i>	<i>Quercus pupescens</i>	<i>Sickingia rubra</i>
<i>Actrostaphylos officinalis</i>	<i>Calendula pluvialis</i>	<i>Dianthus carioophyllus</i>	<i>Hydrastis canadensis</i>	<i>Muclura cochinchinmsis</i>	<i>Quercus racemosa</i>	<i>Simia tinctoria</i>
<i>Actea spicata</i>	<i>Callistephus chinensis</i>	<i>Dicliptera hookeriana</i>	<i>Hymenodictyon dendatum</i>	<i>Muehlenbeckia tamnifolia</i>	<i>Quercus robur</i>	<i>Soghum vulgare</i>
<i>Adansonia digitate</i>	<i>Colosanthos indica</i>	<i>Dicliptera peruviana</i>	<i>Hymenodictyon excelsum</i>	<i>Myrcogenia apiculata</i>	<i>Quercus robur</i> L.	<i>Solanum anam stentorium</i>

(Continued)

Table 1. (Continued).

Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name
<i>Adenanthera pavonina</i>	<i>Caltha officinalis</i>	<i>Digitalis ferruginea</i> L.	<i>Hypericum barbarum</i>	<i>Myrica esculenta</i>	<i>Quercus serrata</i>	<i>Solanum aviculare</i>
<i>Adenostemma lavenia</i>	<i>Caltha perustris</i>	<i>Digitalis lanata</i>	<i>Hypericum empetrifolium</i>	<i>Myrica farquhariana</i>	<i>Quercus sessiflora</i>	<i>Solanum dulcamara</i>
<i>Adenostemma tinctoria</i>	<i>Calycanthus floridus</i>	<i>Digitalis lanata</i> L.	<i>Hypericum empetrifolium</i> Willd.	<i>Myrica gale</i>	<i>Quercus sessiliflora</i>	<i>Solanum nigrum</i>
<i>Adenostemma viscosum</i>	<i>Calypiticus laevis</i>	<i>Digitalis lutea</i>	<i>Hypericum inodorum</i>	<i>Myrica nagi auct. div. non.</i>	<i>Quercus sessilis</i>	<i>Solidago canadensis</i>
<i>Adhoda vasica</i>	<i>Calyptanthes caryhillifolia</i>	<i>Digitalis purpurea</i>	<i>Hypericum laricifolium</i>	<i>Myrica palustris</i>	<i>Quercus suber</i>	<i>Solidago canadensis</i> L.
<i>Aegle marmelos</i>	<i>Carmaedrys officinalis</i>	<i>Digitalis viridiflora</i>	<i>Hypericum lobocartum</i>	<i>Myrica peusylvanica</i>	<i>Quercus tauricola</i>	<i>Solidago microglasa</i>
<i>Aerolopus littoralis</i>	<i>Camellia assamica</i>	<i>Diopyros lotus</i>	<i>Hypericum montanum</i>	<i>Myrica rubra</i>	<i>Quercus tinctoria</i>	<i>Solidago virgaurea</i>
<i>Agatbosma betulina</i>	<i>Camellia japonica</i>	<i>Dioscorea cirrhosa</i> Lour	<i>Hypericum officinarum</i>	<i>Myricaceae chebula</i>	<i>Quercus velutina</i>	<i>Solidago viscosa</i>
<i>Agrimonia eupatoria</i>	<i>Camellia sinensis</i>	<i>Diospyros buxifolia</i>	<i>Hypericum perforatum</i>	<i>Myricaceae chebula citrina</i>	<i>Quercus velutina</i> L.	<i>Solidago virgaurea</i>
<i>Airelle myrtille</i>	<i>Camellia thea</i>	<i>Diospyros ehretioides</i>	<i>Hypericum quadrangulare</i>	<i>Myrrhis odorata</i>	<i>Quercus xalapensis</i>	<i>Sophora du Japon</i>
<i>Alba creta</i>	<i>Camomilla sp.</i>	<i>Diospyros elliptifolia</i>	<i>Hypericum vulgare</i>	<i>Myrsine semiserrata</i>	<i>Quercus velutina</i>	<i>Sophora japonica</i>
<i>Albizia lebbek</i>	<i>Campyloporus sp.</i>	<i>Diospyros embryopteris</i>	<i>Hypogymnia physodes</i>	<i>Myrtus communis</i>	<i>Radix lapathi (acuti)</i>	<i>Sophora japonica</i> L.
<i>Alcea rose</i> L.	<i>Canapa aquatica</i>	<i>Diospyros kaki</i>	<i>Hyssopus officinalis</i>	<i>Nandina domestica</i>	<i>Radix Rubiae</i>	<i>Sophora microphylla</i>
<i>Alcea rosea</i>	<i>Cantharellus cinnabarinus</i>	<i>Diospyros lotus</i>	<i>Ilex coccifera</i>	<i>Nectandra coto</i>	<i>Radix Scutellariae</i>	<i>Sophora tetraptera</i>
<i>Alchemilla vulgaris</i>	<i>Carapa guianensis</i>	<i>Diospyros mollis</i>	<i>Ilex pedunculosa</i>	<i>Nectandra rhodioides</i>	<i>Randia aculeata</i>	<i>Sophora tinctoria</i>
<i>Aleo peryi</i>	<i>Carthamus tinctorius</i> L.	<i>Diospyros mollis</i> GRIFF	<i>Impatiens balsamina</i>	<i>Nepheium lappaceum</i>	<i>Randia scandens</i>	<i>Sorbus aucuparia</i>
<i>Aleurites laccifera</i>	<i>Cassia acutifolia</i>	<i>Diospyros siamang</i>	<i>Impatiens sivestris</i>	<i>Nerprun alaterne</i>	<i>Ranunculus acris</i>	<i>Sorghum bicolor</i>
<i>Alkanna cappadocia</i>	<i>Cassia angustifolia</i>	<i>Diphasterium alpinum</i>	<i>Indigofera anil</i>	<i>Nerprun purgatif</i>	<i>Rauwenhoffia siamensis</i>	<i>Sorghum caudatum</i> var. colorans
<i>Alkanna spuria</i>	<i>Cassia auriculata</i>	<i>Diphysa robinoides</i>	<i>Indigofera argentea</i>	<i>Nopalea cochenillifera</i>	<i>Rauwolfia canescens</i>	<i>Sorghum saccharatum</i>
<i>Alkanna tinctoria</i> Tausch	<i>Cassia fistula</i>	<i>Doria virgaurea</i>	<i>Indigofera arrecta</i>	<i>Nothofagus dombeyi</i>	<i>Reibunium ciliatum</i>	<i>Sorghum vulgare</i> var. durra
<i>Allium cepa</i> L.	<i>Cassia obtusifolia</i>	<i>Doronium arnica</i>	<i>Indigofera arrecta</i>	<i>Nothofagus fusca</i>	<i>Reibunium hirsutum</i>	<i>Sorghum vulgare</i> var. nervosum
<i>Allium porrum</i>	<i>Cassia senna</i>	<i>Doronium montanum</i>	<i>Indigofera articulata</i>	<i>Nothofagus menziesii</i>	<i>Reibunium</i>	<i>Soymida febrifuga</i>
<i>Alnus acuminata</i>	<i>Cassia siamea</i>	<i>Dracaena australis</i>	<i>Indigofera coerulea</i> Roxb	<i>Nothofagus obliqua</i>	<i>Reibunium hypocarpium</i>	<i>Spartium junceum</i> L.
<i>Alnus cremastogyne</i>	<i>Cassia tora</i>	<i>Dracaena boerhavi</i>	<i>Indigofera guatemalensis</i>	<i>Nothofagus pumilia</i>	<i>Reibunium sp.</i>	<i>Spartium tinctorium</i>
<i>Alnus filina</i>	<i>Castalia alba</i>	<i>Dracaena cinnabari</i>	<i>Indigofera Indica</i>	<i>Nuphar lutea</i>	<i>Reseda crispata</i>	<i>Spilanthus tinctorius</i>
<i>Alnus glutinosa</i> L.	<i>Castanea crenata</i>	<i>Dracaena draco</i>	<i>Indigofera michelliana</i> Rose	<i>Nyctanthes arbor-tristis</i> L.	<i>Reseda lutea</i>	<i>Spina cervina</i>
<i>Alnus glutinosa</i> L.	<i>Castanea sariwa</i>	<i>Dracaena fragans</i>	<i>Indigofera sp.</i>	<i>Nyctanthes arbor-tristis</i>	<i>Reseda luteola</i>	<i>Spiraea ulmarina</i>
<i>Alnus incana</i> L.	<i>Castanea sativa</i> Miller	<i>Dracaena ombet</i>	<i>Indigofera Suffruticosa</i>	<i>Nymphaea alba</i>	<i>Reseda luteola</i> L.	<i>Stigmanthus cymosus</i>
	<i>Castanea silvestris</i>	<i>Dracaena rubra</i>	<i>Indigofera Suffruticosa</i> ssp. guate-malensis	<i>Nymphaea affinalis</i>	<i>Reseda orthostyla</i>	<i>Stribilanthus cusia</i>
<i>Alnus japonica</i>	<i>Castanea vesca</i>	<i>Dracaena schizantha</i>	<i>Indigofera Suffruticosa</i> ssp. suffruticosa	<i>Ochrisia maculata</i>	<i>Reseda pseudoviensis</i>	<i>Stribilanthus cusia</i>

(Continued)



Table 1. (Continued).

Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name
<i>Alnus jorullensis</i>	<i>Castanea vulgaris</i>	<i>Dracaena steudtneri</i>	<i>Indigofera suffruticosa</i> Miller	<i>Ochrolechia parella</i>	<i>Rhamnus aleternus</i>	<i>Strobilanthes flaccidifolius</i>	
<i>Alnus nigra</i>	<i>Casuarina equisetifolia</i>	<i>Drosera peltata</i>	<i>Indigofera sumatrana</i>	<i>Ochrolechia tartarea</i>	<i>Rhamnus alnifolia</i>	<i>Strobilanthes flaccidifolius</i>	
<i>Alnus rubra</i> and <i>spps.</i>	<i>Cedrela toona</i>	<i>Drosera rotundifolia</i>	<i>Indigofera tinctoria</i>	<i>Ochrolechia elliptica</i>	<i>Rhamnus amygdalinus</i>	<i>Stropholobium japonicum</i>	
<i>Aloe barbadensis</i>	<i>Ceiba pentandra</i>	<i>Drosera whittakeri</i>	<i>Indigofera tinctoria</i>	<i>Ocotea pseudocoto</i>	<i>Rhamnus caroliniana</i>	<i>Succisa praemorsa</i>	
<i>Aloe ferox</i>	<i>Cenomyce rangiferina</i>	<i>Drymis winteris</i>	<i>Indigofera tinctoria</i> L.	<i>Ocotea rodiaei</i>	<i>Rhamnus cathartica</i>	<i>Succisa pratensis</i>	
<i>Alpinia officinarum</i>	<i>Cercocarpus montanus</i>	<i>Dryophanta divisa</i>	<i>Indigofera tinctoria</i> var. <i>Brachycarpa</i>	<i>Oldenlandia umbellata</i> L.	<i>Rhamnus catharticus</i>	<i>Suillus grevillei</i>	
<i>Alstonia constricta</i>	<i>Ceriops candolleana</i>	<i>Dyospyros spp.</i>	<i>Inula viscosa</i>	<i>Oldenlandia hispida</i>	<i>Rhamnus chlorophorus</i>	<i>Swertia lutea</i>	
<i>Althea rosea</i>	<i>Ceriops candolleana</i>	<i>Echium vulgare</i>	<i>Inula viscosa</i> L.	<i>Oldenlandia umbellata</i>	<i>Rhamnus dahuricus</i>	<i>Symphonia globulifera</i>	
<i>Amaranthus caudatus</i>	<i>Ceriops roxburghiana</i>	<i>Elaeocarpus dendatus</i>	<i>Iris cretensis</i>	<i>Oldenlandia umbellata</i> L.	<i>Rhamnus davuricus</i>	<i>Symplocos crataegoides</i>	
<i>Amaranthus paniculatus</i>	<i>Ceriops tagal</i>	<i>Elaeocarpus hookerianus</i>	<i>Iris deflexa</i>	<i>Ononis anil</i>	<i>Rhamnus frangula</i>	<i>Symplocos fasciculata</i>	
<i>Amarillo indigo</i>	<i>Ceriops tagal</i>	<i>Eleoedendrum glaucum</i>	<i>Iris florentina</i>	<i>Ononis spinosa</i>	<i>Rhamnus graecus</i>	<i>Symplocos paniculata</i>	
<i>Ambrosia peruviana</i>	<i>Ceroplastes rubens</i>	<i>Eleoedendrum glaucum</i>	<i>Iris germanica</i>	<i>Onosma arenarium</i>	<i>Rhamnus infectoria</i>	<i>Symplocos racemosa</i>	
<i>Amomum zedaria</i>	<i>Ceroplastes albolimeatus</i>	<i>Equisetum arvense</i>	<i>Iris nepalensis</i>	<i>Onosma echioides</i> L.	<i>Rhamnus infectorius</i>	<i>Symplocos spicata</i>	
<i>Ampelopsis brevipedunculata</i>	<i>Cetaurea cyanus</i>	<i>Equisetum sylvaticum</i>	<i>Iris pseudacorus</i>	<i>Onosma echioides</i>	<i>Rhamnus japonica</i>	<i>Symplocos tinctoria</i>	
<i>Ampelopsis meliaefolia</i>	<i>Cetaurea jacea</i>	<i>Equisetum vulgare</i>	<i>Iris tectorum</i>	<i>Opuntia exaltata</i>	<i>Rhamnus lycioides</i> ssp. <i>oleoides</i>	<i>Syzgium aromaticum</i>	
<i>Ampelopsis quinquefolia</i>	<i>Cetaurea nigra</i>	<i>Erica minore</i>	<i>Iris violaceae</i>	<i>Opuntia ficus-indica</i>	<i>Rhamnus oleoides</i>	<i>Syzgium cumini</i>	
<i>Anacardium occidentale</i>	<i>Cetaurea scabiosa</i>	<i>Erica vulgaris</i>	<i>Iris vulgaris</i>	<i>Opuntia monacantha</i>	<i>Rhamnus petiolaris</i>	<i>Tabebuia avellanedae</i>	
<i>Ananias comosus</i>	<i>Cetraria ciliaris</i>	<i>Erigeron viscosa</i>	<i>Isatis aleppica</i>	<i>Opuntia soehrensii</i>	<i>Rhamnus petiolaris</i> Boiss	<i>Tabebuia chrysantha</i>	
<i>Anchusa tinctoria</i>	<i>Cetraria islandica</i>	<i>Eriodictyon californicum</i>	<i>Isatis alpina</i>	<i>Opuntia vulgaris</i>	<i>Rhamnus purshianus</i>	<i>Tabebuia lapacho</i>	
<i>Andira araroba</i>	<i>Chaerophyllum sylvestri</i>	<i>Erythrina glutinosum</i>	<i>Isatis glauca</i>	<i>Oxalyllum indicum</i>	<i>Rhamnus saxatilis</i>	<i>Tagetes erecta</i>	
<i>Andira inermis</i>	<i>Chamaemelum nobile</i>	<i>Erythrina americana</i>	<i>Isatis indigotica</i>	<i>Orcanetta amarilla</i>	<i>Rhamnus saxatilis</i> Jacq and <i>spps</i>	<i>Tagetes erecta</i> L.	
<i>Andropogon sorghum</i>	<i>Chamaemelum odoratum</i>	<i>Erythrina coratodendron</i>	<i>Isatis indigotica</i>	<i>Origanum vulgare</i>	<i>Rhamnus saxatilis</i> ssp. <i>tinctorius</i>	<i>Tagetes patula</i>	
<i>Aniba coto</i>	<i>Chamaemelum sylvestri</i>	<i>Erythrina crista galli</i>	<i>Isatis lusitanica</i>	<i>Osyris compressa</i>	<i>Rhamnus spino</i>	<i>Tagetes patulus</i>	
<i>Aniba pseudocoto</i>	<i>Chamomilla nobilis</i>	<i>Erythrina indica</i>	<i>Isatis tinctoria</i>	<i>Ouroouparia gambir</i>	<i>Rhamnus tinctorius</i>	<i>Tamariscus gallicus</i>	
<i>Anogeissus latifolia</i> Wall	<i>Chamomilla officinalis</i>	<i>Erythrina suberosa</i>	<i>Isatis tinctoria</i> L.	<i>Padus racemosa</i>	<i>Rhamnus utilis</i>	<i>Tamariscus troupii</i>	
<i>Anogeissus leiocarpa</i>	<i>Chamomilla recutita</i>	<i>Erythrina variegata</i>	<i>Jacea pratensis</i>	<i>Padus vium</i>	<i>Rhamnus utilis</i> + <i>R. chlorophorus</i>	<i>Tamarix aphylla</i>	
<i>Anogeissus leiocarpus</i>	<i>Chamomilla vulgaris</i>	<i>Erythrophleum africanum</i>	<i>Jacobaea vulgaris</i>	<i>Padus vulgaris</i>	<i>Rhanterium epapposum</i> Ovi.	<i>Tamarix articulata</i>	
<i>Anthemis anvensis</i>	<i>Chebulic myrobalans</i>	<i>Erythroxyllum australe</i>	<i>Jateorhiza palmata</i>	<i>Papaver rhoeas</i>	<i>Rheum frangula</i>	<i>Tamarix furas</i>	

(Continued)

Table 1. (Continued).

Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name
Anthemis chia	Chelidonium luteum	Erythroxylum macrantha	Jatropha curcas	Paratecoma peroba	Rheum franzerbachii	Tamarix gallica
Anthemis cotula	Chelidonium majus	Erythroxylum suberosum	Juglans ailantifolia	Parmelia acetabulum	Rheum nobile	Tamarix orientalis
Anthemis nobilis	Chene peduncul	Escallonia resinosa	Juglans ailantifolia var. ailantifolia	Parmelia caperata	Rheum officinale	Tanacetum vulgare
Anthemis odorata	Chene rouvre	Escobedia curialis	Juglans cathartica	Parmelia centrifuga	Rheum officinale and spps	Tecoma araliacea
Anthemis sp.	Chene valani	Escobedia laevis	Juglans chinera	Parmelia ceratophylla	Rheum palmatum	Tecoma flavescens
Anthemis tinctoria	Chenopodium album	Escobedia linearis	Juglans mandshurica	Parmelia cirrhata	Rheum palmatum var. palmatum	Tecoma ipe
Anthriscus sylvestris	Chloophora tinctoria L.	Escobedia scrabifolia	Juglans neotropica	Parmelia conspersa	Rheum palmatum var. tangut.	Tecoma lapacho
Apium graveolens	Chlorophora affinis	Eucalyptus calophylla	Juglans nigra	Parmelia florida	Rheum rhabarbarum	Tecoma leycoxylon
Arabidaea chica	Chlorophora braziliensis	Eucalyptus citriodora	Juglans oblonga	Parmelia furfuracea	Rheum rhaiponticum	Tecoma ochracea
Arariba rubra	Chlorophora tinctoria	Eucalyptus cordata	Juglans regia	Parmelia manshurica	Rheum rhaiponticum	Tectona grandis
Araucaria araucana	Chloroxylon swietina	Eucalyptus corymbosa	Juglans regia L.	Parmelia oliivacea	Rheum sibiricum	Tephrosia tinctoria
Araucaria rulei	Chrozophora tinctoria	Eucalyptus globulus	Juglans sieboldiana	Parmelia omphalodes	Rheum undulatum	Terminalia bellerica
Arbenia densiflora	Chrysanthemum chamomilla	Eucalyptus gummifera	Juglans spps.	Parmelia physodes	Rhizoma curcumae javanicae	Terminalia bellirica
Arbutus uva ursi	Chrysanthemum indicum	Eucalyptus hemiphloia	Juniperus communis	Parmelia saxatilis	Rhizoma Galangae	Terminalia bellirica and spps.
Arcostaphylos uva-ursi	Chrysanthemum segetum	Eucalyptus macrohyncha	Justicia adhatoda	Parmelia saxatilis L. and spps.	Rhizoma gymnorhiza	Terminalia catappa
Arctostaphilos purgens	Chrysanthemum sp.	Eucalyptus maculata	Justicia colorifera	Parmelia slygia	Rhizoma hydrastis canadensis	Terminalia chebula
Ardisia solanacea	Chrysanthemum graveolens	Eucalyptus occidentalis	Justicia spicigera Schdl	Parmelia tinctorium	Rhizoma mangle	Terminalia chebula
Areca catechu	Chrysanthemum vulgare	Euclea divinorum Hiern	Kageneckia lanceolata	Parthenocissus quinquefolia	Rhizoma mucronata	Terminalia citrina
Areca catechy L.	Chrysanthemum segetum	Eucryphia cordifolia	Kalmia angustifolia	Passiflora incarnata	Rhizoma racemosa	Terminalia indica
Argemone mexicana	Chrysothamnus graveolens	Eugenia aromatica	Kernholz von Adenantha pavonina	Paullinia asiatica	Rhizoma zedoariae	Terminalia mollucana
Argemone mexicana	Chrysothamnus nauseosus	Eugenia jambolana	Kernholz von Artocarpus heterophyllus	Paxillus atrotomentosus	Rhizophora mangle L. and spps.	Terminalia procera
Aristolletia fruticosa	Cissus sicyoides	Eugenia multiflora	Kernholz von Cotinus coggygia	Paxillus involutus	Rhododendron japonicum	Terminalia tomentosa
Aristolletia maqui	Cistus creticus L.	Eukalyptus-Arten	Kernholz von Rhus succedanea	Peganum harmala	Rhododendron maximum	Terra de Siena
Arnebia euchroma	Citrine myrobals	Euonymus europaeus	Kernholz von Robinia pseudacacia	Pelargonium zonale	Rhubarbe officinale	Terra di Siena
Arnebia nobilis	Citrus hystrix	Eupatorium cannabinum	Koanophyllon tinctoria and spps	Peltophorum dasyrachis	Rhus acuminata	Terra japonica
Arnica montana	Citrus limon BURM. Ponderosa Hort.	Eupatorium indigoferum	Krameria triandra	Peltophorum ferrugineum	Rhus canadensis	Terra merita

(Continued)



Table 1. (Continued).

Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name
<i>Arrabidaea chica</i>	<i>Citrus paradisi</i>	<i>Eupatorium laeve</i>	<i>Lacca coerulea</i>	<i>Peltophorum ferruginium</i>	<i>Rhus chinensis</i>	<i>Terra rubica</i>
<i>Arraclan frangula</i>	<i>Citrus sinensis</i>	<i>Eupatorium lamifolium</i>	<i>Lacca muksi</i>	BENTH <i>Peltophorum pterocarpum</i>	<i>Rhus continus</i>	<i>Terra simile cinabro</i>
<i>Artemisia rubra</i>	<i>Cleome serratula</i>	<i>Eupatorium tinctorum</i>	<i>Lacca musica</i>	<i>Peltophorum pterocarpum</i>	<i>Rhus copallina</i>	<i>Teucrium chamaedris</i>
<i>Artemisia tridentata</i>	<i>Clorophora tinctoria</i>	<i>Euphorbia biglandulosa</i>	<i>Lachnanthes tinctoria</i>	<i>Peltophorum vogelianum</i>	<i>Rhus coriaria</i>	<i>Teucrium officinalis</i>
<i>Arthroxon hispidus</i>	<i>Coccoloba unifera</i>	<i>Euphorbia cyparissias</i>	<i>Lactarius sanguifluus</i>	<i>Pentania veronicoides</i>	<i>Rhus elegans</i>	<i>Teucrium scordium</i>
<i>Artocarpus</i>	<i>Coccoloba fibraurea</i>	<i>Euphorbia helioscopia</i>	<i>Lafoesia acuminata</i>	<i>Pergularia tinctoria</i>	<i>Rhus glabra</i>	<i>Thais clavigera</i>
<i>Artocarpus heterophylla</i>	<i>Coccolus palmatus</i>	<i>Euphorbia pulcherrima</i>	<i>Lafoesia puniceifolia</i>	<i>Persea lingue</i>	<i>Rhus histia</i>	<i>Thais coronata</i>
<i>Artocarpus heterophyllus</i> LAM	<i>Cochlospermum tinctorium</i>	<i>Euphorbia rigida</i>	<i>Lagerstroemia parviflora</i>	<i>Persea lingue</i>	<i>Rhus javanica</i> L.	<i>Thalictrum anonyum</i>
<i>Artocarpus integra</i>	<i>Cochlospermum tinctorium</i>	<i>Euphorbia sp.</i>	<i>Laguncularia racemosa</i>	<i>Persea meyeriana</i>	<i>Rhus kakrasingee</i>	<i>Thalictrum flavum</i>
<i>Artocarpus integrifolius</i>	<i>Coelosperrman paniculatum</i>	<i>Evernia prunasti</i>	<i>Lannea barteri</i> ve spps.	<i>Persicaria tinctoria</i>	<i>Rhus myrtifolia</i>	<i>Thalictrum nigricans</i>
<i>Artocarpus jaca</i>	<i>Coelosperrman paniculatum</i>	<i>Evernia vulpina</i>	<i>Lannea microcarpa</i> Engl.	<i>Petalostigma quadriloculare</i>	<i>Rhus pentaphylla</i>	<i>Thalictrum omeinse</i>
<i>Artocarpus pubescens</i>	<i>Cola nitida</i>	<i>Fabiana imbricata</i>	<i>Lapathum acetosa</i>	<i>Petroselinum crispum</i>	<i>Rhus pentaphylla</i>	<i>Thapsia garganica</i>
<i>Asclepias tingens</i>	<i>Cola nitida</i>	<i>Fagopyrum cereale</i>	<i>Lapathum crispum</i>	<i>Petunia hybrida</i>	<i>Rhus semiolata</i>	<i>Thea bohea</i>
<i>Asclepias tinctoria</i>	<i>Cola nuts</i>	<i>Fagopyrum esculentum</i>	<i>Lapathum obtusatum</i>	<i>Peumus boldus</i>	<i>Rhus semiolata</i> var. <i>osbeckii</i>	<i>Thea sinensis</i>
<i>Aspergillus versicolor</i>	<i>Cola vera</i>	<i>Fagopyrum sagittatum</i>	<i>Lapathum obtusifolium</i>	<i>Peumus fragrans</i>	<i>Rhus succedanea</i>	<i>Thea viridis</i>
<i>Asperula ciliata</i>	<i>Colchicum autumnale</i>	<i>Fagopyrum sarraceniium</i>	<i>Lapathum pratense</i>	<i>Phelodendron amurense</i>	<i>Rhus toxidendron</i>	<i>Theka grandis</i>
<i>Asperula odorata</i>	<i>Colpoon compressum</i>	<i>Fagopyrum vulgare</i>	<i>Lappa minor</i>	<i>Philenoptera cyanescens</i>	<i>Rhus trichocarpa</i>	<i>Thespesia populnea</i>
<i>Asperula tinctoria</i>	<i>Columbia serratifolia</i>	<i>Fibraurea chloroleuca</i>	<i>Lardizabala bitemata</i>	<i>Philenoptera laxiflora</i>	<i>Rhus trilobata</i>	<i>Thymus sp.</i>
<i>Asteroccephalus succasa</i>	<i>Combretum glutinosum</i>	<i>Fibraurea tinctoria</i>	<i>Larix decidua</i>	<i>Phormium tenax</i>	<i>Rhus typhina</i>	<i>Tilia argentea</i>
<i>Astronium fraxinifolium</i>	Perrottet	<i>Fibraurea tinctoria</i>	<i>Larrea mexicana</i>	<i>Phyllanthus emblica</i>	<i>Rhus vernicifera</i>	<i>Tithymalus cyparissias</i>
<i>Atriplex hortensis</i>	<i>Commelina communis</i>	<i>Fibraurea tinctorum</i>	<i>Lasallia pustulata</i>	<i>Phylloclades trichomanoides</i>	<i>Rhus viridiflora</i>	<i>Toddalia asiatica</i>
<i>Avicennia marina</i>	<i>Commelina communis</i> var. <i>hortensis</i>	<i>Ficus altissima</i>	<i>Lasianthus chinensis</i>	<i>Phytolacca americana</i>	<i>Ribes nigrum</i>	<i>Toona australis</i>
<i>Baccaurea griffithii</i>	<i>Comocladia integrifolia</i>	<i>Ficus bengalis</i>	<i>Laurelia aromatica</i>	<i>Pinus contorta</i>	<i>Ribes olidum</i>	<i>Toona ciliata</i>
<i>Baccaurea sapida</i>	<i>Concholepas concholepas</i>	<i>Ficus benghalensis</i>	<i>Laurus nobilis</i>	<i>Piper betle</i>	<i>Ribes vero</i>	<i>Toona ciliata</i>
<i>Baccharis</i> genistellodes	<i>Conocarpus racemosa</i>	<i>Ficus benjamina</i>	<i>Laurus nobilis</i> L.	<i>Piper crocatum</i>	<i>Robinia comum</i>	<i>Toona ciliate</i>
<i>Baccharis lanceolata</i>	<i>Continus coggygia</i>	<i>Ficus indica</i>	<i>Lawsonia alba</i>	<i>Piper macrocarpa</i>	<i>Robinia pseudoacacia</i>	<i>Tormentilla erecta</i>
<i>Baccharis latifolia</i>	<i>Convolvus scamonia</i>	<i>Ficus mysorensis</i>	<i>Lawsonia inermis</i>	<i>Piper peregrina</i>	<i>Rubea major</i>	<i>Tormentilla officinalis</i>
<i>Baccharis polyantha</i>	<i>Coprosma acerosa</i>	<i>Ficus religiosa</i>				

(Continued)

Table 1. (Continued).

Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name
<i>Baccharis quitensis</i>	<i>Coprosma areolata</i>	<i>Filipendula ulmaria</i>	<i>Lawsonia inermis</i> L.	<i>Piper rigida</i>	<i>Rubia akane</i>	<i>Toxicodendron succedaneum</i>
<i>Baccharis salicifolia</i>	<i>Coprosma australis</i>	<i>Flaveria contrayerba</i>	<i>Lawsonia spinosa</i>	<i>Piptadenia cebil</i>	<i>Rubia akane</i> NAKEL	<i>Trifolium nigrescens</i>
<i>Balochia lucida</i>	<i>Coprosma australis</i>	<i>Flemingia congesta</i>	<i>Leucanthemum chamaemelum</i>	<i>Pipturus argenteus</i>	<i>Rubia anglia</i>	<i>Trifolium pratense</i>
<i>Baphia nitida</i> Afzel.	<i>Coprosma grandiflora</i>	<i>Flemingia macrophylla</i>	<i>Leucanthemum odoratum</i>	<i>Pistacia atlantica</i>	<i>Rubia cardobolia</i> L.	<i>Trifolium purpureum</i>
<i>Baphicacanthus cusia</i> NEES	<i>Coprosma linariifolia</i>	<i>Flemingia rhodocarpa</i>	<i>Ligusticum acutilobum</i>	<i>Pistacia interregima</i>	<i>Rubia chinensis</i> var. <i>glabrescens</i>	<i>Trifolium repens</i>
<i>Baptisia tinctoria</i>	<i>Coprosma lucida</i>	<i>Flindersia xanthoxyla</i>	<i>Ligustrum vulgare</i>	<i>Pistacia khinjuk</i>	<i>Rubia cordata</i>	<i>Trigonella foenum graecum</i>
<i>Barosma betulina</i>	<i>Coprosma parviflora</i>	<i>Foenum-graecum sativum</i>	<i>Linaria vulgaris</i>	<i>Pistacia lentiscus</i>	<i>Rubia cordifolia</i>	<i>Tripodanthus acutifolius</i>
<i>Bauhinia variegata</i>	<i>Coprosma rhamnoides</i>	<i>Folia bucca longa</i>	<i>Linociera ramiflora</i>	<i>Pistacia lentiscus</i> L. and <i>spps</i>	<i>Rubia cordifolia</i> var. <i>Munjista</i>	<i>Triticum dicocon</i>
<i>Bedens pilosa</i>	<i>Coptis chinensis</i>	<i>Folia Sennae</i>	<i>Lithospermum arvense</i>	<i>Pistacia palaestina</i>	<i>Rubia davisiana</i> Ehtend.	<i>Trollius europaeus</i>
<i>Berberis aquifolium</i>	<i>Coptis japonica</i>	<i>Folium purpureum</i>	<i>Lithospermum carolinense</i>	<i>Pistacia terebinthus</i>	<i>Rubia iberica</i>	<i>Tropaeolum majus</i>
<i>Berberis aristata</i>	<i>Coptis orientalis</i>	<i>Folium rubeum</i>	<i>Lithospermum erythrorhizon</i>	<i>Pistacia terebinthus</i> L.	<i>Rubia khasiana</i>	<i>Trunculariopsis trunculus</i>
<i>Berberis asiatica</i>	<i>Coptis teeta</i>	<i>Folium saphireum</i>	<i>Lithospermum euchromum</i>	<i>Pistacia terebinthus</i> L.	<i>Rubia lucida</i>	<i>Tsuga canadensis</i>
<i>Berberis bolivianna</i>	<i>Coptis trifolia</i>	<i>Fragaria vesca</i>	<i>Lithospermum officinale</i>	<i>Pithecellobium dulce</i>	<i>Rubia munjista</i>	<i>Tsuga canadensis</i> L.
<i>Berberis commutate</i>	<i>Coptis trifolia</i> L.	<i>Fragula alnus</i>	<i>Lithospermum officinale</i> var. <i>erythrorhizon</i>	<i>Pithecellobium pachypus</i>	<i>Rubia peragrina</i> L.	<i>Tsuga heterophylla</i>
<i>Berberis congestiflora</i>	<i>Cordylone australis</i>	<i>Fragula alnus</i> Miller ve <i>sp.</i>	<i>Lithospermum pulmonaria</i> var. <i>hypomela</i>	<i>Plastimatia glauca</i>	<i>Rubia peregrina</i>	<i>Tsuga heterophylla</i>
<i>Berberis crataegina</i>	<i>Cordylone rubra</i>	<i>Fragula fragula</i>	<i>Lithospermum retigera</i>	<i>Platonia insignis</i>	<i>Rubia sikkimensis</i>	<i>Tussilago farfara</i>
<i>Berberis crataegina</i> DC	<i>Coreopsis gigantea</i>	<i>Fragula pentaphylla</i>	<i>Lobium japonicum</i>	<i>Plicopurpura patula</i> and <i>spps</i>	<i>Rubia sikkimensis</i> KURZ	<i>Ulex armoricanus</i>
<i>Berberis cretina</i>	<i>Coreopsis sp.</i>	<i>Fragula purshiana</i>	<i>Lomatia ilicifolia</i>	<i>Podocarpus hallii</i>	<i>Rubia tetragona</i>	<i>Ulex compositus</i>
<i>Berberis cretica</i>	<i>Coreopsis tinctoria</i>	<i>Fragula vulgaris</i>	<i>Lomatia longifolia</i>	<i>Polygonum cuspidatum</i>	<i>Rubia tinctoria</i>	<i>Ulex europaeus</i>
<i>Berberis Darwini</i>	<i>Coriaria myrtifolia</i>	<i>Fraxinus excelsior</i>	<i>Lomatia obliqua</i>	<i>Polygonum fagopyrum</i>	<i>Rubia tinctorum</i>	<i>Ulex floridus</i>
<i>Berberis femontizum</i>	<i>Coriaria ruscifolia</i>	<i>Fraxinus ornus</i>	<i>Lomatia silaifolia</i>	<i>Polygonum hydrasper</i>	<i>Rubia tinctorum</i> L.	<i>Ulex grandiflorus</i>
<i>Berberis fremontii</i>	<i>Cornus florida</i>	<i>Fuchsia excorticata</i>	<i>Lonchocarpus cyanescens</i>	<i>Polygonum multiflorum</i>	<i>Rubus fruticosus</i>	<i>Ulex hibernicus</i>
<i>Berberis heterophylla</i>	<i>Cornus mas</i>	<i>Fuchsia integrifolia</i>	<i>Lonchocarpus cyanescens</i> BENT	<i>Polygonum tinctorium</i>	<i>Ruellia indigofera</i>	<i>Ulex mitis</i> hort.
<i>Berberis japonica</i>	<i>Cornus macrostema</i>	<i>Fuchsia montana</i>	<i>Loranthus heterophyllus</i>	<i>Polygonum tinctorium</i> AIT	<i>Ruellia indigotica</i>	<i>Ulex apisthalepis</i>
<i>Berberis laurina</i>	<i>Cortex Araribae rubrae</i>	<i>Fuchsia lutea</i>	<i>Loranthus sternbergianus</i>	<i>Populus nigra</i>	<i>Rumex acetosa</i>	<i>Ulex strictus</i>
<i>Berberis lutea</i>	<i>Cortex coto verus</i>	<i>Fuchsia parviflora</i>	<i>Lycopodium alpinum</i>	<i>Potentilla erecta</i>	<i>Rumex acetosa</i> L. ve <i>sp</i>	<i>Ulex vernalis</i> et <i>major</i>
<i>Berberis lycium</i>	<i>Cortex Quebracho Colorado</i>	<i>Fumaria media</i>	<i>Lycopus albus</i>	<i>Potentilla recta</i>	<i>Rumex acetosella</i>	<i>Ulmaria palustris</i>
<i>Berberis oxyacantho</i>	<i>Cortinus coggygia</i>	<i>Fumaria officinalis</i>	<i>Lycopus aquaticus</i>	<i>Potentilla silvestris</i>	<i>Rumex acutus</i>	<i>Ulmaria pentapetala</i>
<i>Berberis thunbergii</i> and <i>Spps</i>	<i>Corydalis cava</i>	<i>Fumaria sturmi</i>	<i>Lycopus europaeus</i>	<i>Potentilla tetrapetala</i>	<i>Rumex crispus</i>	<i>Uncaria gambier</i>
<i>Berberis vulgaris</i> L.	<i>Corydalis sempervirens</i>	<i>Fumaria vulgaris</i>	<i>Lycopus palustris</i>	<i>Potentilla tormentilla</i>	<i>Rumex hymenosepalus</i>	<i>Uncaria gambir</i>
<i>Betula alba</i>	<i>Corylus avellana</i>	<i>Gale belgica</i>	<i>Lycopus vulgaris</i>	<i>Primula vulgaris</i>	<i>Rumex nepalensis</i>	<i>Urtica dioica</i> L.

(Continued)



Table 1. (Continued).

Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name
<i>Betula alnus</i>	<i>Corylus silvestris</i>	<i>Gale gale</i>	<i>Lysimachia vulgaris</i>	<i>Prosopis juliflora</i>	<i>Rumex obtusifolius</i>	<i>Uva ursini</i>
<i>Betula nana</i>	<i>Coscinium fenestratum</i>	<i>Gale palustris</i>	<i>Lythrum fruticosum</i>	<i>Prosopis-Kino</i>	<i>Rumex romassa</i>	<i>Uva ursi procumbens</i>
<i>Betula papyrifera</i>	<i>Cosmos sulphureus</i>	<i>Galega officinalis</i>	<i>Maclura aurantiaca</i>	<i>Prunus avium</i>	<i>Rumex root</i>	<i>Vaccinium angulosum</i>
<i>Betula pendula</i>	<i>Cotinus cogglyria</i>	<i>Galega tinctoria</i>	<i>Maclura pomifera</i>	<i>Prunus capuli</i>	<i>Rumex silvestris</i>	<i>Vaccinium montanum</i>
<i>Betula pubescens</i>	<i>Cotinus cogglyria</i> SCOP	<i>Galium album</i>	<i>Maclura pomifera</i> RAF	<i>Prunus cerasus</i>	<i>Rumex spp.</i>	<i>Vaccinium myrtillus</i>
<i>Betula verrucosa</i>	<i>Couepia chrysocalix</i>	<i>Galium aparine</i>	<i>Maclura tinctoria</i>	<i>Prunus domestica</i>	<i>Rush aromatica</i> Ation	<i>Vaccinium myrtillus</i> L. ve tüneri
<i>Bidens aenidicola</i>	<i>Couleria tinctoria</i>	<i>Galium atherodes</i>	<i>Maclura tinctoria</i> L.	<i>Prunus mahaleb</i>	<i>Rush coriaria</i> L.	<i>Vaccinium vitis idaea</i>
<i>Bidens cannabina</i>	<i>Crataegus monogyna</i>	<i>Galium boreale</i>	<i>Macropiper excelsium</i>	<i>Prunus mume</i>	<i>Rush glabra</i> L.	<i>Variegata orientalis</i>
<i>Bidens tripartita</i>	<i>Crataegus oxyacantha</i>	<i>Galium dasypodium</i>	<i>Magnolia grandiflora</i>	<i>Prunus padus</i>	<i>Rush typhina</i> L.	<i>Vataireopsis araroba</i>
<i>Bidens triplinervia</i> Kunth	<i>Crocus cartwrightianus</i>	<i>Galium matrisiva</i>	<i>Mahonia a feuilles de houx</i>	<i>Prunus persica</i>	<i>Ruta graveolens</i>	<i>Ventilago viminalis</i>
<i>Bidens venata</i>	<i>Crocus sativus</i>	<i>Galium mollugo</i>	<i>Mahonia aquifolium</i>	<i>Prunus racemosa</i>	<i>Salix alba</i>	<i>Veratrum album</i>
<i>Bignonia tecmooides</i>	<i>Crocus sativus</i> L.	<i>Galium odoratum</i>	<i>Mahonia aquifolium</i> and spp.	<i>Prunus serotina</i>	<i>Salix aurita</i>	<i>Verbascum densiflorum</i>
<i>Bignonia chica</i>	<i>Crocus tourneforti</i>	<i>Galium odoratum</i> L. and spp.	<i>Mahonia japonica</i>	<i>Prunus serratula</i> LINDL. var. <i>Albida</i>	<i>Salix caerulea</i>	<i>Verbascum sp.</i>
<i>Bignonia indica</i>	<i>Croton aromaticus</i>	<i>Galium pratense</i>	<i>Mahonia nepalensis</i>	<i>Prunus spinosa</i>	<i>Salix caprea</i>	<i>Verbena hybrida</i>
<i>Bignonia tecoma</i>	<i>Croton bibiscifolius</i>	<i>Galium pumilum</i>	<i>Mahonia nepalensis</i>	<i>Prunus yedoensis</i>	<i>Salix cinerea</i>	<i>Vestis fucatae</i>
<i>Bignonia triphylla</i>	<i>Croton draco</i>	<i>Galium saxatile</i>	<i>Maitenus boaria</i>	<i>Pseudopanax arboreum</i>	<i>Salix daphnoides</i>	<i>Vestia lycioides</i>
<i>Bindens cernua</i>	<i>Croton gossypifolium</i>	<i>Galium tinctoria</i> L.	<i>Mallotus discolor</i>	<i>Pseudevernia furfuracea</i>	<i>Salix fragilis</i>	<i>Vicia faba</i>
<i>Bixa americana</i>	<i>Croton insularis</i>	<i>Galium verum</i>	<i>Mallotus japonicus</i>	<i>Pseudevernia guajava</i>	<i>Salix humboldtiana</i>	<i>Viola odorata</i>
<i>Bixa orellana</i>	<i>Croton laciferus</i>	<i>Galium verum</i> L.	<i>Mallotus philippinensis</i>	<i>Psychotria tinctoria</i>	<i>Salix serotina</i>	<i>Viola serotina</i>
<i>Bixa platycarpa</i>	<i>Croton occidentalis</i>	<i>Gallae Pistaciae</i>	<i>Malus domestica</i>	<i>Pteridium aquilinum</i>	<i>Salix nigricans</i>	<i>Viola tricolor</i>
<i>Bixa urucurana</i>	<i>Croton palanostigma</i>	<i>Gallae von Quercus infectoria</i>	<i>Malus domestica</i>	<i>Pteridium aquilinum</i> ssp. <i>typicon</i>	<i>Salix pentandra</i>	<i>Viscaria vulgaris</i>
<i>Bixe orellana</i> L.	<i>Croton patulinianus</i>	<i>Galluna vulgaris</i>	<i>Malus sylvestris</i>	<i>Pteris aquilina</i>	<i>Salix purpurea</i>	<i>Vitex agnus castus</i> L.
<i>Bocconia pearcei</i>	<i>Croton philippinensis</i>	<i>Garance sauvage</i>	<i>Malva sylvestris</i>	<i>Pteris lanuginosa</i>	<i>Salix repens</i>	<i>Vitex agnus-castus</i>
<i>Boidea boldus</i>	<i>Croton salutaris</i>	<i>Garcinia dulcis</i>	<i>Malva sylvestris</i>	<i>Pterocarpus angolensis</i>	<i>Salix lucens</i>	<i>Vitex lucens</i>
<i>Boidea fragans</i>	<i>Croton tinctorium</i>	<i>Garcinia mangostana</i>	<i>Marsdenia tinctoria</i>	<i>Pterocarpus bussei</i>	<i>Salix viminalis</i>	<i>Vitex verticillata</i>
<i>Boldoa chilensis</i>	<i>Cruetianella maritima</i>	<i>Garcinia morella</i>	<i>Marsdenia tinctoria</i> R.BR.	<i>Pterocarpus dalbergioides</i>	<i>Salvia auriculata</i>	<i>Vitis vinifera</i>
<i>Boldoa fragrans</i>	<i>Cryptolepis sanguinolenta</i>	<i>Garcinia spicata</i>	<i>Materia medica</i>	<i>Pterocarpus dekinatians</i>	<i>Salvia officinalis</i>	<i>Vitis vinifera</i> L.
<i>Boldu chilianum</i>	<i>Cudrania javanensis</i>	<i>Gardenia augusta</i> L.	<i>Matricaria chamomilla</i>	<i>Pterocarpus draco</i>	<i>Salvia patens</i>	<i>Waltheria americana</i>
<i>Boldu chilensis</i>	<i>Cudrania javanensis</i> TREC	<i>Gardenia gummiifera</i>	<i>Matricaria chamomilla</i>	<i>Pterocarpus erinaceus</i>	<i>Salvia sp.</i>	<i>Weinmannia racemosa</i>
<i>Boletus bovinus</i>	<i>Curcuma aromatica</i>	<i>Gardenia jasminoides</i>	<i>Melanella fuliginosa</i>	<i>Pterocarpus indicus</i>	<i>Salvia triloba</i>	<i>Weinmannia sylvicola</i>
<i>Boletus calopus</i>	<i>Curcuma domestica</i>	<i>Gardenia lucida</i>	<i>Melastoma malabathricum</i>	<i>Pterocarpus indicus</i> Willd	<i>Sambuco nero</i>	<i>Woodfordia floribunda</i>
<i>Boletus edulis</i>	<i>Curcuma domestica</i> VAL	<i>Gardenia resinifera</i>	<i>Melissa officinalis</i> L.	<i>Pterocarpus marsupium</i>	<i>Sambucus ebulus</i>	<i>Wrightia laevis</i> and spp.
<i>Boletus elegans</i>	<i>Curcuma domestica</i> Val	<i>Gascardia madagascariensis</i>	<i>Memecylon capitellatum</i>	<i>Pterocarpus santalinus</i>	<i>Sambucus humilis</i>	<i>Wrightia religiosa</i> and spp.
<i>Boletus erythropus</i>	<i>Curcuma long</i> L.	<i>Genipa americana</i>	<i>Memecylon edule</i>	<i>Pterocarpus santalinus</i> L.	<i>Sambucus medullina</i>	<i>Wrightia tinctoria</i>
<i>Boletus jungquillus</i>	<i>Curcuma longa</i>	<i>Genista lydia</i>	<i>Memecylon tinctorium</i>	<i>Pterocarpus soyauxii</i>	<i>Sambucus nigra</i>	<i>Wrightia tinctoria</i>

(Continued)

Table 1. (Continued).

Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name	Scientific name
<i>Boletus plorans</i>	<i>Curcuma xanthorrhiza</i>	<i>Genista ovata</i>	<i>Menispermum fenestratum</i>	<i>Pterocarpus soyauxii</i> Taubert	<i>Sambucus nigra</i> L. and spps.	<i>Xanthium strumarium</i>
<i>Boletus pulverulentus</i>	<i>Curcuma zedoaria</i>	<i>Genista scoparia</i>	<i>Mentha longifolia</i>	<i>Pterocarpus sp.</i>	<i>Sanguinaria canadensis</i> L.	<i>Xerocomus badius</i>
<i>Boletus radicans</i>	<i>Curcuma zerrumbet</i>	<i>Genista scorpius</i>	<i>Mentha sp.</i>	<i>Pterocarpus tinctorius</i> Welw	<i>Sanguinaria acaulis</i>	<i>Xerocomus chrysenteron</i>
<i>Boletus rhodoxanthus</i>	<i>Cuscuta americana</i>	<i>Genista tinctoria</i>	<i>Menyanthes trifoliata</i>	<i>Pterocarpus wallichii</i>	<i>Sanguinaria canadensis</i>	<i>Xerocomus chrysenteron</i>
<i>Boletus satanoides</i>	<i>Cuscuta europaea</i>	<i>Genista tinctoria</i> L.	<i>Mercurialis leiocarpa</i>	<i>Pterocarpus zollingeri</i>	<i>Sanguis draconis</i>	<i>Xerocomus parasiticus</i>
<i>Boletus variegatus</i>	<i>Cyanus jacea</i>	<i>Gentiana lutea</i>	<i>Mesosa ferrea</i>	<i>Pterocarya stenoptera</i>	<i>Sanguis draconis</i> canariensis	<i>Xerocomus</i> <i>subtomentosus</i>
<i>Broussonetia tinctoria</i>	<i>Cybastax antisiphilitica</i>	<i>Gentiana verna</i>	<i>Mesosa speciosa</i>	<i>Pterospermum</i> <i>acerifolium</i>	<i>Sapium indicum</i>	<i>Zanthoxylum amiflorum</i>
<i>Bruguiera gymnorhiza</i>	<i>Cybastax antisiphilitica</i> Martius	<i>Genziana maggiore</i>	<i>Michelia champaca</i>	<i>Pterospermum mireum</i>	<i>Sapium sebiferum</i>	<i>Zanthoxylum brachy-</i> <i>canthum</i>
<i>Bysonima crassifolia</i>	<i>Cynometra ramiflora</i>	<i>Geranium pratense</i>	<i>Michelia rufiservis</i>	<i>Pulmonaria arorea</i>	<i>Sarcocephalus esculentes</i>	<i>Zanthoxylum caribaeum</i>
<i>Butea monosperma</i>	<i>Cytisus scoparius</i>	<i>Giallo indiano</i>	<i>Miconia chrysophylla</i>	<i>Punica granatum</i>	<i>Sarcoscypha coccinea</i>	<i>Zanthoxylum fraxineum</i>
<i>Butea monosperma</i> Taubert	<i>Daemonorops accendens</i>	<i>Gingko biloba</i>	<i>Mimosa arabica</i>	<i>Punica granatum</i> L.	<i>Sarothamnus glabrum</i>	<i>Ziziphus jujuba</i>
<i>Butea monosperma</i>	<i>Daemonorops</i>	<i>Gossypium arboreum</i>	<i>Mimosa catechu</i>	<i>Pyrethrum tanacetum</i>	<i>Sarothamnus scoparius</i>	<i>Ziziphus mauritania</i>
<i>Butea monosperma</i> Taubert	<i>didymophyllus</i>	<i>Gossypium barbadense</i>	<i>Mimosa catechuoides</i>	<i>Pyrethrum vulgare</i>	<i>Sarothamnus vulgaris</i>	
<i>Byrsonima</i>	<i>Daemonorops draco</i>	<i>Gossypium herbaceum</i>	<i>Mimosa sundra</i>	<i>Pyrus communis</i>	<i>Sassafra albidum</i>	
<i>chrysophylla</i>	<i>Daemonorops draco</i>	<i>Guaiaacum coulteri</i>	<i>Mirabilis jalapa</i>	<i>Pyrus toringo</i>	<i>Scabiosa praemoisa</i>	
<i>Byssoloma</i>	<i>Daemonorops draco</i>	<i>Guarea glabra</i>	<i>Miscanthus chinensis</i>	<i>Quebrachio lontzii</i>	<i>Scabiosa succisa</i>	
<i>tricholomum</i>	<i>micracanthus</i>					
<i>Caesalpinia brasiliensis</i>	<i>Daemonorops mattanensis</i>	<i>Guettardella putaminosa</i>	<i>Miscanthus sinensis</i>			
<i>Caesalpinia coriaria</i>	<i>Daemonorops motleyi</i>	<i>Haematoxylon braziletto</i>	<i>Miscanthus tinctorius</i>			
	<i>Daemonorops niger</i>	<i>Haematoxylon braziletto</i>	<i>Miscanthus tinctorius</i>			
<i>Caesalpinia digyna</i>	<i>Daemonorops propinquus</i>	<i>Haematoxylon braziletto</i>	<i>Miscanthus tinctorius</i>			
<i>Caesalpinia bicolor</i>	<i>Daemonorops rotang</i>					
<i>Caesalpinia</i>		<i>Haematoxylon</i>	<i>Moghania macrophylla</i>			
<i>brasiliensis</i> L.		<i>campechianum</i>				
<i>Caesalpinia</i>						
<i>brasiliensis</i> L.						

Table 2. List of dye insects.

Scientific name
<i>Porphyrophora hameli</i> Brand
<i>Kerria chinensis</i>
<i>Porphyrophora hirsutissima</i>
<i>Porphyrophora tritici</i> Bod.
<i>Kermes vermilio</i> Planchon
<i>Dactylopius coccus</i> Costa
<i>Kerria lacca</i> Kerr
<i>Porphyrophora crithmi</i>
<i>Porphyrophora polonica</i> L.
<i>Porphyrophora sophorae</i>
<i>Dactylopius confusus</i>
<i>Dactylopius confuses</i>
<i>Dactylopius ceylonicus</i>

2002; Cardon 2007; Karadag 2007; Schweppe 1992) and many publications (Baliarsingh et al. 2012; Petroviciua et al. 2012; Shahid, Islam, and Mohammad 2013). The NODS includes 1546 dye plants (Table 1).

Dye insects

Generally, red and purple colors were obtained from dye insects. The main coloring compounds (dyestuffs) of the dye insects are carminic acid, kermesic acid, flavokermesic acid, and laccaic acid as included in many. The coloring compounds are anthraquinones books (Böhmer et al. 2002; Cardon 2007; Karadag 2007; Schweppe 1992) and many publications (Amin et al. 2020; Ammayappan and Shakyawar 2016; Cooksey 2019; Raisanen 2009; Reese 2008; Shaheen, Iqbal, and Hussain 2018; Shahid, Islam, and Mohammad 2013; Şahinbaşkan, Karadag, and Torgan 2018). The standard includes 13 dye insects (Table 2).

Dye molluscs

The purple color was obtained from dye mollusks. The purple dye extracted from mollusks has historically been considered a luxurious color and evidence of its first use has been found around the Mediterranean basin. The color has been known as Imperial and Royal purple since ancient times. The dye mollusks include indigoid coloring compounds, as contained in many books (Böhmer et al. 2002; Cardon 2007; Karadag 2007; Schweppe 1992) and many publications (Karapanagiotis et al. 2007; Reese 2008). The standard includes 12 dye mollusks (Table 3).

Table 3. List of dye mollusks.

Scientific name
<i>Rapana venosa</i>
<i>Rapana bezoar</i>
<i>Stramonita chocolata</i>
<i>Thais savignyi</i>
<i>Nucella lapillus</i>
<i>Thais kiosquiformis</i>
<i>Hexaplex trunculus</i> L.
<i>Thais kiosquiformis</i>
<i>Stramonita biserialis</i>
<i>Stramonita haemastoma</i> L.
<i>Bolinus brandaris</i> L.
<i>Ocenebra erinaceus</i>

Table 4. List of dye lichens.

Scientific Name	Scientific Name	Scientific Name	Scientific Name	Scientific Name	Scientific Name
<i>Alectoria sarmentosa</i>	<i>Cladonia pyxicata</i>	<i>Lecanora sulphurea</i>	<i>Lichen pulmonaire</i>	<i>Roccella canariensis</i>	<i>Solorina crocea</i>
<i>Bryopogon jubatum</i>	<i>Cladonia rangiferina</i>	<i>Lecanora tartarea</i>	<i>Lichen pulmonarius</i>	<i>Roccella flacida</i>	<i>Teloschistes exilis</i>
<i>Caloplaca arenaria</i>	<i>Cladonia silvatica</i>	<i>Letharia vulpina</i>	<i>Lichen Quebracho Colorado</i>	<i>Roccella fuciformis</i>	<i>Teloschistes flavicans</i>
<i>Caloplaca cinnabarina</i>	<i>Diploschites scruposus</i>	<i>Letharia vulpina</i> L.	<i>Lichen rocella</i>	<i>Roccella loriformis</i>	<i>Teloschistin flavicans</i>
<i>Caloplaca elegans</i>	<i>Fulgensia fulgida</i>	<i>Lichen a Nombri</i>	<i>Lichen tartareus de Linne</i>	<i>Roccella montagnei</i>	<i>Usnea spp</i>
<i>Caloplaca feruginea</i>	<i>Lecanora epanora</i>	<i>Lichen de Roche</i>	<i>Lobaria pulmonaria</i>	<i>Roccella phycopsis</i>	<i>Xanthoparmelia chlorochroa and spp</i>
<i>Caloplaca percrocata</i>	<i>Lecanora parella</i>	<i>Lichen floridus</i>	<i>Ochrolechia parella</i> L. and spp.	<i>Roccella portentosa</i>	<i>Xanthora parietina</i> L.
<i>Cladonia pyxicata</i>	<i>Lecanora rupicola</i>	<i>Lichen parellus</i>	<i>Ochrolechia tartarea</i> L.	<i>Roccella tinctoria</i>	

Table 5. List of dye fungi.

Scientific Name	Scientific Name	Scientific Name	Scientific Name	Scientific Name	Scientific Name
<i>Boletinus cavipes</i>	<i>Gomphilius glutinosus</i>	<i>Pertusaria corallina</i>	<i>Pycnoporus cinnabarinus</i>	<i>Suillus bovinus</i>	<i>Usnea florida</i>
<i>Chlorella fusca</i>	<i>Gomphilius maculatus</i>	<i>Pertusaria dealbata auct</i>	<i>Ramalina crassa</i>	<i>Suillus grevillei</i>	<i>Usnea hirta</i>
<i>Chlorociboria aeruginosa</i>	<i>Hapalopilus rutilans</i>	<i>Pertusaria dealbescens</i>	<i>Sphaerophorus fragilis</i>	<i>Suillus grevillei</i>	<i>Usnea longissima</i>
<i>Chlorociboria aeruginosum</i>	<i>Hydnum aurantiacum</i>	<i>Pertusaria lactea</i>	<i>Stereocaulon corticulatum var. procerum</i>	<i>Suillus piperatus</i>	<i>Usnea pectinata</i>
<i>Chlorosplenium aeruginosum</i>	<i>Hydnum soaveolens</i>	<i>Pertusia spp.</i>	<i>Sticta aurata</i>	<i>Suillus variegatus</i>	<i>Usnea plicata</i>
<i>Chrolechia pallenscens</i>	<i>Inonotus hispidus</i>	<i>Piptoporus australiensis</i>	<i>Sticta colensii</i>	<i>Suillus variegatus</i>	<i>Xanthoria elegans</i>
<i>Coriolus sanguineus</i>	<i>Laricifomees officinalis</i>	<i>Pisolithus arhizus</i>	<i>Sticta coronata</i>	<i>Trametes cinnabaria</i>	<i>Xanthoria fallax</i>
<i>Cortinarius sanguineus</i>	<i>Lasallia pustulata</i>	<i>Podaxis pistillaris</i>	<i>Sticta coronata</i>	<i>Umbicilaria pustula</i>	<i>Xanthoria parietina</i>
<i>Cortineus sanguineus</i>	<i>Mycoblastus sanguinarius</i>	<i>Polyporus leucomelas</i>	<i>Sticta fuliginosa</i>	<i>Ungulina fomentaria</i>	<i>Xanthoria parietina var. Aureola</i>
<i>Echinodontium tinctorium</i>	<i>Nephroma laevigulatum</i>	<i>Polyporus mori</i>	<i>Sticta pulmonacea</i>	<i>Usnea barbata</i>	<i>Talaromyces verruculosus</i>
<i>Fomes fomentarius</i>	<i>Nephromopsis endocrocea</i>	<i>Polystictus cinnabarinus</i>	<i>Sticta pulmonaria</i>	<i>Usnea barbata var. florida</i>	<i>Chlorociboria aeruginosa</i>
<i>Gomphidius glutinosus</i>	<i>Paxillus atrotomentosus and spp.</i>	<i>Polystictus versicolor</i>	<i>Suillus bovinus</i>	<i>Usnea dasypoga</i>	<i>Scytalidium cuboideum</i>

Dye lichens

Several dyes have been obtained from lichens, and the use of lichens to produce dyes has a long history. Lichens form a group comprising of more peculiar natural colorants in dyeing violet and purple colors that have been widely used in Europe and other parts of the world since ancient times up until the beginning of the Middle Ages. The standard includes mainly 46 dye lichens (Cardon 2007; Schweppe 1992) as do many publications (Raisanen 2009; Shaheen, Iqbal, and Hussain 2018) (Table 4).

Table 6. List of dyestuff.

(1) Dyestuff	CAS NUMBER
Carminic acid	1260-17-9
Kermesic acid	18499-92-8
Flavokermesic acid	18499-84-8
Laccaic acid A	60687-93-6
Laccaic acid B	17249-00-2
Laccaic acid C	23241-56-7
Laccaic acid D	18499-84-8
Laccaic acid E	14597-16-1
6' - bromoindirubin	667463-62-9
6,6' - dibromoindigotin	19201-53-7
6,6' -dibromoindirubin	1147124-21-7
Hydroxysafflor yellow A	78281-02-4
Anhydrosafflor yellow B	184840-84-4
acetylalkannin	34232-27-4
ruberythric acid	152-84-1
eupatorin	855-96-9
Dibromoindigo	19201-53-7
Monobromoindigo	139582-54-0
Monbromoindirubin	57-13-6
Alizarin	72-48-0
Purpurin	81-54-9
Munjistin	478-06-8
Rubiadin	117-02-2"
Pseudopurpurin	476-41-5
Juglons	281-688-1
Indigotin	482-89-3
Indirubin	479-41-4
Luteolin	491-70-3
Apigenin	520-36-5
Naringenin	480-41-1
Fisetin	528-48-3
Sulfuretin	120-05-8
Quercetin	117-39-5
Berberine	633-65-8
Genistein	446-72-0
Kaempferol	520-18-3
Delphinidin	528-53-0
Cyanidin	528-58-5
Petunidin	1429-30-7
Pelargonidin	134-04-3
Malvidin	643-84-5
Myricetin	529-44-2
Catechines	154-23-4
Epicatechin	490-46-0
Hesperitin	520-26-3
Gallic acid	149-91-7
Ellagic acid	476-66-4
Tannin	1401-55-4
Hespidin	520-26-3
Precarthamin	102716-32-5
Carthamin	36338-96-2
Saflomin A	78281-02-4
Safflor yellow A	85532-77-0
Saflomin C	78281-02-4
Naphthazarin	475-38-7
Alkannin	517-88-4
Diospyrin	28164-57-0
Shikonin	54952-43-1
Mamegakinone	17734-93-9
Diosindigo A	31241-57-3
Lawson	83-72-7
Maderone	84929-38-4
Ventilone	51022-70-9

(Continued)

Table 6. (Continued).

(1) Dyestuff	CAS NUMBER
Chrysophanol	83-72-7
Aleo-emodin	481-72-1
Rhein	478-43-3
Emodin	518-82-1
Physcion	521-61-9
Alaternin	641-90-7
Islandicin	476-56-2
Xanthorin and derivatives	17526-15-7
Ventinone A	73726-67
Xanthopurpurin	518-83-2
Alizarin 1-methyl ether	6170-06-5
Lucidin and derivatives	478-08-0
Damnacanthal	477-84-9
Munjistin	478-06-8
Soranjidiol	518-73-0
Antragallo	602-64-2
Morindone	478-29-5
Oruwal	36956-68-0
Crisilinol	51874-89-6
Xanthomicrol	16545-23-6
Norartocarpetin	520-30-9
Genkwanin	437-64-9
Artocarpesin	3162-09-2
Norartocarpin	62949-79-5
Arthroxin	23986-34-7
Tricin	520-32-1
Artonin A and Artonin B	
Galangin	548-83-4
Fisetin	528-48-3
Kaempferol	520-18-3
Eupalitin	29536-41
Isokaempferide	1592-70-7
Morin	480-16-0
Quercetin	117-39-5
Myricetin	529-44-2
Quercetagetin	90-18-6
Formononetin	485-72-3
Osajin	482-53-1
Isoliquiritigenin	961-29-5
Butein	487-52-5
Okanin	484-76-4
Flemingin A, B, C	18296-58-7
Chalcone	614-47-1
Sulfuretin and derivatives	120-05-8
Maclurin	519-34-6
Rottlerin	82-08-6
Cyanomaclurin	18422-83-8
Pelargonidin	134-04-3
Cyanidin	528-58-5
Delphinidin	528-53-0
Peonidin	134-01-0
Petunidin	1429-30-7
Malvidin	643-84-5
Apigeninidin	1151-98-0
Luteolinidin	1154-78-5
Tricetinidin	65618-21-5
Aurantininidin	25041-66-1
6-Hydroxycyanidin	42529-06-6
6-Hydroxydelphinidin	28094-15-7
5-Methylcyanidin	178436-69-6
Rosinidin	4092-64-2
Pulchellinidin	25791-96-2
Europinidin	19077-87-3

(Continued)

Table 6. (Continued).

(1) Dyestuff	CAS NUMBER
Hirsutidin	4092-66-4
Capensinidin	19077-85-1
Brazilin	474-07-7
Brazilein	600-76-0
Sappanol	111254-19-4
Episappanol	111254-18-3
Sappanone	102067-84-5
Protosappanin	102036-28-2
Protosappanin E	102036-28-2
Caesalpin J	99217-67-1
Santalin	529-60-2
Santarubin	37381-57-0
Pterocarpin	524-97-0
Homopterocarpin	606-91-7
Clausequinone	35878-39-8
Bixin	6983-79-5
Trans-bixin	39937-23-0
Crocetin	27876-94-4
Curcumin	458-37-7
Canadine	522-97-4
Oxyacanthine	548-40-3
Berbamine	478-61-5
Sanguinarine (cation)	2447-54-3
Chelerythrine (cation)	3895-92-9
Berberine	633-65-8
Jatrorrhizine	3621-38-3
Columbamine	3621-36-1
Palmatine	10605-02-4
Canadine	522-97-4
Coptisine	3486-66-6
Worenine	38763-29-0
Phellodendrine	6873-13-8
Magnoflorine	2141-09-5
Oxyacanthine	548-40-3
Berbamine	478-61-5
Sanguinarine	5578-73-4
Chelerythrine	34316-15-9
Cryptolepine	480-26-2
Pentagalloyl-B-D-glucose	14937-32-7
Tara tannin	94855-05-7
Corilagin	23094-69-1
Chebulinic acid	18942-26-2
Tellimagrandin I	79786-08-6
Casuarictin	79786-00-8
Pedunculagin	7045-42-3
Vescalin	34112-28-2
Vescalagin	36001-47-5
Roburin A	132864-75-6
Roburin B	132864-75-6
Roburin E	132864-75-6
Alnusiin	78836-99-4
Punicalin	65995-64-4
Granatin A	161205-11-4
Granatin B and chebulagic acid	77322-54-4
Punicacortein A	103488-35-3
Punicacortein C	103488-37-5
Puniguconin	103488-38-6
Woodfructosin	126347-63-5
Flavan	494-12-2
Gambiriin C	76236-89-0
Fisetinidol	490-49-3
Robinetinidol	528-56-3
Proanthocyanidin	20347-71-1

(Continued)

Table 6. (Continued).

(1) Dyestuff	CAS NUMBER
Acutissimin A	108906-66-7
Orsellinic acid	480-64-8
Lecanoric acid	480-56-8
Orcinol	504-15-4
Phenoxazone	135-67-1
Orceins	1400-62-0
Erythrin	480-57-9
Diploschistesic acid	537-08-6
Gyrophoric acid	548-89-0
Physodic acid	84-24-2
B-orcinol	6153-39-5
Atranorin	479-20-9
Thamnolic acid	484-55-9
Barbatic acid	67-52-7
Barbatolic acid	529-50-0
Protocetraric acid	489-51-0
Fumarprotocetraric acid	489-50-9
Physodalic acid	84-24-2
Psoromic acid	7299-11-8
Lobaric acid	522-53-2
Salazinic acid	521-39-1
Usnic acid	7562-61-0
Pulvinic acid	26548-70-9
Involutin	13677-78-6
Polyporic acid	548-59-4
Flavomentins A,B,C,D	121254-52-2
Spiromentins A,B,C,D	4829-36-1
Thelephoric acid	479-64-1
Parietinic acid	17636-18-9
Fallacinal	569-05-1
Phycion	521-61-9
Emodin	518-82-1
Norbadiione-A	90295-68-4
Bisnorbadioquinone-A	90295-70-8
Fomentariol	53948-12-2
Anhydrofomentariol	63521-58-4
Hispidin	555-55-5
Cinnabarin	146-90-7
Echinotinctone	176181-82-1

Dye fungi

Fungi occupy a unique place in the history of dyeing. The fungi class of organisms previously considered part of the plant kingdom, is now recognized as a separate kingdom, distinct from both plants and animals. Most fungi produce pigments that are water-soluble and ideal for industrial production since they can be easily scaled up in industrial fermenters and extracted without the use of organic solvents (Venil et al. 2020). The standard includes 72 dye fungi (Cardon 2007; Schweppe 1992) as do many publications (Venil et al. 2020) (Table 5).

Coloring compounds (dyestuffs)

Natural coloring compounds include a group of quinones (naphthoquinone, anthraquinone, etc.), flavonoids, anthocyanin, carotenoids, indigoids, and tannins (Böhmer et al. 2002; Cardon 2007; Karadag 2007; Schweppe 1992) demonstrated as well in many publications (Andsen and Markham 2006). The standard includes 228 coloring compounds (Table 6).

Table 7. List of fastness values.

<i>Technical Quality Parameters</i>		
Parameter	Criteria	Test Method
Rubbing fastness (dry)	3-4	ISO 105 × 12
Rubbing fastness(wet)	2	ISO 105 × 12
Sweat fastness (alkaline and acidic)	3-4	ISO 105 E04
Sweat fastness	3	ISO 105 E04
Lightfastness	3-4	ISO 105 B02
Saliva fastness (baby products only)	5	BVL B82.92.3 DIN 53,160-1
Washing fastness (40°C)	3-4	ISO 105 C06 A1 M

Table 8. Inorganic Element Content Maximum Limits in the Natural Dyed Product.

Inorganic element content	CAS NO	Maximum limit (mg/kg)
Fe	7439-89-6	free
Ca	7440-70-2	free
Cu	7440-50-8	<25.00
Cr	7440-47-3	<1.00
Ni	7440-02-0	<1.00
Ba	7440-39-3	<1000.00
Si	7440-21-3	free
K	7440-09-7	free
Pb	7439-92-1	<0.20
As	7440-38-2	<0.20
Sn	7440-31-5	<0.20
Cd	7440-43-9	<0.10
Co	7440-44-0	<1.00
Hg	7439-97-6	<0.02
Se	7782-49-2	<0.20
Mn	7439-96-5	<90.00
Zn	7440-66-6	<750.00
Sb	7440-36-0	<0.20
Al	7429-90-5	free

Table 9. Prohibited and Restricted Substances.

Substance group	Criteria
Aromatic and halogenated solvents	Prohibit
Flame retardants	Prohibited ones <ul style="list-style-type: none"> – Chlorinated flame retardants – Brominated flame retardants – Phosphorus flame retardants – Flame retardants containing antimony – Disodium octaborate
Chlorinated benzenes and toluene	Prohibit
Chlorophenols (salts and esters)	Prohibit
Complexing agents and surfactants	Prohibited ones <ul style="list-style-type: none"> ● All AP and APEO ● EDTA ● DTPA ● NTA ● LAS ● α -MES
Endocrine disruptors	Prohibit
Formaldehyde and other aldehydes	Prohibit
Glycol derivatives	Prohibit

Table 10. Maximum Limits of Residues in Products.

Parameter	Criteria	Test Method
Alkyl phenol	<20 mg/kg	GC/MS, HPLC/MS
AOX	<5 mg/kg	ISO9562
Aryl amines	<20 mg/kg	HPLC/GCMS
Formaldehyde	<16 mg/kg	ISO 14,184-1
Glyoxalin	<20 mg/kg	ISO 17,226-1 (HPLC)

Table 11. Natural mordant substance in the product content.

Mordant substance	CAS NO	Maximum limit (mg/kg)
KAl(SO ₄) ₂ ·12 H ₂ O	7784-24-9	free
Al ₂ (SO ₄) ₃	10043-01-3	free
FeSO ₄	7782-63-0	free
Fe ₂ (SO ₄) ₃	10028-22-5	free
Ca compounds	all	free
Mg compounds	all	free
K compounds	all	free
Si compounds	all	free

Table 12. Synthetic dyestuffs and binders contained in the product.

Dyestuff	Group	Maximum limit (mg/kg)
Azoik dyestuffs	All	0.00
Direct dyestuffs	All	0.00
Vat Dyestuffs	All	0.00
Sulfur dyestuffs	All	0.00
Reactive dyestuffs	All	0.00
Reducing dyestuffs	All	0.00
Oxidation dyestuffs	All	0.00
Acid dyestuffs	All	0.00
Alkali dyestuffs	All	0.00
Mordant dyestuffs	All	0.00
Chrome dyestuffs	All	0.00
Disperse dyestuffs	All	0.00
Pigment dyestuffs	All	0.00
Synthetic binders	All	0.00

Fastness

The color fastness property of textile materials, especially fabric is very important for processing and use. It is the ability to withstand the reduction of color from the surface of textile materials when undergoing different processes and treatments. The response of the color fastness property to washing, light, rubbing, and sweat fastness (alkaline and acidic) of the dyed goods was determined according to ISO 105 C06 A1 M, ISO 105 B02, ISO 105 × 12, and ISO 105 E04, respectively (Table 7).

Prohibited and restricted substances

Prohibited and restricted substances in the GOTS (Global Organic Textile Standard) were prohibited and restricted by the NODS (Natural Organic Dye Standard) (Tables 8–12). Synthetic coloring compounds (dyestuffs) and synthetic binders are also prohibited under GOTS standards (<https://global-standard.org/>). In addition, list of restricted substances in finished products, major risk areas in the textile supply chain, and the importance of manufacturing restricted substances were given (Gobalakrishnan, Das, and Saravanan 2021).

Result and discussion

NODS was set as a standard after the needs of the textile industries and the demand of customers. Numerous published articles (Deveogl and Karadag 2019; Şahinbaşkan, Karadag, and Torgan 2018) and books (Böhmer et al. 2002; Cardon 2007; Karadag 2007; Raisanen 2009; Schweppe 1992) about natural dyes and natural coloring compounds have been published in the last thirty years. NODS includes natural dyes/coloring compounds found in textile goods (Tables 1–6). It rates the fastness of natural dyes lower than of synthetic dyes in cellulose-based fibers or fabrics. For this reason, it has been assumed that the fastness of natural dyes is moderate. However, the fastness values are sufficient for the textile companies using them for natural dyed textiles goods (Table 7). Heavy metals and substances that are restricted, prohibited, and limited to use in textile products according to GOTS standards were also restricted, prohibited, and limited uses in NODS standards (Tables 8–10).

Free mordant metals and some free elements were given in the NODS (Table 11). All synthetic dyestuff groups and all synthetic binder groups contained in the textile product were prohibited in the NODS (Table 12).

Conclusion

Quality, sustainability, eco-friendly, awareness, ZHCD, GOTS, and other criteria now outweigh price as the prime consideration for customers. Natural dye resources and natural coloring compounds (dyestuffs) are increasingly used in high-volume textile production industries (Karadag 2022, 2023). With both consumer and brand demand, it has become a necessity set a standard (NODS) in the dyed textile products for natural dyes as well as the other desirable standards for textile products. NODS criteria are also requested in the natural dyed productions. To respond to this demand, the articles have developed criteria for NODS based on previous research. When purchasing textiles that follow the NODS, the consumers can be sure that the goods are colored with natural dye and will be able to use them with confidence. Brands and textile industries that produce according to the NODS will be earning more while contributing to sustainability and eco-friendly dyeings.

By its nature, the NODS does not include dangerous substances, heavy metals, toxic dyes, carcinogenic substances, pesticides, and synthetic dyes.

Following new developed in technology and materials, and responding to new customer demands, and to new analysis methods, engineers and chemists are constantly improving and refining standards such as GOTS, OEKO-TEX, ZDHC, and others. For similar reasons, new versions of NODS will also respond to changes in science. NODS creates important and timely new standards for the textile industry. It is created exclusively for textiles that use natural dyes and is not suitable for synthetic materials or synthetic dyes. The image of the NODS standard was designed as above the title.

Acknowledgments

Support from the Turkish Cultural Foundation is gratefully acknowledged (www.turkishculturalfoundation.org; www.tcfdatau.org). The author would like to thank Tuğçe Günaydın Sinir for the NODS logo design, and Prof. Amanda Phillips and Dr.Yusuf Yıldız for editorial comments.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Highlights

- Natural dyes have been used in the textile dyeing industry in recent years and are increasing rapidly. However, there is no standard for the use of natural dyes in textile goods and textile dyeings.

- One of the most important issues of recent years is the Zero Discharge of Hazardous Chemicals (ZDHC) concept in textile dyeing and goods. It is known that natural dye is the most suitable method for the criteria of ZDHC and this dyeing is encouraged in the textile dyeings by important textile companies.
- All dye plants, dye insects, and dye mollusks were given used in the natural dyeings in the manuscript.
- Fastness tests were given in the manuscript.
- NODS is demanded by the textile industries and their customers.

References

- Accessed October 3, 2022, <https://global-standard.org/> (2021, version 3.1)
- Accessed October 3, 2022, https://chem-map.com/zdhc-mrsl/?gclid=EAIAIQobChMI5KDr5PXD-gIVieh3Ch16HA3gEAAAYAiAAEgLLpPD_BwE
- Accessed October 3, 2022, <https://textileexchange.org/standards/recycled-claim-standard-global-recycled-standard/>
- Alkan, R., E. Torgan, and R. Karadag. 2017. The investigation of antifungal activity and durability of natural silk fabrics dyed with madder and gallnut. *Journal of Natural Fibers* 14 (6):769–80. doi:10.1080/15440478.2017.1279101.
- Amin, N., F. Rehman, S. Adeel, T. Ahamd, M. Muneer, and A. Haji. 2020. Sustainable application of cochineal-based anthraquinone dye for the coloration of bio-mordanted silk fabric. *Environmental Science and Pollution Research* 27:6851–60. doi:10.1007/s11356-019-06868-3.
- Ammayappan, L., and D. B. B. Shakyawar. 2016. Dyeing of Carpet Woolen Yarn using Natural Dye from Cochineal. *Journal of Natural Fibers* 13:42–53. doi:10.1080/15440478.2014.984054.
- Andsen, Ø. M., and K. R. Markham, ed. 2006. *Flavonoids*. New York: Taylor and Francis Group, CRC Press.
- Baaka, N. 2020. Sustainable Dyeing of Wool Fabric Using Kermes Oak (*Quercus Coccifera* L) as Source of Natural Colorant. *Journal of Natural Fibers* 19:1–9. in press. doi:10.1080/15440478.2020.1726250.
- Baliarsingh, S., A. K. Panda, J. Jena, T. Das, and N. B. Das. 2012. Exploring sustainable technique on natural dye extraction from native plants for textile: Identification of colourants, colourimetric analysis of dyed yarns and their antimicrobial evaluation. *Journal of Cleaner Production* 37:257–64. doi:10.1016/j.jclepro.2012.07.022.
- Böhmer, H., N. Enez, R. Karadag, and C. Kwon. 2002. *Koekbonya*. Ganderkesee, Germany: Natural Dyes and Textiles.
- Caniato, F., M. Caridi, L. Crippa, and A. Moretto. 2012. Environmental sustainability in fashion supply chains: An exploratory case based research. *International Journal of Production Economics* 135:659–70. doi:10.1016/j.ijpe.2011.06.001.
- Cardon, D. 2007. *Natural Dyes*. London, United Kingdom: Archetype Publications Ltd.
- Cooksey, C. J. 2019. The red insect dyes: Carminic, kermesic and laccaic acids and their derivatives. *Biotechnic & Histochemistry* 94 (2):100–07. doi:10.1080/10520295.2018.1511065.
- Deveoglu, O., and R. Karadag. 2019. A Review on the Flavonoids – a Dye Source. *International Journal of Advances in Engineering and Pure Sciences* 3:188–200. doi:10.7240/jepps.476514.
- Gobalakrishnan, M., S. Das, and D. Saravanan. 2021. Hazardous, restricted, and manufacturing restricted substances in textiles and clothing supply chain Subramian, S.M. In *Chemical Management in Textiles and Fashion*, 113–33. (*The Textile Institute Book Series*).
- Guzel, T. E., and R. Karadag. 2021. Sustainability of organic cotton fabric dyeing with a natural dye (Gallnut) and analysis by multitechnique approach. *Journal of Natural Fibers* 18 (8):1107–18. doi:10.1080/15440478.2019.1687064.
- Guzel, E. T., K. Karadag, and R. Alkan. 2020. Durability, antimicrobial activity and HPLC analysis of dyed silk fabrics using madder and gall oak. *Journal of Natural Fibers* 17 (11):1654–67. doi:10.1080/15440478.2019.1588827.
- Hou, J. G. L., L. Liu, M. Chen, Y. Yao, P. H. Fallgren, S. Jin, and S. Jin. 2022. Electrochemical destruction and mobilization of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) in saturated soil. *Chemosphere* 287:132205. doi:10.1016/j.chemosphere.2021.132205.
- ISO 105-B02 (A1S). 2013. *Textiles: Tests of Color Fastness, Part B02: Colour Fastness to Artificial Light: Xenon arc Fading Lamp Test*. Basel: ISO.
- ISO 105-C06 (A1S). 2010. *Textiles: Tests for Colour Fastness, Part C06: Colour Fastness to Domestic and Commercial Laundering*. Basel: ISO.
- ISO 105-E04. 2013. *Textiles: Tests for Color Fastness, Part E04: Color Fastness to Perspiration*. Basel: ISO.
- ISO 105-X12. 2001. *Textiles: Tests for Color Fastness, Part X12: Color Fastness to Rubbing*. Basel: ISO.
- Karadag, R. 2007. Doğal boyamacılık. In *Kültür ve Turizm Bakanlığı, Geleneksel El Sanatları ve Magazalar İşletme Müdürlüğü Yayınları*, ed. T. C. Ankara. Ankara: T.C. Kültür ve Turizm Bakanlığı.
- Karadag, R. 2022. Sustainable and Mass Production of Cotton Dyeing with Natural Dye (Weld) in the Textile Industry. *Journal of Natural Fibers* 19 (15):10935–45. doi:10.1080/15440478.2021.2002781.
- Karadag, R. 2023. Cotton Dyeing with Cochineal by Just in Time Extraction, Mordanting, Dyeing, and Fixing Method in the Textile Industry. *Journal of Natural Fibers* 20 (1):1–11. doi:10.1080/15440478.2022.2108184.
- Karadag, R., B. Y. Buyukakinci, and E. T. Guzel. 2022. Extraction and natural cotton dyeing of Valonia Oak and Anatolian Buckthorn by microwave irradiation. *Journal of Natural Fibers* 19 (1):159–72. doi:10.1080/15440478.2020.1731907.

- Karadag, R., and Y. Yildiz. 2022. Examination of Dyeing Properties of the Dyed Organic Cotton Knitting Fabrics Using Yarrow (*Achillea Biebersteinii* AFAN and *Achillea Millefolium* L. *Journal of Natural Fibers* 19 (14):7374–81. doi:10.1080/15440478.2021.1946881.
- Karapanagiotis, I., V. Villemereuil, P. Magiatis, P. Polychronopoulos, K. Vougianniopoulou, and A. L. Skaltsounis. 2007. Identification of the Coloring Constituents of Four Natural Indigoid Dyes. *Journal of Liquid Chromatography & Related Technologies* 29:1491–502. doi:10.1080/10826070600674935.
- Ozdemir, M. B., and R. Karadag. 2023. Madder (*Rubia tinctorum* L.) as an Economic Factor Under Sustainability Goals in the Textile Dyeing. *Journal of Natural Fibers* 20 (1):138–47. doi:10.1080/15440478.2022.2128968.
- Petroviciua, I., I. V. Berghe, I. Cretuc, F. Albu, and A. Medvedovic. 2012. Identification of natural dyes in historical textiles from Romanian collections by LC-DAD and LC-MS (single stage and tandem MS). *Journal of Cultural Heritage* 13:89–97. doi:10.1016/j.culher.2011.05.004.
- Raisanen, R. 2009. Dyes from Lichens and Mushrooms. Ed., Bechtold, T., Mussak, R., *Handbook of Natural Colorant* 183–200.
- Reese, D. S. 2008. Shells from Sarepta (Lebanon) and East Mediterranean Purple Dye Production. *Mediterranean Archaeology and Archaeometry* 10 (1):113–141.
- Schwepe, H. 1992. *Handbuch der Naturfarbstoffe. -Vorkommen-Verwendung-Nachweis: Ecomed, Landsberg/Lech.*
- Shaheen, S., Z. Iqbal, and M. Hussain. 2018. First Report of Dye Yielding Potential and Compounds of Lichens; a Cultural Heritage of Himalayan Communities, Pakistan. *Pakistan Journal of Botany* 51:1–20. doi:[http://dx.doi.org/10.30848/PJB2019-1\(15\)](http://dx.doi.org/10.30848/PJB2019-1(15)).
- Shahid, M., S. Islam, and F. Mohammad. 2013. Recent advancements in natural dye applications: A review. *Journal of Cleaner Production* 53:310–31. doi:10.1016/j.jclepro.2013.03.031.
- Şahinbaşkan, B. Y., R. Karadag, and E. Torgan. 2018. Dyeing of silk fabric with natural dyes extracted from cochineal (*Dactylopius coccus* Costa) and gall oak (*Quercus infectoria* Olivier). *Journal of Natural Fibers* 15 (4):559–74. doi:10.1080/15440478.2017.1349708.
- Venil, C. K., P. Velmurugan, L. Dufossé, P. R. Devi, and A. V. Ravi. 2020. Fungal Pigments: Potential Coloring Compounds for Wide Ranging Applications in Textile Dyeing. *Journal of Fungi* 6 (68):1–23. doi:10.3390/jof6020068.