

Freshwater lichens in a small riparian Nature Reserve of Northern Italy: species richness and conservation issues

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Abstract – In Italy several natural reserves include riparian habitats, whose role in lichen conservation is still unknown. This work aims at improving floristics on freshwater lichens of Italy, and at evaluating the importance for freshwater lichen conservation of a small riparian nature reserve in NE-Italy surrounded by a highly disturbed landscape. A floristic survey on freshwater habitats was carried out in the nature reserve Vincheto di Celarda, according to the general aims of the biodiversity monitoring and restoration program of a LIFE-Natura project coordinated by the National Forestry Service. Lichens were collected in four sites, three perennially submerged and one only periodically submerged. Six species were found: one is new to Italy, and two are new to Veneto confirming that freshwater habitats are still poorly known in Italy, and further research is required. Despite the highly disturbed surrounding landscape, the freshwater lichen flora is relatively rich in species, suggesting that local habitat quality is effective for freshwater lichen conservation.

habitat quality / LIFE-Natura / *Thelidium inundatum* / *Verrucaria aquatilis* / *Verrucaria dolosa*

INTRODUCTION

Riparian and freshwater habitats are subject to several kinds of human impact that are highly detrimental for biodiversity. Artificial water basins, water pollutants, eutrophication, and cementification are only some examples of human pressure on these habitats. Since semi-natural riparian and freshwater habitats are becoming rare and threatened in Europe, they are included in the EU 92/43 directive (“Habitat directive”) as being worthy of conservation.

Lichens mostly colonise terrestrial habitats, but a few species are restricted to submerged or partially inundated habitats. Freshwater lichens are widespread throughout Europe as typical elements of vegetation of springs, rivers, and lakes (Thüs, 2002). Their main morphological adaptations and ecological requirements are summarized in the recent review by Aptroot & Seaward (2003). Freshwater lichens belong to a few genera, the most representative being *Verrucaria*. Species distribution is affected by several ecological parameters such as inundation, substrate and water pH, substrate stability, light, silting, and eutrophication (Aptroot & Seaward, 2003; Gilbert, 1996; Gilbert & Garavini, 1997; Thüs, 2002).

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Nascimbene & Nimis (2006) provided a review on freshwater lichens of the Italian Alps, underlining an urgent need of further research for improving floristics in these lichenologically poorly known habitat in Italy.

In Italy, several nature reserves belonging to the Natura 2000 network include riparian habitats, which, however are lichenologically poorly known, so that their role in lichen conservation is still unknown. Due to a poor taxonomic knowledge, freshwater lichens conservation is mostly entrusted to a generalized habitat protection and specific actions are rarely attempted. They are mainly threatened by hydroelectric developments, water pollutions and silting (Nascimbene & Nimis, 2006; Thüs 2002).

Thus, the aim of this work is to improve floristics on freshwater lichens of Italy, by surveying the freshwater habitats of a small riparian nature reserve of northern Italy. Since the reserve is surrounded by a highly disturbed landscape a rough evaluation of its habitat quality, and its effectiveness for freshwater lichens conservation is discussed.

MATERIALS AND METHODS

The study was carried out in the small Nature Reserve “Vincheto di Celarda” extending on a 92 ha surface along the right orographic side of river Piave at ca. 310 m a.s.l. The reserve, managed by the State Forestry Service, is located in an urbanized and agricultural landscape in the valley bottom of Val Belluna (Veneto, NE Italy).

The main source of water for the reserve is represented by the Caorame river in the northern part and the Celarda River in the southern part. The former comes directly from the Pre-Alps crossing low disturbed areas, while the latter has springs 1 km far from the reserve in an almost undisturbed site.

Since 1976, the reserve is classified as a humid area of international interest on the basis of the Ramsar Convention. Since 2004 the National Forest Service coordinated a LIFE-Nature project (LIFE04NAT/IT/000190) whose main aim is to improve quality and increase surfaces of freshwater habitats within the reserve.

Four sites, characterized by a pebbles riverbed, were preferentially selected for floristic surveying (Table 1), as they appeared suitable for rich freshwater lichen communities. This kind of habitat is rather rare in the reserve, since muddy riverbeds prevail.

Table 1. Localization of the sampling sites. Coordinates are expressed according to European 1950.

<i>Site n°</i>	<i>River</i>	<i>N Coordinate</i>	<i>E Coordinate</i>	<i>Submersion</i>
1	Caoramello river	46°00'55''	011°58'30.9''	Perennially
2	secondary river	46°00'41.1''	011°58'33.9''	Perennially
3	secondary river	46°00'34.1''	011°58'29.3''	Periodically
4	Celarda river	46°00'25.3''	011°58'19.5''	Perennially

In sites 1, 2, and 4 lichens are perennially submerged, while in site 3 they are only periodically submerged. Site 1 is in well lit conditions, while the others are in shaded habitats within a forest. Calcareous rocks are the main geological substrate, however some siliceous pebbles are present as well.

In each site lichens were surveyed in detail, collecting abundant material within a 2-3 m² surface.

Species were identified according to the standards in lichenology; critical material was submitted to specialist for confirmation or identification. Specimens were stored in the personal herbarium of the senior author (inv.: JN1631, JN1701, JN1702, JN1705, JN1706). Nomenclature follows Nimis & Martellos (2003).

RESULTS AND DISCUSSION

Six species of aquatic lichens were found, five belonging to *Verrucaria*.

They are:

Thelidium inundatum Zschacke, an endolithic amphibian lichen found in site n° 3 in periodically submerged conditions. It is new to Italy. It should be looked for in the calcareous areas of the Alps, where it could be rather common.

Verrucaria aethiobola Wahlenb., found in site n° 3 in periodically submerged conditions on siliceous pebbles.

Verrucaria aquatilis Mudd, found in sites 1 and 4 in perennially inundated conditions, is new to Veneto region. Probably overlooked, like many freshwater lichens in Italy (Nimis, 2003).

Verrucaria dolosa Hepp, found in site 3 in periodically submerged and shaded conditions, is new to Veneto region. It is a probably holarctic early colonizer of small pebbles near the ground, both on calcareous and base-rich siliceous rocks, in sheltered situations, perhaps overlooked in Italy (Nimis, 2003).

Verrucaria elaeomelaena (A.Massal.) Arnold, found in site 3 on calcareous pebbles in submerged and shaded conditions. According to Nimis (2003) it is a cool-temperate to boreal-montane, perhaps circumpolar species, almost perennially submerged in cold montane to Alpine creeks, emerging only in very shaded situations; perhaps more widespread in the Alps.

Verrucaria hydrela Ach., found in site 2 on siliceous fragments included in calcareous pebbles. According to Nimis (2003) the species establishes in humid-shaded habitats (e.g. in open woodlands), sometimes on boulders in creeks, but never submerged for long periods.

In each perennially inundated site only one species was found, *Verrucaria aquatilis* being the most characteristic and abundant. In periodically inundated conditions, lichen communities are richer in species, since some amphibian/terrestrial lichens can establish as well (e.g. *Verrucaria aethiobola/V. dolosa*).

The survey allowed to significantly improve floristics on freshwater lichens in Italy demonstrating the urgent need of further research on this ecological-specialized group. In Veneto, only ten species were known (Nimis, 2003). They are now thirteen, 50% of which were found in this small riparian reserve.

Among the five *Verrucaria*, only *V. dolosa* was previously found in the submediterranean belt in Italy. In their discussion on the altitudinal distribution of freshwater lichens in the Italian Alps, Nascimbene & Nimis (2006) indicated the subalpine belt as the most suitable for these lichens since their main ecological requirements are simultaneously fulfilled. They hypothesized that lowland areas host poor communities since they are the most disturbed. However, this survey demonstrated that species supposed to be “alpine” should be looked for even in the lowlands, where species richness of freshwater lichens could be relatively high when habitat availability and quality fulfil their main requirements.

In the study area the surrounding highly disturbed landscape seems to have a low effect in affecting freshwater lichens richness probably due to the fact that waters flowing along the reserve are independent from those crossing the industrial and intensively cultivated areas. Therefore, even a small reserve can succeed in freshwater lichens conservation by maintaining a high habitat quality at local level.

Since muddy riverbeds largely prevail within the reserve, freshwater lichens are restricted to a few sites. Retention and restoration of pebbles riverbeds is fundamental to improve freshwater lichens richness, while the maintenance of a constant hydrometric regime is important for long term-conservation of those species restricted to perennially inundated conditions.

Due to the vulnerability of their habitat, freshwater lichens should be considered as nationally important target species for conservation and deserve to be mentioned in the action plans of the nature reserves according to Natura 2000 and Ramsar criteria for biodiversity conservation.

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