

MATTIA MENCHETTI^(a,b) - FABIO CIANFERONI^(c,*) - GIUSEPPE MAZZA^(d) - MATTEO DAL CIN^(a) - DEBORA BARBATO^(e) - ANDREA BENOCCI^(f) - RITA CERVO^(a) - LEONARDO DAPPORTO^(a) - MALAYKA SAMANTHA PICCHI^(g) - LORENZO VANNI^(h) - RICCARDO CABRINI⁽ⁱ⁾ - EMILIANO MORI^(c,i)

CHECKLIST OF MACRO-INVERTEBRATES OF THE SPECIAL CONSERVATION AREA “POGGI DI PRATA” (GROSSETO, CENTRAL ITALY) THROUGH A CITIZEN-SCIENCE AND EXPERT-BASED APPROACH

- a) *Dipartimento di Biologia dell'Università di Firenze, Via Madonna del Piano 6 - 50019 Sesto Fiorentino, Italy. Mattia Menchetti, ORCID ID: 0000-0002-0707-7495; Leonardo Dapporto, ORCID ID: 0000-0001-7129-4526.*
- b) *Institut de Biologia Evolutiva (CSIC-UPF), Passeig Maritim de la Barceloneta 37/49 08003 Barcelona, Spain.*
- c) *Consiglio Nazionale delle Ricerche – Istituto di Ricerca sugli Ecosistemi Terrestri (CNR-IRET), Via Madonna del Piano 10, 50019, Sesto Fiorentino (FI), Italy. Fabio Cianferoni, ORCID ID: 0000-0003-3170-0774; Emiliano Mori, ORCID ID: 0000-0001-8108-795.*
- d) *CREA Research Centre for Plant Protection and Certification, Via di Lanciola 12/a, Cascine del Riccio, 50125, Firenze, Italy. Giuseppe Mazza: ORCID ID: 0000-0002-6644-1429.*
- e) *Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università di Siena, Via Mattioli 4, 53100 Siena, Italy.*
- f) *Museo di Storia Naturale dell'Accademia dei Fisiocritici, Piazzetta Silvio Gigli 2, 53100 Siena, Italy.*
- g) *Scuola Superiore Sant'Anna, Institute of Life Sciences, Piazza Martiri Della Libertà 33, 56127 Pisa, Italy.*
- h) *Dipartimento di Biologia, Università di Pisa, Via Volta 6, I-56126, Pisa, Italy.*
- i) *Successione Ecologica - APS, Via Rinetta 18B, 26025 Pandino (Cremona), Italy.*

*Corresponding Author. Email: fabio.cianferoni@cnr.it

Menchetti M., Cianferoni F., Mazza G., Dal Cin M., Barbato D., Benocci A., Cervo R., Dapporto L., Picchi M.S., Vanni L., Cabrini R., Mori E. - Checklist of macro-invertebrates of the Special Conservation Area “Poggi Di Prata” (Grosseto, central Italy) through a citizen-science and expert-based approach.

The assessment of species composition in a certain area may become outdated over time due to community dynamics including species range expansion, but also to local extinctions, species introductions and taxonomic redefinition. Therefore, updated checklists are required for animal conservation and management. Exhaustive checklists of invertebrate species may be challenging, as species determination often requires the analysis by specialists, but they are fundamental for local conservation practices. In this work, we provided an annotated preliminary checklist of invertebrates of the Special Conservation Area “Poggi di Prata” (province of Grosseto, southern Tuscany), detected through field samplings with experts, and a permanent Bioblitz set out on an online citizen-science platform (iNaturalist.org). The final dataset (1898-2020) included 329 records of 282 species (217 insects, 34 gastropods, 30 arachnids and 1 chilopod). Most records were uploaded on iNaturalist (about 56.5%), others came from observations or sampling collections (37%) and were determined by specialists. Only the remaining 6.5% of records came from published studies. Three species were protected by the Habitat Directive, 15 by the Tuscan Regional Law. We also detected two endemic or near-endemic taxa of this area: the beetle *Paramaurops diecki massetanus* and the land snail *Marmorana saxetana*. The unexpected (Italian southernmost) record of *Gaurotres virginea* needs to be deepened. Furthermore, 12 alien species, including insects affecting human economy and wellness (e.g., *Rhinophorus ferrugineus*, *Aedes albopictus*, *Halyomorpha halys*, *Dryocosmus kuriphilus* and *Cydalima perspectalis*), were also detected. With our work, we confirmed that citizen-science platforms (e.g. iNaturalist) are valuable tools, complementary to field-work by specialists, to map local biodiversity and they may help to improve biogeographical knowledge.

KEY WORDS: Arachnids; Gastropods; Insects; species inventory; bioblitz; taxonomy.

INTRODUCTION

Species checklists are basic tools both for conservation and for environmental management, as they may be used to improve local red lists, as well as to map species distributions, including new areas of biological invasions (DROEGE *et al.*, 1998; TENQUIST and CHARLESTON, 2001; BENCATEL *et al.*, 2018). As to vertebrates, apart from few cryptic species requiring molecular analyses (WIELSTRA *et al.*, 2013; ANCILLOTTO *et al.*, 2020; MORI *et al.*, 2020),

checklists are easily filled, particularly in small study areas (e.g. MORI *et al.*, 2014; MULARGIA *et al.*, 2018; AGNELLI *et al.*, 2019; LORENZONI *et al.*, 2019). Differently from vertebrates, invertebrates cannot be easily recognised at the species level through direct field observation and may require sample collection, genetics or analysis of genital morphology (e.g. BERCHI *et al.* 2017; CSABAI *et al.* 2017; CIANFERONI, 2019).

However, invertebrates include about 95% of the total Italian animal biodiversity (COLONNELLI, 2003; LETARDI

and PANTALEONI, 2007; DI GIOVANNI *et al.*, 2015) and, among those, 56 species are listed within the Annexes of the Habitat Directive (Council Directive 92/43/EEC), thus requiring 6-years reports on their national conservation status (STOCH and GENOVESI, 2016). Furthermore, several Italian regional laws include within protected species a high number of insects (e.g., Tuscan Regional Laws 56/2000 and 30/2015). Despite this, data on their distribution and occurrences are still scanty. Exhaustive checklists of invertebrates need a huge sampling effort and a high number of specialized taxonomists to identify the collected material.

Citizen-science, i.e. the collection of scientific data by the general public as part of a collaborative project with professional scientists, has been shown to be a valuable, economic method to map species distribution, whose direct monitoring would require a well-addressed, time-consuming field effort (JOHNSON *et al.*, 2020).

In recent times, citizen-science has been proven to be effective in mapping also the occurrence of invertebrates, apart from those requiring detailed lab analyses for correct identifications. This is mostly linked to the use of thematic groups on Social Networks and of online biodiversity platforms and forums (e.g., iNaturalist: www.inaturalist.org; Forum Natura Mediterraneo: www.naturamediterraneo.com; Forum Entomologi Italiani: www.entomologiitaliani.net), which allow also inexperienced observers to upload photos and to automatically take contact with experts who identify the species (e.g. MICHONNEAU and PAULAY, 2015; MENCHETTI *et al.*, 2016; ÅRJE *et al.*, 2020; VAN DER HEYDEN, 2020). However, only a few groups of invertebrate species may be easily-identified (e.g. ladybirds: WERENKRAUT *et al.*, 2020; mantids: BATTISTON *et al.*, 2020; invasive species: MAISTRELLO *et al.*, 2016; MAZZA *et al.*, 2020; species affecting human health: PERNAT *et al.*, 2020), thus potentially limiting the success of citizen-science.

The work we are presenting has been conducted in an area of naturalistic values and conservation concern (MELINI, 2005; PERUZZI *et al.*, 2008; SELVI and STEFANINI, 2010; VICIANI and GABELLINI, 2013). Although previous studies dealt with vertebrate fauna in the same site (reptiles and amphibians, CANTINI *et al.*, 2013; mammals, MORI *et al.*, 2014), the area is currently lacking any comprehensive study on invertebrate species. We aimed at providing an annotated preliminary checklist of some groups of invertebrates (mostly insects) of the Special Conservation Area “Poggi di Prata” (province of Grosseto, southern Tuscany), detected through addressed samplings with experts on the field, and a permanent Bioblitz set out on an online citizen-science platform (www.inaturalist.org).

MATERIALS AND METHODS

STUDY AREA

The Special Area of Conservation “Poggi di Prata” is located in the North-East of the province of Grosseto (southern Tuscany), in a rural hilly area (1100 ha, 620-903 m a. s. l.). Most of the study area (67%) is covered with deciduous woodland (*Quercus cerris* L., *Castanea*

sativa Mill., *Ostrya carpinifolia* Scop., *Carpinus betulus* L., *Fraxinus ornus* L. and *Robinia pseudoacacia* L.), surrounded by a scrubland belt (*Juniperus* spp., *Rubus* spp., *Erica scoparia* L. and *Spartium junceum* L.: 2%). Fallow count for 20%, and cultivations (8%) include sunflower, lucerne, and cereals. Coniferous woodlands (re-forestation programs: *Pinus nigra* J.F. Arnold and *Cupressus arizonica* Greene, 2%) and few human settlements (1%) also occur (CANTINI *et al.*, 2013; MORI *et al.*, 2014). The climate shows sub-montane features, with an average annual rainfall of 873±92 mm (including rare episodes of snowfall), and an average annual temperature of about 14±2.6°C. Human activities only occur within the immediate surroundings of the village of Prata and are represented by agriculture, sheep breeding and lumber trade (CANTINI *et al.*, 2013; MORI *et al.*, 2014).

DATA COLLECTION

Searching literature for such a localized area is very challenging and almost exclusively pertaining for specialists. Therefore, this type of research was possible only for a few groups, despite revealing only a few published data relating to this area, one on Staphylinidae (CASTELINI, 1975) and one on the genus *Dolichopoda* (BACCETTI and CAPRA, 1959). POGGI and SABELLA (2015) also reported an observation of a Staphylinid beetle in 1898. However, we tried to search for available literature on the macroinvertebrate fauna (i.e. Arthropoda and Mollusca) in this area published between 1850 and 2020, by conducting further specific research on scientific websites (Scopus, ISI Web of Knowledge and Google Scholar) and by using these keywords, both in Italian and in English: insect*, invertebrate*, “Poggi di Prata”, Prata, arthropod*, arachnid*, spider*, gastropod*, crustacean*. We retrieved only one work on Neuroptera (LETARDI, 2018). Other data on invertebrate species were detected as “ancillary data” in other works conducted in the same study area (e.g. in the diet of insectivore species, or in the description of the study area: MORI *et al.*, 2013, 2015, 2016; ANCILLOTTO *et al.*, 2014).

Novel data on arthropods and gastropods were collected on a 24-hours Bioblitz organised by the Association “Successione Ecologica” in September 2016, which involved 15 experts determining species during a 24-hours field trip. Given the wide richness of invertebrate species, several field techniques were used to sample as many species as possible along all the walking paths of the study area. About 10 pitfall traps have been placed on paths to intercept species which ranges at the ground level. Light traps which remained active throughout the night allowed us to detect insects attracted to light by phototropism (e.g. moths), which were observed and photographed on the white cloth prepared ad hoc. Mowing nets were used to catch those insects living on the grass. The entomological umbrella was used for to sample insects (e.g. xylophagous beetles) stationed on tree branches. Individuals felt from the branches were picked up by hand, photographed, identified and subsequently released at the sampling site. An active search for larvae of xylophagous species was carried out by examining the dead parts of wood (branches and/or trunks). As to diurnal lepidopterans, sweeping nets were used in areas sui-

table for the presence of these species. For large-sized and/or common species, the specific determination was immediate, but for small species it has been necessary to proceed with the determination by comparing them with reference collections. Terrestrial gastropods were searched on sight throughout the study area, in every environment and on every substrate. To haphazardly collect other occurrence data uploaded by citizens, we created a “permanent Bioblitz project” on the online platform iNaturalist (<https://www.inaturalist.org/projects/biodiversity-of-the-site-of-community-importance-poggi-di-prata>) in June 2014.

We created a final dataset including all observations and records we obtained, including those from iNaturalist, published data and further private observations by the authors. We also reported whether each species was alien or native and whether it was protected by Regional and/or the International Laws. As well, we also included the name of experts who identified species from collected samples, photos sent through messaging apps and uploaded records on iNaturalist.

RESULTS

The dataset included 329 records collected between 1898 and 2020, belonging to at least 282 species (N = 217 insects, N = 34 gastropods, N = 30 arachnids and N = 1 chilopod: Supplemental material: Tables 1-3). Most of these records are uploaded on iNaturalist (about 56.5%), others came from observations or sampling collections (37%) and were determined by authors or other specialists. Only the remaining 6.5% of records came from published studies. Over 65% of these species are “Not Evaluated” by the IUCN (International Union for the Conservation of Nature) and 30% are “Least Concern”. One of the observed species is considered “Endangered” (*Ephippiger zelleri* Fischer, 1853: Orthoptera, Tettigoniidae), one “Vulnerable” (*Cerambyx cerdo* Linnaeus, 1758: Coleoptera, Cerambycidae) and 4 “Near Threatened” (*Marmorana saxetana* (Paulucci, 1886): Pulmonata, Helicidae; *Cerambyx welensii* (Kuster, 1846): Coleoptera, Cerambycidae; *Lucanus cervus* (Linnaeus, 1758): Coleoptera, Lucanidae; *Hipparchia fagi* (Scopoli, 1763): Lepidoptera, Nymphalidae). *Campylaea planospira* (Lamarck, 1822: Pulmonata, Helicidae) is “Data Deficient”.

Three species are protected by the Habitat Directive, *L. cervus*, *Melanargia arge* (Sulzer, 1766: Lepidoptera, Nymphalidae) and *Euplagia quadripunctaria* (Poda, 1761: Lepidoptera, Erebidae), whereas 15 are listed in the Annexes of the Regional Law. Alien species detected were 12, all included among insects: *Leptoglossus occidentalis*, *Sceliphron curvatum*, *Halyomorpha halys*, *Harmonia axyridis*, *Periplaneta americana*, *Aedes albopictus*, *Megachile sculpturalis*, *Megachile parietina*, *Dryocosmus kuriphilus*, *Torymus sinensis*, *Cydalima perspectalis* and *Rhynchophorus ferrugineus*.

(Supplemental material: Tables 1-3: http://www.re-dia.it/images/stories/pdf2021/Menchetti_et_al_Red-dia_104_2021_Tables_Supplementary_Material.pdf)

DISCUSSION

Our work provides the first list of invertebrate species observed in the Special Area of Conservation “Poggi di Prata”. Furthermore, our work has shown that having a permanent project on online platforms may help to collect a reliable amount of data also on insects and other invertebrates.

According to our results, the Special Area of Conservation “Poggi di Prata” has been confirmed to represent an important biogeographical area, as being the geographical limit for the extent of occurrence of several species: for instance, the cerambycid beetle *Gaurotes virginea* was recorded for the first time in Tuscany with this work. This mountain species was known until now only from the Alps and this record is the southernmost in Italy (see SAMA, 2005; SAMA and RAPUZZI, 2011). Although the documentation consists of only a single photo, the identification was confirmed by several entomologists (see supplementary material for further information). Its discovery in the study area is totally unexpected and further research is required to verify if an actual population occurs or whether it was a single individual accidentally introduced by humans (e.g. tourists, trade). It is however possible that the specimen may have been introduced (transfaunation) and also this scenario needs to be considered and verified.

The subspecies of pselaphine beetle *Paramaurops diecki massetanus* has been described exactly from this area, and it represents an endemism of the Metalliferous Hills (province of Grosseto, Central Italy: CASTELLINI, 1975).

Similarly, the Near Threatened *Marmorana saxetana* is a land snail endemic of inland cliffs and calcareous rocky areas of Southern Tuscany and Tuscan Archipelago (FIORENTINO *et al.*, 2010). In “Poggi di Prata” and nearby sites this species has been only recorded in artificial habitats (walls in strictly urban or peri-urban areas). Although the presence of the species in the study area is probably due to accidental human introduction and therefore, it may represent an interesting finding from the biogeographical and ecological point of view.

Among spiders, *Eresus kollari* (see ŘEZÁČ *et al.*, 2008) is an uncommon species (CIANFERONI *et al.*, 2010) considered rare in “Spiders of Europe” edited by NENTWIG *et al.* (2020). Interesting is also the record of *Latrodectus tredecimguttatus* of which only few and very old published data seem to exist for continental Tuscany (ROSSI, 1790; PALAU, 1878).

Three species, *Melanargia arge*, *Lucanus cervus* and *Euplagia quadripunctaria* are protected by the Habitat Directive and their presence in this area requires population monitoring (STOCH and GENOVESI, 2016). Particularly, the presence of *Melanargia arge*, which has been observed only twice since 2010, would require further field effort. The Tuscan Regional Law protected 14 species detected also in this area, including 3 gastropods (*Oxychilus uziellii*, *Marmorana saxetana* and *Retinella olivetorum*) and 11 insects (*Charaxes jasius*, *Melanargia arge*, *Euplagia quadripunctaria*, *Calosoma sycophanta*, *Scarites buparius*, *Lucanus cervus*, *Amphimallon solstitialis*, *Polyphylla fullo*, *Cerambyx cerdo*, *Boyeria irene*,

and *Dolichopoda schiavazzii*). Amongst alien species, some of them are pests for cultivated plants (i.e., *Dryocosmus kuriphilus*, *Halyomorpha halys*, *Cydalima perspectalis* and *Rhynchophorus ferrugineus*), some others were initially released for biocontrol and reached our study area through range expansion (i.e., *Harmonia axyridis* and *Torymus sinensis*).

Among the listed species, only *Aedes albopictus* may affect human health (MAZZA and TRICARICO, 2018). Even some of the spiders recorded can cause medically relevant bites, in particular *Latrodectus tredecimguttatus* and *Loxosceles rufescens*, but also *Eresus kollari*, *Zoropsis spinimana* etc. (see NENTWIG *et al.*, 2013; DI PAOLA *et al.*, 2020).

The local absence of cultivated or native palm trees (Arecaceae) suggests that the individuals of *Rhynchophorus ferrugineus* could have arrived with trade travels or with tourists, from areas hosting reproductive populations of this weevil, not far from our study area.

Citizen-science represents a powerful cost-effective strategy to collect some baseline scientific data (e.g. occurrence data) by involving common, i.e. non-professional, people, helped by the growing public awareness and the current increase of wildlife enthusiasts (SILVERTOWN *et al.*, 2011; WILLEMEN *et al.*, 2015; MCCAFFERTY, 2016). Citizen-scientists have also increased due to the widespread use of smartphones and tablets (WANG *et al.*, 2014; LIEBENBERG *et al.*, 2017; POCKOCK *et al.*, 2017), which have greatly simplified the procedure to collect and upload data (e.g. pictures and gps GPS coordinates). The use of citizen-science data requires confirmation and verification by professional researchers, but it has allowed scientists to improve studies on species biogeography, including also alien species range expansion (SULLIVAN *et al.*, 2014; CHANDLER *et al.*, 2017; VENDETTI *et al.*, 2019; MAZZA *et al.*, 2020). Although citizen-science is an opportunistic approach which does not rely on standardized protocols (DICKINSON *et al.*, 2010; CRALL *et al.*, 2011), it allows for the collection of extremely informative data that have been extremely helpful in conservation.

ACKNOWLEDGEMENTS

We would like to thank Leonardo Ancillotto, Agostino Letardi, Alessio Ippolito, Daniele Petricci, Enzo Mori, Sofia Bogi, Giacomo Bogi, Graziano Lenzi, Luisa Graneli, Marco Biagetti, Mattia Ricci, Dario Verdiani and Simone Lolini for record collection. Alberto F. Inghilesi, Andrea Galimberti, Claudio Flamigni, Bernard Dutrillaux, Sandro Lovari, Marco A. Bologna, Elisa Montera-stelli, Emiliano Franci, Fabio Mazzetto, Giuseppe Manganeli, Giorgio Riccarducci, Marco Ciambotta, Jakob Fahr, Filippo Ceccolini, Luca Picciau, Marco Gottardo, Marianna Pontini, Matteo Montagna, Nicola Bodino, Piergiorgio Di Pompeo, Benoit Pisanu, Vincent Smith, Valentina Bugelli and Roberto Battiston helped in the identification of collected records. Thanks are due also to an anonymous reviewer who kindly improved our MS with his/her comments.

REFERENCES

- AGNELLI P., BELLINI L., VANNI S., CHITI-BATELLI A., SPOSIMO P., MORI E., 2019 – *Checklist of terrestrial vertebrates of a northern Apennines of conservation concern (Prati di Logarghena-Valle del Caprio, province of Massa-Carrara)*. – Quaderni del Museo Civico di Storia Naturale di Ferrara, 7: 51-59.
- ANCILLOTTO L., MAZZA G., MENCHETTI M., MORI E., 2014 – *Host specificity of the badger's flea (Paraceras melis) and first detection on a bat host*. – Parasitology Research, 113: 3909-3912.
- ANCILLOTTO L., BOSSO L., SMERALDO S., MORI E., MAZZA G., HERKT M., GALIMBERTI A., RAMAZZOTTI F., RUSSO D., 2020 – *An African bat in Europe, Plecotus gaisleri: Biogeographic and ecological insights from molecular taxonomy and species distribution models*. – Ecology and Evolution, 10: 5785-5800.
- ÄRJE J., MELVAD C., JEPPESEN M.R., MADSEN S.A., RAITOHARJU J., RASMUSSEN M.S., IOSIFIDIS A., TIRONONEN V., GABBOUJ M., MEISSNER K., HØYE T.T., 2020 – *Automatic image-based identification and biomass estimation of invertebrates*. – Methods in Ecology and Evolution, 11: 922-931.
- BACCETTI B., CAPRA F., 1959 – *Notulae Orthopterogicae. XII. Revisione delle specie italiane del gen. Dolichopoda Bol. (Orthopt. Raphidophoridae)*. – Redia, 44: 165-217.
- BATTISTON R., BOMBIERI G., CORRADI L., DALL'Ò M., GLERAN P., MORIN L., PESARINI S., TABARELLI DE FATIS K., TAMI F., 2020 – *Rotta a Nord Est: l'espansione dell'Ameles spallanzania (Rossi, 1792) nell'Italia Nord-Orientale*. – Studi Trentini di Scienze Naturali, 99: 9-13.
- BENCATEL J., FERREIRA C.C., BARBOSA A.M., ROSALINO L.M., ÁLVARES F., 2018 – *Research trends and geographical distribution of mammalian carnivores in Portugal (SW Europe)*. – PLoS ONE, 13(11): e0207866.
- BERCHI G., COPILAŞ-CIOCIANU D., KMENT P., BUZZETTI F., PETRUSEK A., RÁKOSY I., CIANFERONI F., DAMGAARD J., 2017 – *Molecular phylogeny and biogeography of the West-Palaearctic Velia (Heteroptera: Gerromorpha: Veliidae)*. – Systematic Entomology, 10.1111/syen.12273
- CANTINI M., MENCHETTI M., VANNINI A., BRUNI G., BORRI B., MORI E., 2013 – *Checklist of Amphibians and Reptiles in a hilly area of Southern Tuscany (Central Italy): an update*. – Herpetology Notes, 6: 223-228.
- CASTELLINI G., 1975 - *Catalogo degli Pselafidi della Toscana con alcune note di morfologia (Coleoptera)*. – Redia, 56: 29-81.
- CHANDLER M., SEE L., COPAS K., BONDE A.M.Z., LÓPEZ B.C., DANIELSEN F., LEGIND J.K., MASINDE S., MILLER-RUSHING A.J., NEWMAN G., ROSEMARYN A., TURAK E., 2017 – *Contribution of citizen science towards international biodiversity monitoring*. – Biological Conservation, 213: 280-294.

- CIANFERONI F., MAZZA G., ZINETTI F., 2010 – *Ragni*. In: Petri L. (Ed.). *Biodiversità in Provincia di Prato*. Volume 6 - Insetti e Ragni. *Effigi Edizioni*, pp. 213-245.
- CIANFERONI F., 2019 – *Review of the aquatic Hemiptera from Cephalonia, with a checklist for the Ionian Islands, Greece (Heteroptera: Gerromorpha, Nepomorpha, Leptodomorpha)*. – *Zootaxa*, 4576 (1): 46–60.
- COLONNELLI E., 2003 – *A revised checklist of Italian Curculionoidea (Coleoptera)*. – *Zootaxa*, 337: 1-142.
- CRALL A.W., NEWMAN G.J., STOHLGREN T.J., HOLFELDER K.A., GRAHAM J., WALLER D.M., 2011 – *Assessing citizen science data quality: an invasive species case study*. – *Conservation Letters*, 4: 433-442.
- CSABAI Z., SOÓS N., BERCHI G.M., CIANFERONI F., BODA P., MÓRA A., 2017 – *Aquatic and semiaquatic Heteroptera (Nepomorpha and Gerromorpha) fauna of Greek holiday islands (Rhodes, Crete and Corfu) with first records of three species from Europe and Greece*. – *Zootaxa*, 4231 (1): 51-69.
- DICKINSON J.L., ZUCKERBERG B., BONTER D.N., 2010 – *Citizen science as an ecological research tool: challenges and benefits*. – *Annual Review of Ecology, Evolution, and Systematics*, 41: 149-172.
- DI GIOVANNI F., RESHCHIKOV A., RIEDEL M., DILLER E., SCHWARZ M., 2015 – *New records of Ichneumonidae (Hymenoptera) for the Italian fauna*. – *Biodiversity Data Journal*, 3: e5057.
- DI PAOLA G., CIRRONIS M., SCARAVAGGI G., CASTORANI L., PETROLINI V.M., LOCATELLI C.A., 2020 – *Latrodectism in Italy: First report of successful treatment of L. tredecimguttatus envenomation using L. mactans antivenom from North America*. – *Toxicon*, 179: 107-110.
- DROEGE S., CYR A., LARIVEE J., 1998 – *Checklists: An underused tool for the inventory and monitoring of plants and animals*. – *Conservation Biology*, 12: 1134-1138.
- FIORNTINO V., SALOMONE N., MANGANELLI G., GIUSTI F., 2010 – *Historical biogeography of Tyrrhenian land snails: the Marmorana-Tyrrheniberus radiation (Pulmonata, Helicidae)*. – *Molecular Phylogenetics and Evolution*, 55: 26-37.
- JOHNSON B.A., MADER A.D., DASGUPTA R., KUMAR P., 2020 – *Citizen science and invasive alien species: An analysis of citizen science initiatives using information and communications technology (ICT) to collect invasive alien species observations*. – *Global Ecology and Conservation*, 21: e00812
- LETARDI A., PANTALEONI R.A., 2007 – *Survey towards an inventory of Italian Neuropterida*. – *Annali del Museo Civico di Storia Naturale di Ferrara*, 8: 87-93.
- LETARDI A., 2018 – *Contributo alla conoscenza dei Neuroterroidei italiani attraverso eventi Bioblitz (Insecta: Raphidioptera, Neuroptera)*. – *Onychium*, 14: 99-104.
- LIEBENBERG L., STEVENTON J., BRAHMAN N., BENADIE K., MINYE J., LANGWANE H.K., 2017 – *Smartphone Icon User Interface design for non-literate trackers and its implications for an inclusive citizen science*. – *Biological Conservation*, 208: 155-162.
- LORENZONI M., BORGHESEAN F., CAROSI A., CIUFFARDI L., DE CURTIS O., DELMASTRO G., DI TIZIO L., FRANZOI P., MAIO G., MOJETTA A., NONNIS MARZANO F., PIZZUL E., ROSSI G., SCALICI M., TANCIONI L., ZANETTI M., 2019 – *Check-list dell'ittiofauna delle acque dolci italiane*. – *Italian Journal of Freshwater Ichthyology*, 1: 239-254.
- MAISTRELLO L., DIOLI P., BARISELLI M., MAZZOLI G.L., GIACALONE-FORINI I., 2016 – *Citizen science and early detection of invasive species: phenology of first occurrences of Halyomorpha halys in Southern Europe*. – *Biological Invasions*, 18: 3109-3116.
- MAZZA G., NERVA L., STRANGI A., MORI E., CHITARRA W., CARAPEZZA A., MEI M., MARIANELLI L., ROVERSI P.R., CAMPANARO A., CIANFERONI F., 2020 – *Scent of jasmine attracts alien invaders and records on citizen science platforms: multiple introductions of the invasive lacebug Corythauma ayyari (Drake, 1933) (Heteroptera: Tingidae) in Italy and the Mediterranean basin*. – *Insects*, 11: 620.
- MAZZA G., TRICARICO E., 2018 – *Invasive species and human health*. CABI Editions, London, UK.
- MCCAFFERTY D.J., 2016 – *How can we be better citizen scientists?* – *The Glasgow Naturalist*, 26: 1-2.
- MELINI D., 2005 – *La gestione forestale nei siti di importanza comunitaria. il sito "Poggi di Prata" (GR)*. – *L'Italia Forestale e Montana*, 60: 249-267.
- MENCHETTI M., MORI E., CECCOLINI F., PAGGETTI E., PIZZOCARO L., CIANFERONI F., 2016 – *New occurrences of the alien invasive Harmonia axyridis (Pallas, 1773) in Southern Italy (Coleoptera: Coccinellidae)*. – *Onychium*, 12: 137-139.
- MICHONNEAU F., PAULAY G. 2015 – *Using iNaturalist to learn more about echinoderms*. – *Reef Encounter*, 30: 29-31.
- MORI E., BRUNI G., DOMENEGHETTI D., MENCHETTI M., 2013 – *Pelophylax synklepton hispanicus on the branches of a tree: description of an unusual behaviour*. – *Herpetology Notes*, 6: 515-517.
- MORI E., MENCHETTI M., DONDINI G., BIOSA D., VERGARI S., 2014 – *Theriofauna of Site of Community Importance Poggi di Prata (Grosseto, Central Italy): terrestrial mammals and preliminary data on Chiroptera*. – *Check-List*, 10: 718-723.
- MORI E., SFORZI A., MENCHETTI M., MAZZA G., LOVARI S., PISANU B., 2015 – *Ectoparasite load in the crested porcupine Hystrix cristata Linnaeus, 1758 in Central Italy*. – *Parasitology Research*, 114: 2223-2229.
- MORI E., MENCHETTI M., MAZZA G., ANCILLOTTO L., 2016 – *Ectoparasites of the European Red Squirrel from the Apennine ridge*. – *Atti del Congresso Nazionale di Teriologia*, 10: 125.
- MORI E., BRAMBILLA M., RAMAZZOTTI F., ANCILLOTTO L., MAZZA G., RUSSO D., AMORI G., GALIMBERTI A., 2020 – *In or out of the checklist? DNA barcoding and distribution modelling unveil a new species of Crocidura shrew for Italy*. – *Diversity*, 12: 380.
- MULARGIA M., CORTI, C., LUNGI, E., 2018. - *The herpetofauna of the Monte Albo, Sardinia (Italy)*. - *Russian Journal of Herpetology*, 25: 172-176.

- NENTWIG W., GNÄDINGER M., FUCHS J., CESCHI A., 2013 – *A two year study of verified spider bites in Switzerland and a review of the European spider bite literature.* – *Toxicon*, 73: 104-110.
- NENTWIG W., BLICK T., BOSMANS R., GLOOR D., HÄNGGI A., KROPF C., 2020 – *Spiders of Europe.* Version 11.2020. Online at <https://www.araneae.nmbe.ch>, accessed on 11/11/2020. <https://doi.org/10.24436/1>
- PALAU C., 1878 – *Catalogo degli Araneidi dei dintorni di Fauglia.* Livorno, 1-8.
- PERNAT N., KAMPEN H., JESCHKE J.M., WERNER D., 2020 – *Citizen science versus professional data collection: comparison of approaches to mosquito monitoring in Germany.* – *Journal of Applied Ecology*, doi: <https://doi.org/10.1111/1365-2664.13767>.
- PERUZZI L., MANCUSO E., ANSALDI M., DE ANGELI E., TROMBETTI G., 2008 – *Distribuzione, caratterizzazione e consistenza delle popolazioni toscane di Fritillaria montana Hoppe (Liliaceae).* – *Webbia*, 63: 309-315.
- POGGI R., SABELLA G. 2005 – *Insecta Coleoptera Staphylinidae Pselaphinae.* In: Ruffo S. & Stoch F. (Eds.), *Checklist e distribuzione della fauna italiana.* – *Memorie del Museo Civico di Storia Naturale di Verona*, 2^a serie, Sezione Scienze della Vita, 16, 183–184 + CD-ROM.
- POCOCK M.J., TWEDDLE J.C., SAVAGE J., ROBINSON L.D., ROY H.E., 2017 – *The diversity and evolution of ecological and environmental citizen science.* – *PLoS ONE*, 12: e0172579.
- ŘEZÁČ M., PEKÁR S., JOHANNESSEN J., 2008 – *Taxonomic review and phylogenetic analysis of Central European Eresus species (Araneae: Eresidae).* – *Zoologica Scripta*, 37: 263-287.
- ROSSI P., 1790 – *Fauna Etrusca systems Insecta quae in provinciis Florentina et Pisana praesertim collegit. Tomus secundus.* Typis Thomae Masi & Sociorum, Livorno, 348 pp.
- SAMA G., 2005 – *Insecta Coleoptera Cerambycidae.* In: Ruffo S., Stoch F. (Eds.), *Checklist e distribuzione della fauna italiana.* – *Memorie del Museo civico di Storia naturale di Verona*, 2^a Serie, Sezione Scienze della Vita, 16: 219-222+ CDROM.
- SAMA G., RAPUZZI P., 2011 – *Una nuova checklist dei Cerambycidae d'Italia.* – *Quaderni di Studi e Notizie di Storia Naturale della Romagna*, 32: 121-164.
- SELVI F., STEFANINI P., 2010 – *Biotopi naturali e aree protette della Provincia di Grosseto. Componenti floristiche e aspetti vegetazionali.* – *Quaderni delle Aree Protette*, 1: 1-144.
- SILVERTOWN J., COOK L., CAMERON R., DODD M., MCCONWAY K., WORTHINGTON J., SKELTON P., ANTON C., BOSSDORF O., BAUR B., SCHILTHUIZEN M., FONTAINE B., SATTMANN H., BERTORELLE G., CORREIA M., OLIVEIRA C., POKRYSZKO B., OZGO M., GILL E., RAMMUL U., SÖLYMOS P., FÉHER Z., JUAN X., 2011 – *Citizen science reveals unexpected continental-scale evolutionary change in a model organism.* – *PLoS ONE*, 6: e18927.
- STOCH F., GENOVESI P., 2016 – *Manuali per il monitoraggio di specie e habitat di interesse comunitario (Direttiva 92/43/CEE) in Italia: specie animali.* Edizioni ISPRA, Serie Manuali e linee guida, 141/2016, Roma, Italy.
- SULLIVAN B.L., AYCRIGG J.L., BARRY J.H., BONNEY R.E., BRUNS N., COOPER C.B., DAMOULAS T., DHONDT A.A., DIETTERICH T., FARNSWORTH A., FINK D., FITZPATRICK J.W., FREDERICKS T., GERBRACHT J., GOMES C., HOCHACHKA W.M., ILIFF M.J., LAGOZE C., LA SORTE F.A., MERRIFIELD M., MORRIS W., PHILLIPS T.B., REYNOLDS M., RODEWALD A.D., ROSENBERG K.V., TRAUTMANN N.M., WIGGINS A., WINKLER D.W., WONG W.K., WOOD C.L., YU J., KELLING S., 2014 – *The eBird enterprise: An integrated approach to development and application of citizen science.* – *Biological Conservation*, 169: 31-40.
- TENQUIST J.D., CHARLESTON W.A.G., 2001 – *A revision of the annotated checklist of ectoparasites of terrestrial mammals in New Zealand.* – *Journal of the Royal Society of New Zealand*, 31: 481–542.
- VAN DER HEYDEN T. 2020 – *First record of Corythauma ayyari (Drake, 1933) (Hemiptera: Heteroptera: Tingidae) in Egypt.* – *Journal of the Heteroptera of Turkey* 2: 1–2.
- VENDETTI J.E., BURNETT E., CARLTON L., CURRAN A.T., LEE C., MATSUMOTO R., MC DONNELL R., REICH I. AND WILLADSEN O., 2019 – *The introduced terrestrial slug Ambigolimax nyctelius (Bourguignat, 1861) and Ambigolimax valentianus (Férussac, 1821) (Gastropoda: Limacidae) in California, with a discussion of taxonomy, systematics, and discovery by citizen science.* – *Journal of Natural History*, 53: 25-26.
- VICIANI D., GABELLINI A., 2013 – *Contributo alla conoscenza della vegetazione della Foresta Regionale "Monte Arsenti-Poggi di Prata" (Toscana centro-meridionale).* – *Informatore Botanico Italiano*, 45: 3-25.
- WANG D., XIANG Z., FESENMAIER D.R., 2014 – *Adapting to the mobile world: A model of smartphone use.* – *Annals of Tourism Research*, 48: 11-26.
- WERENKRAUT V., BAUDINO F., ROY H.E., 2020 – *Citizen science reveals the distribution of the invasive harlequin ladybird (Harmonia axyridis Pallas) in Argentina.* – *Biological Invasions*, 22: 2915-2921.
- WIELSTRA B., BAIRD, A. B., ARNTZEN, J. W., 2013 - *A multimarker phylogeography of crested newts (Triturus cristatus superspecies) reveals cryptic species.* - *Molecular Phylogenetics and Evolution*, 67: 167-175.
- WILLEMEN L., COTTAM A.J., DRAKOU E.G., BURGESS N.D., 2015 – *Using social media to measure the contribution of red list species to the nature-based tourism potential of African protected areas.* – *PLoS ONE*, 10: e0129785.