BORNH
ISSN 2724-4393
Volume 4 Number 1, 2024

BORNH Bulletin of Regional Natural History

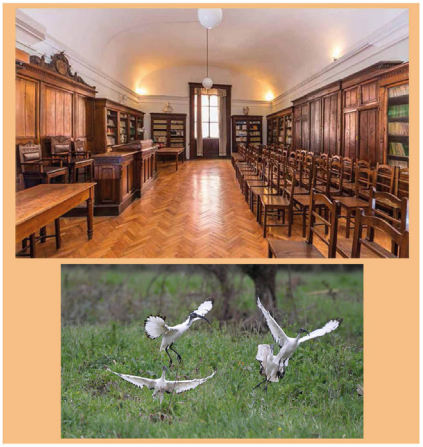
Formerly Bollettino della Societá dei Naturalisti in Napoli

Bulletin of Regional Natural History (BORNH), formerly Bollettino della Società dei Naturalisti in Napoli, is an online peer reviewed open access journal from Società dei Naturalisti in Napoli that promotes studies dealing with environmental, natural and earth sciences at local and regional scale.

Official website of BORNH: http://www.serena.unina.it/index.php/bornh/index
Official website of Società dei Naturalisti in Napoli: https://www.societanaturalistinapoli.it/

Cover photos by Antonio Calamo (above), and Francesco Bolinesi (below).

BORNH
ISSN 2724-4393
Volume 4 Number 4, 2024
BORNH Bulletin of Regional Natural History
Formerly Bollettino della Società dei Naturalisti in Napoli



Volume 4, Number 1 2024

Bulletin of Regional Natural History
Formerly Bollettino della Società dei Naturalisti in Napoli

New records of African Sacred Ibis *Threskiornis aethiopicus* (Latham, 1790) (Pelecaniformes: Threskiornithidae) from Salerno Province (Southern Italy)

Nicola Maio[1*], Maurizio Fraissinet[2], Francesco Pollaro[3], Carmela De Luca[3], Francesco Bolinesi[1] and Fabio Maria Guarino[1]

DOI https://doi.org/10.6093/2724-4393/10943

***Correspondence:**
nicomaio@unina.it
https://orcid.org/0000-0002-2304-5565

Affiliation:
[1] Department of Biology, University of Naples Federico II, Naples, Italy.
[2] Associazione Studi Ornitologici Italia Meridionale (ASOIM), Naples, Italy.
[3] Centro Studi Ecosistemi Mediterranei, Pollica (Salerno), Italy.

Conflict of Interest: The author declares that he has no conflict of interest.
Financial Disclosure Statement: The author declares that no specific funding was received for this work

Submitted: 28 Feb. 2024
Revised: 25 Mar. 2024
Accepted: 30 Mar. 2024
Published: 17 May 2024

Associate Editor:
Giovanni Scillitani

Abstract

We report the first records of African sacred Ibis *Threskiornis aethiopicus* from Salerno Province (Campania, Southern Italy). The species was first reported in Italy from 1989 and in Campania in 2015 from the Province of Caserta. The African Sacred Ibis has been listed as an invasive species by the European Union.

Keywords: *Threskiornis aethiopicus*, alien species, Salerno Province, Campania.

Riassunto

Si riportano le prime segnalazioni di Ibis sacro *Threskiornis aethiopicus* per la Provincia di Salerno (Campania, Sud Italia). La specie è stata segnalata per la prima volta in Italia a partire dal 1989 e in Campania nel 2015 in Provincia di Caserta. L'Ibis sacro è stato inserito nell'elenco delle specie invasive dell'Unione Europea.

Parole chiave: *Threskiornis aethiopicus*, specie aliena, Provincia di Salerno, Campania.

The African Sacred Ibis *Threskiornis aethiopicus* (Latham, 1790) (Pelecaniformes: Threskiornithidae) is a monotypic species native to sub-Saharan Africa with an estimated population of 200,000 - 450,000 individuals, and a small, declining population located in south-eastern Iraq. In the second half of the 20th century, several non-native populations derived from introduction or escaped individuals were recorded in different European states (Yésou et al., 2017).

The African Sacred Ibis has a completely white body plumage with the exception of some black plumes on the back, while legs, neck, beak and tail are black. It inhabits cultivated areas, wetlands, dumps, flooded meadows, estuaries. It is a colonial nesting species. It is a colonial species.

In Italy, where it has recently been considered 'naturalized' (Brichetti & Fracasso, 2018), it started nesting in 1989 in the Province of Vercelli (Piedmont) (Carpegna et al., 1999). Since then, the Italian population has undergone a process of numerical growth, colonizing several regions in Central-Northern Italy, reaching a breeding population estimated at 400 - 420 pairs in 2016 (Brichetti & Fracasso, 2018).

The first report from Campania dates back to 2015 and refers to two individuals observed in the wetlands of Villa Literno (Caserta) during the spring period (Finati et al., 2015). Since that date, reports have followed one another, but always localised in the Province of Caserta in the northern part of the Region (Fraissinet & Usai, 2020; Fraissinet & Usai, 2021). In the Salerno Province, the first published report concerns 1-2 individuals resting and in trophic activity in the wetlands of the Sele Plain (2 individuals - 29-30 November, 1 individual - 4 December 2023) (Usai et al., 2023).

On November 20 of 2023 a flock of 13 specimens was photographed in a fallow field of the locality Gaiarda (Fig. 1A) and on December 4 of 2023 a flock of 19 specimens was photographed in another fallow field of the locality Spinazzo both in the Municipality of Capaccio Paestum (Salerno) (Fig. 1B-D). In the 24th of February 2024 one specimen was observed in a moat in the locality Fiocche near Eboli, and a flock of 31 specimens was photographed in a fallow field in the Municipality of Serre near Borgo S. Cesareo (Municipality of Albanella, Salerno). The latest sighting dates back to the 7th of April 2024 with one specimen sighted in the Calore River banks in the locality Cerrocupo (Municipality of Altavilla Silentina, Salerno).

Figure 1. Individuals of *T. aethiopicus* photographed in the 20th of November 2023 in a fallow field of locality Gaiarda (Capaccio Paestum, Salerno)(A). Individuals of *T. aethiopicus* photographed in the 4th of December 2023 feeding in the canals in another fallow field of the locality Spinazzo (Capaccio Paestum, Salerno)(B). (Photos by C. De Luca).

The repert of the 20 th of November 2023 is the first in Province of Salerno in temporal order, and the other reports from the Province

Figure 2. Individuals of *T. aethiopicus* photographed in a fallow field in the Municipality of Serre near Borgo S. Cesareo (Municipality of Albanella, Salerno) (Photos by F. Bolinesi).

of Salerno confirm that the number of individuals found is also interesting and really much higher than previously considered. The dispersal capacity of the African Sacred Ibis is well known, even within its home range, with movements of over 1000 kilometres, and it is therefore difficult to trace the area of origin of the flock observed in Paestum localities (Fig. 2). It will be interesting to follow the evolution of the species' presence in the Salerno area, also because, following the reports of November-December 2023, other reports have been made in locations not far from the city of Salerno (Fig. 3).

Following the measures adopted by the European Union to combat the spread of alien species, the African Sacred Ibis has been included in the list of invasive species and is therefore subject to specific control and eradication programmes (DAISIE, 2009). It is in fact a species that causes considerable damage to populations of Italian and European endemic species, which is why it is extremely important to tracing the dispersion pattern and knowing the areas of new colonization.

Author contribution

Conceptualization: NM, FB, FMG
Data curation: NM, MF, FP, CDL, FN, FMG
Writing original and final draft preparation: NM, MF, FP, CDL, FN, FMG

References

Brichetti P., Fracasso G. (2018). *The Birds of Italy 1. Anatidae-Alcidae*. Belvedere, Historia Naturae (6), Latina, 512 pp.

Carpegna F., Della Toffola M., Alesandria G., Re A. (1999). L'Ibis sacro *Threskiornis aethiopicus* nel Parco Naturale "Lame del Sesia" e sua presenza in Piemonte. *Avocetta*, **23**: 82.

Delivering Alien Invasive Species Inventories for Europe (DAISIE) (2009). *Handbook of Alien Species in Europe*. Springer, Dordrecht, 399 pp.

Finati R., De Rosa D., Janni O. (2015). Annuario 2015 di EBN Italia. *Quaderni di Bird-Watching*, **21**: 68.

Fraissinet M., Usai A. (2020). Le altre specie, pp. 108-109. In: Fraissinet M. (Ed.) *Ciconiformi, Suliformi e Pelecaniformi della Campania. Cicogne, Sula, Cormorani, Ibis e Aironi della Campania.* Monografia n.18 dell'ASOIM, Alfa Grafica, Napoli, 117 pp.

Fraissinet M., Usai A. (2021). The Checklist of Birds from Campania Region (updated to 31th January 2021). *Bulletin of Regional Natural History (BORNH)*, **1** (2): 70-104. DOI https://doi.org/10.6092/2724-4393/7913

Usai A., De Filippo G., Dovere B. (2023). Espansione dell'Ibis sacro *Threskiornis aethiopicus* in Italia Meridionale: aggiornamento dalla Campania. U.D.I., **48**: 82-84.

Yésou P., Clergeau P., Bastian S., Reeber S., Maillard J.F. (2017). The Sacred Ibis in Europe: ecology and management. *British Birds*, **110**: 197-212.

Bulletin of Regional Natural History (BORNH) ISSN 2724-4393.

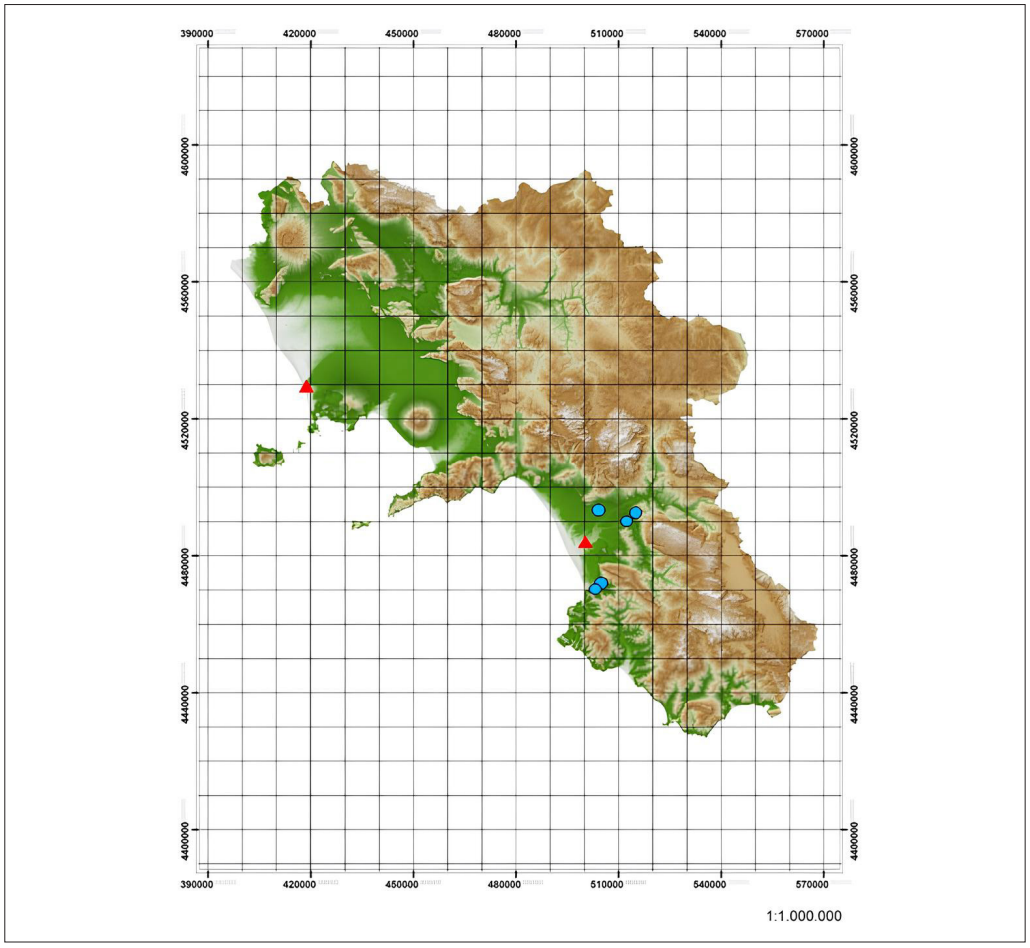


Figure 3. Records of *T. aethiopicus* from Campania. ▲ First report from Campania of 2015 in the wetlands of Villa Literno (Caserta) (Finati et al., 2015) and the Sele Plain in the 2023 (Usai et al., 2023). ● Individuals observed in the 2023 and 2024 in Province of Salerno.

Bulletin of Regional Natural History
Formerly Bollettino della Societá dei Naturalisti in Napoli

Semantic Study of Sanskrit Names of Fifteen Indian Medicinal Plants

Vijay J Tiwari[1] and Abhay M Ittadwar[2]

DOI https://doi.org/10.6093/2724-4393/10948

***Correspondence:**
vijaysstiwari@gmail.com, abhayittadwar@yahoo.com

Affiliation:
[1] Retired Associate Professor, P G Department of Botany, J M Patel College, Bhandara 441 904 MS, India.
[2] Principal, Gurunanak College of Pharmacy, Kamgar Nagar, Nagpur, M.S 440026 Nagpur, MS, India.

Conflict of Interest: The author declares that he has no conflict of interest.
Financial Disclosure Statement: The author declares that no specific funding was received for this work.

Submitted: 30 Apr. 2024
Revised: 05 May 2024
Accepted: 11 May 2024
Published: 29 May 2024

Associate Editor:
Antonino Pollio

Abstract

The purpose of the study is to analyze the semantic motivation of Sanskrit names of Indian Medicinal Plants therefore it is essential to known true literary meanings of names and their indication about pharmacological and medicinal uses of plants. Ancient herbalist and Ayurveda practitioners have studied the medicinal properties of plants and accumulated information about their uses through the process of long term cognitive and transformative activities. As a result vast amount of information about ancient uses of plants is available in Ayurveda. Keeping these views in mind semantic study of Sanskrit names of 15 Indian medicinal plants have been undertaken to find out rationale behind these names and decipher their hidden meanings.

Keywords: Semantic Study, Rationale, Sanskrit Names, Indian Medicinal Plants, Pharmacology

Riassunto

Lo scopo dello studio è quello di analizzare la motivazione semantica dei nomi sanscriti delle piante medicinali indiane: è essenziale conoscere i significati letterari dei nomi e le loro indicazioni sugli usi farmacologici e medicinali delle piante. Gli antichi erboristi e i praticanti dell'Ayurveda hanno studiato le proprietà medicinali delle piante e hanno accumulato informazioni sui loro usi attraverso un processo di attività cognitiva e trasformativa a lungo termine. Di conseguenza, in Ayurveda è disponibile una grande quantità di informazioni sugli antichi usi delle piante. Tenendo conto di questi punti di vista, è stato intrapreso uno studio semantico dei nomi sanscriti di 15 piante medicinali indiane per scoprire la logica alla base di questi nomi e decifrarne i significati nascosti.

Keywords: Studio semantico, fondamento logico, nomi sanscriti, piante medicinali indiane, farmacologia

How to cite

V. J. Tiwari and A. M. Ittadwar, Semantic Study of Sanskrit Names of Indian Medicinal Plants. Bulletin of Regional Natural History (BORNH) Bollettino della Società dei Naturalisti in Napoli. Vol.4, pp. 16-24 , ISSN 2724-4393.

Introduction

Sanskrit is the most ancient language of the world, dated back about 5000 years ago. The Indian seers, sages and Ayurveda practitioners had given specific names to plants on the basis of their pharmacological activity and medicinal uses. They were logical and visionaries in naming the plants. Plants species has significant role in the people's life since ancient times, and the Sanskrit names of plants reflect the cognitive activities of ancient people. Etymological research has been carried out by various researchers to find out the meaning of common names of plants in different languages: Albanian (Saraci & Damo, 2021); Greek (Dawkins, 1936); English (Prosyannikova, 2020); Kaytetype (Turpin, 2013); Kanekes (Hidayati et al., 2022); Australian (Evans, 1997). These researchers have focused on plant names because they represent a condensed form of traditional knowledge. In India, the medicinal activity of many plants was described in Sanskrit language (Sensarma, 1992) as recently reported by Tiwari & Ittadwar (2023). Thomas et al. (2020) emphasized that an interdisciplinary approach is needed to solve controversial identity of medicinal plants because multiple names were assigned to particular plant species in Sanskrit language. A preliminary literature review has revealed that there are no reports on the evaluation of the rationality and validity of Sanskrit plant names. The present study provides first important indications about the semantic motivational features of the names expressing the medicinal properties of some of the most representative Indian medicinal plants.

Methodology

The Sanskrit names have been sorted out from the revised version of *Nighantu -Encyclopedia of Indian Medicinal Plants Used in Ayurveda* (Kamat (2002), Leucas (2017) and websites, as *www.bsienivs.nic.in*, www.envis.frlht.*org.*, www.wisdomlib.org. The web page of Botanical Survey of India, Government of India www.efloraofindia.com, has been referred to verify latest botanical nomenclature of plant species. The contextual and true meanings of Sankrit names were checked from online dictionaries www.deal.uchicago.edu, www.sanskritdictionary.org, *www.kosha.sanskrit.today/words/sa,* and manual dictionaries by Apte (1993, 1997).

The methodology of splitting the words (*Sandhivigraha*) is adopted to know true meanings of words because every single word in Sanskrit is referred as root (*Dhatu*), which is also a name for any constituent elementary substance. It is observed that Sanskrit names consist of various components viz., noun, verb, adjective etc. The meaning of Sanskrit names is supplemented with phytochemical and pharmacological data which can be used as evidence to justify their validity.

Results

Artemisia vulgaris L. (Asteraceae): It is named as "*Damanka",* that means control or oppression. The name implies an indirect reference to the property of the plant, which signifies that it is used to control so many diseases. The biological activities viz., gastrointestinal disorders, gynecological

diseases, antifungal anti-bacterial, antioxidant, antispasmolytic, estrogenic, cytotoxic, hepatoprotective, antimalarial, anti-inflammatory, antitumor, immunomodulatory etc. activities are attributed to the presence of flavonoids, sesquiterpene lactones and coumarins (Abiri et al., 2018, Ekiert et al., 2020).

Averrhoa carambola L. (Oxalidaceae): It is named as *"Brihadamla"*, *Brihad* meaning large and *Amla* meaning acidity. Its use against acidity is supported by its gastric antiulcerogenic activity in rats reported by Goncalves et al. (2006). Fruits contain acidic crystals of potassium oxalate. Another name of plant is *Rujakaram,* meaning sickness or disease. Its hidden meaning reflect that it is used to cure so many diseases which is attributed to antibacterial, anti-inflammatory, antipyretic etc. activities (Luan et al., 2021).

Chrysopogon zizanioides (L.) Roberty (Poaceae): one of Sanskrit names assigned to the plant is **"***Udicyam"*, meaning perfume. The property of fragrance is attributed to its roots, which yielded essential oil known as *Khas*. Chou et al. (2012) have reported the chemical composition of perfume oil. Another name is *Sheetmoola*, that consists of two words, *Sheet* meaning cool and *Moola* meaning roots. The meaning implies that roots have cooling effects on the body, which is correlated with its use in preparation of *Khas* sherbet or cold drinks. The name *Abhaya*, also used for this species, consists of a single component meaning that it can be used to cure many diseases.

Cinnamomum tamala (Buch.-Ham.) T.Nees & C.H.Eberm. (Lauraceae): the name **"***Chandanam"*, that means cool, is substantiated by antipyretic activity (Thamizhselvam et al., 2012). Other names are *"Gandhipatrika", Gandhi* meaning fragrance and *Patri* meaning leaves, and *"Surabhigandha", Surabhi* meaning sweet and *Gandha* meaning fragrance. The fragrance is due to presence of 53 aromatic compounds in plant (Wang et al., 2020). The plant is also named "R*ukshakam"* meaning reduces fats from the body. This property is corroborated with its hypolipidemic activity reported by Kumar et al. (2012). Finally, the name *Vasana* means the impression of anything remaining in the unconscious mind that leads to the feeling of sadness or happiness. This property could be correlated with its neurobiological effects (Upadhyay et al. 2016).

Curcuma longa L. (Zingiberaceae): This plant is known as turmeric, and it has been used as an ancient skin care cosmetic and drug plant of India with myriad of health benefits. The rhizome bright yellow powder is used for food coloring, condiment, spice and flavoring agent. Three names are assigned to the plants - *"Nisakaya", Nisa* meaning glowing and *Kaya* skin; *"Yositpriya", Yosit* meaning young woman; *Priya* meaning dear or beloved; *"Varavarnini", Vara* meaning turmeric; *Varini* meaning beautiful. These names implies that it is used as a skin care cosmetic. Another Sanskrit name used for this species is *Krimighni* consist of single component, related to its vermifuge activity which is supported with its anthelmintic activity (Ullah, 2013). The name "*Visaghni*" means that it is used to remove poison from body. This use is attributed to its anti-toxic activity (Khisamova & Gizinger, 2020). The name "*Varnavilasini",* Varna meaning Class or group of people; Vilasini meaning lustful woman. It literary indicates a class or group of lustful coquettish women. The name indicates that plant may be used as an aphrodisiac or antifertility drug. This

information needs to be verified by further investigations. The pharmacology of active compound Curcumin reported by Jain et al. (2007), Hewling & Kalman (2017) and Fuloria et al. (2022) rationalises its versatile use as a cosmetic and medicinal plant.

Fagonia cretica L. (Zygophyllaceae): The name is "*Kasaya*" and refers to the dose and method of preparation. It means that one part medicine plus four, eight- or sixteen-part water is used for boiling till we get ¼ th decoction. The use of decoction is corroborated with its medicinal properties viz., astringent, anti-inflammatory, laxative, anti-hemorrhagic, carminative etc. activities (Qureshi et al., 2015).

Gymnema sylvestre (Retz.) R.Br. ex Sm. (Asclepiadaceae): Two names are assigned to species are *"Bahalchakshu", Bahal* meaning thick and swollen; *Chakshu* meaning eyes. It means that it is used to cure sore and swollen eye. It is correlated with its antibacterial and anti-inflammatory activities (Satdive et al., 2003; Malik et al., 2008), because eye diseases could be due to bacterial infections. Another name is "*Madhunasini", Madhu* means sugar; *Nasini* means destroyer. This name points to its anti-diabetic activity which is corroborated with clinical application of plant against Type-2 diabetes mellitus and its associated pathologies (Yadav et al., 2019; Laha & Paul, 2019).

Hemidesmus indicus (L.) R. Br. (Apocynaceae): The name *"Anantamool"*, is derived from *Ananat* meaning infinite; *Mool* meaning roots. The meaning indirectly implies that roots are used to cure so many diseases. This observation is supported by reports of its hepatoprotective, anticancer, antidiabetic, antiulcer, neuroprotective, antioxidant, cardio protective, anti-inflammatory, antimicrobial etc. activities. Roots yielded aromatic aldehydes and their derivatives, phenolics, triterpenoids and so many other bioactive compounds (Nandy et al., 2020). Another name "*Candana"* indicates its cooling property, that needs to be confirmed by further investigation.

Indigofera tinctoria Chapm. (Fabaceae): This plant yields Blue Indigo Dye, and is identified by the name "*Tuttha"*, meaning collyrium. The meaning of name implies that it cures infection of eyes. This use is attributed to its antimicrobial, cytotoxic and anticancer activities (Renukakumari et al., 2011; Vijayan et al., 2016. Another name "*Vishodhini*" means laxative, which is supported by its laxative activity reported by Gerometta et al. (2020).

Jatropha glandulifera Roxb. (Euphorbiaceae): This plant is extremely poisonous. The name *"Dravanti"* means purgative properties, confirmed by Sabandar et al. (2013). Another name "*Musakahavya"*, from *Musakah*, which means swelling of the testicles, and *Havya*, which means offering. The name signifies that the species is used to reduce swelling and pain of testicles. This activity has been attributed to the anti-inflammatory activity of 3,3,dimethyacrylshikonin, and acetylshikonin (Ballantine, 1969).

Justicia adhatoda L. (Acanthaceae): The name of plant is **"***Bhishajmata", Bhishaj* meaning medicine and *Mata* meaning mother, which indirectly means that it is a powerful drug plant. This property of plant is correlated with quinazoline alkaloids, vaccine, vasicinone, vasicinol, vasicinine, vasicoline showing lot of pharmacological activities (Khursheed et al., 2010; Singh et al. 2011). Other two Sanskrit names are "*Vasa"* and "*Vasaka"*. The meaning of these names indicates that the plant reduces

the fats of the body, as confirmed by its anti-hyperlipidemia activity reported by Chowdhury et al. (2020).

Soymida febrifuga (Roxb.) Juss. (Meliaceae): Names assigned to this plant are *"Atiruha", Ati* meaning extremely and *Ruha* meaning heal up wounds, and "*Mamsarohini", Mamsa* meaning flesh; *Rohini* meaning red color. These names indicate healing of wounds, that could be related to the antibacterial activity of *S. febrifuga* (Mishra et al., 2017).

Syzygium aromaticum (L.) Merr. & L.M. Perry (Myrtaceae): This species is named as *"Candanapuspam", Candana* meaning cooling and *Puspam* meaning flowers. The name indicates its cooling property. Other name is "*Varisambhavam", Vari* meaning fragrance, *Sambhavam* existence. This name refers to the fragrance of flowers due to the presence of volatile essential oil and active ingredient eugenol, chemically known as 4-allyl-2-methoxyphenol (https://pubchem.ncbi.nlm.nih.gov/compound/Eugenol).

Senna tora (L.) Roxb. (Caesalpiniaceae): Two names are assigned to this plant: "*Cakramarda", Cakra* meaning circular appears like ringworm; *Mardah* meaning destroying *and "Dadrughana", Dadru* meaning sub cutaneous eruptions of skin, *Ghana* meaning destroyer. These names implies that the species was used to cure ringworm and sub cutaneous eruptions of the skin (prickly heat during summer). Acharya et al. (1975) reported that the plant contains Chrysophonic acid-9-anthrone, which is the major antifungal principle against *Microsporum canis, Candida albicans, Aspergillus fumigatus*. According to Rios et al. (1989) *S. tora* showed antibacterial activities against *Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, Proteus vulgaris, Escherichia coli***.** Phongpaichit et al. (2004) reported the antifungal activity from leaf extract of S. *tora* against *Trichophyton rubrum, Microsporum gypseum, Penicillium marneffi.*

Trichosanthes dioica Roxb. (Cucurbitaceae): several names were assigned to the species, such as "*Pandukah" and "Panduphala", Pandu* means jaundice*; Phala* meaning fruits. The meaning of the name implies that it is used to cure jaundice and anemic conditions. The uses indicated by these names are validated by reports about the hepatoprotective activity of aqueous and ethanolic extracts of the plant (Ghaisas et al., 2008). Another name is "*Kusthaha"*, means leprosy, and is attributed to its antibiotic activities (Bhattacharya & Haldar, 2010). The plant was also named as "*Viryagarbhapratanah"*, consisting of three components: *Virya,* meaning vigour or fertility; *Garbha,* meaning conception; *Pratanah,* meaning fall down. The meaning of the words reflects that it can cure weak uterine problems, such as frequent abortions, which is supported by reports of cytotoxic and wound-healing activity (Khandekar et al. 2018). One more name is "*Kasamuktidah", Kasa* meaning cough, *Mukti* relief and *Dah* heat of body. This name indicates that the plant can cure cough with fever, as confirmed by the antipyretic activity reported by Alam et.al. (2011). Its use as expectorant and antitussive properties has not been reported, therefore it needs further investigations. Most active principles are Cucurbitacin B and Trichosanthin which are showing lot of pharmacological activities (https://pubchem.ncbi.nlm.nih.gov/#query=Trichosanthin; https://pubchem.ncbi.nlm.nih.gov/#query=Cucurbitacin%20B).

Discussion and Conclusions

Based on these observations, the plant species included in this study can be divided into two classes:

1. Species for which the uses indicated by the Sanskrit names are supported by experimental evidence. This category includes: *Averrhoa carambola*, *Chrysopogon zizanoides, Cinnamomum tamala*, *Curcuma longa*, *Fagonia cretica, Gymnea sylvestre Hemidesmus indicus*, *Indigofera tinctoria, Justicia adhatoda*, *Jatropha glandulifera, Justicia adhatoda, Senna tora, Soymida febrifuga, Trichosanthes diocia*. The Sanskrit meanings of plant names is strictly related to their medicinal uses which are supported by relevant phytochemical and pharmacological activities.

2. Species for which the uses indicated by the Sanskrit names are not corroborated by present knowledge. This category includes six plants. *Artemisia vulgaris* is believed to be used to control many diseases; *Syzygium aromaticum* flowers, used as cooling agent; *Trichosanthes dioica,* administered as expectorant and antitussive; *Curcuma longa,* considered as an aphrodisiac and antifertility drug; *Hemidesmus indicus,* to whom are attributed cooling property; *Cinnamomum tamala* used to cure psychiatric problems. These uses are not confirmed by current relevant pharmacological and phytochemical data, therefore need further investigations.

The present study has revealed the true meanings of Sanskrit names of Indian medicinal plants, and possible rationales and validity of these names have been critically examined. Authors feel that further phytochemical and pharmacological studies are urgently needed, particularly for on the species included in the second class.

Author contributions

Conceptilisation: V.J.T., A.M.I
Data Curation: V.J.T.
Formal Analysis: V,J,T., A.M.I
Investigation: V.J.T.
Methodology: V.J.T., A.M.I.
Project Administration: V.J.T.
Resources: A.M.I
Writing-Original and Final Draft Preparation and Publication of Paper: V.J.T

Acknowledgement

Authors are expressing deep sense of gratitude to The Sikh Education Society and Gurunanak College of Pharmacy, Kamgar Nagar, Nari, Nagpur for providing basic infrastructure to carry out the present research work. The authors are thankful to Mr. Anil N. Thakre for typing and grammatical corrections.

References

Abiri R., Silva A.L.M., de Mesquita L.S.S., de Mesquita J.W.C., Atabaki N., de Almeida E.B. Jr., Shaharuddin N.A., Malik S. (2018). Towards a Better Understanding of *Artemisia vulgaris*: Botany, phytochemistry, pharmacological and biotechnological potential. *Food Res. International* 109:403-415 DOI:10.1016/j.foodres.2018.03.072.

Acharya T.K. and Chatterjee I.B. (1975). Isolation of Chrysophonic-acid-9-anthrone, the major antifungal principle of *Cassia tora* L., *Lloydia* **38**(3), 218-220.

Alam M.B., Hossain M.S., Chowdhary N.S., Asdujjaman M., Zahan R., Islam M.M., Mazumder M. E.H., Haque M.E., Islam A. (2011). Antioxidant, anti-inflammatory, antipyretic activities of *Trichosanthes dioica*

Roxb. fruits., *Journal of Pharmacology***6**, 440-453.

Apte V.S. (1993). *The Concise Sanskrit – English Dictionary*. *Motilal and Banarasidas Publishers Delhi, India*.

Apte V.S. (1997). Sanskrit- Hindi Kosh (Dictionary)., *Motilal and Banarasidas Publishers Delhi, India*.

Ballantine J.A. (1969). The isolation of two esters of Naphtoquinone Alcohol, Shikonin from the shrub *Jatropha glandulifera*. *Phytochemistry* **8**,1587 –1590 DOI:10.1016/S0031-9422(00)85935-X.

Bhattacharya S., Haldar P.K. (2010). Antibacterial activity of *Trichosanthes dioica* Roots. *Global Journal of Pharmacology* **4**(3), 122-126.

Chou S.T., Lai C.P., Lin C.C., Shih Y. (2012). Study of chemical composition, antioxidant and anti-inflammatory activity of essential oil from *Vetiveria zizanioides*., *Food Chemistry* **134**, 262-268 DOI:10.1016/j. foodchem.2012.02131.

Chowdhury I.I., Rahman M.A, Hashem M.A., Bhuiyan M.M.H., Hajjar D., Alelwani W., Makki A.A., Haque M.A., Tangpong J., Bakhtiar M.T.B. (2020). Supplement of an aqueous combination of Justicia adathoda and Ocimum tenuiflorum boost antioxidative effects and impede hyperlipidemia., *Animal Model Experimental Medicine* **3**(2), 140-151 DOI:10.1002/ame2.12115.

Dawkins R.M. (1936). The Semantics of Greek Names for Plants. *The Journal of Hellenic Studies*, **56**, 01 – 11. JSTOR, DOI: 10.2307/626030.

Ekiert H., Pajor J., Klin P., Rzepiela A., Slesak, H., Szopa A. (2020). Significance of *Artemisia vulgaris* L., (Common Mugwort) in the History of Medicine and Its possible Contemporary Applications Substantiated by Phytochemical and Pharmacological Studies, *Molecules*, **25**, 4415, DOI:10.3390/ molecules25194415.

Evans N. (1997). Sign Metonymies and the Problem of Flora-Fauna Polysemy in Australian Linguistics. In: *Tyron D., Walsh M., (Eds) Boundary Rider Essay in Honor of Geoffrey O Grady, Pacific Linguistic*.

Fuloria S., Mehta J., Chandel A., Sekar M., Rani N.N.I.M., Begum M.Y., Subramaniyan V., Chidambaram K., Thangavelu L., Nordin R., Wu Y.S., Sathasivam K.V., Lum P.T., Meenakshi D.U., Kumarasamy V., Azad A.K., Fuloria N.K.A. (2022). Comprehensive Review on the Therapeutic Potential of *Curcuma longa* Linn., In Relation to Its Major Active Constituent Curcumin. *Front. Pharmacol*. **13**, 820806 DOI:10.3389/ fphar.2022.820806.

Ghaisas M.M., Tanwar M.B., Ninave P.B., Navghare V.V., Deshpande T. (2008). Hepatoprotective Activity of Aqueous and Ethanolic Extract of *Trichosanthes diocia* in Ferrous Sulfate Induced Liver Injury, *Pharmacognosyonline* **3**, 127 – 135 DOI: 10.4103/0973-7847.95886.

Gerometta E., Grondin I., Smadja J., Fredrich M., Gauvun-Bialecki A. (2020). A review of Traditional uses, Phytochemistry and Pharmacology of Genus *Indigofera*., pp.01 – 82. Version of Record: https://www. sciencedirect.com/science/article/pii/ S0378874119326674.

Goncalves S T., Baroni S., Bersani-Amado F A., Melo G.A.N., Cortez D.A.G., Amado C.A.B., Cuman R.K.N. (2006). Preliminary Studies on Gastric Antiulcerogenic Effects of *Averrhoa carambola* in Rats., *Acta Farmaceutica Bonaerese* **25**(2), 245 www. latamjpharm.org.

Hewling S.J. and Kalman D.S. (2017). *Curcumin*: A Review of its Effects on Human Health, *Foods* 6, 92, o1 to 11. DOI: 10.3390/foods6100092.

Hidayati S., Merlin Franco F., Suhaimi A. (2022). Chapter 7. Folk Plant Names are Condensed Forms of Traditional Knowledge: Case Study with the Urang Kanekes of Banten, Indonesia. Franco F M., Knudsen, M., Hassan N H (Eds.) *Asia in Transition 19., Case Studies in Biocultural*

Diversity from Southeast Asia. Traditional Ecological Calenders, Folk Medicine and Folk Names. DOI: 10.1007/978-981-16-6719-0, Springer Publ., Singapore.

Jain S., Srivastava S., Nayak S., Sumbhate S. (2007). Recent Trends in *Curcuma longa* Linn. *Pharmacognosy Reviews* 1(1):119 – 126, http://www.phcogrev.com.

Kamat D.K. (2002). Studies on Medicinal Plants & Drugs in Dhanvantari Nighantu., *Chaukhamba Surbharati Prakashan,Varanasi, India.*

Khandekar M., Akter S., Imam M.Z. (2018). *Trichosanthes dioica* Roxb.: A Vegetable with Diverse Pharmacological Properties. *Food Science and Human Wellness* **7**, 34-48 DOI:10.1016/j.fshw.2017.12.005.

Khisamova A and Gizinger O. (2020). The Antitoxic and Protective Effects of *Curcuma longa* and its active agent *Curcumin*: Overview. *Terapevt, (General Physician)*, 66-72., DOI: 10.33920/MED-12-2006-09.

Khursheed A., Pathak D., Ansari S.H. (2010). Phytochemical and Pharmacological Investigations on *Adathoda zeylanica* Medic: A Review., *Pharmacognosy Journal* **2**(12), 513-519, DOI:10.1016/s0975-37575(10)80041-0.

Kumar S., Vasudeva N., Sharma S. (2012). GC-MS Analysis and Screening of Anti-diabetic, Antioxidant and Hyoplipidemic Potential of *Cinnamomum tamala* in Streptozotocin Induced Diabetes Mellitus in Rats., Cardiovascular Diabetology, **11**:95, 1 – 11.

Laha S. and Paul S. (2019). *Gymnema sylvestre* (Gurmar): A potent Herb with Anti-Diabetic and Antioxidant Potential. *Pharmacogenomics Journal*, **11**(2), 201-206.

Leucas D.S. (2017). Bhavprakasa Nighantu (Indian Materia Medica)., *Chaukhambha Visvabharati Publ., Varanasi, India.*

Luan F., Peng L., Lei Z., Jia X., Zou F., Yang Y., He X., Zeng N. (2021). Traditional Uses, Phytochemical Constituents and Pharmacological Properties of *Averrhoea carambola* L., A Review. *Frontiers in Pharmacology*, **12**, 699899, DOI: 10.3899/fphar.2021.699899.

Malik J.K., Manvi F.V., Alagawadi K.R., Noolvi M. (2008). Evaluation of anti-inflammatory activity of *Gymnema sylvestre* leaves extract in Rats. *International Journal of Green Pharmacy*, **2**(2), 114-115.

Mishra M.P., Rath S., Swain S.S., Ghosh G., Das D., Padhye R.N. (2017). *In Vitro* Antibacterial Activity of Crude Drug Extracts of nine selected medicinal plants against UTI causing MDR Bacteria., *Journal of King Saud University-Science* **29**, 84-95, DOI: 10.1016/j.jksus.2015.05.007.

Nandy S., Mukherjee A., Pandey D.K., Ray P., Dey A. (2020). Indian Sarsaparilla (*Hemisdesmus indicus*): Recent Progress in Research on Ethnobotany, Phytochemistry and Pharmacology., *Journal of Ethnopharmacology*, **23**; 254 DOI:10.1016/j.jep.2020.112609.

Phongpaichit S., Pujenjob N., Rukachaisirikul V., Ongsakul M. (2004). Antifungal Activity from leaf extracts of *Cassia alata* L, *Cassia fistula* L., and *Cassia tora* L., Songklanakarim *Journal of Science and Technology*, **26**(5),741-748.

Prosyannikova O.I. (2020). Old English plant names with component-wyrt and their modern names: structural and semantic aspect. *Liberal Arts in Russia*, **9**(4), 246-255.

Qureshi H., Asif S., Ahmed H., Al-Kahtami H.A., Hayat K. (2015). Chemical Composition and Medicinal Significance of *Fagonia cretica* : A Review. *Natural Product Research*, **30** (6), 625 – 639 DOI: 10.1080/14786419.2015.1036268.

Renukakumari K.P., Sultana S.S. (2011). Determination of Antibacterial, Antioxidant and Cytotoxic Effects of *Indigofera tinctoria* on Lung Cancer Line NCI-h69. *International Journal of Pharmacology,* **7**(3), 356-362.

Rios J.L., Recto M.C, Villar A. (1989). Screening Methods for Natural Products with Antimicrobial activity. A Review of Literature. *Journal of Ethnopharmacology,*

23,127-149.

Sabandar C.W., Ahmat N., Jaafar P.M., Sahidin I. (2013). Medicinal Property, Phytochemistry and Pharmacology of several *Jatropha* species (Euphorbiaceae): A Review. *Phytochemistry* **85,** 7-29 DOI: 10.1016/j.phytochem.2012.10.009.

Saraci A., Damo R. (2021). Semantic Reflections of Human /Animal Genitalia in Albanian Plant Names., *Analele Universitatii din Craiova, Seri Stiinte Filologice. Lingvistica, Anul.* **XLIII** (1-2), pp.425 – 445.

Satdive R.K., Abhilash P., Fulzele D.P. (2003). Antimicrobial activity of *Gymnema sylvestre* leaf extract. *Fitoterapia* **74**(7-8), 699-701. DOI: 10.1016/s0367-326x (03)00154-0.

Sensarma P. (1992). Plant Names Sanskrit and Latin. *Ancient Science of Life* **12**(1 -2), 201 – 220.

Singh T.P., Singh O.M., Singh H.B. (2011). *Adathoda vasica* Nees., Phytochemical and Pharmacological Profile, *The Natural Product Journal*, **1**, 29-39.

Thamizhselvam N., Soumya S., Sanjayakumar Y.R., Salinichandran K., Venugopalan T.N., Jaya N. (2012). Anti-inflammatory, Analgesic and Antipyretic activity of Methanolic Extract of *Cinnamomum tamala* (Nees.) in Experimental Animal Models, *International Journal of Bioassays*, **1**(9), 26-29., ISSN: 2278-778X.

Thomas V., Nair S.N.V., Ved D.K., Shankar D. (2020). Controversial Identities of Medicinal Plants in Classical Literature of Ayurveda. *Journal of Ayurveda and Integrative Medicine* **11**(4), 565-572 DOI: 10.1016/j.jaim.2019.09.003.

Tiwari V.J and Ittadwar A. (2023). Philological Study of Sanskrit Names of Medicinal Plants. *Research Journal of Pharmacognosy and Phytochemistry,* **15** (1), 91 -95 DOI:10.52711/0975-4385.2023.00014.

Turpin M. (2013). Semantic Extension in Kaytetye Flora and Fauna Terms. *Australian Journal of Linguistics*, **33** (4), 488-518.

Ullah, S., Khan M.N., Sajid M.S., Muhammad G. (2013). Comparative Anthelmintic Efficacy of *Curcuma longa*, Citrullus *colocynthis* and *Peganum harmala*. *Global Veterinaria* **11** (5), 560-567.

Upadhyay G., Khosla S., Kosuru R., Singh S. (2016). Anxiolytic, Anti-depressant and Anti-stress activities of the aqueous extract of *Cinnamomum tamala* Nees & Eberm. in Rats., *Indian Journal Pharmacology* **48**, 555. DOI: 10.4103/0253-7613.190752.

Vijayan R., Joseph S., Mathew B. (2016). *Indigofera tinctoria* Leaf Extract Mediated Green Synthesis of Silver and Gold Nanoparticles and Assessment of their Anticancer, Antimicrobial, Antioxidant and Catalytic properties., *Artificial Cells, Nanomedicine and Biotechnology* **46**, 4, 861 – 871, DOI:10 .1080/21691401.2017.1345930.

Wang J., Su B., Jiang H., Cui N., Yu Z., Yang Y., Sun Y. (2020). Traditional Uses, Phytochemistry and Pharmacological Activities of the Genus *Cinnamomum* (Lauraceae): A Review., *Fitoterapia*, **146**, 104675 DOI:10.1016/j. fitote.2020.104675.

Yadav D., Kwak M., Jin J.O. (2019). Clinical applications of *Gymnema sylvestre* against Type 2 Diabetes Mellitus and its Associated Abonormalites., *Progress in Nutrition* **21** (2), 258-269 DOI: 10.23751/pn.v21i2.7780.

Bulletin of Regional Natural History (BORNH) ISSN 2724-4393.

Bulletin of Regional Natural History
Formerly Bollettino della Società dei Naturalisti in Napoli

New data about breeding success of the Eurasian Eagle Owl, *Bubo bubo* in the Oasis "Gravina di Laterza" (Apulia, Italy)

Gaetano Luce[1], Elisabetta D'Amicis[1-2], Michele Natale[1], Manuél Marra[1]

DOI https://doi.org/10.6093/2724-4393/10958

***Correspondence:**
gaetano.luce1@gmail.com
https://orcid.org/0009-0009-4658-8376

Affiliation:
[1] Lipu - Lega Italiana Protezione Uccelli – Parma – Italy.
[2] Università degli Studi di Bari Aldo Moro, Dipartimento di Bioscienze, Biotecnologie e Ambiente (DBBA), Via Orabona 4, Bari.

Conflict of Interest: The author declares that he has no conflict of interest.
Financial Disclosure Statement: The author declares that no specific funding was received for this work

Submitted: 28 Feb. 2024
Revised: 10 Apr. 2024
Accepted: 20 Apr. 2024
Published: 31 May 2024

Associate Editor:
Giovanni Scillitani

Abstract

The Eurasian Eagle Owl, *Bubo bubo* is considered a globally declining species. Except for the Alps regions, the Eurasian Eagle Owl is irregularly distributed throughout Italy. Knowledge in Apulia and Basilicata is lacking, particularly in the Gravine Area, where sporadic sightings have been documented in recent decades. The aim of this work is to update information about the status of the Eurasian Eagle Owl in the area of the Lipu Oasis "Gravina di Laterza" and try to estimate the minimum number of reproductive pairs.
The study was developed over the years 2020 to 2023 by multiple methods, such as playback, camera trapping, and listening to spontaneous singing. Five monitoring stations were located in relation to various factors considered in the literature to be of primary importance for the owl. The first year a response was obtained from a male individual. In the same spot, in the following years, calls from a female and subsequently from two young individuals were recorded. A male individual was repeatedly filmed by camera trap. It is therefore believed that a stable reproductive pair of the species is present in the study area.

Keywords: *Bubo bubo*, Gravina di Laterza Oasis, nesting.

Riassunto

Il gufo reale, *Bubo bubo* è considerato una specie globalmente in declino. Fatta eccezione per le regioni alpine, il Gufo reale è irregolarmente distribuito in tutta Italia. Le conoscenze sulla distribuzione della specie in Apulia e Basilicata sono abbastanza lacunose, in particolare nell'Area delle Gravine, dove negli ultimi

decenni sono stati documentati solo sporadici avvistamenti. Lo scopo di questo lavoro è quello di aggiornare le informazioni relative allo status del Gufo reale nell'area dell'Oasi Lipu "Gravina di Laterza" cercando di stimare il numero minimo di coppie riproduttive. Questo studio è stato sviluppato nel corso degli anni dal 2020 al 2023, applicando una combinazione di più metodi tra cui l'emissione del playback, il fototrappolaggio e l'ascolto del canto spontaneo. Le 5 stazioni di monitoraggio sono state selezionate in relazione a diversi fattori considerati in letteratura di primaria importanza per la specie. Il primo anno è stata ottenuta una risposta da un individuo di sesso maschile. Nello stesso punto, negli anni successivi, sono stati ascoltati prima un individuo di sesso femminile e poi una coppia di giovani. Nel punto in cui era posizionata la fototrappola, invece, è stato ripreso più volte un individuo di sesso maschile. Si ritiene quindi che nell'area di studio sia presente una coppia riproduttiva stabile.

Parole chiave: *Bubo bubo*, Oasi Gravina di Laterza, nidificazione

Introduction

The Eurasian Eagle Owl, *Bubo bubo* is considered a globally declining species (IUCN, 2017). The species is considered No-SPEC according to Burfield et al. (2023), is included in Annex I of the Birds Directive, in Annex II of the Bern Convention and is present in the Red List of Italian Birds (Gustin et al., 2021).

The Eurasian Eagle Owl is a species irregularly distributed throughout Italy (Lardelli et al., 2022) except for Sicily, where it was recently declared extinct (Sarà et al., 1987) and Sardinia, where it has never been reported (Fasce, 1993).

In Apulia, knowledge about its status is incomplete: in particular, in the Terra delle Gravine Regional Natural Park, sporadic sightings have been documented in recent decades (Sigismondi, 1987, 2005; Scorrano, 2008), plus a nesting with the fledging of two young (Sigismondi et al., 1987) and the discovery of a deceased individual in the municipal area of Massafra (Chiatante, pers. com.). The latest research in 2019 confirmed its presence only in the area of "Gravina di Laterza" (Luce et al, 2021)

The aim of this work is to update the status of the Eurasian Eagle Owl in the area of the Lipu Oasis "Gravina di Laterza" by estimating the minimum number of reproductive pairs and describing the areas of greatest conservation value for the species.

Materials and methods

The study area is the Oasis "Gravina di Laterza", covering approximately 870 hectares, was established in 1999 thanks to a collaboration agreement between the Province of Taranto, the Municipality of Laterza and the Lipu (Italian League for Bird Protection). It is included in the SAC/SPA IT9130007 called "Area delle Gravine", 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 is also included in the Natural Regional Park "Terra delle Gravine", about 25000 ha wide, established by the Apulia Region by Regional Law 18/05 in December 2005 (modified with Regional Law 6/2011).

In the present study we used a combination of some methods like playback, collection of presence signals (feathers, bird pellets and remains of prey), camera trapping and listening to spontaneous song, to confirm the presence of the eagle owl in the site and to

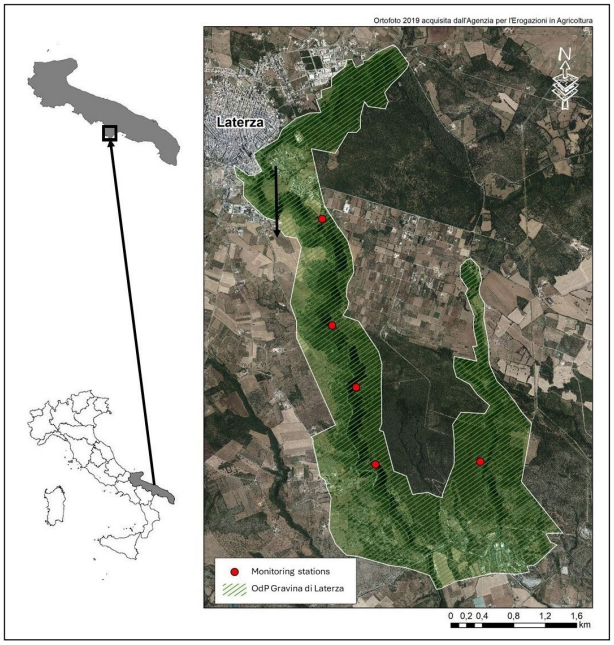


Figure 1. Study area with the five monitoring stations

assess nesting and reproductive success.
The research activity was carried out during the period 2020-2023, for a total of 56 field trips. Each sampling year was further divided into two sessions: winter (from November to January) and summer (from April to July) (Tab. 1).

Table 1. Field trips of research activity during the period 2020-2023

Year	Invernal session	Spring session	Total
2020	From 16/11/19 to 29/01/20	From 20/05/20 to 16/07/20	9
2021	From 19/11/20 to 20/01/21	From 12/04/21 to 21/07/21	17
2022	From 28/12/21 to 27/02/22	From 03/04/22 to 02/07/22	14
2023	From 23/12/22 to 16/01/23	From 27/04/23 to 15/07/23	16

The following methods were used throughout the monitoring period, except for camera trapping, used only in 2022:

- The playback method; is used to certify the presence in a territory of some species that are particularly difficult to observe and register and consists of imitating the song of the male individual with a recorded call or by voice to induce him to emit a response (Bergerhausen & Willelms, 1988; Pedrini, 1989). The aim of the stimulation is to obtain a response from at least one individual, who defends his territory through sound communication and reacts aggressively to the invasion of the territory by the presumed intruder, simulated by the emission of the recorded call (Bibby et al., 1992) and, possibly, try to identify the daytime resting site or the nesting site through triangulation (Bux, 2008).
- Bird pellets; they are discards containing undigested food remains. It is possible to find pellets near the perches assiduously frequented by a species.
- Camera trap technique; it allows to photograph wildlife through an instrument (camera trap) operated by infrared sensors and does not require permanent presence of an operator. This method, used for the first time in 1890 and then refined over the years, is due to the naturalist photographer George Shiraz, who developed a technique which, through the use of a long cable, allowed the animals themselves to take a self-portrait, simultaneously triggering a flash (Kucera & Barrett, 2011);
- Listening to spontaneous songs; it involves exclusively listening to the vocalizations that the Eurasian Eagle Owl emits from its perch, and is useful for counting territorial males in the period from November to March (Mikkola, 1983; Cramp, 1985; Pedrini, 1989), applying the listening stations method (Bibby et al., 1992) and in the March – April period when the contact of individuals occurs through listening to the songs that precede mating (Penteriani, 2003; Muscianese, 2006);

Using open-source software such as Qgis and Google Earth, emission and listening points were selected using information about the ecology of the eagle owl and previous data on the presence of the species. Thus, five sampling stations were chosen close to the edge of the ravine, thus exploiting its particular geomorphology for better sound diffusion of the playback (Fig.1).
Sessions and number of surveys carried out from 2020 to 2023.
The territorial vocalization of the male individual used in this study was obtained from the xeno-canto website, dedicated to recording and sharing the calls and sounds of different bird species from all over of the world.
At the selected emission points, sessions were carried out with the playback method, while spontaneous listening sessions were carried out exclusively in the points where at least one response was obtained during playback and the presence of the species was recorded previously (Luce et al., 2021).

Figure 2. Feather of Eurasian Eagle Owl found in one of the sampling stations.

Results

Stimulation with the playback method allowed to hear the territorial response of a male individual only in one of the monitoring stations. The individual was contacted in the 2020 winter session (December 19, 2020). At this station, therefore, only spontaneous listening sessions were carried out not to disturb the species.
During these sessions the male's territorial emission was heard several times (12 April 2021, 28 December 2021, 19 January 2022).
During the surveys, a perch usually frequented by the species was identified, confirmed by the presence of numerous wads and feathers (Figs. 2,3). The camera trap placed on 19 January 2022 therefore confirmed the assiduous attendance of the roost by a male individual (Fig.4). In the spring session of 2022 (April 12, 2022), the spontaneous singing of a female individual was heard for the first time, and subsequently both sexes were heard interacting with each other (June 4, 2022). In July several targeted spontaneous listening sessions were carried out to assess a possible nesting. During these sessions, both the male and female individuals were heard again, but no vocalizations were attributable to young individuals.
In the spring session of 2023 (18 April 2023), the male and then the female individual were heard again. In this monitoring year, several listening sessions of spontaneous singing were carried out to verify effective reproduction. In July (July 6, 2023), two juvenile vocalizations were heard for the first time, attributed to at least two individuals. A second session was also carried out (15 July 2023) aimed at confirming reproduction, during which the presence of at least two young individuals was therefore confirmed.

Figure 3. Pellet of Eurasian Eagle Owl found in one of the sampling stations.

Discussion

The "Gravina di Laterza" is confirmed as an important site of presence of the eagle owl, as previously reported (Sigismondi, 1987, 2005; Scorrano, 2008; Luce et al., 2021). For the first time, this paper confirms a breeding pair. However, it is appropriate to remember that the low densities that characterize some populations led us to avoid territorial manifestations such as singing ones. A similar condition would also be confirmed by the studies of Penteriani & Pinchera (1989). It is probable that in a densely populated area such as that of this study, the species chooses the less anthropized and more difficult to reach areas. For this reason, it is necessary to enforce and expand conservation measures, in order to preserve this and other species present in the area (Penteriani & Pinchera, 1989).

The "Gravina di Laterza", in fact, is one of the best-preserved sites in the arc of the Ionian ravines, thanks also to the Lipu Oasis, instituted about twenty years ago, which contributes to the conservation of biodiversity. Infact, Among the species of conservation interest there are the Black Stork, *Ciconia nigra*, the Lanner, *Falco biarmicus*, the Lesser Kestrel, *Falco naumanni*, the Short-toed snake eagle, *Circaetus gallicus,* the Black Kite, *Milvus migrans* (Bellini et al., 2008), the Leopard Snake, *Zamenis situla*, the Apennine yellow-bellied toad, *Bombina variegata pachypus,* and the Otter, *Lutra lutra* (Marra et al., 2023).

Studies on top predators are essential in managing and conservation strategies for species and habitats (Newton, 1979). From a methodological point of view, the method presents a simple applicability, despite some limitations represented by some logistical and accessibility aspects of the sites. The particular geomorphology of the geological form known as "Gravina" plays an important role in the sound diffusion of the playback, in fact, based on the context of each individual station it is necessary to adapt the monitoring method to the specific characteristics of each one, such as the positioning of the acoustic emitter in a specific point located high up or at the edges of the ravines to attenuate the echo. An important limiting factor is wind which could alter the operators' ability to listen

Figure 4. Male Eurasian Eagle Owl photo-trapped near the Gravina di Laterza.

or simply alter the transmission of sound.
In the near future, it is hoped that studies like this will continue in order to further investigate the distribution and trend of the Eurasian Eagle owl in in the Ionian ravines in its entirety 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

Conceptualization: G.L., M.M.
Field research: G.L., M.M., E.D.A., M.N.
Writing of the original draft, review and editing: G.L., M.M.
Project administration: M.M.

References

Bellini F., Cillo N., Giacoia V., Gustin M., (eds) (2008). L'avifauna di interesse comunitario delle gravine ioniche. Oasi LIPU Gravina di Laterza, Laterza (TA).

Bergerhausen W., Willems H. (1988). Methodik und Effizienz der Bestandskontrolle einer Population des Uhus (*Bubo bubo L.*). *Charadrius*, **24,** 171-187.

Bibby C. S., Burgess, N. D., Hill D. A. (1992). *Bird census techniques*. Academic Press, London, UK, pp. 257.

BirdLife International (2017). European birds of conservation concern: populations, trends and national responsibilities. Cambridge, UK: BirdLife International.

Brichetti P., Fracasso G. (2006). Ornitologia Italiana. 3 Stercorariidae-Caprimulgidae. Alberto Perdisa Editore, Bologna.

Burfield I.J., Rutherford C.A., Fernando E., Grice H., Piggott A., Martin R.W., Balman M., Evans M.I., Staneva A. (2023). Birds in Europe 4: the fourth assessment of Species of European Conservation Concern. *Bird Conservation International*, **33**, e66, 1–11.

Bux M. (2008). Rapaci notturni, pp 64-68. In: *L'avifauna di interesse comunitario delle gravine ioniche*. Bellini F., Cillo N., Giacoia V. & Gustin M., (eds). Oasi LIPU Gravina di Laterza, Laterza (Taranto).

Cramp S. (1985). *Handbooks of the birds of Europe, The Middle East and North Africa*. Vol.4, Oxford Univ. Press, Oxford, 960 pp.

Fasce P. (1993). Gufo reale. In: Atlante degli Uccelli nidificanti in Italia. Meschin E., Frugis S. (eds.). *Supplemento Ricerche Biologia della Selvaggina*, XX, 1-344.

Google Earth. (2024). Available at: https://www.google.com/intl/it/earth/about/

Gustin M., Nardelli R., Brichetti P., Battistoni A., Rondinini C., Teofili, C. (compilatori) (2021). *Lista Rossa IUCN degli uccelli nidificanti in Italia 2021*. Comitato Italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Roma.

IUCN (2017). The IUCN Red List of Threatened Species. Version 2017-1. Available at: www.iucnredlist.org.

Kucera T.E., Barrett R.H. (2011). A History of camera trapping, pp. 9-19. In: *Camera Traps in Animal Ecology: Metods and Analyses*. O'Connell A.E., Nichols J.D., Karanth U.K (eds). Tokyo, Springer Inc.

Lardelli R., Bogliano G., Brichetti P., Caprio E., Celada C., Conca G., Fraticelli F., Gustin M., Janni O., Pedrini P. et al. (a cura di). (2022). Atlante degli uccelli nidificanti in Italia. Edizioni Belvedere (Latina), *historia naturae*, (11), 704 p.

LIPU & WWF (a cura di Calvario L., Gustin M., Sarrocco S., Gallo-Orsi U., Bulgarini F., Fraticelli F.) (1999). Nuova lista rossa degli uccelli nidificanti in Italia - The new Red List for Italian birds. *Rivista italiana di ornitologia,* **69,** 3-43.

Luce G., Marra M., Pinto R., Gaudiano L. (2021). Indagine preliminare sulla presenza del Gufo reale *Bubo bubo* nel Parco Naturale Regionale Terra delle Gravine e nel Parco Regionale della Murgia Materana. *Alula*, **28** (47-54).

Marra M., Magaletti N., Giacoia V., Luce G. (2023). 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". *Bulletin of Regional Natural History,* **Vol.3**, **no.2**, 1-6.

Mikkola H. (1983). *Owls of Europe*. T & AD Poyser Ltd, Calton, 397 pp.

Newton I. (1979). *Population Ecology of Raptors*. T. and A. D. Poyser, Berkhamsted, England. 399 pp.

Pedrini P. (1989). Indicazione per la localizzazione al canto di territori di Gufo reale. Atti II Seminario italiano Censimenti Faunistici dei Vertebrati. *Supplemento Ricerche Biologia della Selvaggina*, **16**, 379-384.

Penteriani V., Pinchera F. (1989). Il metodo del playback e dell'ascolto sistematico nel censimento di una popolazione di Gufo reale, *Bubo bubo*. Atti 2 Seminario italiano Censimenti faunistici dei Vertebrati. *Supplemento Ricerche Biologia della Selvaggina*, **16**, 385-388.

Penteriani V. (2003). Breeding density affects the honesty of bird vocal display sas possible indicators of male/territori qualità. *Ibis,* **145,** E127-E135.

QGIS.org. (2024). QGIS Geographic Information System. Open Source Geospatial Foundation Project. Available at: http://www.qgis.org

Rondinini C., Battistoni A., Peronace V., Teofili C. (compilatori) (2013). *Lista Rossa IUCN dei Vertebrati Italiani*. Comitato Italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Roma.

Sarà M., Siracusa M., Ciaccio A. (1987). Estinzione del Gufo reale, *Bubo bubo*, in Sicilia. *Rivista italiana di ornitologia*, **57**, 50-56.

Scorrano S. (2008). Gufo reale, pp 69-73. In: Bellini F., Cillo N., Giacoia V., Gustin M. (eds.). *L'avifauna di interesse comunitario delle gravine ioniche*. Oasi LIPU Gravina di Laterza, Laterza (Taranto).

Sigismondi A. (1987). Il Gufo reale signore della notte. *Umanesimo della pietra verde*, **2**, 37-42.

Sigismondi A., Caldarella M., Cillo N., Laterza M., Marrese M., Scorrano S. (2005). Contributo alla conoscenza dello status del Gufo reale *Bubo bubo* in Apulia e Basilicata. *Avocetta*, **29**, 123.

Bulletin of Regional Natural History (BORNH) ISSN 2724-4393.

Bulletin of Regional Natural History
Formerly Bollettino della Società dei Naturalisti in Napoli

The Ornithic Community of the "Taburno-Camposauro" Regional Park (Benevento – South Italy) according to taxonomic categories, phenology, and environmental types

Elio Esse[1], Danila Mastronardi[1] and Sabrina Maria Marsala[2]

DOI https://doi.org/10.6093/2724-4393/11065

***Correspondence:**
elioesse58@gmail.com

Affiliation:
[1] Associazione Studi Ornitologici Italia Meridionale A.S.O.I.M. ODV.
[2] AnEcoEvo Laboratory Animal Ecology and Evolution, Dip. Agraria – Università degli Studi di Napoli Federico II – Italy.

Conflict of Interest: The author declares that he has no conflict of interest.
Financial Disclosure Statement: The Authors declare that received funding for this work as part of the project financed by Fondazione con il Sud "Sve(g)liamo la dormiente"

Submitted: 28 Feb. 2024
Revised: 22 May 2024
Accepted: 03 Jun. 2024
Published: 02 Jul. 2024

Associate Editor:
Maurizio Fraissinet

Abstract

The avifauna of the Taburno-Camposauro Regional Park (RP in Province of Benevento - South Italy) was investigated from February 2019 to January 2022, as part of the project financed by Fondazione con il Sud "Sve(g)liamo la dormiente." The bird community was monitored with the VCP (Variable Circular Plot) method, which allowed the identification of 23 observation points in all the representative environmental typologies of the Park. Observations were carried out once per phenological season over the 3-year study. At the end each point has been visited 12 times (264 total monitoring sessions). The VCP were grouped according to the prevailing environmental typology, identified by the coding provided by "Carta della Natura": mesophilous forest, chestnut grove, beech grove, extensive crops, olive grove, dry grassland, coniferous forests. At the end of the study, 85 species were observed, 8 of which are included in Annex I of the Dir. 2009/147/EC (*Pernis apivorus, Circaetus gallicus, Aquila chrysaetos*, *Milvus migrans, Falco peregrinus, Lanius collurio, Lullula arborea, Anthus campestris).*
The taxonomic distribution of the species shows that *Passeriformes* represent 70% of the community, followed by *Accipitriformes* (7%), *Strigiformes*, *Piciformes,* and *Columbiformes* (5%). As regards the phenological categories, 70% are residents, 19% are nesting migrants, 6% are migrants and 5% are wintering, Species richness has been compared with the environmental typologies and appears to be at its maximum in extensive crops, at its minimum in coniferous reforestation and beech forests. Chaffinch and blackcap were the most frequent species in 4 environmental typologies.

Key-words: forest avifauna, open environments, bird community, PR Taburno-Camposauro, campanian Appennines.

Riassunto

L'avifauna del PR Taburno-Camposauro è stata studiata dal mese di febbraio 2019 a gennaio 2022 nell'ambito del progetto finanziato da Fondazione con il Sud "Sve(g)liamo la dormiente". La comunità ornitica è stata monitorata col metodo dei punti di ascolto a raggio variabile (VCP) individuando 23 punti ricadenti nelle tipologie ambientali rappresentative del Parco. Questi sono stati effettuati una volta per ogni stagione fenologica nei 3 anni di studio per cui ogni punto è stato visitato 12 volte per 264 uscite complessive. I punti di ascolto sono stati raggruppati per tipologia ambientale prevalente in base alla codificazione della Carta della Natura: bosco mesofilo, castagneto, faggeta, colture estensive, oliveto, prateria arida, conifere. Al termine dello studio sono state rilevate 85 specie di cui 8 inserite nell'All.I della Dir. Uccelli (*Pernis apivorus, Circaetus gallicus, Aquila chrysaetos*, *Milvus migrans, Falco peregrinus, Lanius collurio, Lullula arborea, Anthus campestris)*.

La ripartizione da un punto di vista tassonomico mostra che i Passeriformi rappresentano il 70% della comunità, seguiti da Accipitriformi con il 7%, dagli Strigiformi, i Piciformi e i Columbiformi con il 5%. Per quanto riguarda le categorie fenologiche, il 70% sono residenti, il 19% migratrici nidificanti, il 6% migratrici e il 5% svernanti. La ricchezza di specie è stata confrontata con le tipologie ambientali e risulta essere massima nelle colture estensive, minima nelle riforestazioni a conifere e nella faggeta. Fringuello e capinera risultano essere le specie più frequenti in 4 tipologie ambientali.

Parole chiave: avifauna forestale, ambienti aperti, comunità ornitica, PR Taburno-Camposauro, Appennino campano.

Introduction

Forest ecosystems host almost half of the European animal and plant species. In addition to that 39 of the 132 EU habitats in Italy recognized by the Council Directive 92/43/EEC are forest, and 12 of whom are priority interest (Barbera et.al., 2022). Forest formations are associated with other environmental types, such as upland plateaus managed with grasslands or meadows/grazing, and traditional agricultural systems that contribute to the increase of local biodiversity. The avifauna of forest environments currently enjoys a good conservation status nationwide, with generally positive population trends (Londi *et al*., 2019); on the contrary open environments avifauna shows a consistent decrease, as evidenced by the Farmland Bird Index in whose latest update shows that there are 15 threatened or with unfavorable conservation status species out of the total 41 species that make up the FBI_{pm} index (Farmland Bird Index for mountain grasslands) (National Rural Network & LIPU, 2023). Our work aims to fill a knowledge gap on the avifauna of the Taburno-Camposauro Regional Park by analyzing the bird communities in its forests and mountain grasslands.

Study area

The Taburno-Camposauro Regional Park covers about 13,000 hectares in the province of Benevento (Campania – South of Italy). The Park was designated, and its boundaries defined by Regional Law No. 33 on September 1, 1993. The Park Authority was established by Regional Council Resolution No. 1404 on April 12, 2002, and by Decree of the President of the Regional Council of Campania No. 779 on November 6, 2002. It protects the carbonate massif of Mount Taburno 1394 m high (to the south), Mount Camposauro 1388 m high and Mount Pentima 1170 m high (to the north)

and the forests, especially beech forests, that grow there. The Park overlaps with two sites of commmity importance (ZSC), "IT802007 Camposauro" and "IT802008 Taburno". At the base of the massif, particularly along the east, west, and south-facing slopes, there are stands of downy oak (*Quercus pubescens*). These stands indicate a broader historical distribution of this species before human intervention significantly thinned the forest, replacing it with cultivated land, particularly orchards and olive groves. Notably, some large trees remain among the fields. Along the detrital zone of the slopes, up to elevations of 750-800 m, the vegetation is less xerophytic than that of the downy oak forests. This area features coppice woods composed of manna ash (*Fraxinus ornus*), hop hornbeam (*Ostrya carpinifolia*), downy oak, hazel (*Corylus avellana*), and various maples (*Acer campestre*, *A. monspessulanum*, *A. neapolitanum*). Around 600 m, turkey oak (*Quercus cerris*) also appears, representing remnants of woods previously cut by humans, with a few old trees. Chestnut (*Castanea sativa*) is quite widespread, especially on the east and north slopes of Taburno and Camposauro. On the northern slope of Monte Pentime, an interesting forest formation can be found, predominantly consisting of chestnut, maples, hazel, manna ash, and hawthorn (*Crataegus monogyna)*. Furthermore, the Regional Park includes in its southern part, one of the largest state-owned forests in the Campania region, called the Taburno Forest which covers about 614 ha.

This area is characterized by an association of european beech (*Fagus sylvatica*) and silver fir (*Abies alba*), the latter introduced during the Bourbon era in 1838. The fir plantation currently covers about 18 hectares, with trees ranging from 50 to 70 years old, and some specimens exceeding 100 years. At elevations generally above 1000 m, there are grasslands of karstic or tectonic origin. These are mainly thermoxerophilous pastures belonging to the *Xerobromion* associations.

The limestone mountainous complex is isolated from the Apennine that runs through Campania region. The two main blocks, Taburno and Camposauro, are separated by the tectonic basin of Piana di Prata, following the classic Horst-Graben geological system. The same extensional phenomenon has separated Camposauro from Monte Pentime, where evident fault mirrors can be observed. The limestones of these three main blocks date back to the period between the Triassic (200 million years ago) and the Upper Jurassic (140 million years ago). The presence of blue clays and fossil sands suggests that the area was once a shallow sea with varying depths, from a few to several tens of meters. In the bottoms of the karst-tectonic basins, pyroclastic material covers extensive stretches of limestone rock and contributes to soil formation, resulting in mixed terrains due to its degradability.

Karst phenomena are frequent, with the presence of dolines and karst fields such as those of Campo di Cepino, Campo Trellica, and Campo di Camposauro. Caves like San Mauro (569 m above sea level), Madonna del Taburno (550 m above sea level), and San Simeone (525 m above sea level) are also present, all located on the southern slope of Taburno.

The calcareous nature of the mountainous reliefs results in high drainage of meteoric waters, which are channeled underground and re-emerge at the base. This is the case with the famous Fizzo Springs and the numerous abundant springs at the base of Camposauro that feed the Calore River and Lake Telese. The mountainous massif lacks surface hydrography, but numerous watercourses flow around it, all part of the hydrography of the Volturno River Basin. Among these, the main ones are: the Jenga and Jerino rivers to the east, the Isclero to the west (originating from the Partenio chain), and the Calore Beneventano River, which is one of the main tributaries of the Volturno to the north.

Materials and methods

Avifauna monitoring of the Taburno-Camposauro Regional Park began in February 2019. The 15- minute variable circular plot (VCP Reynolds et al., 1980) was chosen as the field methodology. All individuals detected by listening or sighting were noted. Also, all individuals were distinguished into contacts made within and over a distance of 100 m from the observer. In the following GIS analyses, a total of 23 VCP were identified. They fall within all environmental types surveyed in the Regional Park and they are evenly distributed throughout the territory. Each of these points was visited four times a year (once per season) over the three years. The VCP were grouped according to the prevailing environment present in each of them, listed hereafter: (MW) mixed woodland, (CW) chestnut woodland, (B) beech forest, (EC) extensive crops, (O) olive grove, (DG) dry grassland, coniferous reforestation. In accordance with the IOC WORLD BIRD LIST, this paper provides the list of the identified species along with their conservation status the SPEC category (Burfield et al., 2023), based on the presence of the species in Annex I of the Dir. 2009/147/EC , their inclusion in the National Red List (Gustin et al, 2019), their taxonomic orders and their phenological categories. The Passerines/Non Passerine (P/NP), species richness (S) and abundance of individuals (A) were calculated for each VCP. Mean indices values were merged by season and environment typology. In the VCPs, detection frequencies of each species were calculated by limiting the analysis to resident species, by counting the number of detections with a given species in that VCP against the number of repetitions at that point. The points were merged by environment and the two most frequently contacted species for each environmental type were then reported. In case of ex aequo, all species with equal frequency were reported. The Ornithological Value Index of breeding species was calculated using the following algorithm OVI= Stot [Σ (SSPEC1 × 1,00) + (SSPEC2 × 0,75) + (SSPEC3 × 0,50) + (SNONSPECE × 0,25) +(SCR × 1,0) + (SEN × 0,80) + (SVU × 0,60) + (SNT × 0,40) + (SLC × 0,20) + (S147 x 1,0)]× 100-1.

Results

Tab. 1 shows the check-list of detected birds. It can be noticed that 85 species were detected during our survey, and 8 of them are included in Annex I of the Dir. 2009/147/EC;, 3 of them are SPEC1, 3 of them are SPEC2, 12 of them are SPEC3, and 23 are included in the National Red List, 22 of them in the Least concern (LC) category and 1 of them in the Vulnerable (VU) category. The OVI index, calculated for breeding species only, was 24.32 a low-average value compared to that of the Castel Volturno State Natural Reserve of 2.47 (Mastronardi et al., 2020), the Matese Regional Park of 68.06 (Fraissinet et al., 2009) and the province of Naples of 45.88 (Fraissinet & Mastronardi, 2010). Fig. 1 shows that Passeriformes is the most represented order with 70% of detections, followed by *Accipitriformes* and immediately after by *Strigiformes*, *Piciformes,* and *Columbiformes*. The Non-Passerine/Passerine (NP/P) index is 0.44. Also, Fig. 2 highlights that the highest percentage of species are breeding residents, followed by breeding migrants. The two categories bring the percentage of nesting species in the Park to 89% of the total of detected species. The percentage of wintering and non-breeding migratory species is very low, 5% and 6% respectively. The analysis summarized in Fig. 3 shows that extensive crops have the highest values of species richness, followed by the olive grove. In all other environments, species richness shows similar values, with its minimum in beech forests. Abundance follows a similar trend with its highest value in extensive crops, followed by the olive grove, and a minimum

in coniferous reforestations. Referring to the trends of the two indices in the seasons, Fig.4 shows slight differences between the seasons. However, the season with the highest species richness is spring, followed by summer. Winter shows the lowest values. The abundance of individuals is higher in summer and spring, and again winter shows the lowest values. Tab. 2 highlights that eurasian chaffinch and eurasian blackcap are the most frequent species in four environmental types, the blackbird instead is more frequent only in two environmental types. All other species are found to be the most frequent in only one environmental type.

Tab.1: Checklist of detected species, their conservation status (presence in Annex I of the Dir. 2009/147/EC, SPEC category and national Red List listing) and phenology.

Common name	Species name	Annex I	SPEC category	National Red List	Phenology
Quail	*Coturnix coturnix*		SPEC3	LC	M,B
Common swift	*Apus apus*		SPEC3	LC	M
Cuckoo	*Cuculus canorus*			LC	M,B
Columbus var. domestica	*Columba livia* var. *domestica*			LC	SB
Wood pidgeon	*Columba palumbus*		NON SPEC^{E}	LC	SB
Eurasian collared dove	*Streptopelia decaocto*			LC	SB
Wild turtledove	*Streptopelia turtur*		SPEC1	VU	M,B
Woodcock	*Scolopax rusticola*			LC	W, M
Honey buzzard	*Pernis apivorus*	x		LC	M,B
Short-toed snake eagle	*Circaetus gallicus*	x		LC	M,B
Golden eagle	*Aquila chrysaetos*	x		LC	Mreg
Eurasian sparrowhawk	*Accipiter nisus*			LC	SB, M,W
Black kite	*Milvus migrans*	x		LC	M
Buzzard	*Buteo buteo*		NON SPEC^{E}	LC	M,W,SB
Barn owl	*Tyto alba*			LC	SB
Little owl	*Athene noctua*		SPEC3	LC	SB
Scops owl	*Otus scops*		NON SPEC^{E}	LC	M,B
Tawny owl	*Strix aluco*		NON SPEC^{E}	LC	SB
Eurasian hoopooe	*Upupa epops*			LC	M,B
European bee-eater	*Merops apiaster*			LC	M
Eurasian wryneck	*Jynx torquilla*			LC	M,B
Lesser spotted woodpecker	*Dryobates minor*			LC	SB
Great spotted woodpecker	*Dendrocopos major*			LC	SB
European green woodpecker	*Picus viridis*			LC	SB
Common kestrel	*Falco tinnunculus*		SPEC3	LC	SB
Peregrine falcon	*Falco peregrinus*	x		LC	SB
Woodchat shrike	*Lanius senator*		SPEC1	LC	Mirr

Red-backed shrike	*Lanius collurio*	x	NON SPEC[E]	LC	M,B
Golden oriole	*Oriolus oriolus*			LC	M,B
Eurasian jay	*Garrulus glandarius*			LC	SB
Eurasian magpie	*Pica pica*			LC	SB
Western jackdaw	*Coloeus monedula*		NON SPEC[E]	LC	SB
Hooded crow	*Corvus cornix*			LC	SB
Common raven	*Corvus corax*			LC	SB
Marsh tit	*Poecile palustris*		NON SPEC[E]	LC	SB
Coal tit	*Periparus ater*			LC	SB
Great tit	*Parus major*			LC	SB
Blue tit	*Cyanistes caeruleus*		NON SPEC[E]	LC	SB
Wood lark	*Lullula arborea*	x	NON SPEC[E]	LC	SB,M,W
Crested lark	*Galerida cristata*		SPEC3	LC	SB?
Barn swallow	*Hirundo rustica*		SPEC3	LC	M,B
Western house martin	*Delichon urbicum*		SPEC2	LC	M,B
Long-tailed tit	*Aegithalos caudatus*			LC	SB
Chiffchaff	*Phylloscopus collybita*		NON SPEC[E]	LC	SB,W,M
Wood warbler	*Phylloscopus sibilatrix*			LC	M,B
Melodious warbler	*Hippolais polyglotta*		NON SPEC[E]	LC	M
Zitting cisticola	*Cisticola juncidis*		NON SPEC[E]	LC	SB
Eurasian blackcap	*Sylvia atricapilla*			LC	SB,M,W
Lesser whitethroat	*Curruca curruca*			LC	M
Sardiniand warbler	*Curruca melanocephala*			LC	SB
Eastern subalpine warbler	*Curruca cantillans*		NON SPEC[E]	LC	M,B
Greater whitethroat	*Curruca communis*		NON SPEC[E]	LC	M,B
Firecrest	*Regulus ignicapilla*		NON SPEC[E]	LC	SB, M,W
Eurasian wren	*Troglodytes troglodytes*			LC	SB
Wood nuthatch	*Sitta europaea*			LC	SB
Short-toed treecreeper	*Certhia brachydactyla*		NON SPEC[E]	LC	SB
Common starling	*Sturnus vulgaris*			LC	SB,M,W
Blackbird	*Turdus merula*		NON SPEC[E]	LC	SB,M,W
Mistle thrush	*Turdus viscivorus*		NON SPEC[E]	LC	SB,M,W
Song thrush	*Turdus philomelos*		NON SPEC[E]	LC	M,W,B
Spotted flycatcher	*Muscicapa striata*		NON SPEC[E]	LC	M
Robin	*Erithacus rubecula*		NON SPEC[E]	LC	W,M,B
Nightingale	*Luscinia megarhynchos*		NON SPEC[E]	LC	M,B

Common redstart	*Phoenicurus phoenicurus*		NON SPEC[E]	LC	W,B,M
Black redstarrt	*Phoenicurus ochruros*			LC	W,B,M
Blue rock thrush	*Monticola solitarius*			LC	SB,M,W
Stonechat	*Saxicola rubicola*			LC	M,W,SB
Italian sparrow	*Passer italiae*		SPEC1	VU	SB
Eurasian tree sparrow	*Passer montanus*		SPEC3	LC	SB
Dunnock	*Prunella modularis*		SPEC2	LC	W,M
Western yellow wagstail	*Motacilla flava*			LC	M,B?
White wagtail	*Motacilla alba*			LC	SB,M,W
Grey wagtail	*Motacilla cinerea*		SPEC3	LC	SB,M,W
Tawny pipit	*Anthus campestris*	x	SPEC3	LC	M,B
Meadow pipit	*Anthus pratensis*		SPEC2	LC	M,W
Tree pipit	*Anthus trivialis*		SPEC3	LC	M,B
Water pipit	*Anthus spinoletta*			LC	M,W
Chaffinch	*Fringilla coelebs*		NON SPEC[E]	LC	SB, M,W
Greenfinch	*Chloris chloris*		NON SPEC[E]	LC	SB,M,W
Common linet	*Linaria cannabina*		NON SPEC[E]	LC	SB
Goldfinch	*Carduelis carduelis*		NON SPEC[E]	LC	SB
Serin	*Serinus serinus*		NON SPEC[E]	LC	SB,M,W
Eurasian siskin	*Spinus spinus*		NON SPEC[E]	LC	W, M
Corn bunting	*Emberiza calandra*		NON SPEC[E]	LC	SB,M,W
Black bunting	*Emberiza cirlus*		NON SPEC[E]	LC	SB,M,W

Tab.2: Detection frequency of resident species. For each environment type are here summarized the first two most frequent species. In case of ex aequo, all species with the same frequency are reported. B=beech forest; EC=extensive crops; CW=chestnut woodland; O=olive grove; MW=mixed woodland; DG= dry grassland; C= coniferous reforestation.

	B	EC	CW	MW	O	DG	C
Wood nuthatch	X						
Chaffinch	X		X	X			X
Eurasian blackcap		X		X	X		X
European greenfinch		X					
Hooded crow		X					
Blackbird			X	X			
Great tit						X	
Robin				X			
Chiffchaff				X			
Italian tree sparrow					X		
Eurasian jay						X	
Eurasian blue tit			X				

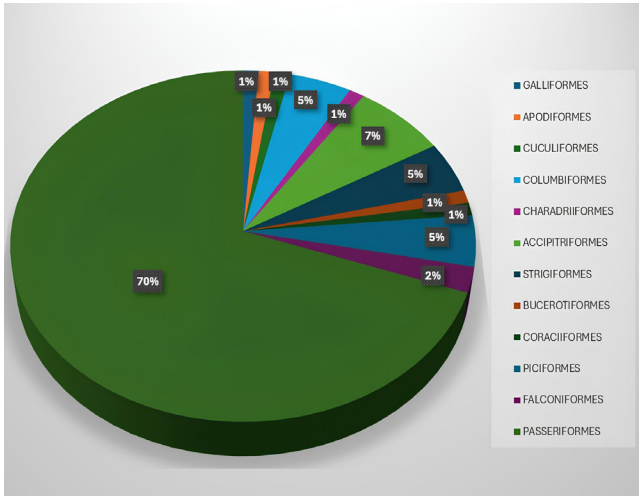


Fig.1: Distribution of the detected species in taxonomic orders

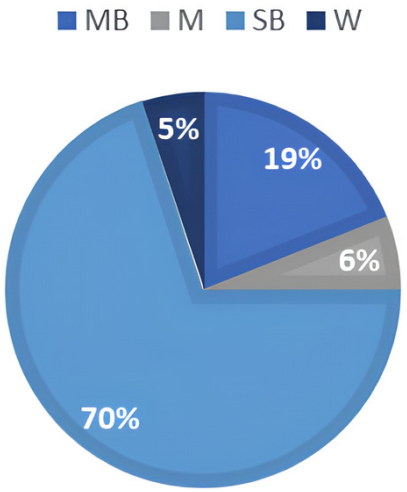


Fig. 2: Percentage distribution of the phenological categories of the detected species (MB = Migratory breeding; B = Breeding; SB = Resident Breeding; W = Wintering)

Discussion

The Taburno-Camposauro Regional Park has a rich and diverse ornithic community, making it a significant area for wildlife conservation in the Campania Region and beyond, not just for birds. The 85 species recorded rely on such stopover areas for the natural and proper progression of their biological cycles. The NP/P ratio is consistent with values observed in inland areas lacking significant wetland zones, which typically host a high number of species from other orders, thereby increasing the index value. The frequency of species detection in the various environments shows how important is the presence of different environmental types in the Regional Park, that support a diverse ornithic community and thus high biodiversity. In particular, attention should be paid to extensive crops and upland pastures that, despite they have shown the highest species richness and abundance of individuals, these environments host species with negative trends at the European level. The distribution according to phenological categories shows a peak in species richness and abundance during the spring and summer months, which is expected in a high-altitude territory. Therefore, maximum conservation attention should be given during this period, as the risk of disturbing breeding fauna is also highest. Open environments still show good species diversity, particularly the plains used for extensive cultivation, such as the tectonic Prata basin. This open area is influenced by the surrounding slopes covered with mesophilic mixed forests, Turkey oak woods, and chestnut groves, which increase species richness with typical woodland species. The plain's surface is characterized by a mosaic of pasture meadows and small gardens scattered with individual trees or groves, mainly large willows (*Salix sp.*) and various conifers (*Pinus sp.*, *Abies sp.*). Landscape elements such as fences and hedges, as well as several buildings in various states of preservation, are abundant. Sheep and goat farming is widespread. All these factors contribute to the high number of bird species, including some of high conservation value. The lowest species richness was recorded in conifer reforestations, consistent with other studies conducted in Italy and abroad (Disney & Stokes, 1976; Pielou, 1966), followed by beech forests. There is a lack of selective species for forest environments, where a rather poor and trivialized avifauna was found. The medium-low OVI is an important

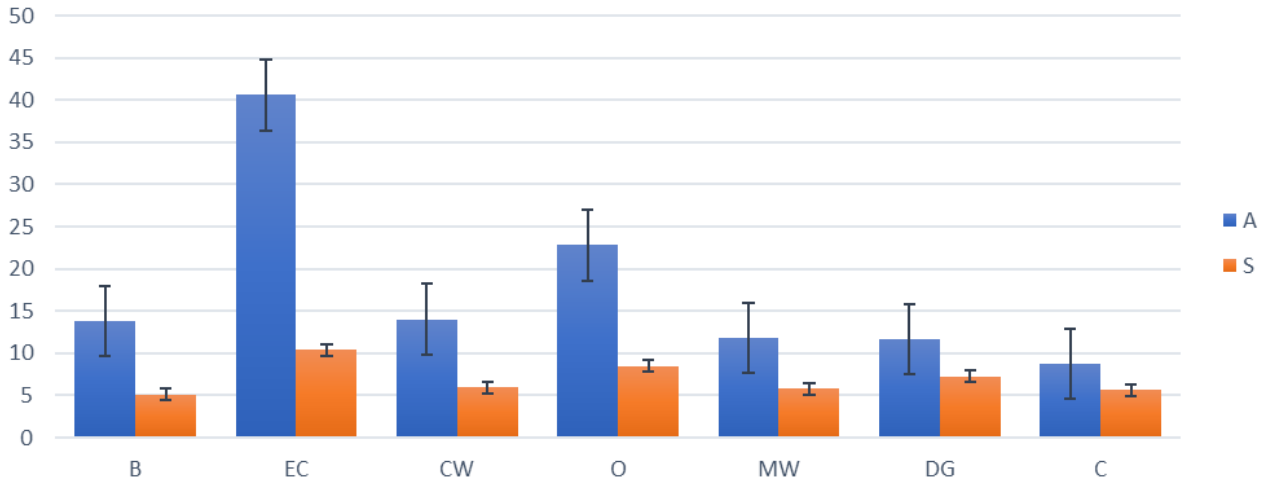


Fig. 3: Mean values of the indices of Abundance (A) and Species Richness (S) in the environmental types. B= beech woodland; EC= extensive cultivation; CW= chestnut woodland; O= olive woodland; MW= mixed woodland; DG= dry grassland; C= coniferous reforestation.

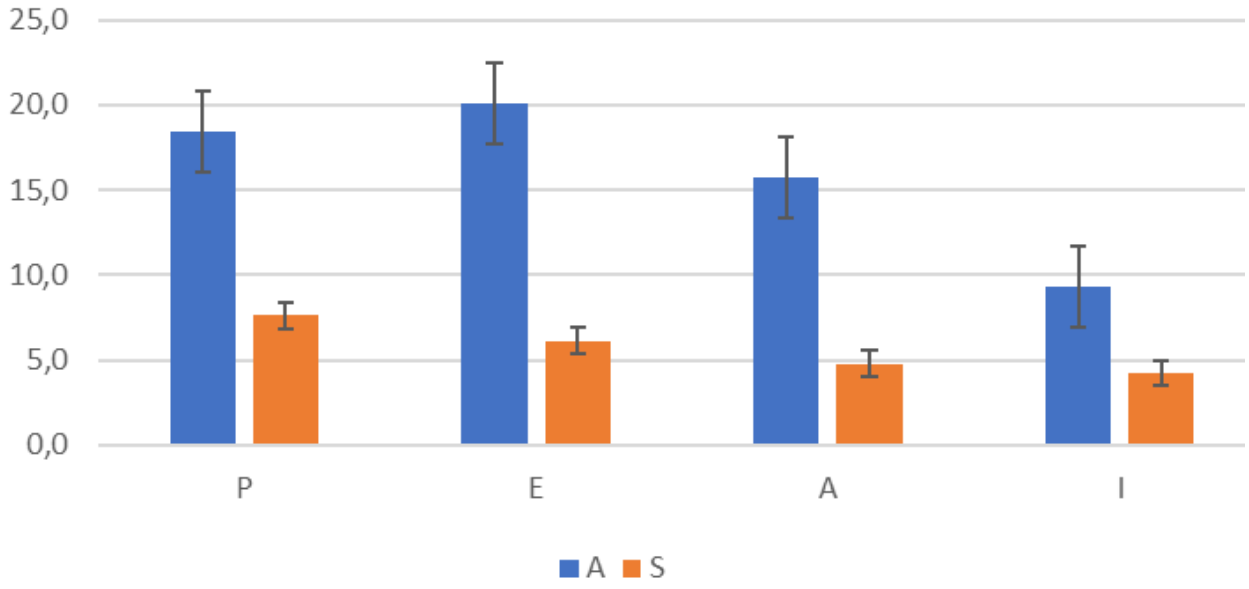


Fig. 4: Mean values of abundance (A) and species richness (S) in astronomical seasons. S= spring; Su = summer; A= autumn; W = winter

evidence of that.
This calls for reflection on forest management, which should favor the regeneration capacity of the ecosystem and the natural evolution towards old-growth forests.

Acknowledgements

The authors thank the WWF Sannio for supporting the initiative, and the anonymous referees.

Author contributions

Conceptualisation: E.E., D.M.
Data Curation: E.E., D.M.
Formal Analysis: E.E.,D.M.
Investigation: E.E., D.M., S.M.M.
Methodology: E.E., D.M.
Project Administration not applicable
Resources: not applicable
Writing – Original and Final Draft Preparation: E.E., D.M., S.M.M.

References

Barbera F., Gallerano L., Nicoletti A., Raimondi S. La Bioeconomia delle Foreste (2022). V Forum nazionale sulla gestione forestale sostenibile. www.legambiente.it.

Burfield I.J.,. Rutherford C.A, Fernando E., Piggott H.G.A, Martin R.W, Balman M.,Evans M.I., Staneva A. (2023). Birds in Europe 4: the fourth assessmentof Species of European Conservation Concern-Conservation International, 33, e66, 1–11https://doi.org/10.1017/S0959270923000187

Disney H.J., Stokes A. (1976). Birds in pine and native forests. *Emu-Austral Ornithology*, **76** (3), 133-138.

Fraissinet M., Argenio A., Cavaliere V., Esse E., Janni O. (2009). L'avifauna del Parco Regionale del Matese (Campania). *Picus*, **35**, 105-123.

Fraissinet M., Mastronardi D. (2010). Atlante degli uccelli nidificanti in provincia di Napoli (2007-2009). Alfa tipografia. Napoli, 303 pp.

Gustin M., Nardelli R., Brichetti P., Rondinini C., Teofili C. (2019). Lista Rossa IUCN degli uccelli nidificanti in Italia. Comitato italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Roma. 47 pp.

ISPRA (2009), Dipartimento Difesa della Natura. Il progetto Carta della Natura alla scala 1:50000 - Manuali e Linee guida 48/2009 ISBN 978-88-448-0381-0

Londi G., Bonazzi P., Campedelli T., Tellini Florenzano G., Fornasari L., Cutini S., Calvi G. (2019). Andamenti di popolazione dell'avifauna forestale italiana (progetto MITO 2000-2017). *Atti XX CIO* (Convegno Italiano di Ornitologia) Napoli, pp. 26-29.

Mastronardi D., Buongiovanni L., Di Lauro F., Esse E., Marsala S., Motta A., Rizzo S. (2020). Check-list e comunità ornitica di un gradiente vegetazionale costiero in contesto antropizzato: la Riserva naturale Statale di Castel Volturno (CE). *Picus* **46** (89-90), 15-25.

Pielou E.C. (1966). The measurement of diversity in different types of biological collections. *Journal* of Theoretical Biology **13,**121-144.

Rete Rurale Nazionale & LIPU. (2023). Uccelli comuni delle zone agricole in Italia. Aggiornamento degli andamenti di popolazione e del Farmland Bird Index per la Rete Rurale Nazionale dal 2000 al 2022. Arti Grafiche Castello.

Reynolds R.T., Scott J.M., Nussbaum R.A. (1980). A Variable Circular Plot Method for Estimating Bird Numbers. *The Condor* **82**, 309-313.

Bulletin of Regional Natural History (BORNH) ISSN 2724-4393.