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An inventory of the spider species of "La Mandria" Regional Natural Park (NW Italy) (Arachnida: Araneae)

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Abstract
We present an inventory of the spider species of the "La Mandria" Regional Natural Park (Province of Turin, Piedmont, Italy), mostly based on original data collected between 2022 and 2023. Spiders were sampled by means of pitfall traps and beating trays in the most representative habitats of the Park. Few additional species were included to the inventory from iNaturalist observations and from available literature data. We reported a total of 149 species, representing 100 genera and 28 families. Thirty-seven species are recorded for the first time in the Province of Turin and 12 are new for Piedmont. The most represented families were Lycosidae and Linyphiidae, followed by Gnaphosidae and Thomisidae. The highest number of species (60) was recorded in woodland edges, followed by mown meadows (57) and mixed broadleaved woods (50). The composition of the spider assemblages aligns with those found in similar habitats in the frame of other studies conducted in the Po Valley. Most of the species have a Palaeartic distribution, followed by Turanic-European-Mediterranean and European elements. Noteworthy, we recorded two endemic species (*Nemesia pedemontana* and *Dysdera lantosquensis*) and three alien species (*Mermessus trilobatus*, *Erigone autumnalis* and *Theridula gonygaster*). We also provide new taxonomic illustrations of two riparian Gnaphosidae (*Gnaphosa dolosa* and *G. rhenana*). Besides the faunistic contribution, this inventory aims at providing a basis for further studies on the conservation ecology of spiders in NW Italy.

Key words: lowland forest, pitfall traps, beating trays, protected area, faunistic inventory, spider assemblages.

Introduction

The Regional Natural Park of "La Mandria" is a protected area extending in the outskirts of the metropolitan area of Turin. The area served as hunting reserve for the Savoia royal family from the 16th to the end of the 19th century. Later, after relevant deforestation it became a farming area until, in 1976, an important portion of the estate was sold to the Regional administration. The Regional Park was established in 1978 aiming at enhancing the former royal properties (Castle of Venaria Reale, the Mandria Castle, the Royal Estate and the Hunting Reserve), and at protecting and restoring the original habitats of the lowland forest of the Po Plan. Due to its history and management over time, the Park now encompasses a heterogeneous patchwork of woodlands and mown meadows, lakes, streams, moors and rural areas. This verdant sanctuary near the city is currently included in the Natura 2000 network as a Special Area of Conservation [IT1110079 "La Mandria"].

Although the biodiversity of this area is generally well-known from the faunistic and floristic point of view, there is a complete lack of knowledge regarding spiders. To fulfil this gap, we investigated the spider fauna of the Park between 2022 and 2023 by means of different sampling methods, focusing on the most representative habitats therein.

Material and methods

Study area

The Regional Park of "La Mandria" is located in the region of Piedmont, 8 km north-west from the city of Turin (NW-Italy). The protected area covers 6,571 hectares with an elevation ranging from 250 to 420 m asl. It encompasses a buffer area of 3,193 hectares and a core area of 3,378 hectares. The core area includes a private part (approximately 1,500 hectares) and a public one of approximately 1,800 hectares.

The area is included within the western subcoastal rainfall regime and within the Continental biogeographic region. From a geological point of view, the study area rests on high Quaternary terraces referable to the Mindel-Riss interglacial period alternated with lower surfaces shaped by the recent stream network (E.G.A.P. Parchi Reali 2019).

The core area of the Park is almost entirely surrounded by a wall 30 km long, which makes it the second largest enclosed Park in Europe. In 2017, in accordance with the Habitats Directive 92/43/EEC, this area was declared as a Special Area of Conservation (SAC), primarily to protect the largest remnant patch of the lowland forest in the upper Piedmont Plain, namely the *Carpinion* alliance dominated by oak, durmast, Turkey oak, birch, ash, linden and wild cherry [Natura 2000 Codes 9160 and 9190] (E.G.A.P. Parchi Reali 2019).

Our study focused specifically on the public part of the SAC, which is mostly characterised by a mixed landscape of woodlands (64%) and grasslands (25%). Other habitats mostly refer to gravel beds, small wetlands, water bodies and urban areas (11%). Woodlands are mostly dominated by oaks and hornbeams alternated with younger mixed broadleaved woods with hazelnut, honey locust, red oak, and elm, but also chestnuts and black alder in the most humid areas [Natura 2000 Codes 91E0* priority habitat]. Grasslands include *Molinia arundinacea* meadows and moorlands [Natura 2000 Codes 6410 and 4030] and permanent managed grasslands [Natura 2000 Codes 6510]. Along the riverbank of the main streams, vegetation is dominated by shrubby willows [Natura 2000 Codes 3240]. Additionally, small wetlands, artificial lakes, marshes and pools are also present [Natura 2000 Codes 3130, 3140 and 3150] (E.G.A.P. Parchi Reali 2019).

Data collection

To obtain a comprehensive overview on the spider fauna of the Park, we combined literature data with field data.

Literature data were obtained from the updated version of the online Catalog of the Italian Spiders "araneae.it" (Pantini & Isaia 2019). The Catalog reported for this area just a few records scattered throughout faunistic, systematic or ecology papers (Isaia et al. 2007; Isaia et al. 2018a, b; Duque et al. 2023). No arachnological works focusing specifically on the Park were found. In addition, a few photographic records from iNaturalist (available from https://www.inaturalist.org, accessed on 11/11/2023) were also included. Such photographic records were filtered and verified by the authors through photos uploaded onto the portal and only the species that were unequivocally identified were considered valid records.

To increase the knowledge on the spider fauna of the protected area, we identified 12 locations of the most representative habitats in the Park, ranging from 279 to 341 m. Each plot encompassed a mixed broadleaved wood, a mown meadow (mown twice per year) and a woodland

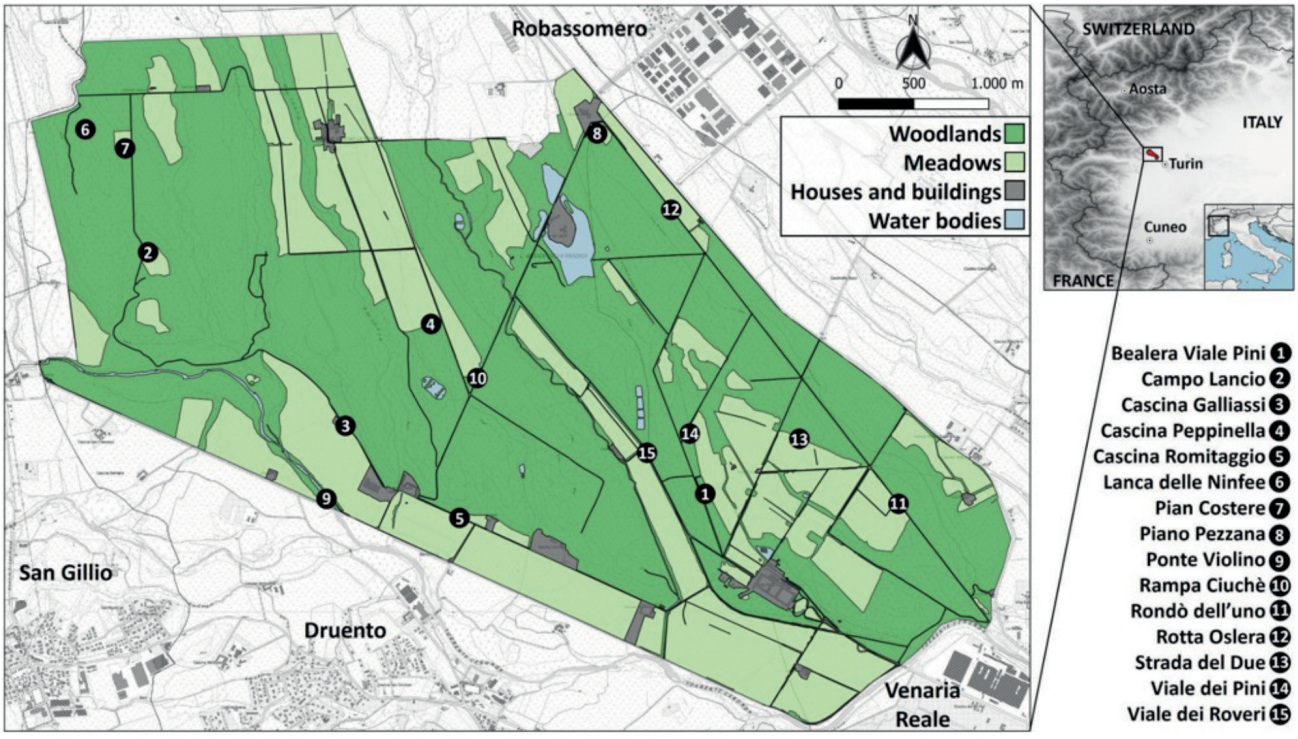
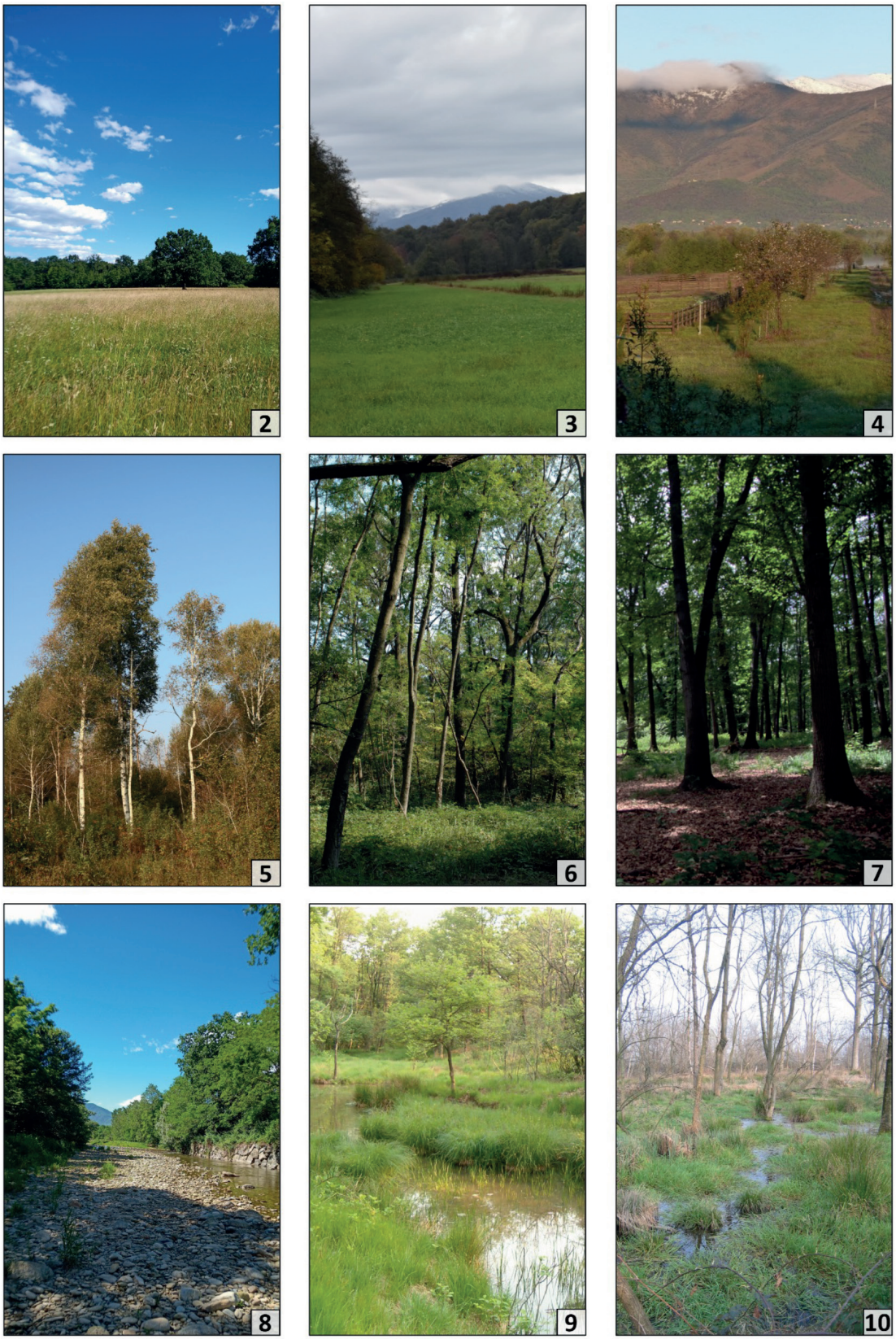


Fig. 1 – Study area within the Special Area of Conservation IT1110079 "La Mandria". The numbered dots refer to the sampling sites (see Table 1 and S1).



Figs 2-10 – Some of the sampling sites of the Special Area of Conservation IT1110079 “La Mandria” considered in this work: **2**, mown meadow of Campo Lancio; **3**, mown meadow of Strada del Due; **4**, mown meadow of Cascina Romitaggio; **5**, mixed broadleaved woods of Rotta Oslera; **6**, mixed broadleaved woods of Viale dei Pini; **7**, mixed broadleaved woods of Pian Costere; **8**, gravel bed of Ponte Violino; **9**, damp wood of Lanca delle Ninfee; **10**, damp wood of Bealera dei Pini. (Photo credits: EGAP Parchi Reali archive photos except 2 and 8 E. Forgnone).

edge. Spiders were sampled by means of pitfall traps (three in the wood and three in the mown meadow) and beating tray (two samples). Moreover, we added one plot in a gravel bed (5 pitfall traps) and two plots in damp woods (4 pitfall traps in each plot) (Fig. 1 and 2-10 and Table 1).

Pitfall traps were placed in mid May 2022 and emptied four times approximately every three weeks from June to September (Table 2). In total, we placed an amount of 340 pitfall traps. Beating trays were carried out in autumn (3 October 2022) and spring (22 May 2023), for an amount of 60 sampling events.

Illustrations were prepared by Alessandro Infuso directly on specimens observed under a Leica Stereozoom S8-APO stereomicroscope and from multifocus Z-stack images taken with the same instrument.

Table 1 – Localities of the new data with geographical coordinates (Latitude and Longitude in decimal degrees: SR EPSG: 4326 – WGS84) and elevation in meters.

N	Locality	Lat °N	Lon °E	Elevation (m)
1	Bealera Viale Pini	45.1519	7.5938	297
2	Campo Lancio	45.1658	7.5462	331
3	Cascina Galliassi	45.1556	7.5632	282
6	Cascina Peppinella	45.1618	7.5703	319
7	Cascina Romitaggio	45.1502	7.5730	279
6	Lanca delle Ninfee	45.1731	7.5407	346
7	Pian Costere	45.1720	7.5441	341
8	Piano Pezzana	45.1734	7.5841	321
9	Ponte Violino	45.1512	7.5617	280
10	Rampa Ciuchè	45.1586	7.5743	316
11	Rondò dell'Uno	45.1515	7.6102	287
12	Rotta Oslera	45.1689	7.5905	313
13	Strada del Due	45.1553	7.6017	293
14	Viale dei Pini	45.1555	7.5924	305
15	Viale dei Roveri	45.1543	7.5888	302

Table 2 – Time series of pitfall trap sampling. Placement and collection dates described as day/month/year. Time interval listed as number of days.

Pitfall Time series	Placement date	Collection date	Time interval
I	19/05/2022	09/06/2022	22
II	09/06/2022	29/06/2022	21
III	29/06/2022	21/07/2022	23
IV	21/07/2022	05/09/2022	47

Results

The examination of literature provided a list of 6 species previously known for the Parks, scattered in 4 papers published between 2007 and 2023 (Table 3): *Dolomedes fimbriatus* (Clerck, 1757), *Pardosa proxima* (C. L. Koch, 1847), *Pardosa tenuipes* L. Koch, 1882*, Pardosa wagleri* (Hahn, 1822), *Trochosa hispanica* Simon, 1870 and *Nemesia pedemontana* Decae, Pantini & Isaia, 2015. All six species have been recollected during our work.

The list of the species collected in this work is presented in Table 4. All data about material (locality, date of collection, number of specimens, sex, taxonomy, distribution and new records for the region of Piedmont or the province of Turin are presented in Supplementary Material, Table S1).

The material is stored in Marco Isaia's collection at the Department of Life Sciences and Systems Biology of the University of Turin (excluding iNaturalist photo observation).

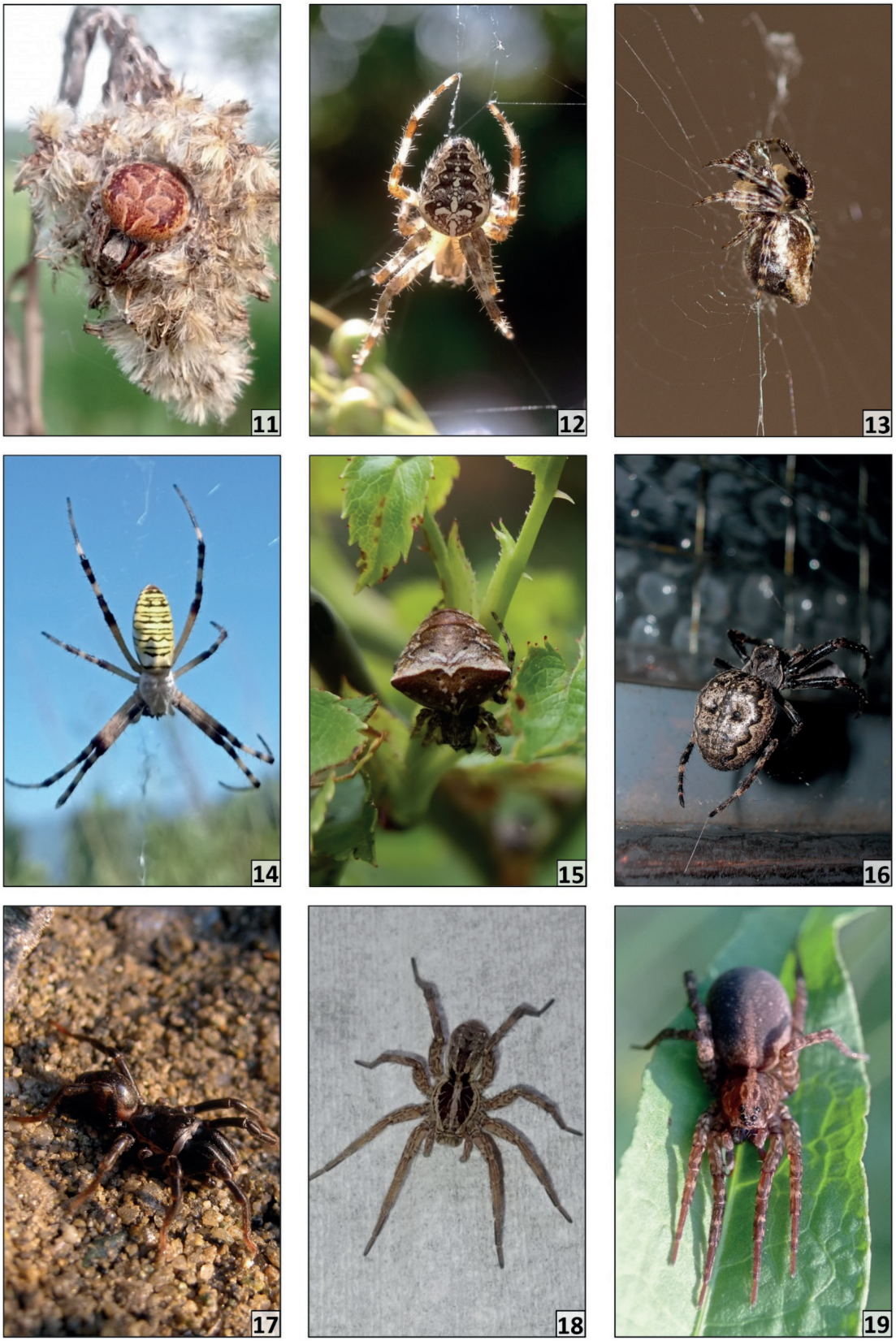
Table 3 – List of the publications referring to spider species found in the study area, total number of records (Recorded species) and number of new records (New records).

Literature	Recorded species	New records
Isaia et al., 2007	1	1
Isaia et al., 2018a	1	1
Isaia et al., 2018b	1	1
Duque et al., 2023	4	3
Total from literature	**7**	**6**
Original data from this work	149	143
Total		**149**

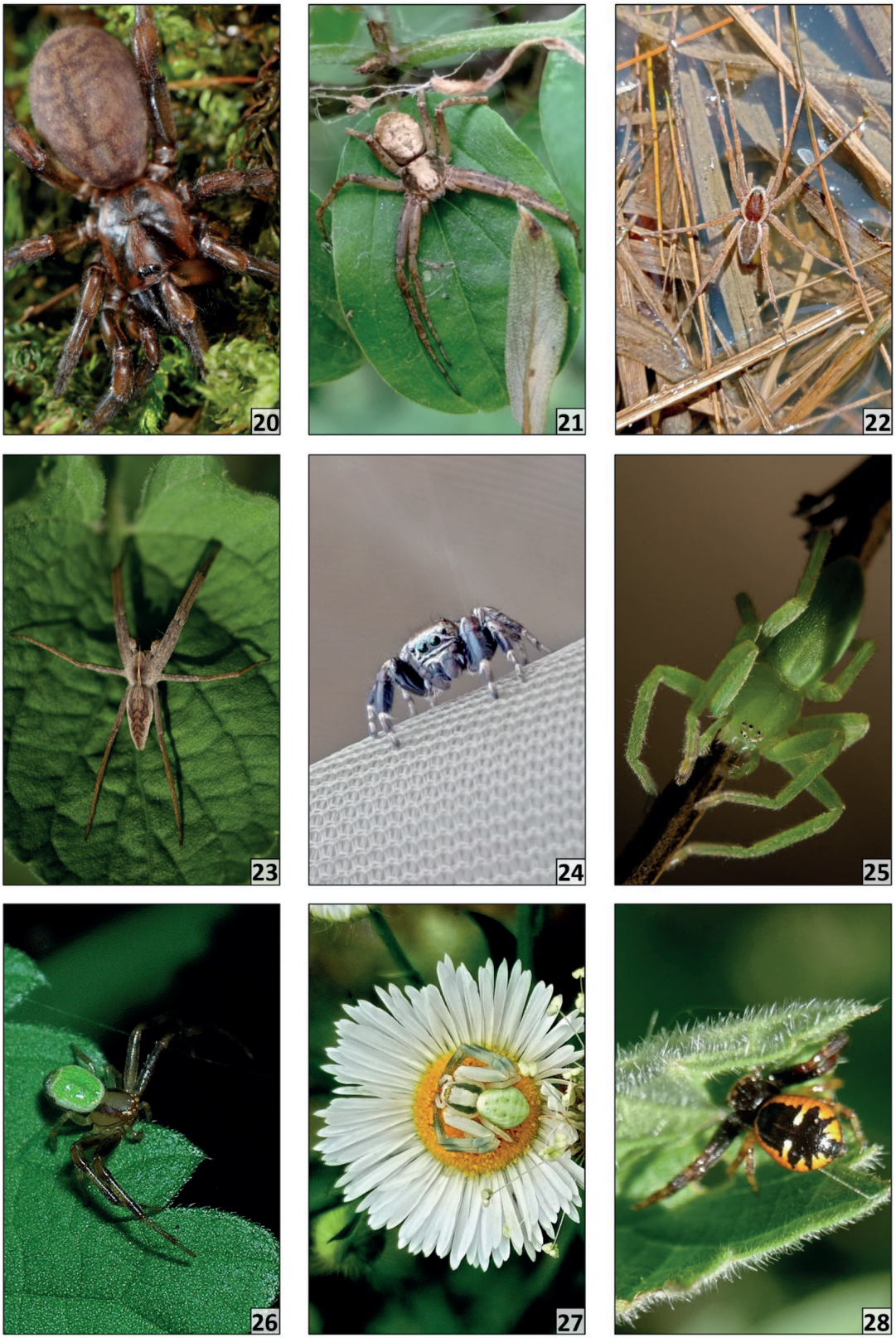
Our campaign led to the collection of 2,166 specimens (1,178 in pitfall traps, 979 from beating trays and 9 from photo observations). The study identified the presence of 149 species of spiders belonging to 100 genera and 28 families. A selection of photographs of the most representative species of the Park is presented in Figs 11-19 and 20-28.

The most diverse families in terms of species were Lycosidae (18 species) and Linyphiidae (18 species), followed by Gnaphosidae (16) and Thomisidae (15) (Fig. 29). Overall, with the beating tray method we sampled 60 species of mostly foliage-dwelling spiders, while pitfall traps sampled 91 species of mostly ground-dwelling spiders. Only 10 species were collected by both methods. In beating tray sampling, we mainly collected Salticidae (9 species), followed by Araneidae, Theridiidae and Thomisidae with 8 species each (Fig. 30). Regarding pitfall traps, Lycosidae stand out with 18 species, followed by Gnaphosidae (15 species), Linyphiidae (14 species) and Thomisidae (9 species) (Fig. 31).

The most abundant species collected with beating trays in woodland edges were *Anyphaena accentuata* (Walckenaer, 1802), *Dolomedes fimbriatus* and *Synema globosum* (Fabricius, 1775) with respectively 328, 97 and 56 specimens. Instead, the most abundant species recorded with pitfall traps were *Pardosa proxima*, *Trochosa hispanica* and *Zodarion italicum* (Canestrini, 1868) respectively with 121, 120 and 80 specimens.



Figs 11-19 – Spider species of the Special Area of Conservation IT1110079 “La Mandria”: **11**, Araneidae – *Agalenatea redii* (Scopoli, 1763); **12**, Araneidae – *Araneus diadematus* Clerck, 1757; **13**, Araneidae – *Cyclosa conica* (Pallas, 1772); **14**, Araneidae – *Argiope bruennichi* (Scopoli, 1772); **15**, Araneidae – *Gibbaranea bituberculata* (Walckenaer, 1802); **16**, Araneidae – *Nuctenea umbratica* (Clerck, 1757); **17**, Atypidae - *Atypus* sp.; **18**, Lycosidae – *Hogna radiata* (Latreille, 1817); **19**, Lycosidae – *Trochosa* sp. (Photo credits: A. Girodo)



Figs 20-28 – Spider species of the Special Area of Conservation IT1110079 "La Mandria": **20**, Nemesidae – *Nemesia pedemontana* Decae, Pantini & Isaia, 2015; **21**, Philodromidae – *Philodromus* sp.; **22**, Pisauridae – *Dolomedes fimbriatus* (Clerck, 1757); **23**, Pisauridae – *Pisaura mirabilis* (Clerck, 1757); **24**, Salticidae – *Evarcha arcuata* (Clerck, 1757); **25**, Sparassidae – *Micrommata virescens* (Clerck, 1757); **26**, Thomisidae – *Ebrechtella tricuspidata* (Fabricius, 1775); **27**, Thomisidae – *Misumena vatia* (Clerck, 1757); **28**, Thomisidae – *Synema globosum* (Fabricius, 1775). (Photo credits: A. Girodo except **20** F. Tomasinelli)

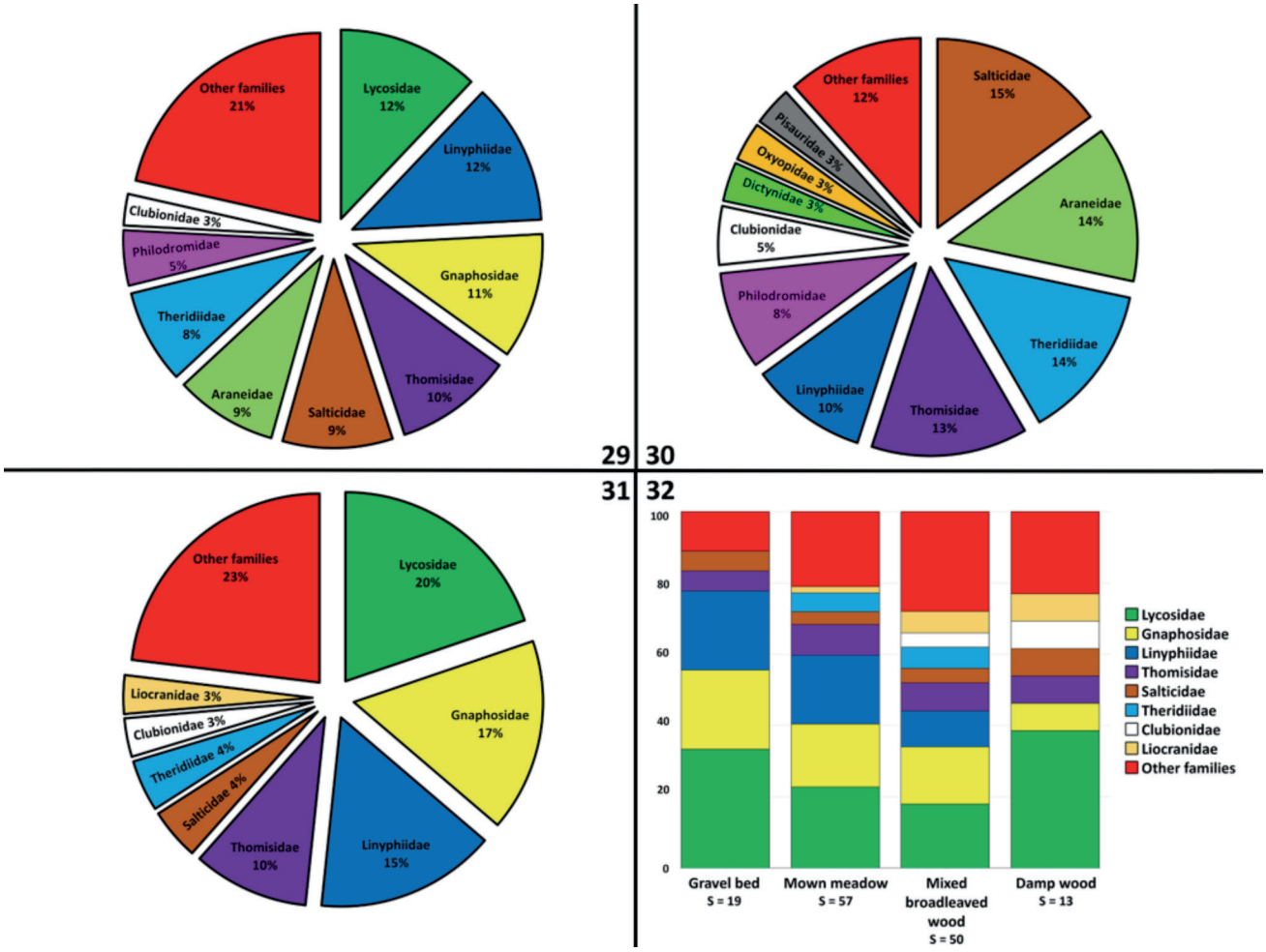
When considering pitfall traps data the percentage distribution of species richness was higher in grasslands and mixed broadleaved woods than in gravel bed and in the damp wood (Fig. 32). Lycosidae was the most abundant family in pitfall traps in all of the considered habitats, followed by the Linyphiidae and Gnaphosidae.

Photographic observations from iNaturalist revealed the presence of 9 species in 4 families, i.e. 5 Araneidae, 2 Salticidae, one Agelenidae and one Zoropsidae. Photographic observations mostly referred to species observed in woodland edges, mown meadows, mixed broadleaved woods and buildings.

In general, a higher abundance paralleled a higher species richness. The woodland edge stands with 60 species and 979 specimens collected, followed by mown meadow with 58 species (684 specimens) and mixed broadleaved wood with 50 species (429 specimens). However, when considering the individual/species richness ratio, damp wood (33/14 specimens) and the gravel bed (32/19 specimens) recorded the highest values (Fig. 33).

The mown meadow was dominated by *Pardosa proxima* (22%), *Arctosa leopardus* (Sundevall, 1833) (11%), *Piratula latitans* (Blackwall, 1841) (10%), *Pardosa tenuipes* (6%) and *Hogna radiata* (Latreille, 1817) (6%). The mixed broadleaved woods was dominated by *Trochosa hispanica* (23%) followed by, *Zodarion italicum* (18%), *Phrurolithus festivus* (C. L. Koch, 1835) (7%), *Euryopis flavomaculata* (C. L. Koch, 1836) (7%) and *Ozyptila praticola* (C. L. Koch, 1837) (4%). The gravel bed was composed by *Gnaphosa rhenana* Müller & Schenkel, 1895 (13%, Fig. 34-35), *Piratula knorri* (Scopoli, 1763) (13%), *Trochosa ruricola* (De Geer, 1778) (10%), *Pardosa wagleri* (10%) and *Gnaphosa dolosa* Herman, 1879 (7%, Fig. 36-39). The dominant species in damp woods (70%) was *Trochosa hispanica* (33%) followed by *Phrurolithus festivus* (17%), *Zodarion italicum* (7%), *Piratula latitans* (7%) and *Trochosa ruricola* (7%).

Regarding chorotypes, over half species (60%) showed a Palaearctic distribution, followed by Turanic-European-Mediterranean (14%), European (13%) and Holartic



Figs 29-32 – 29, species richness by family (in %) in the study area; **30**, species richness by family (in %) of beating tray samplings; **31**, species richness by family (in %) of pitfall trap samplings; **32**, species richness by family (in %) with pitfall trap samplings for each of the considered habitat (S = number of species). For each figure (29, 30, 31, 32) families with a % < 2.5 are filled in "Other families".

species (9%). Mediterranean, endemic and alien species accounted for the remaining 4% (1%, 1% and 2%, respectively) (Fig. 40 and Table 5).

This work check-list provided 37 new records for the province of Turin province and 12 new records for Piedmont (Table 4).

Discussion

Faunistic inventories are essential in the study of biodiversity and conservation, often serving as a starting point for ecological studies (Isaia et al. 2015; Pantini & Isaia 2019; Mammola et al. 2022; Milano et al. 2022b). This work provides the first inventory of spiders for the Special Area of Conservation IT1110079 "La Mandria". The new data added 143 species to the list of spider species known for this area, bringing their total number to 149 (100 genera and 28 families). The spider fauna of the study area represents around 11% of the Italian fauna and includes a quarter of the species currently known for Piedmont. Based on data issued from the Italian Catalog "araneae.it" (Pantini & Isaia 2019) our works bring the total number of known species for the Torino Province to 418 and to 689 for the Region of Piedmont.

The territory of the Natural Park of La Mandria hosts the largest remnant patch of the area of lowland forest in the upper Piedmont Plain and has a long history of anthropic disturbance. Few works deal with spiders from similar habitats in the Po lowland (Pesarini 2002; Bogliani et al. 2003; Paschetta et al. 2012; Pantini & Brunero 2020) and only in one case they dealt with ground dwelling and foliage dwelling spiders at the same time (Pantini & Brunero 2020). Although a direct comparison is rather doable due to different sampling design, effort and methods, the araneological biodiversity of La Mandria seems rather high (149 species in 28 families). Moreover, our choice to combine different sampling methods provides a comprehensive and exaustive framework, being able to sample different ecological guilds. Specifically, the Natural Reserve Bosco della Fontana (Pesarini 2002; methods and sampling design not specified) proved to host 78 species in 22 families, the Regional Parks of Ticino (Bogliani et al. 2003; pitfall traps in one season) 85 species in 19 families, the Natural Special Reserve of Fondo Toce (Paschetta et al. 2012; pitfall traps, one seasons) 35 species in 10 families and the Parco del Roccolo (Pantini & Brunero 2020; pitfall and hand collection, three years) 106 species in 26 families.

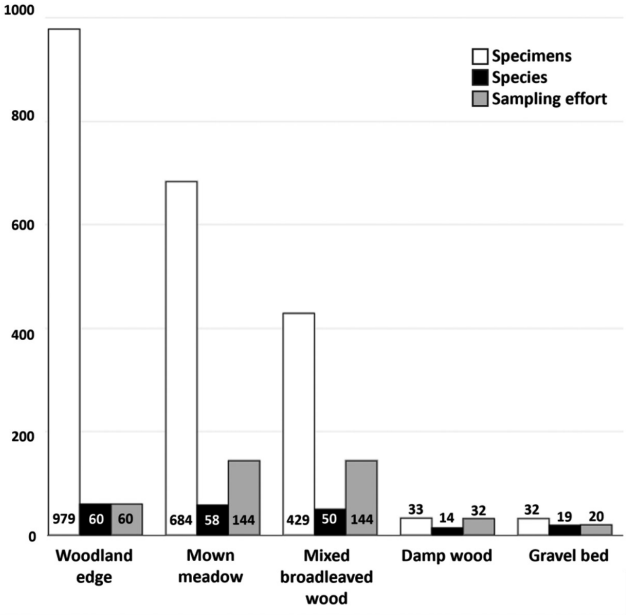


Fig. 33 – Number of specimens (white), number of species (black) and sampling effort (grey) for each habitat. Sampling effort in the woodland edge refers to the number of total samples of beating trays, otherwise to the total number of pitfalls placed therein.

The dominant species in the mixed broadleaved wood of the La Mandria Park are *Trochosa hispanica*, *Zodarion italicum*, *Phrurolithus festivus* and *Ozyptila praticola* that appear to be common in lowland environments in northern Italy such as the one examined in the previously cited papers (Bogliani et al. 2003; Paschetta et al. 2012; Pantini & Brunero 2020). Similar outcomes were also obtained for mown meadows, which showed comparable species composition to other spider communities across the Po lowland, with *Pardosa proxima* and *Arctosa leopardus* as dominant species (i.e. Paschetta et al. 2012). The most abundant foliage-dwelling species of the woodland edge (*Anyphaena accentuata*, *Dolomedes fimbriatus* and *Synema globosum*) are also very common in similar habitats across NW-Italy. Contrary to expectations, our samples from the damp woods did not reveal a specific coenosis associated with wetland habitats. This is likely because this habitat does not remain consistently wet throughout the season. Within the spider assemblage found there, the only hygrophilous species was indeed *Piratula latitans*, which is common in a variety of damp habitats. Conversely, the gravel bed was one of the most interesting habitats due to the presence of species strongly associated with the riparian environment such as *Pardosa wagleri, Piratula knorri, Gnaphosa dolosa* and *G. rhenana*. These Palaearctic species live on gravelly riverbanks in the riparian sand and are mostly found in the immediate vicinity of water. *Pardosa wagleri* is known from the north to the south of the Italian peninsula, with the exception of the major islands. *Piratula knorri* is recorded in the north of Italy and Sardinia. Conversely, records of *Gnaphosa dolosa* and *G. rhenana* are scarce in Italy and were never recorded for Piedmont until now. *G. dolosa* was previously known in four localities in Lombardia, Toscana (Isola d'Elba) and Sicilia (di Caporiacco 1950; Isaia et al. 2007; Dentici 2019; Ciocca & Pantini 2011), while *G. rhenana* was reported in six lo-

Table 4 – List of the species collected in this work with abundances by sampling methods and by habitats. New records for the Province of Turin (○) and the Region of Piedmont (●) are highlighted. Sampling methods acronym; BT (beating tray), PT (pitfall trap), PO (photo observation). Habitats acronym: WE (woodland edge), GB (gravel bed), MM (mown meadow), MW (mixed broadleaved wood), DW (damp wood).

Sampling method	**BT**	**PT**				**PO**	**TOT**
Habitat	**WE**	**GB**	**MM**	**MW**	**DW**		
Agelenidae C. L. Koch, 1837							
Agelena labyrinthica **(Clerck, 1757)**						**1**	**1**
○ *Eratigena fuesslini* **(Pavesi, 1873)**			**1**	**1**			**2**
Anyphaenidae Bertkau, 1878							
Anyphaena accentuata **(Walckenaer, 1802)**	**328**						**328**
Araneidae Clerck, 1757							
Agalenatea redii **(Scopoli, 1763)**						**1**	**1**
Araneus angulatus **Clerck, 1757**						**1**	**1**
Araneus diadematus **Clerck, 1757**						**1**	**1**
Araneus sturmi **(Hahn, 1831)**	**1**						**1**
Araniella cucurbitina **(Clerck, 1757)**	**40**						**40**
Araniella opisthographa **(Kulczyński, 1905)**	**6**						**6**
Argiope bruennichi **(Scopoli, 1772)**						**1**	**1**
○ *Cyclosa conica* **(Pallas, 1772)**	**14**						**14**
Gibbaranea bituberculata **(Walckenaer, 1802)**						**1**	**1**
Larinioides patagiatus **(Clerck, 1757)**	**1**						**1**
Mangora acalypha **(Walckenaer, 1802)**	**30**						**30**
Nuctenea umbratica **(Clerck, 1757)**	**4**			**1**			**5**
○ *Zilla diodia* **(Walckenaer, 1802)**	**1**						**1**
Atypidae Thorell, 1870							
● *Atypus piceus* **(Sulzer, 1776)**				**1**	**1**		**2**
○ *Atypus muralis* **Bertkau, 1890**				**1**			**1**
Cheiracanthiidae Wagner, 1887							
Cheiracanthium mildei **L. Koch, 1864**	**43**						**43**
Clubionidae Simon, 1878							
Clubiona brevipes **Blackwall, 1841**	**1**			**1**			**2**
Clubiona comta **C. L. Koch, 1839**	**3**			**1**			**4**
Clubiona lutescens **Westring, 1851**	**1**						**1**
Clubiona terrestris **Westring, 1851**					**1**		**1**
Dictynidae O. Pickard-Cambridge, 1871							
○ *Brigittea civica* **(Lucas, 1848)**	**1**						**1**
Dictyna arundinacea **(Linnaeus, 1758)**	**1**						**1**
● *Lathys humilis* **(Blackwall, 1855)**				**1**			**1**
Dysderidae C. L. Koch, 1837							
Dysdera lantosquensis **Simon, 1882**			**4**	**15**			**19**
Gnaphosidae Banks, 1892							
Callilepis schuszteri **(Herman, 1879)**			**1**				**1**
Drassodes lapidosus **(Walckenaer, 1802)**		**1**					**1**
Drassyllus praeficus **(L. Koch, 1866)**				**1**			**1**
○ *Drassyllus pumilus* **(C. L. Koch, 1839)**			**5**	**2**			**7**
Drassyllus pusillus **(C. L. Koch, 1839)**			**4**	**7**	**1**		**12**
Drassyllus villicus **(Thorell, 1875)**			**4**	**2**			**6**
● *Gnaphosa dolosa* **Herman, 1879**		**2**					**2**
● *Gnaphosa rhenana* **Müller & Schenkel, 1895**		**4**					**4**

Sampling method	BT	PT				PO	TOT
Habitat	WE	GB	MM	MW	DW		
Haplodrassus silvestris **(Blackwall, 1833)**			1	3			4
Kishidaia conspicua **(L. Koch, 1866)**	1						1
Micaria pulicaria **(Sundevall, 1831)**		1	1				2
Trachyzelotes pedestris **(C. L. Koch, 1837)**				5			5
Zelotes apricorum **(L. Koch, 1876)**			1	5			6
Zelotes hermani **(Chyzer, 1897)**			1	2			3
Zelotes latreillei **(Simon, 1878)**			2				2
Zelotes longipes **(L. Koch, 1866)**			1				1
Linyphiidae Blackwall, 1859							
Agyneta fuscipalpus **(C. L. Koch, 1836)**	1		1				2
Agyneta mollis **(O. Pickard-Cambridge, 1871)**			1				1
Agyneta rurestris **(C. L. Koch, 1836)**	8						8
Bathyphantes nigrinus **(Westring, 1851)**		1					1
Diplostyla concolor **(Wider, 1834)**		1	1	2			4
Drapetisca socialis **(Sundevall, 1833)**	1						1
Erigone autumnalis **Emerton, 1882**			4	3			7
Erigone dentipalpis **(Wider, 1834)**	4	2	3				9
Linyphia triangularis **(Clerck, 1757)**	3						3
Mermessus trilobatus **(Emerton, 1882)**			2	2			4
Neriene clathrata **(Sundevall, 1830)**			1				1
○ *Neriene peltata* **(Wider, 1834)**			1				1
○ *Oedothorax apicatus* **(Blackwall, 1850)**			2				2
Palliduphantes pallidus **(O. Pickard-Cambridge, 1871)**			1	1			2
Pelecopsis parallela **(Wider, 1834)**	1						1
Tenuiphantes tenuis **(Blackwall, 1852)**				4			4
○ *Walckenaeria antica* **(Wider, 1834)**		1					1
● *Walckenaeria atrotibialis* **(O. Pickard-Cambridge, 1878)**			3				3
Liocranidae Simon, 1897							
○ *Agroeca proxima* **(O. Pickard-Cambridge, 1871)**				1			1
Liocranoeca striata **(Kulczyński, 1882)**			1	4	1		6
Scotina celans **(Blackwall, 1841)**				1			1
Lycosidae Sundevall, 1833							
Arctosa leopardus **(Sundevall, 1833)**			64	1			65
○ *Arctosa perita* **(Latreille, 1799)**		1					1
● *Arctosa variana* **C. L. Koch, 1847**			1				1
Aulonia albimana **(Walckenaer, 1805)**			4	5	1		10
Hogna radiata **(Latreille, 1817)**			32	4			36
○ *Pardosa alacris* **(C. L. Koch, 1833)**				1			1
Pardosa amentata **(Clerck, 1757)**			2	11			13
Pardosa **gr.** *lugubris* **(Walckenaer, 1802)**		2	26	49	3		80
Pardosa **gr.** *proxima* **(C. L.** Koch, 1847)			103				103
Pardosa palustris **(Linnaeus, 1758)**			31				31
Pardosa proxima **(C. L. Koch, 1847)**		1	120				121
○ *Pardosa saltans* **Töpfer-Hofmann, 2000**			4	8			12

Sampling method	BT	PT				PO	TOT
Habitat	WE	GB	MM	MW	DW		
Pardosa tenuipes **L. Koch, 1882**			33				33
Pardosa vittata **(Keyserling, 1863)**		1					1
Pardosa wagleri **(Hahn, 1822)**		3					3
○ *Piratula knorri* **(Scopoli, 1763)**		4					4
Piratula latitans **(Blackwall, 1841)**			53	16	2		71
Trochosa hispanica **Simon, 1870**			21	89	10		120
Trochosa ruricola **(De Geer, 1778)**		3	9	2	2		16
Xerolycosa nemoralis **(Westring, 1861)**			31		2		33
Miturgidae Simon, 1886							
○ *Zora nemoralis* **(Blackwall, 1861)**				2			2
● *Zora silvestris* **Kulczyński, 1897**			3	1			4
Nemesiidae Simon, 1889							
Nemesia pedemontana **Decae, Pantini & Isaia, 2015**			1				1
Oxyopidae Thorell, 1869							
Oxyopes lineatus **Latreille, 1806**	11						11
Oxyopes ramosus **(Martini & Goeze, 1778)**	5						5
Philodromidae Thorell, 1873							
● *Philodromus albidus* **Kulczyński, 1911**	1						1
○ *Philodromus aureolus* **(Clerck, 1757)**	3						3
Philodromus cespitum **(Walckenaer, 1802)**	1						1
Philodromus praedatus **O. Pickard-Cambridge, 1871**				2			2
Philodromus rufus **Walckenaer, 1826**	23						23
● *Thanatus atratus* **Simon, 1875**			1				1
Tibellus oblongus **(Walckenaer, 1802)**	2						2
Phrurolithidae Banks, 1892							
Phrurolithus festivus **(C. L. Koch, 1835)**			1	28	5		34
Phrurolithus minimus **C. L. Koch, 1839**			5	6			11
Pisauridae Simon, 1890							
Dolomedes fimbriatus **(Clerck, 1757)**	97	1	7				105
Pisaura mirabilis **(Clerck, 1757)**	23			1			24
Salticidae Blackwall, 1841							
Ballus chalybeius **(Walckenaer, 1802)**	28						28
○ *Carrhotus xanthogramma* **(Latreille, 1819)**	3						3
Euophrys frontalis **(Walckenaer, 1802)**			2	7	1		10
Evarcha arcuata **(Clerck, 1757)**	3						3
Evarcha falcata **(Clerck, 1757)**	2						2
Heliophanus cupreus **(Walckenaer, 1802)**	12	1					13
Marpissa muscosa **(Clerck, 1757)**	3						3
Menemerus semilimbatus **(Hahn, 1829)**						1	1
Myrmarachne formicaria **(De Geer, 1778)**			1				1
○ *Phintella castriesiana* **(Grube, 1861)**	55						55
○ *Pseudeuophrys erratica* **(Walckenaer, 1826)**	1						1
Pseudeuophrys lanigera **(Simon, 1871)**				1			1
○ *Pseudicius encarpatus* **(Walckenaer, 1802)**	1						1
Salticus scenicus **(Clerck, 1757)**						1	1
Segestriidae Simon, 1893							

Sampling method	BT	PT				PO	TOT
Habitat	WE	GB	MM	MW	DW		
Segestria senoculata **(Linnaeus, 1758)**	**2**						**2**
Sparassidae Bertkau, 1872							
Micrommata virescens **(Clerck, 1757)**	**2**			**1**			**3**
Tetragnathidae Menge, 1866							
Pachygnatha degeeri **Sundevall, 1830**			**23**				**23**
Pachygnatha listeri **Sundevall, 1830**			**1**				**1**
Tetragnatha montana **Simon, 1874**	**1**						**1**
Theridiidae Sundevall, 1833							
○ *Anelosimus vittatus* **(C. L. Koch, 1836)**	**26**						**26**
Asagena italica **(Knoflach, 1996)**			**2**				**2**
Crustulina guttata **(Wider, 1834)**			**1**	**2**			**3**
Dipoena melanogaster **(C. L. Koch, 1837)**	**31**						**31**
Enoplognatha ovata **(Clerck, 1757)**				**1**			**1**
Enoplognatha thoracica **(Hahn, 1833)**	**1**						**1**
Euryopis flavomaculata **(C. L. Koch, 1836)**			**3**	**27**			**30**
Parasteatoda lunata **(Clerck, 1757)**	**3**						**3**
Platnickina tincta **(Walckenaer, 1802)**	**15**						**15**
Theridion pinastri **L. Koch, 1872**	**14**						**14**
Theridion varians **Hahn, 1833**	**4**						**4**
● *Theridula gonygaster* **(Simon, 1873)**	**1**						**1**
Thomisidae Sundevall, 1833							
Bassaniodes robustus **(Hahn, 1832)**			**14**	**5**			**19**
Ebrechtella tricuspidata **(Fabricius, 1775)**	**26**						**26**
Misumena vatia **(Clerck, 1757)**	**7**						**7**
Ozyptila praticola **(C. L. Koch, 1837)**	**4**			**17**			**21**
○ *Ozyptila sanctuaria* **(O. Pickard-Cambridge, 1871)**			**1**				**1**
Ozyptila simplex **(O. Pickard-Cambridge, 1862)**			**8**				**8**
○ *Pistius truncatus* **(Pallas, 1772)**	**9**						**9**
Synema globosum **(Fabricius, 1775)**	**56**						**56**
Tmarus piger **(Walckenaer, 1802)**	**5**			**1**			**6**
○ *Tmarus stellio* **Simon, 1875**	**1**						**1**
Xysticus kochi **Thorell, 1872**			**17**				**17**
Xysticus lanio **C. L. Koch, 1835**	**2**						**2**
● *Xysticus lineatus* **(Westring, 1851)**			**1**				**1**
● *Xysticus luctator* **L. Koch, 1870**				**6**	**1**		**7**
○ *Xysticus ulmi* **(Hahn, 1831)**		**1**					**1**
Titanoecidae Lehtinen, 1967							
Titanoeca tristis **L. Koch, 1872**			**1**				**1**
Uloboridae Thorell, 1869							
Hyptiotes paradoxus **(C. L. Koch, 1834)**	**1**						**1**
Zodariidae Thorell, 1881							
Zodarion italicum **(Canestrini, 1868)**			**10**	**68**	**2**		**80**
Zodarion rubidum **Simon, 1914**		**1**					**1**
Zoropsidae Bertkau, 1882							
Zoropsis spinimana **(Dufour, 1820)**						**1**	**1**
TOT	**979**	**32**	**684**	**429**	**33**	**9**	**2166**

calities in Lombardia and Trentino - Alto Adige (Pesarini 2000; Isaia et al. 2007; Steinberger & Zingerle 2009; Ciocca & Pantini 2011).

Although the distribution of the chorotypes of the species found in the Special Area of Conservation "La Mandria" is rather comparable to the regional pool of species of Piedmont, an important difference emerges in terms of endemic species, accounting in the Park for only 1% compared to the 11% at the regional level. The low number of species of conservation interests (i.e stenoendemic species) is possibly related to the historical and the geographical context of the Park. Indeed the Po lowland is a highly urbanised area, whose original environments have been extremely simplified across the centuries due to the intense anthropic activity that has characterised this area since Roman times. It seems likely that such an anthropization process has deeply transformed the local communities, with strong effects on species with the narrowest ecological requirements.

Nemesia pedemontana and *Dysdera lantosquensis* were the only two endemic species recorded in the study area.

N. pedemontana is a mygalomorph spider (family Nemesiidae) whose type series includes material collected in the Park (Decae et al. 2015). *Nemesia* spiders build highly structured 'trapdoors' to seal the entrances of their burrows, waiting for prey at the entrance to the burrow in crepuscular time. Spiders of this genus typically exhibit a trend of local endemism (Decae et al. 2015). In Italy, there are 20 species of *Nemesia,* among which 10 are Italian endemics (Isaia et al. 2018a), being their range fully included within the national borders. In particular, *N. pedemontana,* has an Apenninic chorotype, with a distribution range extending from the foothills of the western Alps to beyond the central Apennines. Due to their cryptic behaviour, phenology and lack of distinctive morphological characters, trapdoor spiders are renowned for being elusive and challenging to research (Decae et al. 2015). Although this species is fairly common in banks with moss in Piedmontese lowland forests (Decae et al. 2015), we found only one juvenile specimen in pitfall traps. Such a low number of specimens is in accordance with the general trend of *Nemesia* spiders in Italy, being generally found in very low numbers in pitfall traps except for short periods in late autumn (generally October-November), when males can become particularly active and fall abundantly in traps. In light of these considerations, investigating the survival of the species in relation to forest management practices, coupled with an assessment of the repercussions of forest fragmentation on local populations, could provide valuable conservation insights on this peculiar Italian endemic species. Additionally, exploring potential impacts of climatic changes on their phenology and evaluating the risk to the habitat posed by the high density of ungulates in the Park could elucidate the status of the population of *N. pedemontana* in the Park.

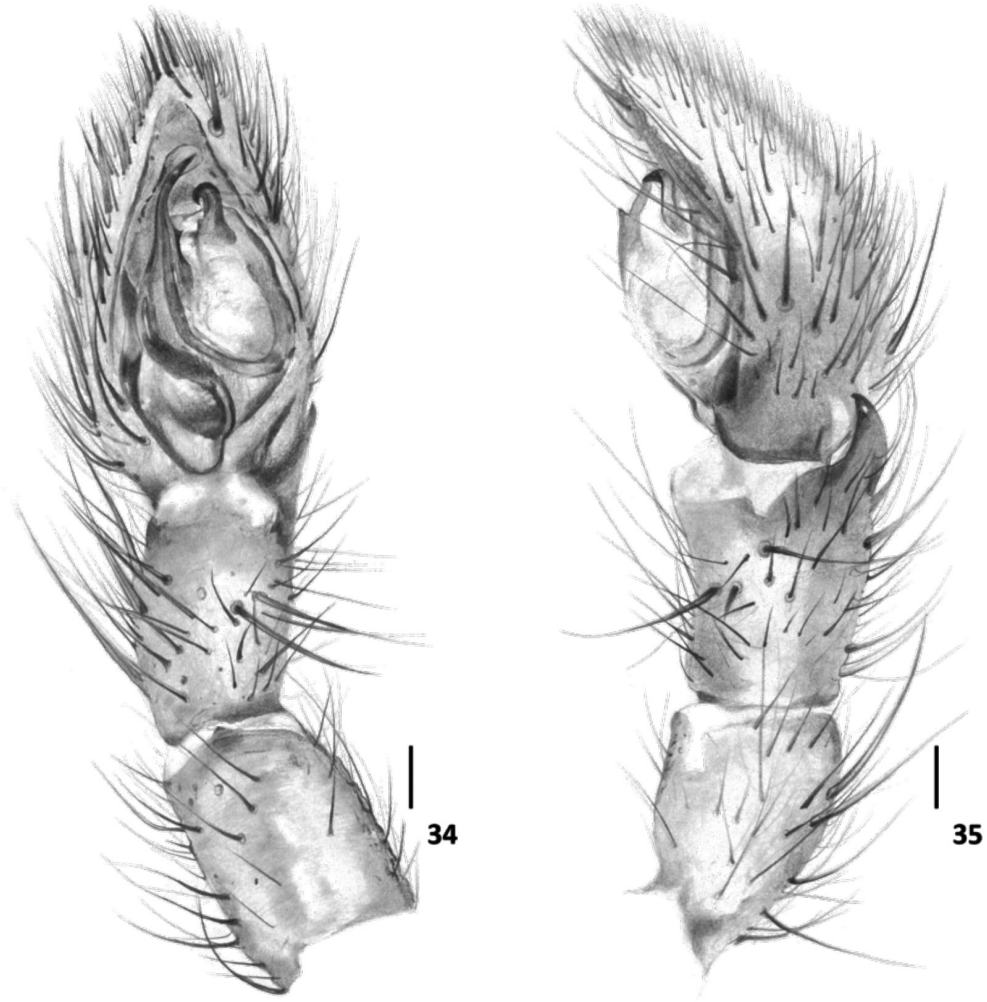
Table 5 – Chorotypes, abbreviation and relative number of species found in the study area and corresponding groups of chorotypes used in Fig. 40. All chorotypes and abbreviation follows Vigna Taglianti et al. (1993, 1999) and Stoch & Vigna Taglianti (2005). Introduced species are characterised based on information provided in World Spider Catalog (2023), accessed on 21/11/2023.

Chorotype	Abbreviation	Number of species	Group (Fig. 40)
Asiatic-European	ASE	34	Palaearctic
Palaearctic	PAL	28	
Siberian-European	SIE	15	
West Paleartic	WPA	4	
Centralasiatic-European	CAE	4	
Centralasiatic-European-Mediterranean	CEM	4	
European-Mediterranean	EUM	1	
Holarctic	OLA	14	Holarctic
Turanic-European	TUE	12	Turanic-European-Mediterranean
Turanic-European-Mediterranean	TEM	6	
Turanic-Mediterranean	TUM	2	
European	EUR	18	European
Central European	CEU	1	
West Mediterranean	WME	1	Mediterranean
Alps-Apenninic Endemic	ALAP	1	Endemic
Apenninic Endemic	APP	1	
Introduced in Europe	-	3	Alien

Dysdera lantosquensis is an endemic Dysderidae, with a restricted distribution to Italy, Corsica and the French side of the Alpes Maritimes. The status of endemic was recently recognized by Rezác et al. 2018, who revised the *Dysdera erythrina* species-complex and referred all Italian records of *D. erythrina* to *D. lantosquensis*. The genus *Dysdera* Latreille, 1804 exhibits a very high level of endemics in the Mediterranean basin and in particular in the Italian peninsula where the genus exhibits 40 species, 27 of them being considered Italian endemics. Despite its endemic status, in contrast to *N. pedemontana*, which is mainly associated with the lowland forest, *D. lantosquensis* does not exhibit specific ecological requirements and it is generally found across a wide range of habitats.

Regarding alien species, in addition to *Mermessus trilobatus* (Emerton, 1882), and *Erigone autumnalis* Emerton, 1882 previously known for the region, our work adds *Theridula gonygaster* (Simon, 1873) and brings the count of alien spider species in Piedmont to four (see Pantini and Isaia 2019).

Theridula gonygaster is a Theridiid originally from Central and South America and the Caribbean spreading across the world, with records in Europe, Africa and Asia. In Europe, this species was recorded for the first time in Italy in the first half of 1800 (Costa 1829). In Italy it is currently recorded in Calabria, Campania, Lazio, Lombardy, Tuscany and Veneto. The species lives on trees and shrubs, even in agricultural areas.



Figs 34-35 – Male genitalia of *Gnaphosa dolosa* Herman, 1879 from Ponte Violino, "La Mandria" Regional Natural Park, Druento (TO), Italy. **34**, left pedipalp (♂) in ventral view; **35**, left pedipalp (♂) in lateral view. Scale bars 0.1mm. Illustrations by Alessandro Infuso.

Mermessus trilobatus is a Linyphiidae from North America, now introduced to Azores and Europe, imported to south-western Germany in the second half of 1900. In Italy, it is reported for the entire northern part of the peninsula. The species is recorded in meadows, grassland, pastures, peat bogs and forest litter.

Erigone autumnalis is another Linyphiidae from North America, now introduced to Azores, Europe, Russia (Caucasus), United Arab Emirates, New Caledonia and Hawaii. In Italy, the species is mainly widespread in northern regions in any environment like grassland, dry meadow, gravel bed, forest, shrub plantations and in urban areas.

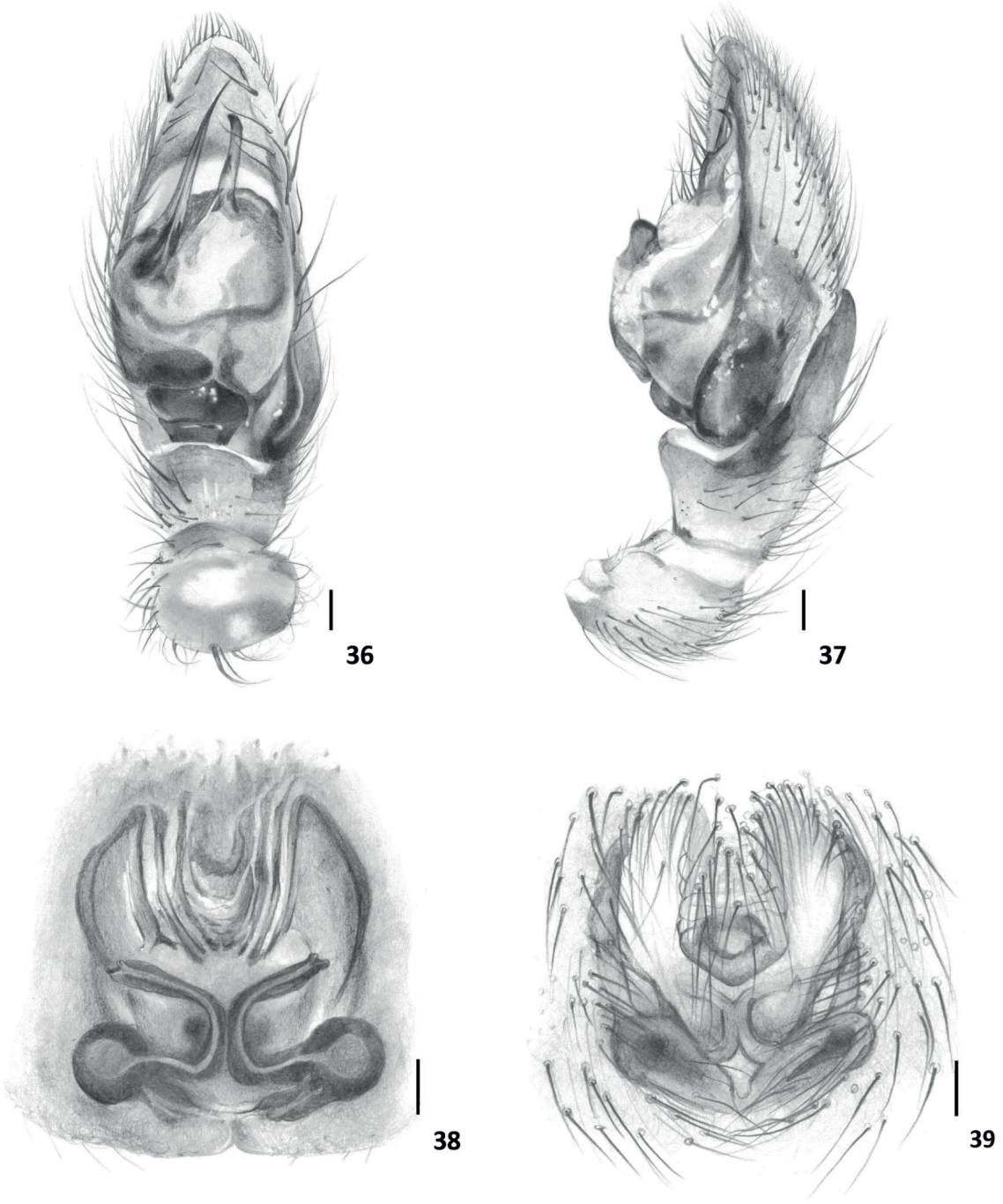
Besides these records, other species deserve particular attention in relation to their peculiar life history, such as *Atypus piceus* (Sulzer, 1776) and *A. muralis* Bertkau, 1890. These mygalomorph spiders (family Atypidae) inhabit a silken tube that runs partly above and partly deep in the ground in dry meadows and slopes with scarce vegetation. The spider awaits at the tube base and when a prey traverses the outer portion, the silken web vibrations prompt the spider to swiftly catch its prey. *A. piceus* has a mostly European distribution from France to Russia and Iran. In Italy it was known in 4 northern regions (Lombardia, Friuli-Venezia-Giulia, Trentino-Alto Adige and Veneto) and now is also recorded for Piedmont. The distribution of *A. muralis* is similar but extends from Central Europe to Turkmenistan. In Italy the species is known in the northern regions, except Friulia-Venezia-Giulia; our record is new for the province of Turin.

Conclusions

Despite their ecological role in the ecosystem and their long evolutionary history, spiders are not extensively investigated for conservation purposes compared to other animal groups (Milano et al. 2021). This is particularly important when considering the species of Parks and protected areas, where knowledge on spiders is often poor and fragmented.

In this work we broadened the knowledge on spiders in the Special Area of Conservation IT1110079 “La Mandria”, increasing the number of recorded species from 6 to 149. This work does not only consist in a faunal inventory updating knowledge on spiders of the area, but it also provides a basis for further studies on conservation ecology of spiders of this Park and in other areas of Piedmont. The “La Mandria” Regional Park stands as a verdant oasis of biodiversity in a densely populated and urbanised landscape, making it an important conservation hotspot.

The woodland integrity and its management are key issues for the survival of some peculiar species such as the Italian endemic mygalomorph *Nemesia pedemontana,* which is closely linked to this type of habitat. Consequently, it seems important to consider its present condition in the management of the Park landscape and habitats.



Figs 36-39 – Genitalia of *Gnaphosa rhenana* Müller & Schenkel, 1895 from Ponte Violino, “La Mandria” Regional Natural Park, Druento (TO), Italy. **36**, left pedipalp (♂) in ventral view; **37**, left pedipalp (♂) in lateral view; **38**, vulva (♀) in dorsal view; **39**, epigyne (♀) in ventral view. Scale bars 0.1mm. Illustrations by Alessandro Infuso.

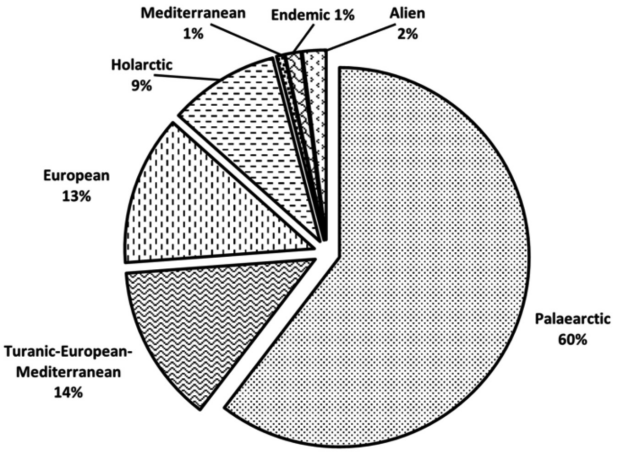


Fig. 40 – Species distribution. Groups of main chorotypes according to Table 5.

Being highly suitable for these species and particularly promising from the biodiversity point of view, a more in-depth study of the wetland habitats within the Park is particularly advocated here. Besides the possible findings of species of conservation interest such as *Dolomedes plantarius* and *Argyroneta aquatica*, exploring the biodiversity of wetlands within the Park could further increase the number of species known for the Park and provide important information about the status of these habitats in the context of the conservation of this protected area.

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