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HYMENOPTERA SPHECIFORMES OBSERVED IN SAN ROSSORE RESERVE (PISA PROVINCE, TUSCANY, ITALY)

Abstract - Several Malaise traps between 1999 and 2011 captured in the San Rossore Estate (Pisa, Italy) a number of Hymenoptera of families Ampulicidae, Sphecidae, and Crabronidae. The study of this material revealed the presence of 3, 14, and 168 species respectively, corresponding to the 47.3 % of the Italian species. Among these, *Sceliphron caementarium* (Drury, 1773), *S. curvatum* (F. Smith, 1870), *Isodontia mexicana* (Saussure, 1867), *Psenulus carinifrons iwatai* (Gussakovskij, 1934) represent allochthonous elements of recent introduction in Italy.

Key words - Hymenoptera, Ampulicidae, Sphecidae, Crabronidae, allochthonous species, San Rossore Estate (Pisa, Italy).

Riassunto - *Imenotteri sfeciformi osservati nella Riserva di San Rossore (Provincia di Pisa, Toscana, Italia)* - Negli anni 1999-2011 hanno operato in diversi luoghi della Tenuta di San Rossore (Pisa) alcune trappole di tipo Malaise per la cattura di Imenotteri. Lo studio del copioso materiale appartenente alle famiglie Ampulicidae, Sphecidae e Crabronidae ha rivelato la presenza rispettivamente di 3, 14, 168 specie nella riserva di San Rossore, corrispondenti al 47.3 % delle specie italiane. Sono anche state osservate quattro *taxa* alloctoni: *Sceliphron caementarium* (Drury, 1773), *S. curvatum* (F. Smith, 1870), *Isodontia mexicana* (Saussure, 1867) e *Psenulus carinifrons iwatai* (Gussakovskij, 1934). Questi *taxa*, la cui introduzione è avvenuta a partire dal 1990, sembrano essersi ormai ben acclimatati.

Parole chiave - Hymenoptera, Ampulicidae, Sphecidae, Crabronidae, specie alloctone, Tenuta di San Rossore (Pisa).

INTRODUCTION

In the past few years we studied the fauna of the aculeate family Chrysididae, Mutillidae and Pompilidae, mainly by means of Malaise traps (Dapporto *et al.*, 2004, 2006; Strumia *et al.*, 2007; Strumia, 2008). During their operation this kind of trap captures a number of flying insects belonging to different orders and families. All this material was preserved in alcohol, and, when possible, mounted and studied with the purpose to better understand the insects community of the reserve. Most of material is deposited in the «Museo di Storia Naturale e del territorio» of Pisa University, only few duplicates are retained by specialist. In addition the biorhythms of several groups of Hymenoptera, Diptera and Lepidoptera were studied by using an especially modified Malaise trap (Strumia, 2012). The Spheciformes is a paraphyletic assemblage of insects' families that in older classifications were called the Sphecoidea or Sphecidae. The biology of this group is fairly diverse. All play a key role, being predators of a variety of potentially dangerous insects like Orthopteroids, Coleop-

tera, Diptera, Lepidoptera and other Hymenoptera. Spheciformes are also among the primary crops pollinators.

MATERIALS AND METHODS

Eighteen Malaise traps operated between 1998 and 2011 in several sites of San Rossore, thus monitoring the main biotopes: shore, wood, open prairies. In addition water traps were occasionally used. Most of the captured material was mounted and studied.

RESULTS

The Spheciformes are present in Italy with 392 species (Pagliano & Negrisolò, 2005; Pagliano, 2009). Presently we can list 185 species captured in San Rossore reserve, corresponding to 47.2% of the known Italian fauna (Tabb. 1, 2, 3).

Tab. 1 - Checklist of Hymenoptera Ampulicidae found in San Rossore.

Spheciformes of Family Ampulicidae	
1	<i>Ampulex fasciata</i> Jurine, 1807
2	<i>Dolichurus bicolor</i> Lepeletier, 1845
3	<i>Dolichurus corniculatus</i> (Spinola, 1808)

Tab. 2 - Checklist of Hymenoptera Sphecidae found in San Rossore.

Spheciformes of Family Sphecidae	
1	<i>Ammophila beydeni</i> Dahlbom, 1845
2	<i>Ammophila sabulosa</i> (Linnaeus, 1758)
3	<i>Isodontia mexicana</i> (Saussure, 1867)
4	<i>Palmodes occitanicus</i> (Lepeletier & Serville, 1828)
5	<i>Palmodes strigulosus</i> (A. Costa, 1858)
6	<i>Podalonia hirsuta</i> (Scopoli, 1763)
7	<i>Prionyx kirbii</i> (Vander Linden, 1827)
8	<i>Prionyx viduatus</i> (Christ, 1791)
9	<i>Sceliphron caementarium</i> (Drury, 1773)
10	<i>Sceliphron curvatum</i> (F. Smith, 1870)
11	<i>Sceliphron spirifex</i> (Linnaeus, 1758)
12	<i>Sphex flavipennis</i> Fabricius, 1793
13	<i>Sphex flavipennis rufocinctus</i> Brullè, 1833
14	<i>Sphex funerarius</i> Gussakovskij, 1934

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Tab. 3 - Checklist of Hymenoptera Crabronidae found in San Rossore.

Spheciformes of Family Crabronidae		Spheciformes of Family Crabronidae	
1	<i>Alysson costai</i> Beaumont, 1953	57	<i>Ectemnius crassicornis</i> (Spinola, 1808)
2	<i>Alysson spinosus</i> Panz., 1801	58	<i>Ectemnius dives</i> (Lepeletier & Brullé, 1835)
3	<i>Alysson tricolor</i> Lepeletier & Serville, 1825	59	<i>Ectemnius guttatus</i> (Vander Linden, 1829)
4	<i>Ammatomus coarctatus</i> (Spinola, 1808)	60	<i>Ectemnius lapidarius</i> (Panzer, 1804)
5	<i>Astata affinis</i> Vander Linden, 1829	61	<i>Ectemnius lituratus</i> (Panzer, 1804)
6	<i>Astata apostata</i> Mercet, 1910	62	<i>Ectemnius rubicola</i> (Dufour & Perris, 1840)
7	<i>Astata boops</i> (Schrank, 1781)	63	<i>Ectemnius rugifer</i> (Dahlbom, 1845)
8	<i>Astata cobosi</i> Giner Mary, 1946	64	<i>Entomognathus brevis</i> (Vander Linden, 1829)
9	<i>Astata costae</i> A. Costa, 1867	65	<i>Gorytes laticinctus</i> (Lepeletier, 1832)
10	<i>Astata gallica</i> Beaumont, 1942	66	<i>Gorytes quinquecinctus</i> (Fabricius, 1793)
11	<i>Astata graeca</i> Beaumont, 1947	67	<i>Gorytes quinquefasciatus</i> (Panzer, 1798)
12	<i>Astata kashmirensis</i> Nurse, 1909	68	<i>Gorytes sulcifrons</i> (A. Costa, 1869)
13	<i>Astata minor</i> Kohl, 1885	69	<i>Harpactus affinis</i> (Spinola, 1808)
14	<i>Astata rufipes</i> Mocsary, 1867	70	<i>Harpactus elegans</i> (Lepeletier, 1832)
15	<i>Bembecinus hungaricus</i> (Fruivaldszky, 1876)	71	<i>Harpactus formosus</i> (Jurine, 1807)
16	<i>Bembecinus tridens</i> (Fabricius, 1781)	72	<i>Harpactus laevis</i> (Latreille, 1792)
17	<i>Bembix bidentata</i> Vander Linden, 1829	73	<i>Harpactus pulchellus</i> (A. Costa, 1859)
18	<i>Bembix oculata</i> Panzer, 1801	74	<i>Harpactus tauricus</i> Radoszkowski, 1884
19	<i>Bembix olivacea</i> Fabricius, 1787	75	<i>Larra anathema</i> (Rossi, 1790)
20	<i>Bembix rostrata</i> (Linnaeus, 1758)	76	<i>Lestica clypeata</i> (Schreber, 1759)
21	<i>Bembix tarsata</i> Latreille, 1809	77	<i>Lindenius panzeri</i> (Vander Linden, 1829)
22	<i>Cerceris arenaria</i> (Linnaeus, 1758)	78	<i>Lindenius pygmaeus armatus</i> (V.d. Linden, 1829)
23	<i>Cerceris bupresticida</i> Dufour, 1841	79	<i>Liris niger</i> (Fabricius, 1775)
24	<i>Cerceris eryngii</i> Marquet, 1875	80	<i>Mimesa crassipes</i> A. Costa, 1871
25	<i>Cerceris fimbriata</i> (Rossi, 1790)	81	<i>Mimesa grandii</i> Moidl, 1933
26	<i>Cerceris flavilabris</i> (Fabricius, 1793)	82	<i>Mimumesa dahlbomi</i> (Wesmael, 1852)
27	<i>Cerceris quadricincta</i> (Panzer, 1799)	83	<i>Mimumesa unicolor</i> (Vander Linden, 1829)
28	<i>Cerceris rubida</i> (Jurine, 1807)	84	<i>Miscophus ater</i> Lepeletier, 1845
29	<i>Cerceris rybyensis</i> (Linnaeus, 1771)	85	<i>Miscophus bicolor</i> Jurine, 1807
30	<i>Cerceris sabulosa</i> (Panzer, 1799)	86	<i>Miscophus eatoni</i> E. Saunders, 1903
31	<i>Crabro peltarius</i> (Schreber, 1784)	87	<i>Miscophus helveticus</i> Kohl
32	<i>Crabro scutellatus</i> (Scheven, 1781)	88	<i>Nitela borealis</i> Valkeila, 1974
33	<i>Crossocerus acanthophorus</i> (Kohl, 1892)	89	<i>Nitela fallax</i> Kohl, 1884
34	<i>Crossocerus annulipes</i> (Lepeletier & Brull, 1835)	90	<i>Nitela spinolae</i> Latreille, 1809
35	<i>Crossocerus binotatus</i> Lepeletier & Brull, 1835	91	<i>Nysson dimidiatus</i> Jurine, 1807
36	<i>Crossocerus capitatus</i> (Shuckard, 1837)	92	<i>Nysson niger</i> Chevrier, 1868
37	<i>Crossocerus cetratus</i> (Shuckard, 1837)	93	<i>Nysson quadriguttatus</i> Spinola, 1808
38	<i>Crossocerus congener</i> (Dahlb., 1844)	94	<i>Nysson tridens</i> Gerstaecker 1867
39	<i>Crossocerus elongatulus</i> (Vander Linden, 1829)	95	<i>Nysson trimaculatus</i> (Rossi, 1790)
40	<i>Crossocerus guichardi</i> Leclercq, 1972	96	<i>Nysson variabilis</i> Chevrier, 1867
41	<i>Crossocerus ovalis</i> Lepeletier & Brullv©, 1835	97	<i>Oryttus concinnus</i> (Rossi, 1790)
42	<i>Crossocerus podagricus</i> (Vander Linden, 1829)	98	<i>Oxybelus bipunctatus</i> Olivier, 1812
43	<i>Crossocerus quadrimaculatus</i> (Fabricius, 1793)	99	<i>Oxybelus dissectus</i> Dahlbom, 1845
44	<i>Crossocerus tarsatus</i> (Shuckard)	100	<i>Oxybelus haemorrhoidalis</i> Olivier, 1812
45	<i>Crossocerus varus</i> Lepeletier & Brullv©, 1835	101	<i>Oxybelus mucronatus</i> (Fabricius, 1793)
46	<i>Didineis lunicornis</i> (Fabricius, 1798)	102	<i>Oxybelus quatuordecimnotatus</i> Jurine, 1807
47	<i>Didineis wuestnei</i> Handlirsch, 1888	103	<i>Oxybelus trispinosus</i> (Fabricius, 1787)
48	<i>Dinetus pictus</i> (Fabricius, 1793)	104	<i>Passaloecus borealis</i> Dahlbom, 1844
49	<i>Diodontus insidiosus</i> Spooner, 1938	105	<i>Passaloecus corniger</i> Shuckard, 1837
50	<i>Diodontus minutus</i> (Fabricius, 1793)	106	<i>Passaloecus eremita</i> Kohl, 1893
51	<i>Diodontus tristis</i> (Vander Linden, 1829)	107	<i>Passaloecus gracilis</i> Curtis, 1834
52	<i>Dryudella tricolor</i> (Vander Linden, 1829)	108	<i>Passaloecus insignis</i> (Vander Linden, 1829)
53	<i>Ectemnius cavifrons</i> (Thomson, 1870)	109	<i>Passaloecus pictus</i> Ribaut, 1952
54	<i>Ectemnius cephalotes</i> (Olivier, 1792)	110	<i>Passaloecus singularis</i> Dahlbom, 1844
55	<i>Ectemnius confinis</i> (Walker, 1871)	111	<i>Passaloecus turionum</i> Dahlbom, 1844
56	<i>Ectemnius continuus</i> (Fabricius, 1804)	112	<i>Passaloecus vandeli</i> Ribaut, 1952
		113	<i>Pemphredon austriaca</i> (Kohl, 1888)

Spheciformes of Family Crabronidae

114	<i>Pempredon inornata</i> Say, 1824
115	<i>Pempredon lethifer</i> (Shuckard, 1837)
116	<i>Pempredon lugens</i> Dahlbom, 1842
117	<i>Pempredon lugubris</i> (Fabricius, 1793)
118	<i>Pempredon morio</i> Vander Linden, 1829
119	<i>Pempredon rugifer</i> (Dahlbom, 1844)
120	<i>Philantbus triangulum</i> (Fabricius, 1775)
121	<i>Pison atrum</i> (Spinola, 1808)
122	<i>Psen exaratus</i> (Eversmann, 1849)
123	<i>Psenulus carinifrons iwatai</i> (Gussakovskij, 1934)
124	<i>Psenulus concolor</i> Dahlb.
125	<i>Psenulus fuscipennis</i> (Dahlbom, 1843)
126	<i>Psenulus laevigatus</i> (Schenck, 1857)
127	<i>Psenulus meridionalis</i> Beaumont, 1937
128	<i>Psenulus pallipes</i> (Panzer, 1798)
129	<i>Psenulus schencki</i> (Tornier, 1889)
130	<i>Rbopalum austriacum</i> (Kohl, 1899)
131	<i>Rbopalum clavipes</i> (Linnaeus, 1758)
132	<i>Rbopalum coarctatum</i> (Scopoli, 1763)
133	<i>Rbopalum gracile</i> Wesmael, 1852
134	<i>Solierella compedita</i> (Piccioli, 1969)
135	<i>Spilomena troglodytes</i> Vander Linden, 1829
136	<i>Stigmus solskyi</i> A. Morawitz, 1864
137	<i>Tachysphex brullii</i> F. Smith, 1833
138	<i>Tachysphex consocius</i> Kohl, 1892
139	<i>Tachysphex coriaceus</i> A. Costa, 1867
140	<i>Tachysphex costae</i> De Stefani, 1882
141	<i>Tachysphex fugax</i> Radoszkowski, 1877
142	<i>Tachysphex fulvitaris</i> A. Costa, 1867
143	<i>Tachysphex helveticus</i> Kohl, 1885
144	<i>Tachysphex incertus</i> Radoszkowski, 1877
145	<i>Tachysphex julliani</i> Kohl, 1883
146	<i>Tachysphex mediterraneus</i> Kohl, 1883
147	<i>Tachysphex nitidior</i> Beaumont, 1940
148	<i>Tachysphex nitidus</i> (Spinola, 1805)
149	<i>Tachysphex obscuripennis</i> (Schenck, 1857)
150	<i>Tachysphex obscuripennis gibbus</i> Kohl, 1885
151	<i>Tachysphex panzeri</i> (Vander Linden, 1829)
152	<i>Tachysphex pompiliformis</i> (Panzer, 1805)
153	<i>Tachysphex psammobius</i> (Kohl, 1880)
154	<i>Tachysphex tarsinus</i> (Lepeletier, 1845)
155	<i>Tachysphex unicolor</i> (Panzer, 1806)
156	<i>Tachytes etruscus</i> (Rossi, 1790)
157	<i>Tachytes europeus</i> Kohl, 1881
158	<i>Tachytes panzeri</i> (Dufour, 1841)
159	<i>Trypoxylon attenuatum</i> F. Smith, 1851
160	<i>Trypoxylon beaumonti</i> Antropov, 1991
161	<i>Trypoxylon clavicerum</i> Lepeletier & Serville, 1828
162	<i>Trypoxylon deceptorium</i> Antropov, 1991
163	<i>Trypoxylon figulus</i> (Linnaeus, 1758)
164	<i>Trypoxylon kolazyi</i> Kohl, 1893
165	<i>Trypoxylon latilobatum</i> Antropov, 1991
166	<i>Trypoxylon medium</i> Beaumont, 1945
167	<i>Trypoxylon minus</i> Beaumont, 1945
168	<i>Trypoxylon scutatatum</i> Chevrier, 1867

The present list includes some allochthonous species recently introduced and established in Italy. They are well known allochthonous like the Sphecidae *Sceliphron caementarium* (Drury, 1773); *Sceliphron curvatum* (F. Smith, 1870); *Isodontia mexicana* (Saussure, 1867) (Pagliano *et al.*, 2000), and the recently discovered *Psenulus carinifrons iwatai* (Gussakovskij, 1934) (Fig.1).

The list represent a quite good approximation of the Spheciformes of the San Rossore reserve, within about 90% by nonparametrical statistical estimators (Magurran, 2004). We could confirm the arrival of four allochthonous species.

Sceliphron caementarium (Drury, 1773)

S. caementarium is a Nearctic species accidentally introduced into Europe, probably at the end of the second world war, and established in southern France in 1970. In Italy *S. caementarium* was found for the first time in 1990 in Tuscany, near Pisa (Strumia 1996). Field observations evidence a slow rate of spread, about 30 km in eight years (Pagliano *et al.*, 2000). In 2011 a Malaise trap operating in the Montecristo Island captured an individual of *S. caementarium*.

Sceliphron curvatum (F. Smith, 1870)

The original distribution of *S. curvatum* is India, Pakistan, Nepal, Tadzshikistan, Kazakhstan and Afghanistan (Hensen, 1987) and was first recorded in south-eastern Austria (van der Vecht, 1984), probably for an accidental introduction. In 1995 it was found for the first time in northern Italy (Veneto, Emilia and Piedmont) (Pagliano *et al.*, 2000). In June 1996, *S. curvatum* was found in Cagliari, Sardinia, and in 1998 in downtown Pisa and Rome. From the available records it appears that this species rapidly diffused westwards and southwards reaching Sicily and Calabria in 2002 (Fig. 2). *S. curvatum* is presently recorded from Spain, France, Switzerland, Austria, Hungary, Serbia, Greece and Bulgaria (Gayubo & Izquierdo, 2006).

Isodontia mexicana (Saussure, 1867)

I. mexicana is a Nearctic species accidentally introduced into Europe. It was first discovered in Herault (southern France) in 1960, and in Italy in 1995 (Bitsch *et al.* 1997:48; Pagliano *et al.*, 2000). Since then it has spread rapidly in Corsica, northern and central Italy where it is now common and widespread.

Psenulus carinifrons iwatai (Gussakovskij, 1934)

In 2009 a Malaise trap operating in the reserve «Laghi salati, Montecatini val di Cecina» (Pisa province) cap-

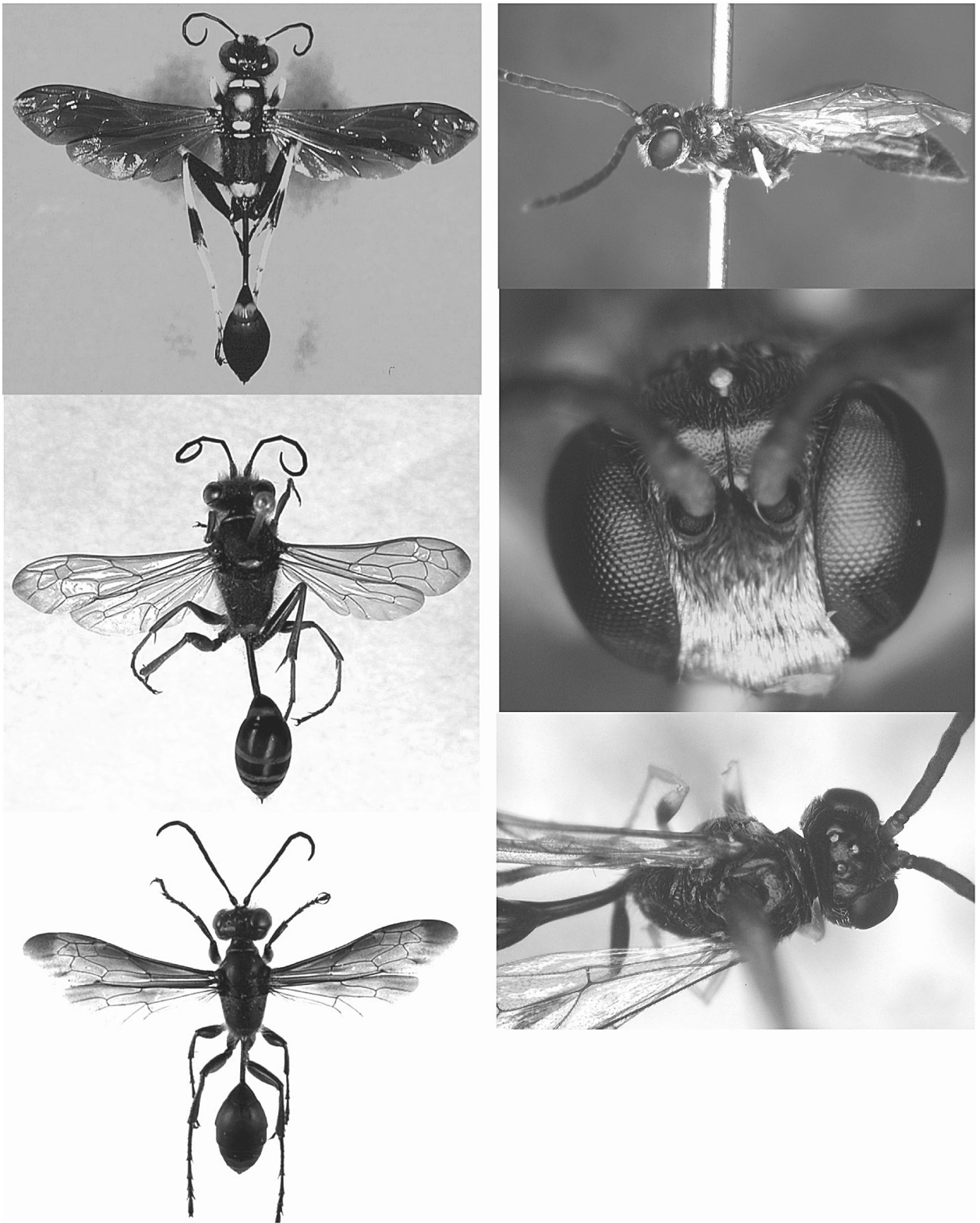


Fig. 1 - Recently introduced allochthonous Spheciformes in San Rossore. Left top: *Sceliphron caementarium* (Drury, 1773); left middle: *Sceliphron curvatum* (F. Smith, 1870); left bottom: *Isodontia mexicana* (Saussure, 1867). Right: *Psenulus carinifrons iwatai* (Gussakovskij, 1934); top: lateral view; middle: face; bottom: dorsal view of head and thorax.



Fig. 2 - Recorded fast diffusion in Italy of *Sceliphron curvatum* (Smith, 1870) in the years 1995-2002: black squares recorded between 1979 and 1990; black dots between 1991 and 1992; open circles from 1995 to 1998; black diamonds from 2000 to 2002.

tured a female of genus *Psenulus* different from the known Italian and European species. In 2010 another malaise trap located in the San Rossore reserve, loc. «Paduletto» (43° 43'8"N - 10° 19'4"E), captured in August and September two females and two males of the same species. The specimens were submitted for identification to Dr. Wojciech J. Pulawski, at the Natural History Museum of San Francisco, USA. After comparison with the material of the museum collection, Dr. Pulawski wrote:

«I was finally able to identify your mysterious *Psenulus* from San Rossore: it is *Psenulus carinifrons iwatai* (Gussakovskij, 1934). *Psenulus carinifrons* has several subspecies ranging from Sri Lanka to Australia, but *iwatai* from Japan is the only one with an all black thorax (as is the case with your specimen). I could compare this individual with the material from Japan in our collection, and it is completely identical. Also, it runs unequivocally to *iwatai* in van Lith's (1966) key to the *pulcherrimus* species group».

Since *P. carinifrons iwatai* (Fig. 1) was captured in 2009, 2010 and 2011 we have evidence that this oriental species is now established in Tuscany. The species of the genus *Psenulus* provisions their nest with small Aphids, thus we can suppose that this newly introduced species will not be dangerous but possibly beneficial. A close autochthonous species, *Psenulus palipes* (Panzer, 1798) is among the most diffuse species in the Pisa province.

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