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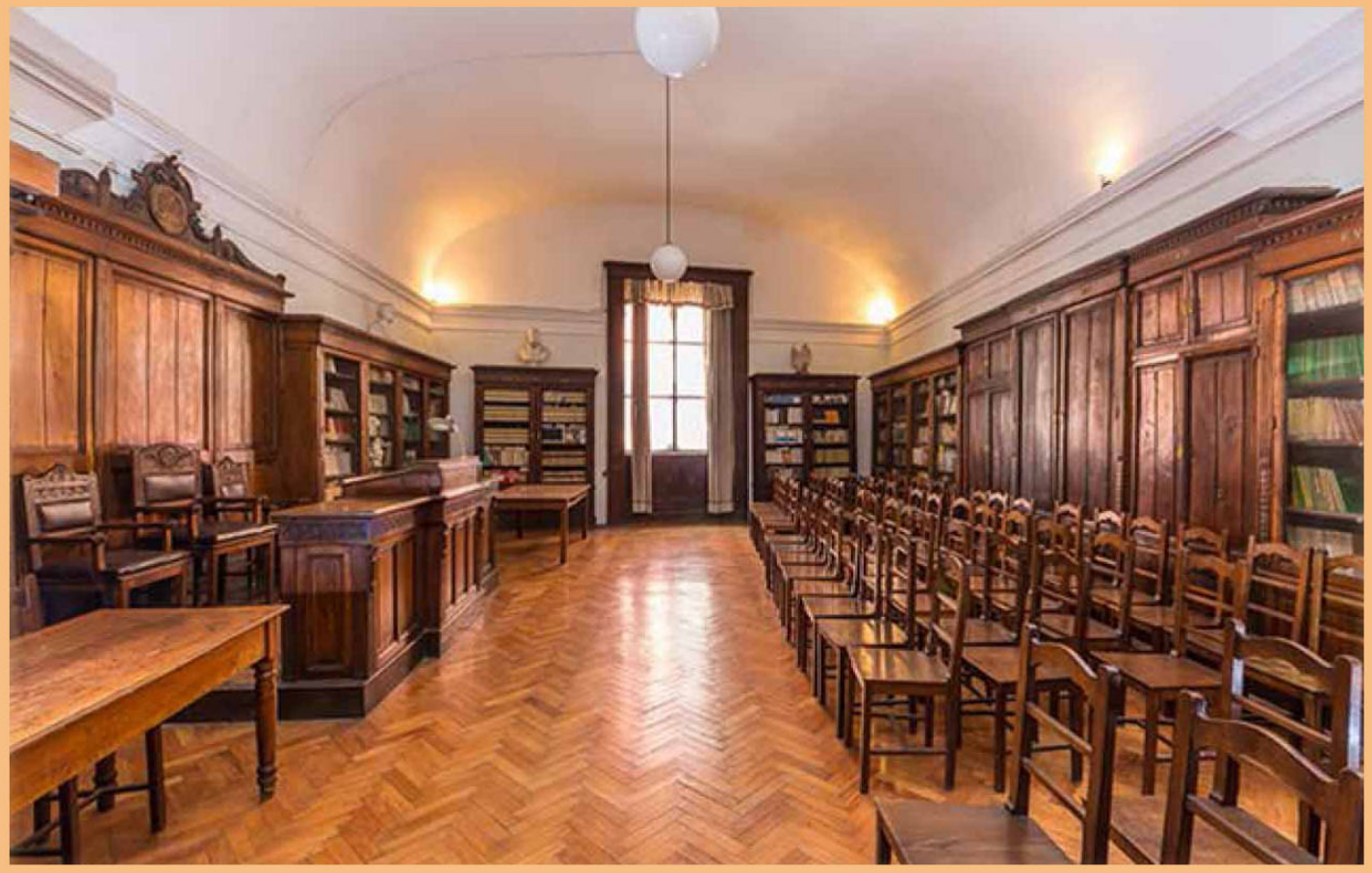

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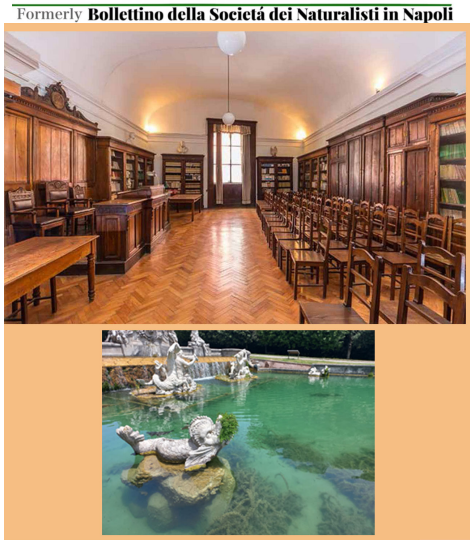

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Updates on the presence of the Eurasian otter, *Lutra lutra* in the SAC/SPA "Area delle Gravine" IT9130007 and first sighting in the Oasis "Gravina di Laterza"

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Original article |Published: 2 aug 2023|Pages: 1 - 6

Towards an environmental open library in the center of Naples. The case of the Library of the Società dei Naturalisti in Napoli

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Technical article |Published: 09 Oct. 2023 |Pages: 7 - 15

Preliminary contribution to the knowledge of aquatic macrophytes and trophic status in the park of the Royal Palace of Caserta

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Fabio Mao Valletta

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Updates on the presence of the Eurasian otter, *Lutra lutra* in the SAC/SPA "Area delle Gravine" IT9130007 and first sighting in the Oasis "Gravina di Laterza"

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Abstract

The Eurasian otter is irregularly distributed in Southern Italy. In Apulia Region presence data are known mostly for the river basins of the Tavoliere delle Puglie, while in the province of Taranto only sporadic signs of presence have been documented in the last decade. Here we report of the presence of the otter in the Gravine Area in 2021 using camera trapping and in the area of LIPU Oasis "Gravina di Laterza", one of the most important and characteristic sites of the whole Gravine Area, in which in 2022 three different individuals were observed.

Keywords: *Lutra lutra*, Gravine, Laterza, Apulia

Riassunto

La lontra è distribuita irregolarmente nel centro e nel sud Italia. I dati di presenza per la regione Puglia provengono per lo più dai bacini fluviali del Tavoliere, mentre nella provincia di Taranto sono stati documentati nell'ultima decade solamente sporadici segni di presenza. Il presente contributo riporta la presenza della specie all'interno della ZSC/ZPS "Area delle Gravine" nel 2021 mediante fototrappolaggio, e di osservazioni di tre individui nel 2022 nel territorio dell'Oasi LIPU della Gravina di Laterza, uno dei siti più importanti e caratteristici di tutta l'Area delle Gravine.

Parole chiave: *Lutra lutra*, Gravine, Laterza, Puglia.

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Introduction

The Eurasian otter, *Lutra lutra* is an important conservation emergency at European level. It is listed as Near Threatened by the International Union for Conservation of Nature (Loy et al., 2023), and it is included in Appendix II of Berne Convention (1979), in Annexes II, IV of Habitat Directive (92/43/CEE) and also in CITES Annex A (Temple & Terry, 2007). In Italy, the species has been protected since 1971 with a Ministerial Decree, while the prohibition of killing and the protection status were subsequently sanctioned with National Law 968/1977. Currently, the otter is given the status of a particularly protected species under the law of 11 February 1992 n.157 (Panzacchi et al., 2011). *L. lutra* is a top predator in freshwater habitats and consequently can play an important role in the functioning and structuring of the ecosystems (Buglione et al., 2020a). As in many polygynous species, males defend a territory that typically overlaps the area of activity of one or more reproductive females (Erlinge, 1968). The activity areas are marked through the deposition of spraints, sometimes covered by gelatinous anal secretions, in given places such as on trunks protruding from the water, on outcropping rocks or under bridges (Prigioni et al., 1997). The otter is present in many areas of Eurasia with a dotted distribution. A field survey carried out in Italy in 1980s evidenced that the most numerous nuclei were located in the central-souther areas (Macdonald & Mason, 1983; Cassola, 1986, Bolinesi et al., 2019), while it was almost extinct in the central-northern Italy (Reggiani *et al.*, 2001; Spagnesi *et al.*, 2000). In Apulia, the presence of the species has been confirmed in many areas (Loy et al., 2018), in particular, in the basin of the Ofanto river, in the Fortore river, in the Carapelle stream from 2007 onwards (Cripezzi et al., 2001; Gioiosa et al., 2008; Marrese et al., 2014) and in other areas of the Tavoliere delle Puglie (Giovacchini et al., 2018; Gaudiano et al., 2023). In the province of Taranto, some dead individuals were found near the area of Mar Piccolo (Buglione et al., 2020b) and at the mouth of Lato river (2022). In this paper we update the knowledge on the status of the otter in the province of Taranto, especially in the SAC/SPA "Area delle Gravine".

Materials and Methods

The study area is included in the SAC/SPA IT9130007 called "Area delle Gravine" (Fig. 1), which falls within the Regional System for the Conservation of Nature in Apulia (L.R. 19/97) in line with the Community directives of the Natura 2000 Network (Habitat Directive 92/43 EEC; Bird Directive 79/409, updated 2009/147/EC). It extends over an area that includes part of the Province of Taranto, touching the municipalities of Statte, Crispiano, Massafra, Mottola, Palagianello, Castellaneta, Laterza and Ginosa, with their respective furrows, located along the Ionian arch up to the border with Basilicata.

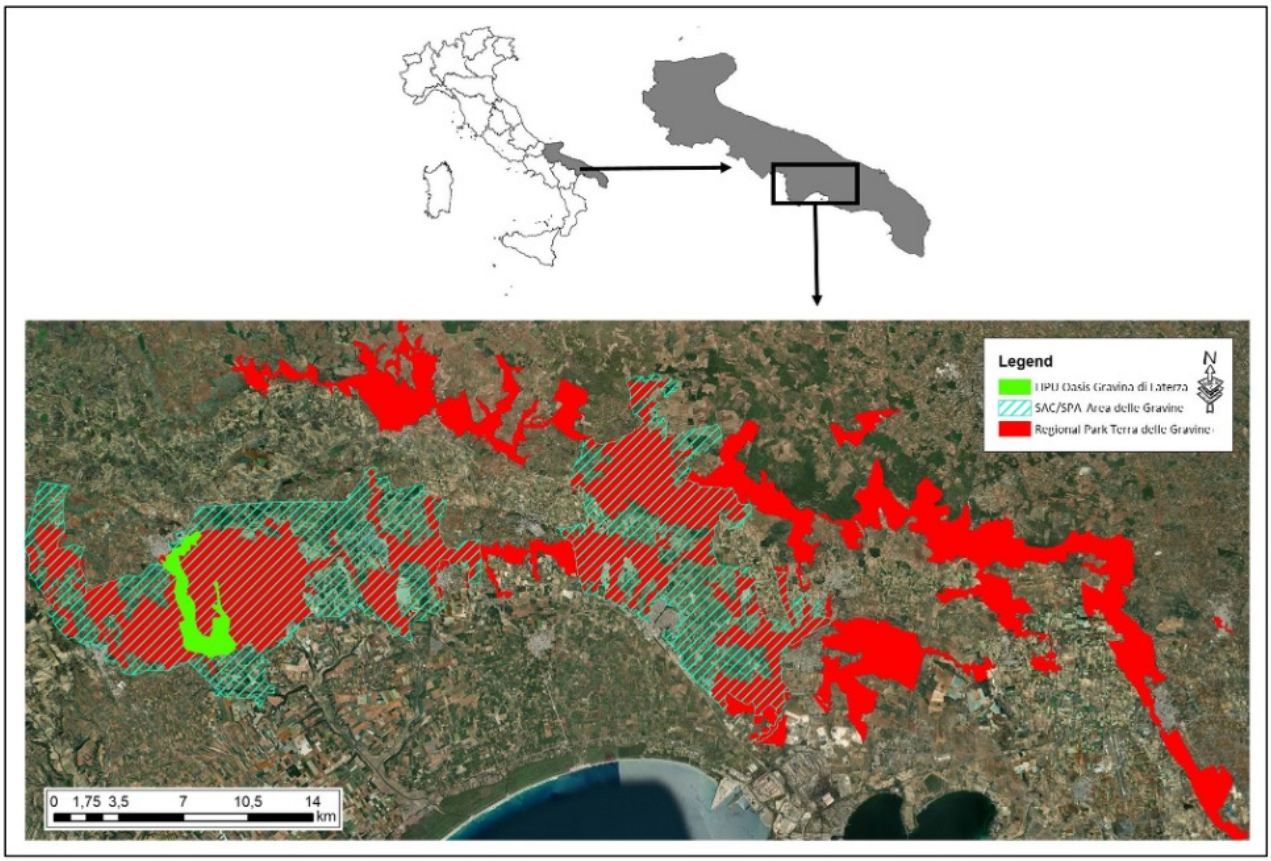

Figure 1: Study area.

Furthermore, part of these territories is included in the Natural Regional Park Terra delle Gravine, over about 25000 hectares, established by the Apulia region with Regional Law 18/05 in December 2005 (modified with Regional Law 6/2011). The SAC/SPA includes the LIPU Oasis of "Gravina di Laterza", covering approximately 870 hectares, established in 1999 thanks to a collaboration agreement between the Province of Taranto, the Municipality of Laterza and the LIPU (Lega Italiana per la Protezione degli Uccelli - Italian League for Bird Protection). Presence data were collected *ad libitum*, during monitoring actions dedicated to other taxa (dragonflies & damselflies and birds) from May 2021 to September 2022. The May 2021 observation (spraint) made in the SAC/SPA "Area delle Gravine" (but outside LIPU Oasis of "Gravina di Laterza") was followed by a small photo-trapping session and a transect-method assessment. The transect method was applied only in this case to verify the actual persistence of river rod use both upstream and downstream of the photo-trapping point.

The data collected in "Gravina di Laterza" were obtained during a bird monitoring session from favourable fixed points (Gilbert et al., 2011), and the presence was proved by a photo shoot.

Results and discussion

In May 2021 in the SAC/SPA "Area delle Gravine" some probable otter spraints were observed. A camera trap was placed near the outcropping rock on which the spraint was found to confirm the effective presence of the mustelid. Indeed, on 11 May 2021 the animal was camera-trapped (Fig. 2). In

Figure 2: Otter adult camera-trapped. *Photo by Marra M. & Luce G.*

September 2021, a single transect of 1800 m along the watercourse was carried out to check for spraints. During sampling, 12 spraints were surveyed and collected (6,6 spraints/km), which will be analyzed in future work.

In September 2022, during a monitoring by observation from favourable fixed points, three individuals were observed for the first time in LIPU Oasis "Gravina di Laterza" (Fig. 3).

The presence of the otter in the SAC/SPA "Area delle Gravine" is very important, since the area is closely connected to the Ionian Arc by various hydrographic networks, which therefore represent important corridors between the coastal strip and the hinterland, particularly with the adjacent Lucanian watersheds where the species was previously recorded (Loy et al., 2015; Panzacchi et al., 2021, Prigioni et al., 2007). On the coastal strip several finds of carcasses are recorded, and spraints were observed in August 2021 on the Tara River (Marra, pers. obs.). The presence of the species is most likely linked to the good flow of the Tara River and the consequent optimal trophic availability (especially fish). Indeed, Ruiz-Olmo (1995) verified that the abandonment by otters of several Mediterranean rivers that dry up or have intermittent flows is due to the death of large numbers of fish during dry periods. The otter adds to several other species present on the site and included in the various Directives of Community interest, like the Eurasian Eagle-Owl *Bubo bubo* (L., 1758), the Lanner Falcon *Falco biarmicus* Temminck, 1825, the Short-Toed Snake-Eagle *Circaetus gallicus* (Gmelin, 1788), the Black Stork *Ciconia nigra* (L.,1758), the Leopard Snake *Zamenis situla* (L.,1758) and the Apennine yellow-bellied toad *Bombina variegata pachypus* (Bonaparte, 1838). The "Gravina di Laterza", in fact, is one of the best-preserved places in the arc of the Ionian Gravine, thanks also to the LIPU Oasis, instituted about twenty years ago, which contributes to the conservation of

Figure 3: Three otter individuals photographed in LIPU Oasis "Gravina di Laterza". *Photo by N. Magaletti.*

biodiversity. In the near future, it is hoped that dedicated studies will continue in order to further investigate the distribution and trend of the otter in the "Gravina di Laterza" and in the surrounding areas in order to apply targeted conservation measures and, at the same time, to adapt management policies aimed at preserving the habitats that characterize these peculiar ecosystems.

Author contributions

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Field research: M. Marra, G. Luce, V. Giacoia, N. Magaletti.

Writing the original draft, review and editing: M. Marra, G. Luce.

Project administration: M. Marra.

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Towards an environmental open library in the center of Naples. The case of the Library of the Società dei Naturalisti in Napoli

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Abstract

In this work, the strategies of the Library of the Società dei Naturalisti in Napoli to promote environmental awareness are described. They are based on three different actions: 1. Highlighting books and other media on Conservationism through a new section named the open consultation room "Lello Capaldo", from the renowned environmentalist, whose heirs donated his collection of more than 3,000 volumes to the Library, 2. Creating a circulating book selection, the "Biblioteca Diffusa dell'Ambiente" that will circulate among city schools, specifically directed to kids from 6 to 12 years, 3. producing actions that communicate and spread more sustainable practices, that reduce the ecological footprints of the library, contributing to disseminate good practices among citizens.

Keywords: Libraries, environmental-dedicated collections, circulating book collections, ecological footprint

Riassunto

In questo articolo vengono descritte le strategie della Biblioteca della Società dei Naturalisti di Napoli per promuovere la consapevolezza ambientale. Esse si basano su tre azioni diverse: 1. Dare risalto a libri e altri media sul tema della conservazione attraverso una nuova sezione denominata sala di consultazione aperta "Lello Capaldo", dal noto ambientalista, i cui eredi hanno donato alla Biblioteca la sua collezione di oltre 3.000 volumi, 2.

Creare una selezione di libri circolanti, la "biblioteca diffusa dell'ambiente" che circolerà tra le scuole cittadine, specificamente rivolta ai ragazzi dai 6 ai 12 anni, 3. Produrre azioni che comunichino e diffondano pratiche più sostenibili, che riducano l'impronta ecologica della biblioteca, contribuendo a diffondere le buone pratiche tra i cittadini.

Parole chiave: Biblioteche, collezioni dedicate all'ambiente, collezioni librarie circolanti, indirizzo ecologico

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Introduction

Public debate on environmental issues as climate changes, water shortage, pollution, loss of biodiversity is often characterized by a general concern not associated to an adequate knowledge about the complexity of the topics. The active participation of people in the most controversial decisions is a crucial point of any political decision to face environmental problems but participation requires, in turn, innovative tools to build up an adequate citizenship awareness: "informed and involved citizens become citizen-experts, understanding technically difficult situations and seeing holistic, community wide solutions (Irvin & Stansbury 2004).

Most of the available information on the present state of the environment comes from the internet, but it can be not easy to draw a well-established framework based on information from the net (Breggin 2000: (Breggin in Enviromental Law Institute, 2000). Moreover, the possibility of meeting citizens and having a direct contact is still the best way of transmitting knowledge (Hider et al., 2023).

The public engagement proposal called "reading the environment – an environmental library in the hearth of Naples" has the ambitious goal of creating in the center of the city of Naples the first specialized library open to all citizens, to spread environmental awareness by ensuring open and easy access to all relevant information on sustainable development goals of ONU Agenda 2030 (https://sdgs.un.org/goals).

Libraries can represent the most important model for the organization of knowledge and the dissemination of information on the recent issues about the environment (Eusepi 2019; Faggiolani 2019; Morriello 2023). In Italy, at the moment there are few libraries with a special focus on ecology and related issues (see https://anagrafe.iccu.sbn.it/it/), but any library can represent a valuable community resource for environmental information, making specialized books available, assisting people in internet navigation, and offering a common place for public discussion (Parlavecchia 2021). But today libraries are gaining new functions, proposing not only free access to information but creating new opportunities of expanding knowledge also outside of the physical space of libraries.

According to Morgese (2019; 2023), the concept of "ecolibrary" encompasses three different aspects:
- a thematic specialization of the collections;
- the promotion of projects, initiatives, services involving people on issues sensitive to environmental issues and ecological values;
- a continuous effort to find architectural, technological, and infrastructural eco-friendly solutions for the spaces of the library.

According to the concept of ecolibrary so far outlined, the Library of the Società dei Naturalisti in Napoli (for the history and evolution of the Society and the Library refer to https://www.societanaturalistinapoli.it/) continues the mission it derives from its prestigious past, but at the same time tries to provide an updated and forward-looking range of services. The aim of the new section "reading the environment" is to include all the aspects related to the concept of ecolibrary in one place. In this respect, a new space dedicated to the conservationist Lello Capaldo was established in the historic center of Naples at the Library of Società dei Naturalisti, to provide a hub for the dissemination of environmental culture to civil society. Based on an extensive thematic book collection and managed by expert naturalists, environmental and sustainability technicians, it aims to raise the cultural level and sensitivity to the issues of nature conservation. The involvement of faculty teachers, technicians, students, and recent graduates will create an effective melting-pot in the transfer and dissemination of information.

At the same time "reading the environment" moves out of the library with the second part of the project. The aim is to help schools to create section of their libraries devoted to environmental topics, starting from a circulating collection of books, belonging to a special fund called "circular environmental library", set up by the Library of Società dei Naturalisti in Napoli,

Finally, the project takes into consideration some actions, presently in progress, whose aim is to make the spaces of the Library more sustainable, showcasing someexamples of environmentally friendly practices.

In this article all the aspect of the project will be briefly described, and their potential importance will be highlighted, describing the first results produced.

The open space of the Biblioteca dei Naturalisti in Napoli: the "Lello Capaldo" environmental section

Libraries are community hubs, meeting places where people can be involved in social activities, that are not limited to simple reading. Today's conception of the public library largely favors open-shelf rooms, where distance is eliminated between books (stripped of their "sacredness") and users. One of the most frequent activities of library patrons is to browse shelves for books or magazines, having the opportunity of looking at covers and leafing through books. Having in mind these aspects, the "Lello Capaldo" environmental open room intends to be a place where it is possible to study or work, and at the same time fulfil the need of making discoveries about different aspects of nature conservation and protection.

The opportunity of creating such a dedicated space was due to the generous gift by heirs of Lello Capaldo private library. Pasquale ("Lello") Capaldo was one of the

protagonists of conservationism in Italy (https://it.wikipedia.org/wiki/Lello_Capaldo) and was also a reader with broad interests, ranging from Natural Sciences to anthropology, archeology, ethnology, and local history. The importance of personal collections on the creation of specialized libraries has been frequently debated (Zagra 2004; Ghersetti et al. 2020). This generous gift has represented an opportunity to significantly improve the environmental section of the Library of the Società dei Naturalisti in Napoli, prompting the librarians also to new acquisitions on items dealing with Natural Sciences and Conservationism.

The "Sala Capaldo" is a free-access room of the library. Most of the books on the shelves, approx. 58%, fall within strictly scientific subjects, while the humanities cover approx. 42%. The room is currently divided into several thematic sections. In order to make the distinction between the sections more immediate, also visually, different colored marker strips have been placed on the edges of the shelves occupied by each section.

Below are the sections and for each of them the percentage of volumes present out of the total volumes: Zoology: 13%; Botany: 9%; Biology: 4%; Earth Sciences: 7%; Ecology: 6%; Geography and explorations: 10%; Archaeology:5%; Mathematical, physical, and chemical sciences:4%; History of science, history, philosophy, folklore, cognitive sciences, etc.: 19%; History and traditions of Naples: 18%; Visual arts: 1%; Urban planning, other arts etc.:4%.

On the whole, in the Sala Capaldo there are 3500 volumes; 2535 books are now catalogued in the Servizio Bibliotecario Nazionale (SBN), of which 2062 belong to the Capaldo collection and 473 to other acquisitions. The book collocation follows the Decimal library classification (DDC) (Dewey1886; Crociani et al. 2016; see also https://en.wikipedia.org/wiki/Dewey_Decimal_Classification), but without adopting its subdivision scheme, in view of the quantitative and typological characteristics of the Capaldo collection. The books in each section are divided into internal subsections gradually becoming more specific, according to the level of detail of the topics covered.

In concrete, the classification/location of the volumes consists of the following elements:

Labelling of the Room (Sala Consultazione Capaldo); Division into general subjects (e.g., "Zoology"); First subsection (e.g., 'Systematics'), expressed by a numerical notation; Second subsection (e.g., "Cephalopoda"), expressed by a numerical notation (Table 1); The three initial letters of the Author's surname, followed by the first three letters of the Title.

The book collocation on the spine label of each volume is indicated, for example, as follows: S. CAP; ZOO; 2/5540; LIB. MOL.

In order to quickly unravel the numerical notation, the reader can have recourse to one of the many 'legenda' in the Sala, which list the subjects corresponding to each number and allow, among other things, the elimination of any possible uncertainty through the presence of disambiguating expressions (e.g.: 2/5540 = Cephalopoda) and appropriate cross-references and references between entries (such as 'see also'. etc.).

Table 1: An example of classification: the zoological sector of the Lello Capaldo open section.

ZOOLOGY			
	1 - GENERAL ZOOLOGY		
	2 - SISTEMATICS	1000	General systematics
		2000	Porifera
		3000	Ctenophora
		4100	*Placozoa*
		4200	*Cnidaria*
		4300	*Xenacoelomorpha*
		5100	*Phoronida*
		5200	*Brachiopoda*
		5300	*Bryozoa*
		5400	*Nemertea*
		5500	*Mollusca*
		5510	Aplacophora
		5520	Monoplacophora
		5530	Polyplacophora
		5540	Cephalopoda
		5550	Gastropoda
		5560	Bivalvia
		5570	Scaphopoda
		5600	*Annelida*
		5700	*Platyhelminthes*
		5800	*Gastrotricha*
		6100	*Rotifera*
		6200	*Micrognathozoa*
		6300	*Gnathostomulida*
		6400	*Chaetognatha*
		7100	*Nematoda*
		7200	*Panarthropoda*
		7250	Arthropoda
		7251	Chelicerata
		7252	Myriapoda
		7253	Oligostraca
		7254	Multicrustacea
		7255	Cephalocarida
		7256	Branchiopoda
		7257	Remipedia
		7258	Hexapoda
		7300	*Scalidophora*
		8100	*Ambulacraria*
		8200	*Chordata*
		8210	Cephalochordata
		8220	Tunicata
		8230	Vertebrata
		8231	Agnatha
		8232	Chondrichthyes
		8233	Osteichthyes
		8234	Amphibia
		8235	Reptilia
		8236	Aves
		8237	Mammalia
	3 - APPLIED ZOOLOGY	1000	Generalia
		2000	Regional fauna
		2100	Anthropozoology
		2200	Wildlife exploitation
		3000	Wildlife protection and management
		4000	Veterinary medicine - zoonoses
	4 - ANIMAL BEHAVIOUR	1000	Ethology general concepts

The scattered environmental library: bringing environmental awareness in the schools

The main objective of the project is to help libraries transform their spaces into centers of social aggregation for young people, promoting the dissemination and use of environmental knowledge, open to all citizens, starting from children and teenagers. It is well known that Italy, as many other Countries, is facing a literacy crisis with many adults reading very basic. According to the social transformations that characterize today's age of complexity, the Library of the Società dei Naturalisti in Napoli launched a new service, called "the circulating environmental library".

A new fund of thematic books on the environment has been dedicated to kids from 6 to 13 years. At the moment, this fund encompasses more than 100 volumes. It represents a documentary core to support initiatives and educational projects aimed at raising awareness on environmental issues and sustainable development, to be activated starting from the schools based at the center of the city of Naples, in a network with the libraries of the other subscribers and future partners. Many kids for different reasons can't get access to public libraries, but the "scattered environmental library" gives the opportunity of having books in their neighbourhoods, representing a resource and a service to the community.

But the establishment of the Scattered Library of the Environment is also the starting point for several actions: in collaboration with Legambiente Parco Letterario Vesuvio, the school I.C. Adelaide Ristori, the Annalisa Durante open library, the Association "Mine Creative" and the AssociazioneItalianaBiblioteche (AIB, Campanian section), an organic "didactic-educational pathway" for groups of students of the I.C. Adelaide Ristori has been set up. In brief:

a) the circulating library will act as a flywheel for the promotion and establishment of a school library proper to the Institute;

b) a program of readings and debates on environmental topics has been defined with the involvement of teachers, animators, authors, publishers, with the consequent elaboration of proposals and planning of active citizenship actions (for example: landscape protection and urban decorum actions, promotion of separate waste collection, small circular economy actions;

c) some guided tours of historical center of Naples will be performed, to promote the knowledge of historical, artistic, and monumental beauties to be preserved, establishing a network with other cultural enhancement initiatives and sustainable tourism actions;

d) the aforementioned actions will be shared with the Culture Service of the Municipality of Naples for the acknowledgement of the established *Biblioteca diffusa dell'Ambiente* and its inclusion as a founding nucleus of the "Tavolo Tematico dell'Ambiente", which belongs to the Patto Locale per la Lettura" of Naples City Hall.

Toward a better eco-sustainability of the spaces hosting the Library of the Società dei Naturalisti

Libraries are often based on physical locations that have a historical appeal but lack any modern approach to sustainability of common spaces. This is also the case of the library of the Società dei Naturalisti. As underlined by Kelly Blanks (https://

blog.pressreader.com/libraries-institutions/sustainability-in-public-libraries): "Libraries have been around for centuries, and so has their model for loaning and sharing access to resources".

In this respect, the library of the Società dei Naturalisti gives the opportunity of accessing other resources, offering the possibility of using different items, spanning five categories:

- assistive, such as magnifiers, illuminated magnifiers, desktop magnifiers;
- games;
- photography: digital camera, photo-lighting Kits, tripods for cameras, video cameras;
- STEMS: microscopes and stereo-microscopes;
- computers, printers and orbital scanners.

Eco-sustainability of libraries is also evaluated in terms of overall comfort of inner environments, possible presence of airborne particles containing allergens and microorganisms potentially dangerous both for human health and documents preservation, reduced consumption of energy and waste production.

In collaboration with the Department of Industrial Engineering of the University of Naples "Federico II" a check list to monitor the present state of the environmental quality of the Library of Società dei Naturalisti in Napoli has been developed. Temperature and air humidity have been regularly checked. Lighting is provided throughout the library by LED lights, and energy savings guaranteed by the automatic dimming and automatic switching off of the lighting, thanks to a series of sensors for person presence and luminance detection has been programmed. These innovations should contribute to improving the quality of life and attractiveness of the library as a building and as a place to stay.

Moreover, microbial occurrence in the air of the library has been controlled with the aim of passive samplings and non-destructive technique of sampling have been also adopted to check the presence of microbial communities on the external cover of books and on paper, as proposed by Pasquarella et al. (2012). Samplings have been carried out by a team from the Department of the Biology of the University Federico II of Naples, that ensure a constant monitoring activity in the spaces of the library.

The most critical situation is related to temperature. Turhan et al. (2019) have stressed the impact that climate change could have in Mediterranean historic Libraries, both in term of increased degradation rates of paper materials and thermal comfort conditions. Temperature measurement carried out in the spaces of the Biblioteca della Società dei Naturalisti have evidenced an annual range between 15 and 25 °C, with peaks of less than 12 °C in winter and more than 28 °C in summer. Temperature control adopting eco-friendly solutions presently represents the most complex problem to be resolved.

Waste production of libraries is often related to print activities. In the Library of the Società dei Naturalisti have been adopted the tips suggested by Singh & Mishra (2019), such as prevalent use of digital formats and, when not possible, use of recycled paper, printing on both side of the paper, use of recycled cartridges.

Conclusions

The new environmental open space of the Library of the Società dei Naturalisti in Napoli represents a promising opportunity, but coordination and planning are required. Libraries can promote environmental knowledge in different ways and have the possibility of reaching a large population, but the cooperation with other public Institutions, as Universities and City Halls is of utmost importance. One of the most striking limitations to the emerging role of the libraries as "ecopoints" is due to reduced funds and personnel, necessary to extend the opening times and for new acquisitions. The role of volunteers can be of great importance, but the enlargement of the budget necessarily requires the participation to specific projects at local, national, and European level.

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Preliminary contribution to the knowledge of aquatic macrophytes and trophic status in the park of the Royal Palace of Caserta

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Abstract

La "Reggia di Caserta" (Caserta Royal Palace) including the park and the gardens are certainly one of the major tourist destinations in Campania (Italy). The waters of the Park have the undoubted and peculiar characteristic of reaching the Park through an almost entirely underground route of 38 km. The collection of water takes place from numerous springs traced by Vanvitelli at the foot of Monte Taburno, in the province of Benevento. This study confirms the high quality of the water, and the presence of fifteen plant species, including six phanerogams, two mosses and seven algae.

Keywords: Campania, Royal Palace, Caserta, macrophytes, IBMR, Carolino Aqueduct

Riassunto

La Reggia di Caserta, compresi il suo parco e i suoi giardini, è sicuramente una delle maggiori mete turistiche della Campania. Le acque del Parco hanno l'indubbia e peculiare caratteristica di arrivare al Parco attraverso un percorso quasi interamente sotterraneo di 38 km. La captazione dell'acqua avviene da numerose sorgenti rintracciate da Vanvitelli alle falde del Monte Taburno, in provincia di Benevento. Questo studio conferma l'alta qualità dell'acqua, e la presenza di quattordici specie di piante, tra cui cinque fanerogame, due muschi e sette alghe.

Parole chiave: Campania, Reggia, Caserta, macrofite, IBMR, Acquedotto Carolino

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Introduction

The Carolino Aqueduct, so named in honor of King Carlo di Borbone, is a masterpiece of hydraulic engineering, that has strongly characterized the territory of Campania region. It is one of the most impressive and significant achievements carried out by the House of Borbone thanks to the genius of the architect Luigi Vanvitelli. Designed to ensure an abundant water supply to the Royal Palace and the great city that would have arisen around it, the Aqueduct was intended to enhance the water supply of the city of Naples and also serve the *real delights* (Bagordo in Cundari, 2005). This cutting-edge infrastructure traversed mountainous and river landscapes from the territory of Benevento to the hills and fertile plains of Terra di Lavoro (Fig. 1).

The aqueduct has a length of approximately 38 km, a width of 1.20 meters, and a height of 1.30 meters, being completely underground except for the parts passing over bridges. To complete its construction, five tunnels had to be built. The route is marked by 67 torrini, characteristic square-shaped constructions with a pyramidal roof, designed as ventilation points and access points for inspection (Patturelli, 1826). Its water source level is 254 meters, while the level at the waterfall of the Royal Palace is 203 meters, resulting in an average slope of ½ mm per meter along the channel. The construction works started in 1753 and were completed in 1770, divided into three sections, with the first two being built simultaneously. These sections allowed the capture of water from numerous springs identified by Vanvitelli at the foothills of Monte Taburno, in the province of Benevento. Near the Fizzo springs, where the path of the Carolino Aqueduct begins, two collectors were built to channel the water into two reservoirs for storage and purification, equipped with an overflow mechanism.

The waters of the park therefore have the undoubted peculiarity of arriving through the Carolino aqueduct from springs collected at the source and brought to the Royal Palace through an almost entirely underground route.

The construction of the Park started in 1753 and continued for over fifty years. During the first phase, between 1753 and 1773, the part on the floor closest to the Palace which includes the Gran Parterre with the large expanses of lawn surrounded by groves, and the so-called *Bosco Vecchio* (Old Forest) were arranged. In 1773, after the death of Luigi Vanvitelli, the works in the park slowed down and in 1777 Luigi's son Carlo, presented to Ferdinando IV di Borbone (Ferdinand IV of Bourbon) a new design, in which his father's original idea was scaled down: Luigi's design was maintained in its main lines and the so-called "Via

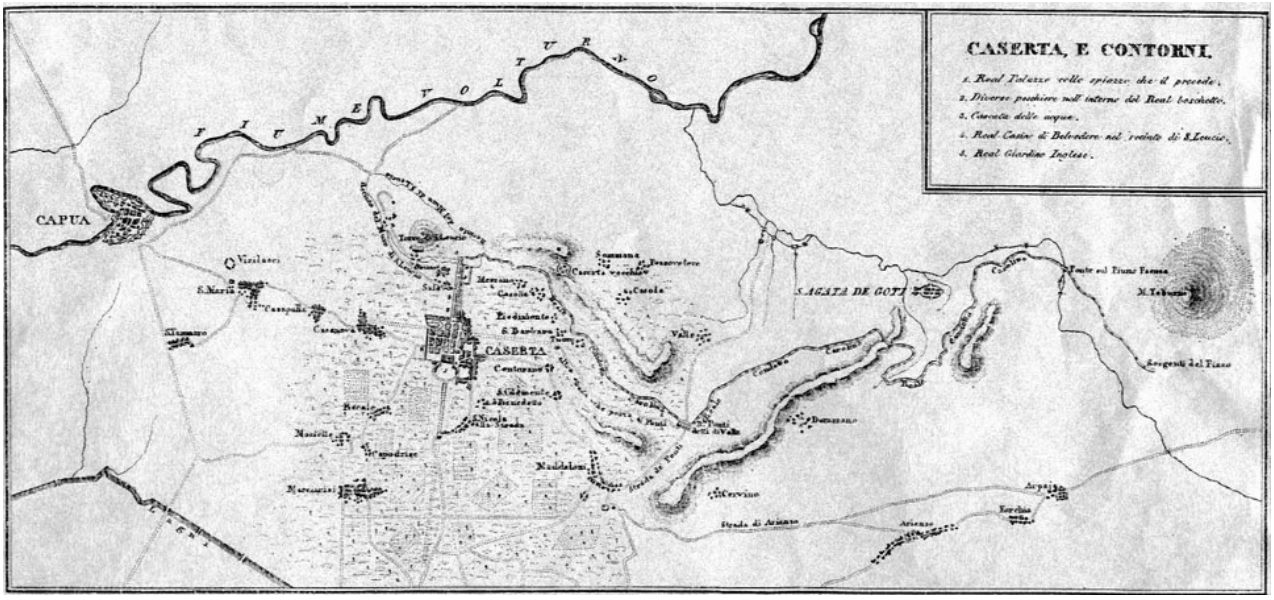

Figure 1: The Acquedotto Carolino from Fizzo springs to Reggia di Caserta (Patturelli, 1826).

d'Acqua" (Fig. 2) was built, a spectacular sequence of waterfalls, fountains, pools and basins arranged along a longitudinal path in a slight slope about 3 km long, up to Briano mountain. The monumental fountains in sequence are: The "Dolphins Fountain", in which the water comes out of the mouths of three large sea monsters carved in stone; "Aeolus Fountain", a large exedra in which there are several caves that evoke the home of the winds, represented by statues of zephyrs. The statue of Juno on a chariot pulled by two peacocks, shown in the act of asking Aeolus to unleash his winds against Aeneas's ships, was never placed in its intended location; "Ceres Fountain", a tribute to the fertility of Sicily, with the scenic layout arranged on three levels; "Fountain of Venus and Adonis", which evokes the myth as narrated by Ovid in his "Metamorphoses". Luigi Vanvitelli was responsible for its innovative hydraulic arrangement and the arrangement of the overlapping pools, all able to be emptied independently into a lateral underground channel to allow cleaning and repairs. Below the waterfall of the Briano Mountain, in a basin known as "The Bath of Diana", two important marble groups depict the myth of Diana and Actaeon, also taken from Ovid's "Metamorphoses" (Bagordo, 2009). Here the water, coming from 38 km away, makes a jump of 80 meters. A careful perspective study has ensured that the pools, thanks to the slope of the site and the alternation with the grasslands, are clearly visible from the entrance vestibule of the Royal Palace. The Park covers an area of about one hundred hectares, to which later were added the twenty-three of the English Garden, forming an articulated and evocative landscape system (Viola. 2022). Knowledge of the botanical aspects of the park is currently rather lacking, limited to the inventory of cultivated (or natural) ornamental species starting from the construction of the complex and the annexed park in the 18th century. During the nineteenth century there are several contributions by Nicola Terracciano (1862, 1864, 1872, 1876, 1887), while in more recent times studies have

Figure 2: Royal Park: "Aeolus Fountain" and "Waterway" (© Reggia di Caserta).

been carried out relating to specific taxa such as orchids (Croce, 2021).

The present work is at sampling and determining the macrophytic component, calculating for knowledge purposes the IBMR index (Index Biologique Macrophyitique en Riviere) and RQE (Ecological Quality Report) (AFNOR, 2003) and comparing the results with the chemical and microbiological analysis of waters (APAT, 2005, 2014) drawn in the Park of the Royal Palace of Caserta. The choice to use the IBMR index was made in line with the requirements of the European Water Framework Directive 2000/60/EC, transposed in Italy with the Law D.lgs. 152/2006 (Decreto Legisativo 3 aprile 2006, n. 152) and technically implemented by DM 260/2010 (Decreto Ministeriale 8 Novembre 2010 n. 260) which established the index's use for its demonstrated validity and applicability in Italy Directive 2000/60/EC (Direttiva 2000/60/CE).

Aquatic macrophytes are a group defined on an ecological-functional basis including the macroscopically visible plants present in inland waters. The communities covered by this protocol consist of phanerogams, pteridophytes, bryophytes and algae of visible size. The macrophytic community represents an important bioindicator of the state of health of water bodies, in particular of their trophic state (Minciardi et al., 2009; ISPRA, 2014). This preliminary study confirms the high water quality and the presence of fourteen species of aquatic plants.

Materials and method

The sampling of plant was carried out using "Protocollo di campionamento ed analisi per le macrofite delle acque correnti" (APAT, 2007). The determination of phanerogams

was carried out using Pignatti (1982; 2019) and https://dryades.units.it. The nomenclature of the species follows that proposed by Pignatti (2019). For algae determination, reference was made to Laplace-Treyture et al. (2014) and Bellinger and Sigee (2015). In this case, in accordance with the requirements for calculating the IBMR index, identification was kept at the genus level (Minciardi et al., 2009). For mosses Contini Pedrotti (2001) was used.

The IBMR index was calculated on the qualitative and quantitative samplings (UNI EN 14184, 2004) of 21 June 2022, using data from the initial part of the watercourse within the Park, from the last (accessible) section of the initial waterfall under the "Bosco di San Silvestro" to the fountains of "Diana, Atteone, and Cerere", and the connecting path. The list of species was integrated in the sampling made on 17 April 2023.

The coverage of the plants in percentage terms over the total area of the tanks and channels is at the lower limit required by the method, which is 5% coverage (APAT, 2014). The artificial nature of the site itself hardly fits into a "standard" application of the Index (Minciardi et al., 2009, 2014). Other factors that affect its application are the substrate, which, where present, comes from the transport and deposition of material in the pools of the fountains, or where the speed of the current allows the accumulation. In our case the macrotype of reference chosen was "Very small and small rivers of the Mediterranean geographical area", whose comparative value for the calculation of RQE is 12.5 (table 4.1/b DM 260/2010).

The sampling of waters aimed at the determination of chemical parameters and field measurements of the basic chemical-physical parameters was carried out using SNPA Guidelines (2018).

The determination of chemical parameters such as Total Suspended Solids, COD, Nitric Nitrogen, Ammonia Nitrogen, Nitrous Nitrogen and microbiological parameter Escherichia coli, were carried out using APAT, CNR, IRSA Analytical Methods (2003, 2005, 2014). BOD_5 was determined using Standard Methods 5210 D (Young et al., 2004). The determination of Metals and Total Phosphorus were carried out using UNI EN ISO Standards 17294-2:2016 (2016).

Results and discussion

The aquatic species found in the park during two samplings, amount to a total of 15 taxa, including seven algae, two bryophytes and six phanerogams. One species, *Nasturtium officinale*, was only found on the side of the "Diana and Atteone" fountain, along the small slope to the right of the fountain, in an environment constantly moist due to leaks from the aqueduct. However, it was not subsequently found in the channels and other fountains. This species was not considered in the calculation of the IBMR index, as well as *Cladophora* sp., which was found downstream and only during the second survey. In addition to the collection and determination of the plants present, their coverage has been estimated as a percentage of the total surface area of the park's basins and channels. Two water samples have been taken for chemical and microbiological analysis, one upstream in the fountain of Diana and Atteone and one downstream, at the end of the channel.

Taxa list

Algae

Binuclearia sp. - A genus of algae found in still and cold waters; it is the less common among the algae in the Park. It is often found associated with other algae.

Chara vulgaris L. - Found in stagnant or weakly flowing waters, this genus is highly dependent on the trophic conditions of the water and sensitive to pollution. In the Diana and Atteone fountain, it forms an almost continuous submerged hilly carpet, occupying almost all the space and inhibiting the presence of other species, which are confined to only a few small areas. *Chara vulgaris* is quite widespread in Campania (Viglietti, unpublished data), the absence (Bazzichelli et al., 2009) of reports is probably due to the lack of studies on the macrophytes present in the rivers of the region. Populations of this species can be traced, for example, in the Picentino river or in the Fortore river (Viglietti, unpublished data).

Spirogyra sp. - Present in stagnant and slow-flowing waters as well as in flowing waters. It is the second most abundant algae in the Park, surpassed only by *Chara vulgaris*.

Draparnaldia sp. - Found along the edges of the channels, the species found in the first sampling in May 2022 was not found in the April 2023 sampling.

Vaucheria sp. - Found on the waterfalls that connect different sections of the channels in the Park.

Cladophora sp. - Found along the walls of the canal. In the waters of the Park, it does not form relevant populations in terms of biomass and was not found in the first sampling.

Nostoc sp. - Abundant on the waterfalls that connect the sections of the various channels of the Park. In some situations, epilytic populations of *Nostoc* are severely limited by the nitrogen content of the medium.

Briophytes

Leptodictyum riparium (Hedw.) Warnst. - Present along the waterfalls that connect the various sections of the channels.

Fontinalis antipyretica Hedw. – In the upper part of the Park, before the Fountain of Diana and Actaeon.

Phanerogams

Apium nodiflorum (L.) Lag. - Slow flowing water. Fountain of Ceres. The accumulation of a minimum of substrate allows the growth of the species in the fountains of the Park.

Myriophyllum spicatum L. - Slow-flowing waters. Fountain of Diana and Actaeon, Fountain of Ceres. These are quite limited populations by the smallness of the substrate.

Mentha aquatica L. – Species quite widespread in Campania, in the Park present only on the waterfall that carries the fountain of Diana and Actaeon and in the constantly wet area beside the same fountain.

Nasturtium officinale R.Br. – Present only on the side of the fountain of Diana and Actaeon, species not used for the calculation of the IBMR index, not being present in tanks and channels.

Potamogeton crispus L. - Slow flowing waters. Fountain of Diana and Actaeon, Fountain of Ceres. As for the myriophyll the species grows with small populations exploiting the little substratum available.

Veronica anagallis-aquatica L. subsp. *anagallis-aquatica* - present only at the

base of the first waterfall after the fountain of Cerere.

Chemical analysis

For this study, since the origin of the waters is known and considering that they do not undergo appreciable variations during the year (since the Carolina aqueduct is buried throughout its entire course), it can be assumed that the results are reliable even in the medium term, net of any exceptional and unpredictable situations. Therefore, while analyzing parameters required by the regulations (DM 260/2010) to establish the chemical quality of a water body, we were limited to a single sampling, on 17 April 2023 deemed suitable for good weather conditions, also in the days preceding the sampling, and such as not to alter the normal water quality of the Park with abnormal inputs. Two water samples were taken, the first in the fountain of Diana and Actaeon, the second downstream at the end of the channel. The values found (Table 1) show a low level of nutrients (between 0.01 and 0.05 mg/l for total phosphorus and nitrous nitrogen), a very low value of *Escherichia coli* (microbiological contamination index of faecal origin), a low conductivity (360 µs/cm) and a basic pH (equal to 8.4). The values found show a very low level of metals: lower than 0.01 mg/L for Aluminium, Total Chromium, Iron, Manganese, Lead, Copper, Zinc and lower than 0.001mg/L for Cadmium. The microbiological parameter Escherichia coli was found between 4 and 6 UFC/100 mL. The analytical framework shows good water quality.

For comparison, the most frequently ascertained values in surface water bodies located in the Province of Caserta ARPAC, 2006) are 400 - 500 µs/cm for conductivity, while the pH can vary from 6 to 8, depending on many factors such as, for example, the characteristics of the soil and surrounding rocks, as well as the presence of wastewater inputs.

IBMR and EQR Index

The calculation of the IBMR index, made to evaluate the trophic level of water gave for the sampling of 21 June 2022 a value of 11.90, which corresponds to a RQE of 0.95 and therefore to a value "average" of trophic and an "elevated" ecological quality.

The results of the analysis showed the high quality of the waters of the Reggia, excluding the presence of pollutants along the route of the Carolinian aqueduct.

Regarding aquatic habitat, the characteristics that a surface water must possess to be considered "suitable" for the life of fish, include pH values between 6 and 8, and nutrient concentrations close to 0.1 mg/l for the parameter Total phosphorus and 1 mg/l for Nitrous nitrogen.

The values found show the presence of trace metals, between lower than 0.01 for Aluminum, Total Chromium, Iron, Manganese, Lead, Copper, Zinc and lower than 0.001 for Cadmium. The values for the microbiological parameter Escherichia coli are also extremely low.

The analytical framework shows good water quality, highlighting the absence of anthropic impacts on the investigated sections.

The plants present, however, have given interesting results. Most of the species present also tolerate fairly high nutrient levels, but in all cases, they are always euriecious species. Table 2 shows the values of the coefficients Csi and Ei for all the entities found, it is possible to note that the

Table 1: Water quality at sampling stations.

Parameters	Unit	Sampling station	
		Fountain of Diana and Actaeon	End of Channel
pH	-	8,46	8,44
Conductivity	µs/cm	347	360
Total Suspended Solids (TSS)	mg/L	4	4
BOD5	mg/L	<1	<1
COD	mg/L	<10	<10
Nitric Nitrogen (NO_3–N)	mg/L	2,32	2,14
Ammonia Nitrogen (NH3 – N)	mg/L	<0,02	<0,02
Nitrous Nitrogen (NO2 – N)	mg/L	<0,05	<0,05
Total Phosphorus(TP)	mg/L	<0,01	<0,01
Aluminium	mg/L	<0,01	<0,01
Cadmium	mg/L	<0,001	<0,001
Total Chromium	mg/L	<0,01	<0,01
Iron	mg/L	<0,01	<0,01
Manganese	mg/L	<0,01	<0,01
Lead	mg/L	<0,01	<0,01
Copper	mg/L	<0,01	<0,01
Zinc	mg/L	<0,01	<0,01
Escherichia coli	UFC/100 mL	7	6

only typical species of oligotrophic waters have a coefficient Ei equal to 3, that is, stenoecious species, the others always have a value Ei of 1 or maximum 2.

The study of the aquatic macrophytes of the waters of the Royal Park of Caserta has allowed to have a picture of the plants in the absence of environmental pressures. Despite low nutrient values, the trophic index IBMR did not reach the expected reference value for a low environmental pressure lowland water body. The RQE value is a high ecological quality indicator. It is believed that the peculiar characteristics of the site, characterized by the high artificiality and the difference in substrate present in the tanks and absent in the channels, has made the index difficult to apply, so that at very low chemical values the present flora has occupied the available ecological niches exploiting the often high levels of tolerance to different environmental conditions, in our case a low level of nutrients.

Table 2: Values of the coefficients of sensitivity (Csi) and stenoecious (Ei) of all the taxa present according to the attributions used for the calculation of the IBMR index.

taxa	Csi	Ci
Binuclearia sp. Wittrock	14	2
Chara vulgaris L.	13	1
Cladophora glomerata. Kützing	6	1
Draparnaldia sp. Bory de St Vincent	18	3
Nostoc sp. Vaucher	9	1
Spirogyra sp. Link	10	1
Vaucheria sp. De Candolle	4	1
Leptodictyum riparium (Hedw.) Warnst.	5	2
Fontinalis antipyretica Hedw.	10	1
Apium nodiflorum (L.) Lag.	10	1
Mentha acquatica L.	12	1
Myriophyllum spicatum L.	8	2
Nasturtium officinale R.Br.	11	1
Potamogeton crispus L.	7	2
Veronica anagallis-acquatica L.	11	2

In conclusion, we can affirm that the waters of the Park of the Royal Palace of Caserta preserve, along the way, the high quality that distinguishes them at the source, the springs of Fizzo on Mount Taburno and host a good level of biodiversity.

Furthermore, due to the very specific characteristics of the site, the result could contribute to perfecting the application of the method in the Mediterranean ecoregion (Minciardi et al., 2009).

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Contribution to the knowledge of two species of psilocybin mushrooms with high therapeutic potential found along the Central-Southern Apennines (Italy): *Psilocybe serbica* M.M. Moser & E. Horak and *Psilocybe semilanceata* (Fr.) P. Kumm. Chorological observations

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Abstract

The research on *Psylocybe* species distribution along the Mediterranean region, has led to new observations regarding two species of psilocybin mushrooms, with high medicinal potential, found along the Apennine mountains of central and southern Italy: *Psilocybe serbica* Moser & Horak and *Psilocybe semilanceata* (Fr.) P. Kumm. New specimen collections, with ecological observations, from Italy as well as from Spain, France, Albania, and Macedonia are reported here, extending the geographical distribution limits of these specie along the Mediterranean.

Keywords: *Psilocybe*, psychotropic mushrooms, chorology, ecology, Mediterranean

Riassunto

La ricerca sulla distribuzione delle specie di *Psylocybe* lungo la regione mediterranea ha portato a nuove osservazioni su due specie di funghi psilocibinici, ad alto potenziale medicinale, presenti lungo le montagne appenniniche dell'Italia centrale e meridionale: *Psilocybe serbica* Moser & Horak e *Psilocybe semilanceata* (Fr.) P. Kumm. Vengono qui riportate nuove raccolte di esemplari, con osservazioni ecologiche, provenienti dall'Italia, dalla Spagna, dalla Francia, dall'Albania e dalla Macedonia, estendendo i limiti geografici di distribuzione di queste specie lungo il Mediterraneo.

Parole chiave: *Psilocybe,* funghi psicotropi, corologia, ecologia, Mediterraneo

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Introduction

Wild and grown mushrooms can represent an abundant, free, and natural renewable source of beneficial compounds. During the last years, a growing number of studies reports that, in addition to edible and medicinal mushrooms, also entheogenic fungi can contain useful compounds with potential applications in wellbeing, medicine, mycorestoration and agroforestry. Still little is known about psilocybin fungi ecological interactions and potential uses; indeed, notwithstanding the already available large body of literature on this subject, a lot needs to be verified, supported, and upgraded. Psilocybin mushrooms have been cultivated in patches around the world for more than 20 years and their use is raising interest among people all around. Moreover, some species are also potentially associated with some anthropogenic distribution or disturbance, as it can be found in artificial coniferous plantations, cemeteries, gardens, urban parks (Stamets 1996). Despite this, little is known about the actual distribution of the genus *Psilocybe* around the world. This study represents the first step to an ethnobotanical and mycological approach dealing with the occurrence and distribution of *Psylocybe* species around the Mediterranean region, contributing to the knowledge of chorology of two psilocybin species, *P. serbica* M.M. Moser & E. Horak (Moser & Horak, 1968) and *P. semilanceata* (Fr.) P. Kumm., along the central and southern Apennines, Italy. A part of this research consists in sampling of specimens for herbarium collections as well in naturalistic and ethnomycological observations. This publication adds new biogeographical reports, with ecological observations, relating to the area under investigation in Italy, and also to France, Spain, Albania and North Macedonia, extending the geographical distribution limits of these taxa along the Mediterranean region.

Materials and Methods

The study on *Psylocybe* distribution in the three continents around the Mediterranean region dates back to 2005; it is very extensive and will take some time to be completed. The present research is being conducted by carrying out the following steps:

a) collecting bibliographic, taxonomic and chorological studies, including documents, publications, monographs and biodiversity catalogs or inventories, about the genus *Psilocybe* and others psychotropic fungi in Italy, Europe and around the Mediterranean area;

b) gathering and mapping the traced observations into collection herbariums and

virtual resources on internet Dataset related to the topic, as the Global Biodiversity Information Facility, Global Soil biodiversity, MycoBank, Index Fungorum, www.speciesfungorum.org, www.Inaturalist.org. In Italy, I contacted the mycological groups and online communities such as the ones of AGMT, MCVE, "Saccardo", "G. Bresadola", as well as some universities known to historically study mycology as the Department of Life Sciences and Systems Biology (Turin) and the Department of Agriculture in Naples;

c) preliminary assessment and feasibility study of habitat survey missions, explorations and sampling campaigns set up. In order to locate areas of interest for expeditions, the evaluation of pluviometry, geological and satellite maps, biodiversity dataset, phytosociological correspondences and anthropogenic disturbance studies have been considered necessary during the preliminary phases. Before most field surveys, it was a set of suitable materials and consumables for short and long-term safe mission accomplishment. Contact was tried to establish with local bureaucratic entities, mycological groups as well the natural parks, in which the explorations were developed, to obtain the relevant permits, facilities as well check about previous local reports;

d) realization of contacts and interview, during the field explorations and consultations into web pages, addressed to specialist mycologists and mycophiles, enthusiasts of biodiversity and ethnomycology, psychonauts, mushrooms collectors and growers, forums (online) and discussion groups focused on the topic as www.mushroomobserver.org, www.mycoportal.org, www.shroomery.org, www.ultimate-mushroom.com, www.mycotaxon.com/resources, www.funghiitaliani.it. When possible was started a discussion of data and suggestions about distribution, phenology and potential areas for the development of related studies based on the author's own observations. As a rule, it has been considered appropriate not to disclose the names of the interviewees in the respect of the legal framework of the law on data;

e) sampling, many observed collections were identified in the field, habitat features as the macro characters are recorded, when possible, with support of digital material shared online into the social network "Inaturalist" within the project named "Psilosoma Project (mediterranean area)". During this research fresh samples were collected and studied from more than one hundred localities around the Mediterranean. Most of the samples were photographed with an Iphone "6s" digital camera. Of some samples it was possible to take the spore print while most of the fresh samples were dried trying to not rich temperatures upper of 50 C°, and conserved in an isolated environment with glass jars or zip-lock plastic bags;

f) microscopic observations, with the support of digital photographs, DNA sequencing for unambiguous identification and chemical analyses are carried out whenever possible and of interest to the author and other scholars.

The samples collected, supported by digital material, are preserved in the naturalist's private collection and visible on line at https://www.inaturalist.org/projects/psilosoma-project-mediterranean-area-759e2919-6e44-46f9-a22b-834a341c7d08.

Some of the donated collection samples from the author and the "PsiloSoma Project" were deposited in the Herbarium of "Società dei Naturalisti in Napoli" (Naples, Italy).

Results

Description of the sampling sites

The Apennines Mountain ranges from the Tuscan-Emilian Apennines to Aspermont, the majority of geologic units are made up of marine sedimentary rocks that were deposited over the southern margin of the Tethys Sea, the large ocean that spread out between the Paleo-European and the Paleo-African plates during their separation in the Mesozoic Era (about 250 to 65 million years ago). Along central-southern Apennines there are large calcareous rock outcrops and limestones, separated by lowland areas of shale and sandstone. The macro-climate is Mediterranean but locally, the sharp altitudinal gradient affects this, from the warm and sub-humid lower elevations to the cold and per-humid higher elevations. The climate of the highest section of the Apennines is continental (as found in the interior of Europe) but ameliorated by Mediterranean influences; snowfalls are frequent, with cold winters and hot summers (average July temperature 24°–35° C). Average rainfall at between 1,000 and 2,000 milliliters per year is higher on the Tyrrhenian slopes than on the eastern, or Adriatic, side of the Apennines. Northern facing slopes experience frequent dense fog due to their exposure to high atmospheric humidity coming from the Tyrrhenian Sea. At medium elevations (up to 1,100 m), it extends the Habitat of Sub-Mediterranean calcicolous beech forests dominated by Fagus sylvatica (*Anemono-Fagetum, Aceri lobelii-Fagetum, Ranunculo brutii-Fagetum*) while at higher altitude can appear mixed beech and silver fir forests with a rather fragmented distribution. Especially into the southern Apennines are distributed the endemic silver fir, the subspecies *Abies alba subsp. apennina* over an altitudinal range which goes from the 650m a.s.l. of Serra S. Bruno (Calabria) to over 1800 m a.s.l. of the Pollino National Park involving both *Quercetalia pubescenti petraeae* and *Fagetalia* woodlands. The serial contacts that these habitats make are highly diversified in relation to the specificity of the beech forest dynamic series, which are also the result of past silvicultural use.

Recent artificial spruce plantations have been established in mountainous areas throughout the Apennines, while palynological studies (Bertolani Marchetti 1986) carried out on the sediments of lake areas and peat bogs in the Apennines have shown that white spruce was more widespread in the past and that the recent range contraction is probably also attributable to the impact of human activities on the forest vegetation. In relation to the time of the silvicultural cycle, situations of codominance or dominance of one of the two species over the other will therefore be observed (Mercurio & Spampinato 2006), which, considering the shifts in utilization, can extend for as long as 80 to 120 years. The clear-cutting of the beech forest, practiced in the past mainly for charcoal production, creates bright environments where the Apennine silver fir is more easily renewed due to its temperament as a more heliophilous species (Di Pietro & Fascetti, 2005). In the predominantly fir forest, the purely sciaphilous conditions favor the renewal of beech, which forms a more or less

dense shrub layer, with the silvicultural utilization of the silver fir, the beech juveniles reconstitute the forest in a condition of clear dominance. Interspersed between the mixed forests, generally located up to 800-1000 m above the sea level, are patches of meadows related to the stationing grounds of mountain pasture with cows and horses. At higher altitude, these patches become hyper-humid grasslands that in some places have very rich and aerated soils with carbonatic terrains covered with a top layer of decomposed dung and fibers. Related to the observations reported from this study are the administrative areas of Monti Simbruini Regional Natural Park, Latium; Gran Sasso and Monti della Laga National Park, Abruzzo, Lazio and Molise National Park; Matese Regional Park, Cilento, Vallo di Diano and Alburni National Park, Campania; Gargano National Park, Apulia; Pollino National Park, Sila National Park, Calabria. Even though these habitat types fall within areas with some kind of environmental management, such as nature parks and reserves, forestry management systems are still often inadequate and usage is overly intense, mismanagement of pastures and grazing has also considerably given the study area both a high naturalistic value and a high anthropic disturbance. In addition to the species reported in this study, along the central-southern Apennines, are reported other psilocybin mushrooms as P. liniformans var. liniformans (Guzmán & Bas 1977) in Latium, RO (Guzmán et al. 2006), P. fimetaria (P.D. Orton) Watling in Campania, CE (Picillo 2018) and in Abruzzo, TE (Herbarium AGMT N°4237), P. Cyanescens Wakef. in Calabria, RC (Grilli 1990; Herbarium AGMT N°1392).

Psilocybe serbica

Description. The pileus can be up to 2.5 cm in diameter and obtusely conical in young stages, later expanding to campanulate, plane or broadly convex in age. It has often a slight central depression or a hint of obtuse umbo, glabrous, hygrophanous, and slightly translucent-striate when moist but not viscid and without a separable gelatinous pellicle, with striated margin due to transparency, yellow-ochre, grey-brown, stains blue-green when touched or even spontaneously. The cap is buff-brown to dingy orangish-brown and pale ochraceous when dry (Fig. 1).

Hymenophore. The gills are adnate to adnexed, often distinctly subdecurrent, they are moderately spaced, sinuous, ventricose, when young greyish then light brown, finally dark brown-purple when ripe, interspersed with several orders of lamellulae the edges remaining paler with white thread.

The stipe is cylindrical, flexuous, twisted, 35-75 mm- long, and 1-3 mm thick. It has an equal structure, slightly enlarging at the base. It is pale brown, whitish and glabrous with a silky gloss, it soon stains blue-green, it can have some whitish remnants of the fibrillose veil and whitish rhizomorphs. The flesh is whitish to cream-colored, bruise blue, has no specific smell (somewhat radish, but never farinaceous), taste is usually bitterish.

It is a highly variable species characterized by various robustness, shape and coloration of fruit bodies, microscopically has a large range of spore size and varies in abundance and shape of pleuro and cheilocystidia. Its variability has led to the description of several species within it, at present, the distinction of varieties and forms on the basis of morphological and microscopic characters is still debated, apparently, they

Figure 1: *Psilocybe serbica. Photo by Fabio Mao Valletta.*

represent morphological and ecological varieties of *P. serbica* s.s with the suggested type form *P. serbica f. sternberkiana* (Borovička et al. 2011). Microscopically it is described with frequent to abundant lageniform pleurocystidia; cheilocystidia are fusiform to lageniform, hyaline, abundant with often a distinctly, straight or flexuous, elongated neck [10–20(– 25) µm long], very narrowly cylindrical, unperforated, but also with mucronate apex. Spores are purple-brown, ellipsoid, slightly flattened, and thick-walled; they are mono or pluriguctulated with evident germinative pore. Basidia are claviform and tetrasporic with basal clamp joints. Lamellar texture regular with cylindrical hyaline hyphae. Pileipellis consists of an ixocutis with cylindrical, slightly intertwined hyphae, with yellowish intracellular pigment and a subcutis with hyphae. Stipitipellis formed by an axis of cylindrical, hyaline, parallel hyphae. Clamp joints present everywhere.

Habitat. *P. serbica* is saprotrophic, terricolous, it grows gregarious on rotting wood and soils rich in plant material, broadleaves and decaying wood frustules, usually in moist places along creeks, in forest path and roadside verges. Some time was possible to observe more than one hundred fruit bodies popping up from the shadowed edges of a single fallen tree trunk. The species grows in sub-mountainous -mixed forest with *Quercus, Fagus, Acer, Abies* and other coniferous. Its type habitats, in the Czech Republic, are the calcicolous forests (Cephalanthero- Fagenion suballiance) that includes beech *Melitti-Fagetum hungaricum* with hornbeam as a thread, *Pinus resinosa* (red pine) and *Pinus sylvestris* (Scots pine). The central-southern Apennines form together with the Balkans, a single Biogeographical Province (Rivas-Martinez 2001); in their southern portion the Balkans (Macedonia, Greece, Albania), *Fagus sylvatica* woodlands are very similar to those of southern Apennine, with which, in

addition to the flora, they share surprising coenological and nomenclatural affinities (*Doronico orientalis Fagenion, Doronico columnae-Fagenion, Campanulo tricocalycinae- Fagetum*). Along the Apennines, I observed this taxon growing copiously into reforested coniferous areas, where logging and other human activities release, on the ground, a lot of wood residues, twigs, and cones, mostly of *Pinus nigra ssp. laricio*, *Abies alba* and *Pseudotsuga menziesii*. In most xerophytic areas like in Sicily (Italy) and Morocco it looks like this taxon is associated with conifers as *Pinus sylvestris*, *Pinus pinaster*, *Abies nebrodensis*, *Abies pinsapo var. marocana*. It is likely that *P. serbica* is fluctuating, around the Mediterranean area range, with the beech forest dynamic series depending on the silvicultural cycle of the area. A special habitat, where I observed it growing in groups, is related to rotting fern stalks; it can be in open grasslands with abandoned mountain pastures, where non-intensive grazing has allowed *Pteridium aquilinum* ferns to grow for a few years and accumulate slowly decomposing plant material on the soil. In some cases, I observed specimens growing on *Hedera spp*. rotting woods on the forest mossy floor. The larger specimens were often observed growing nearby nitrophilous plants as *Urtica spp*., *Fragaria spp*., *Rosa canina* or *Rubus spp*. Additionally, I had the opportunity to observe fructifications growing on human made, plant residues, compost and woodchips, indicating a preference to nitrogenous and a little more acid soil topping the calcareous soils; furthermore, I can suggest that, even if this species is not reported to be synanthropic, is somehow easier to find it where there is anthropic disturbance. I am currently trying to collect samples to study the ecological relationship with certain midges that degrade the fungus and potentially have a role to disperse its spores; the identification of this insect species and its habits could help to clarify some distribution factors.

Chorology. *P. serbica* has been observed, abundant but localized in its growth stations, mainly in some Central European countries, such as Germany, Czech Republic, Austria, Slovakia, Serbia and Romania. During recent years, its presence has been reported in a much wider range around the Mediterranean as in Italy, Corsica (France) and Morocco where this species has been sometimes misinterpreted by various observers and authors in some mycological publications, books and on-line data as *P. mairei* (on-line https://mushroomobserver.org/344663), as *P. cyanescens* (Grilli 1990; Cetto 1995; Galli 2003), on-line (http://www.ambmuggia.it/forum/topic/3658-psilocybe-cyanescens wakef-emend-krieglsteiner/, http://www.salvatoresaitta.it/pages/fungi/psilocybe_cyanescens.htm) and as *P. tenax* (Cetto 1995). Its presence is reported in the mycological herbarium MCVE of the Museum of Natural history in Venice (Herb. N° 9556) and of Tuscan Mycological Groups Association (AGMT Herb. N° 2490, 4100, 4101, 4102, 4159, 4186, 4319, 11119) as well.

A summary of previous reports from northern to southern Italian latitude is listed below:

- Emilia-Romagna. (Galli 2003) Province of Forlì-Cesena, municipality Verghereto, locality Monte Fumaiolo found at the

edge of a stream on beech woody residues.

- Tuscany. (AGMT Herb. N° 2490; 03/11/2018, A. Pierotti & A. Matteini) Prov. Lucca, municipality Villa Basilica, loc. Pizzorne at 800 m under alder; mentioned as *P. serbica var. serbica* voucher, ser. II n. 398 with small subunit ribosomal RNA gene, partial sequence, internal transcribed spacer 1 and 5.8S ribosomal RNA gene, complete sequence and internal transcribed spacer 2, partial seq.; (AGMT Herb. N° 4159; 14/10/2016) province of Grosseto, municipality of Santa Fiora, loc. Bagnoli, Quattro strade, at 1000m under Beech, Spruce trees.
- Sardegna. (MCVE Herb. N° 9556, 12/11/1995) province of Nuoro, municipality of Villanova Strisaili, loc. Bosco S. Barbara.
- Abruzzo. (exsiccatum in the personal herbarium of Mario Iannotti: MI20181006-02) 6/10/2018, province of L' Aquila, municipality Palena, in a mixed wood of *Abies*, *Picea* and various broadleaves including *Fagus*, *Quercus* and *Acer*, on woody debris and decaying plant material. (on-line https://www.funghiitaliani.it/topic/96936-psilocybe-serbica mm-moser-e-horak-1969/).
- Campania. (Picillo 2012) 16-10- 2009, province of Caserta, municipality of San Gregorio Matese, loc. Difesa 1020 m, Matese Regional Park, in a mixed wood of *Fagus sylvatica* and *Abies alba*, on calcareous soil.
- Basilicata, province of Potenza, municipality Grumento nova, loc. Lucano Val d'Agri Apennine National Park. Observer Luca Pasquali in 8/10/2014, alt. 580 m. Lat: 40.28025 Long: 15.90275 (http://mushroomobserver.org/observer/show_observation/204184).
- Calabria (AGMT Herb. N° 4100; 17/10/03) Province of Reggio Calabria, municipality San Luca, loc. Canovai- Aspromonte, at 1800 m near Laricio pine;
  (AGMT Herb. N° 4101; 22/10/03) province of Cosenza, municipality of Celico, loc. Midilli, at 1180m, *Quercus cerris, Pinus nigra subsp. laricio and subsp. calabrica*; (AGMT Herb. N° 4102; 20/10/04) prov. COSENZA, municipality San Demetrio Corone, at 680m near *Castanea sativa*, mentioned as *P. serbica* var. *arcana*.
- Sicily. (Salvatore Saitta 23/10/2008) Province of Messina, loc. Malabotta Forest Special Area of Conservation, alt 1200m, Lat: 37.974199, Long: 15.049651 mentioned as *P. cyanescens* (http://www.salvatoresaitta.it/pages/fungi/psilocybe_cyanescens.htm); (AGMT Herb. N° 4319; 05/12/18 Panchetti M.) province of Messina, municipality of Tortorici, loc. Contrada La Sciabola, at 650 m near pine, chestnut trees mentioned as *P. serbica var. moravica*; (AGMT Herb. N° 11119; 12/01/2021) province of Messina, municipality of Barcellona P. G., loc. Piano Milioso, at 500 m near *Pinus pinea* trees, mentioned as *P. serbica var. arcana*.

New records reported in this study

- Campania: 21/11/2022, province of Caserta, Matese regional Park, growing on fern stalks alt.1200 m, Lat: 41.397325, Long: 14.37013; 21/11/2022, province of Caserta, San Gregorio Matese, Matese regional Park, growing on fern stalks alt. 1150 m, Lat: 41.407903, Long: 14.365938; 21/11/2022, province of Caserta, Matese regional Park, growing on fern stalks alt. 1100 m, Lat: 41.40773, Long: 14.346347;

19/12/2022, province of Caserta, Matese regional Park, growing on fern stalks alt. 1080 m, Lat: 41.422601, Long: 14.402148; 23/12/2022, province of Salerno, loc. Monte Cervati, Motola e Balze di Teggiano, Cilento, Vallo di Diano and Alburni National Park growing on *Pseudotsuga menziesii* decayed wood, on twigs and cones, alt. 1180 m, Lat: 40.307317, Long: 15.402927; 27/12/2022, province of Salerno, Monte Gelbison Cilento, Vallo di Diano and Alburni National Park on *Pseudotsuga menziesii* and *Abies alba* decayed wood, on twigs and cones alt.1550m, Lat: 40.213878, Long: 15.331642.

- Calabria: 6/10/2019, province of Cosenza, municipality *Camigliatello silano, Sila* National Park, alt.1700 m, Lat: 39.287168, Long: 16.460698;1/11/2019, province of Cosenza, municipality of Longobucco, nei pressi dell'area pic nic Fossiata alt. 1340 m near rotting *Pinus nigra laricio* and along *Urtica spp., Fragaria spp.* or *Rubus spp,* Lat: 39.397586, Long: 16.589133;11/11/2019, province of Cosenza, municipality of Corigliano Calabro in bosco con pino loricato alt. 580 m, Lat: 39.54029, Long: 16.541805; 19/12/2020, province of Cosenza, municipality of Aprigliano loc. Caporosa, Sila National Park, alt. 1720 m, in clear forest with *Pinus nigra laricio*, Lat: 39.214729, Long: 16.603796; 9/11/2020 province of Catanzaro, municipality of Magisano, Parco nazionale della Sila, in bosco con pino loricato alt. 1240 m, Lat: 39.047247, Long: 16.652005.
- Apulia: 1/12/2022 province Foggia, loc. Foresta Umbra, Parco Nazionale del Gargano, nei pressi del laghetto d'Umbra nella riserva naturale Falascone su rametti, alt. 780 m, Lat: 41.818113, Long: 16.00668. These samples got rotten from insects before it was possible to properly dry and conserve. Future sampling missions cover the gap and hopefully will evaluate which species of insects are eating and possibly interacting with the mushroom spore dispersal.
- North Macedonia: 5/11/2018, proince of Skopje, municipality of Tetovo, locality Šipkovica harvested an altitude between 1900-2100 m, Lat: 42.015438, Long: 20.813506.

According to Global Biodiversity Information Facility (GBIF, observed on-line in data 16/05/2023) and from the evaluation of the above reported data we can resume that in Italy the blooming pick is in october-november (Fig. 2) and the southern boundary is in Sicily province of Palermo, loc. Mufara mount, Madonie Park; the minimum altitude (500 m), is reported in province of Messina, while the highest altitude (1800 m) is reported in province of Reggio Calabria. Concerning the Mediterranean region, it is reported as present in Greece (Thessaly in Amárantos and Longá), in France (Corsica in loc.S. Georges), Spain (Navarra in Sierra de Aralar and Quinto Real). In Morocco, province of Marrakesh it is observed on the southern Mediterranean boundary while in North Macedonia prov. Skopje is observed at the highest altitude for this taxon at 2080 m up the sea level.

Psilocybe semilanceata

Description. *P. semilanceata* (Fig. 3) is the type species of the genus and of the division *Semilanceatae* characterized by subellipsoid, thick (1 -2 µm), more or less thin-walled (0.5 µm) spores, usually without pleurocystidia. It is the first psychotropic mushroom studied in

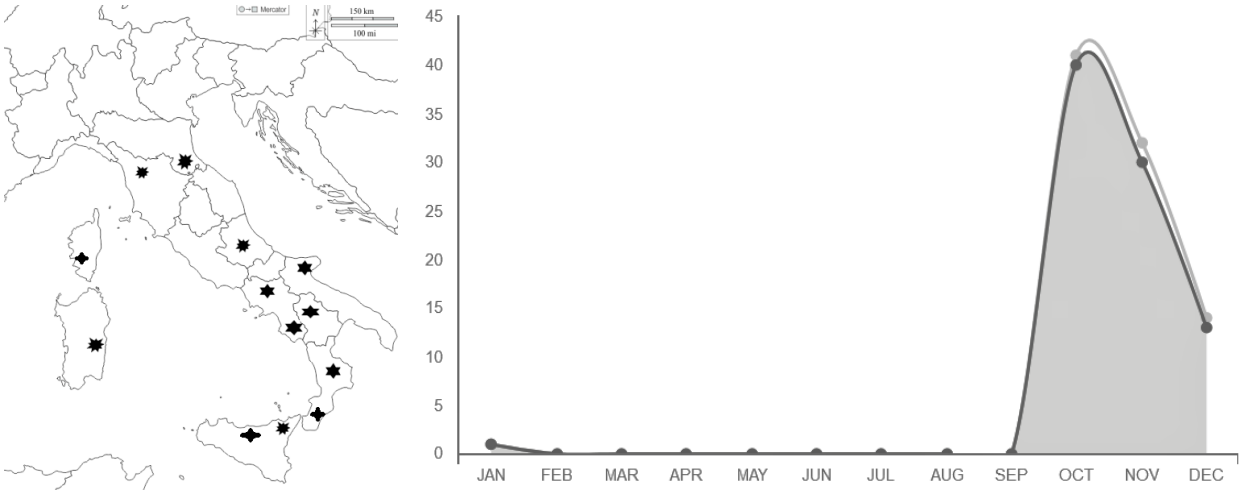

Figure 2: Italian distribution map and seasonality of *Psilocybe serbica* (as reported in https://www.inaturalist.org/taxa/518938-Psilocybe-serbica). Hexagonal symbols represent observations made by the author; others symbols represent observations previously reported by other authors. Y- axis indicates the number of individuals.

Europe, its widely distributed species, known and well- studied throughout the world and Mediterranean areas.

This species has extremely variable morphological characteristics depending on the climatic conditions, specific locations and the height of the grass in the meadow where it grows in which it is grown. The pileus is conical-acute with a very pronounced umbo, often darker in the center, it is covered with a thin transparent film and is very viscous and sticky, is very small in size with 5-25 mm in diameter and 6-22 mm in height. Due to the hygrophania, the color varies from ochre-grey to chestnut brown: in dry weather the cap is much paler, more like a light brown-yellow-white color; with wet weather the gills are visible in transparency giving at the pileus a fine striated appearance with clear olive or olive-green shades, especially in the periphery and towards the margin. The gills are more or less ascending-adnate, fairly dense interspersed with lamellulae, dark purplish-brown with whitish olive-brownish wavy thread margin.

The stem is striate fibrillose, pithy, glabrous, fistulous-midribose, fairly flexible, firm, serpentiform, never straight, but always has a wavy shape; it can be very long 2-15 cm, 1-3 mm in diameter and thickens at the base, it has a from pale ochre to brown color and after harvesting it can turn blue particularly at the base. Sometimes there are traces of a ring due to a fleeting curtain. The Flesh is membranous, odorless or slightly floury, mild earthy taste.

Spores are blackish-brown, elliptically elongated, smooth with a germinative pore. Basidia claviform, often with a slight central constriction, tetrasporic, very rarely bisporic. Cheilocystidia lageniform with more or less enlarged belly and tapering upper portion with apex, interspersed with others with irregularly shaped belly and bifid apex. Sterile lamella filament. Subhimenium composed of a short subisodiametric or inflated cell overlying a layer of filamentous

Figure 3: *Psilocybe semilanceata*. Photo by Fabio Mao Valletta.

hyphae. Lamellar texture is regular. Pleurocystidia not present. Pileipellis arranged in ixocutis, formed by septate hyphae, smooth or finely encrusted, immersed in a hyaline gel. Subpellis arranged in cutis, consisting of a dense layer of hyphae finely encrusted and pigmented with ochre-yellow. Stipitipellis arranged in cutis, consisting of septate hyphae. Caulocystidia lageniform, with enlarged belly and tapering upper portion with apex. No bifid cheilocystidia and clamp joints abundantly present everywhere. As some other *Psilocybe* mushrooms may form sclerotia, a dormant form of the fungus, which affords it some protection from wildfires and other natural disasters.

Habitat. It is localized in its growing stations on drained acid and sunny wetlands, where there are very rich aerated terrains, mainly grassy and moisty pasture areas of medium to high mountain (200 - 2000 m above the sea level). These mushrooms are known to feed on putrescent grassroots, often in association with *Deschampsia caespitosa* (L), *Festuca filiformis, Lolium spp* and other raygrasses of the family *Poaceae* (Keay S.M. & Brown A.E., 1989). Often, I observed these mushrooms fruiting in terrain depressions where water flows during rainfall, on the edges of rivulets or canals at the side of roads and paths. In areas where water is more constant and, in some cases, stagnant, it is much rarer; in these conditions I have only observed that this species rarely grows on sandy soil or in grass stumps raised above the ground.

On Apennines carbonated soils this taxon seems mainly related to the stationing grounds of mountain pasture with cows and horses, generally located up to 800-1000 m;

probably, dung decomposition provides an optimal habitat with the top layering, grasses seeds and fibers, nutrients and, not less important, a strip of topsoil that is more acidic than the limestone soil below it. In fields with a lot of dung, I observed in different cases that this species can grow through droppings that probably fell on the decaying grass due to the previously active mycelium, acting as an optional fimiculous. In Latium and Campania, it was possible to observe very rarely this species, prevalently in humid protected places and during rainy days. However, due to the milder climate, the nature of soils and the land uses along Apennine mountains it can grow to higher altitudes and occasionally during winter and spring. The less constant rainfall and the particularly draining soil could be the cause of a lower abundance and size of fruiting bodies and could explain why the presence of the pecies in the areas under study was not previously reported.

Chorology. It is distributed worldwide, and it is considered to be endemic to Europe where it is cited in 17 countries (Watling 2007). Around the Mediterranean it is distributed in Turchia, (Makalesi et al., 2016), Slovenia (Slovenian Forestry Institute), Italy, France and Spain (GBIF consulted on-line on 16/05/2023). In this study its presence is cited for the first time in Albania and North Macedonia.

This taxon has been found along the entire Alpine arc and along most part of the Apennines. It is preserved in the mycological collection MCVE (Herbarium N° 20458, 1987) and the Saccardo Mycological Group (Herbarium N° 7598, 7537, 5472, 3579), as well it is reported in some publications as in province of Trento (Bresadola 1928), Turin (Fiussello & Ceruti Scurti 1972), Brescia, Bergamo, Sondrio (Gitti et al., 1983; Samorini 1988), in the alpine environment of the Tuscan-Emilian Apennine ridge like into the provinces of Modena, Bologna and Florence (Samorini 1989). Then was reported it in the province of Novara (Jamoni 1990) with a more limited presence at altitudes of 200-300 metres, Bolzano and Pistoia, Reggio Emilia (Samorini 1993) and of Udine, Verona, and Lucca (Cacialli et al. 1996; Doveri 2004), Cuneo, Arezzo, Aquila, Frosinone and Potenza (Samorini 2005).

New records reported in this study

- Latium: 18/10/2022, province of Rome, municipality of Livata, Simbruini Mountains Regional Nature Park, on grassland, alt. 1550 m, Lat: 41.948815 Long: 13.164968.
- Abruzzo: 4/10/2020 province of Aquila, municipality of Opi, Abruzzo, Lazio and Molise National Park, in meadow with horse pasture, alt. 1500 m, Lat: 41.78652, Long: 13.811945; 14/10/2020 province of Teramo, municipality of Crognaleto, monte Gorzano, Gran Sasso e Monti della Laga National Park, in meadow alt. 2400 m, Lat: 42.622565, Long: 13.404978.
- Molise: 9/11/2022, province of Campobasso, municipality of Bojano, in a meadow into an area bordering the Matese Regional Park, alt. 1650 m, Lat: 41.444532, Long: 14.424349; 10/11/2022 province of Campobasso, municipality of. Bojano, in a meadow into an area bordering the Matese Regional Park, alt. 1630 m, Lat: 41.44454, Long: 14.383281.
- Campania: 8/11/2022, province of Caserta, municipality of. San Gregorio Matese, in a meadow, alt. 1030 m, Lat: 41.408924, Long: 14.387133; 24/11/2022 province of

Salerno, Monte Cervati, Motola and Balze di Teggiano National Park of Cilento, Vallo di Diano and Alburni, in grassland alt. 1280 m, Lat: 40.307667, Long: 15.473639.

- Calabria: 19/12/2019, Province of Cosenza, municipality of Longobucco, loc. Cava di melis, la fossa del lupo, Sila National Park, near recreational area alt. 1140 m, Lat: 39.35916, Long: 16.672793; 10/10/2019 province of Cosenza, municipality. Saracena, loc. Piano di Novacco, Pollino National Park, in pastureland, alt. 1300 m, Lat: 39.807856, Long: 16.044617; 2/11/2018 province of Catanzaro, municipality of Taverna, loc. Buturo, present at the edge of woods, alt. 1260 m, Lat: 39.066774, Long: 16.648114.

This study adds the provinces of Rome, Campobasso, Caserta, Salerno, Cosenza and Catanzaro where *P. semilanceata* is mentioned so far. The report of Catanzaro at an altitude of 1520 m signals the most southerly boundary for this species in Italy.

Moreover, I observed the presence of *P. semilanceata* in different Mediterranean localities of other countries such as France, Spain, Albania and North Macedonia, as below:

- France, 12/8/2021, municipality of Fontpédrouse, Languedoc-Roussillon, Pyrénées-Orientales, 2150m, Lat: 42.441761, Long: 2.163367.
- Spain: 11/11/2017, Andalucia, province of Granada, municipality of. Trevélez, Parque Nacional de Sierra Nevada alt. 2650 m Lat: 37.041968, Long: -3.287341; 8/12/2021, Galicia, province of A Coruña, municipality of Cedeira, loc. Santo André de Texido, alt 200m Lat: 43.710675, Long: -7.978597.
- Albania, 25/10/2018, province of Dibër, loc. Cerjan Liqeni i Gramës, Mount Korab, on grassland alt. 1780 m, Lat: 41.756785, Long: 20.494816.
- North Macedonia, 2/11/2018, province of Skopje, municipality of Tetovo alt. 2020 m, Lat: 42.019329, Long: 20.825393; 2/11/2018, province of Skopje, municipality of Tetovo alt. 2300 m, Lat: 42.008069, Long: 20.83543; 5/11/2018 province of Skopje, municipality of Tetovo, loc. Shipkovica alt. 2220 m, Lat: 42.019003, Long: 20.860489.

According to Global Biodiversity Information Facility (observed on line in data 16/05/2023) and from the evaluation of the above reported data we can resume that, about Mediterranean countries, *P. semilanceata* carpophores blooming pick is in october-november (Fig. 4) and in Spain are reported the highest altitude and the most southerly boundary reported, about 2650 m in Sierra Nevada Granada, as well the lower altitude, about 190 m in the Atlantic coast of Galicia.

Further chorological exploring missions, that I'm preparing with the "*Psilosoma Project*", could verify the presence of this taxon also in the rest of Balkan countries as (Croatia, Bosnia Herzegovina, Montenegro), Greece, and North African countries such as Morocco and Algeria, as well Est-Asia.

Conclusions

While *P. semilanceata* is a well-studied psilocybe species, *P. serbica* is very poorly known and further investigation on its morphological variability, distribution and relationship to other similar toxic species is needed. This study suggests a continuum in the distribution of the taxa *P. serbica* from Europe to Africa. Where no psilocybin specimens were still encountered, their

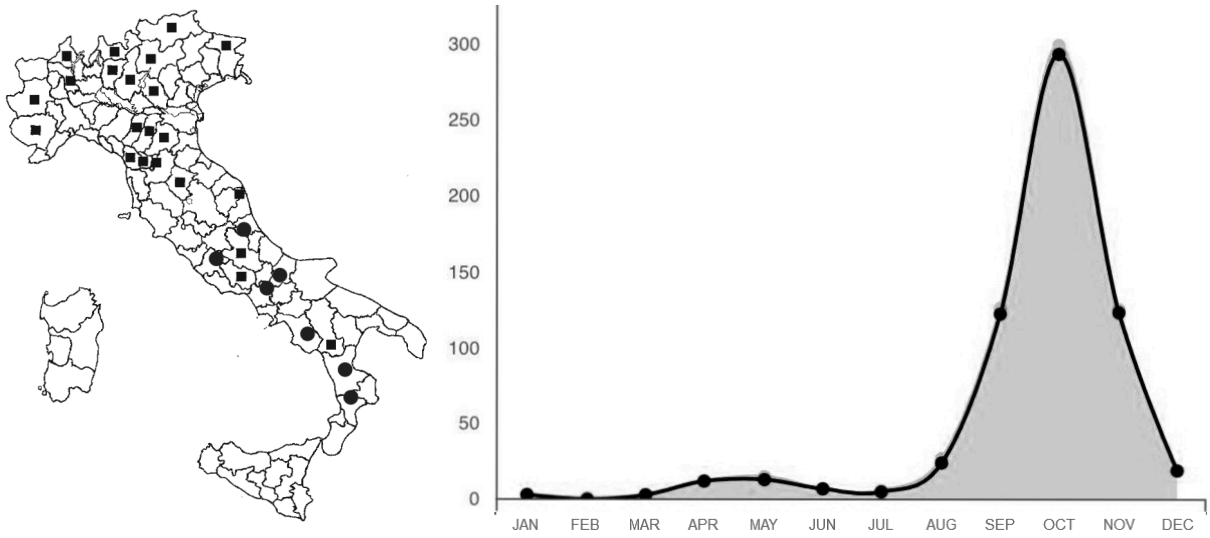

Figure 4: Italian distribution map and seasonality of *Psilocybe semilanceata* (as reported in https://www.inaturalist.org/taxa/518938-Psilocybe-serbica). Spherical symbols represent observations made by the author; quadrangular symbols represent observations previously reported by other authors. Y- axis indicates the number of individuals.

relative presence cannot be ruled out, due to the fluctuations of climatic conditions, along with the difficulty to properly observe and identify these mushrooms.

Psychotropic mushrooms are difficult to find in the field and even more in the central and south Mediterranean region due to the environmental and geological factors that characterize these areas.

Indeed, even though many taxa can be easily identified in the field or using images evidencing key macro characters, often a microscopic study is necessary for unambiguous identification. Thanks to recent reports dealing with herbarium samples and to up-dated internet databases we are discovering that the so called "magic mushrooms" are much more widespread than we knew.

This study confirms the presence of *P. serbica and P. semilaceata* in the Apennines of southern Italy, extending their range of distribution further south and east in the Mediterranean region. Along the central-southern Apennines are reported other psilocybin species as *P. liniformans var. liniformans* (Guzmán and Bas, 1977) in Latium, Province of Rome (Guzmán et al. 2006), *P. fimetaria* (P.D. Orton) Watling in Campania, Province of Caserta (Picillo 2018) and in Abruzzo, Province of Teramo [Herbarium AGMT N°4237], *P. cyanescens* Wakef. in Calabria, Province of Reggio Calabria (Grilli 1990) [Herbarium AGMT N°1392]. Central and South Apennines deserve further study in the fields of *Psilocybe* taxonomy, biogeography, ethnomycology, and potential medicinal and bio-remedial applications. It is suggested that samples reported here will be included in the catalogs and dataset of the mycological flora in Italy, Albania, North Macedonia, France and Spain.

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Some divulgation works of the "PsiloSoma Project" are available on the YouTube channel "NaturalMao". Requests for copy documents and samples material to study can be addressed to psilosoma.project@gmail.com.

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