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INFLUENCE OF A HUMID ZONE ON ENTOMOCOENOSIS DIVERSITY

SUMMARY

The authors studied the insect diversity associated to humid and dry zones in the Caselli Nature Reserve (Pisa, Tuscany) in 2016 by using two Malaise traps. The average number of species and individual captures increased in the humid zone to about 118% for species and to 152% for individuals respectively. This richness increase was observed for some families of Coleoptera and Hymenoptera Aculeata and Apoidea. Surprisingly, a richness decrease of Lepidoptera (to 89% and 66% respectively for species and individuals) and Orthoptera (to 44% and 21% respectively for species and individuals) in the humid zone has been observed.

Key words: humid zone, Lepidoptera, Hymenoptera Apoidea, Mutillidae, Chrysididae, Gasteruptiidae, Pompilidae, Coleoptera Buprestidae, Orthoptera, Tuscany

RIASSUNTO

Influenza di una zona umida sulla diversità delle entomocenosi. Gli autori hanno studiato nel 2016 la diversità di insetti associati a due zone, una umida e l'altra secca, nella Riserva Naturale di Caselli (Pisa, Toscana), facendo uso di due trappole Malaise. Il numero medio di specie e di individui catturati è risultato generalmente più alto nella zona umida rispettivamente del 118% (specie) e del 152% (individui). Questa ricchezza specifica è stata osservata per alcune famiglie di Coleoptera ed Hymenoptera Aculeata e per gli Apoidea. Sorprendentemente, invece è stato osservato un decremento di specie e individui nella zona umida sia per i Lepidoptera (89% e 66% rispettivamente per specie e individui) che per gli Orthoptera (44% e 21% rispettivamente per specie e individui).

Parole chiave: zona umida, Lepidoptera, Hymenoptera Apoidea, Mutillidae, Chrysididae, Gasteruptiidae, Pompilidae, Coleoptera Buprestidae, Orthoptera, Toscana

INTRODUCTION

It is a common opinion that in the Mediterranean Region a humid zone has a richer biodiversity either as biomass and species richness than in other regions. Recently we could investigate several humid zones of Pisa province thanks to the UE project Zoumgest 2010-2012 (CAVALLI, 2012), having the opportunity to confirm this belief (STRUMIA, 2011a).

In 2015 and 2016 we operated Malaise traps in the Caselli Nature Reserve (Pisa Province) to monitor the insects populations. This natural reserve extends on the hills range parallel to the Tyrrhenian coast, and is one of less populated sites of Pisa province. The climate and vegetation are typical Mediterranean with a dry summer season. The insects numbers are maximum until June and July and decrease in the hot and dry midsummer, recovering in September.

Inside the Caselli Reserve there is a small permanent lake (Poggio of Acquaferrata lake, 43°13'46"N-10°41'57"E, 250 m above sea level), surrounded by an open wood of small typical Mediterranean trees and shrubs (Fig 1)

Fig. 1 — South view of the Acquaferrata Lake in the Caselli Reserve (Pisa, Tuscany). The white Malaise trap is visible on the opposite lakeshore.

Material and methods

The site near the lake is supposed to attract and preserve a rich insects population all year around and particularly during the hot and dry summer. This local population was studied in 2015 by operating a Malaise trap positioned a few meters from the lake's shore. Results confirm the presence of a rich population.

In 2016 we decided to quantitatively check the "humid zone effect" by operating two traps: the first in the same 2015 place (trap No. 1, Fig.3), the second positioned in a dry place about 294 m away from the lake, but at same altitude. (Trap No. 2, Figs 2 and 4). The traps operated continuously from 18.V.2016 to 17.IX.2016 and captured a large insects number, particularly wild bees, aculeate Hymenoptera, Coleoptera Buprestidae and Lepidoptera.

The captured material was stored in 60% ethyl alcohol and successively mounted, labeled and identified by specialists. Most of this material was then deposited in the Natural History Museum of Pisa University or retained by specialists. The prolonged immersion in alcohol deteriorated the Rhopalocera colors, especially Pieridae and small Lycaenidae individuals, making dif-

Fig. 2 — Malaise trap No. 2 view: 43°13'450"N – 10°41'39"E, 254 m a.s.l. It is located about 300 m southwest from Malaise trap No. 1.

Fig. 3 — View of 2016 Malaise trap No. 1 near the shore of Acquaferrata lake.

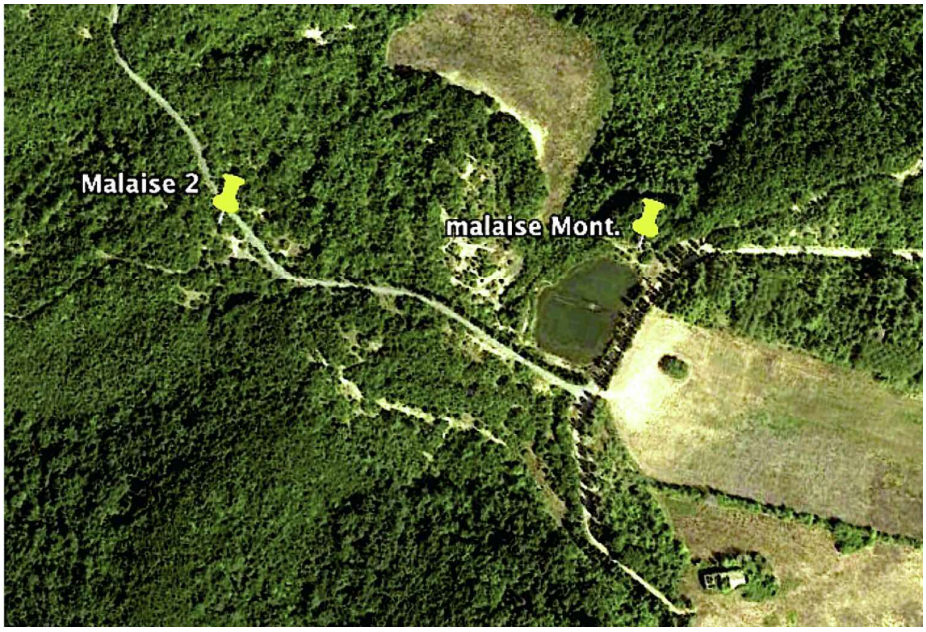

Fig. 4 — Aerial view of the two traps (No.1 and No. 2) operated in 2016.

ficult the species identification but not the species counting. The material captured by the traps was studied respectively by: D. Gianasso (Buprestidae), L. Filippi (Apoidea and Pompilidae), B. Massa (Orthoptera), G. Pagliano (Mutillidae) and F. Strumia (Chrysididae and Rhopalocera).

Results

For the purposes of present investigation we avoid to present some of the long species lists and we report only the summarized results for each group. Detailed data will be published elsewhere.

From the material captured in 2016 we obtained the following results.

Lepidoptera Rhopalocera

The number of captured butterflies in 2016 was high (about 1350 individuals and 54 species), taking also in account the particularly arid 2016 summer. On the contrary the captures of nocturnal Lepidoptera were unusually scarce.

The trap No. 2 (dry site) captured 817 specimens and 44 species. Surprisingly the trap No. 1 (humid site) captured less: 550 specimens and 38 species. The butterflies species observed in the Caselli Nature Reserve are 54 as reported in Table 1.

A few species were captured in large number (but larger in dry site), *Lasiommata megera* and *Polyommatus icarus,* thus evidencing the presence of an abundant and ubiquitous population.

Table 1

List of Lepidoptera Rhopalocera species captured in Caselli Reserve in 2016. The asterisk shows the species captured by only one trap

		Mal.2	Mal.1	Only Mal.2	Only Mal.1
1	*Aricia agestis* (Denis & Schiffermuller, 1775)	1		*	
2	*Celastrina argiolus* (Linnaeus, 1758)		1		*
3	*Coenonympha elbana* Staudinger, 1901	43	15		
4	*Coenonympha pamphilus* (Linnaeus, 1758)	5	16		
5	*Colias alfacariensis* Berger, 1948	3		*	
6	*Colias crocea* (Geoffroy, 1785)	1	2		
7	*Colias* sp ?	2	4		
8	*Colias hyale* (Linnaeus, 1758)	8	8		
9	*Cupido alcetas* (Hoffmansegg, 1804)		12		*
10	*Cupido argiades* (Pallas, 1771)		1		*
11	*Cupido minimus* (Fuessli, 1775)	1	33		
12	*Cyaniris semiargus* (Rottemburg, 1775)	1		*	

Continua: Tabele 1

Segue: Table 1

		Mal.2	Mal.1	Only Mal.2	Only Mal.1
13	*Erynnis tages* (Linnaeus, 1758)	10	11		
14	*Gegenes pumilio* (Hoffmansegg, 1804)		1		*
15	*Gonepteryx cleopatra* (Linnaeus, 1767)	10		*	
16	*Gonepteryx rhamni* (Linnaeus, 1758)	21	11		
17	*Issoria lathonia* (Linnaeus, 1758)	2		*	
18	*Lampides boeticus* (Linnaeus, 1767)		2		*
19	*Lasiommata maera* (Linnaeus, 1758)	1		*	
20	*Lasiommata megera* (Linnaeus, 1767)	247	166		
21	*Leptidea sinapis* (Linnaeus, 1758)	9	6		
22	*Leptotes pirithous* (Linnaeus, 1767)	16	42		
23	*Limenitis reducta* Staudinger, 1901	1	1		
24	*Lycaeides idas* (Linnaeus, 1761)	18	7		
25	*Maculinea arion* (Linnaeus, 1758)		1		*
26	*Maniola jurtina* (Linnaeus, 1758)	10	8		
27	*Melanargia galathea* (Linnaeus, 1758)	26	1		
28	*Melitaea athalia* (Rottemburg, 1775)	1		*	
29	*Melitaea cinxia* (Linnaeus, 1758)	2		*	
30	*Melitaea didyma* (Esper, 1779)	11	11		
31	*Melitaea phoebe* (Goeze, 1779)	1		*	
32	*Ochlodes venatus* (Bremer & Grey, 1853)	5	6		
33	*Papilio machaon* Linnaeus, 1758	1	3		
34	*Pieris brassicae* (Linnaeus, 1758)	1	4		
35	*Pieris mannii* (Mayer, 1851)		1		*
36	*Pieris napi* (Linnaeus, 1758)	2		*	
37	*Pieris rapae* (Linnaeus, 1758)	34	30		
38	*Plebejus argus* (Linnaeus, 1758)	8		*	
39	*Polyommatus bellargus* (Rottemburg, 1775)	71	45		
40	*Polyommatus coridon* (Poda, 1761)	1		*	
41	*Polyommatus icarus* (Rottemburg, 1775)	121	52		
42	*Polyommatus thersites* (Cantener, 1834)	27	13		
43	*Pseudophilotes baton* (Bergsträsser, 1779)	1		*	
44	*Pyrgus alveus* (Hubner, 1803)		1		*
45	*Pyrgus armoricanus* (Oberthur, 1910)		2		*
46	*Pyrgus malvoides* (Elwes & Edwards, 1897)	2	6		
47	*Pyrgus onopordi* (Rambur, 1839)	1	7		
48	*Pyrgus serratulae* (Rambur, 1839)		3		*
49	*Satyrium acaciae* (Fabricius, 1787)	1		*	
50	*Satyrium ilicis* (Esper, 1779)	2	3		
51	*Satyrium spini* (Denis & Schiffermuller, 1775)	37		*	
52	*Thymelicus action* (Rottemburg, 1775)	12	3		
53	*Thymelicus lineolus* (Ochsenheimer, 1808)	3		*	
54	*Thymelicus sylvestris* (Poda1761)	36	1		
	No. individuals	**817**	**540**		
	No. of species	**44**	**39**	**17**	**10**

The presence of two species in Caselli reserve (*Coenonympha elbana* and *Colias* sp.*?*) is of particular interest. *C. elbana* is considered a threatened endemism of Tuscan Archipelago. The number of captured specimens suggests that a stable population of *C. elbana* is present and reproducing in Caselli. Four males of a *Colias* similar to the *C. erate* (Esper, 1805) were captured by trap 1 and 2 in 2016. *C. erate* is a vagile species from Oriental Europe, East Germany and Austria; its arrival in the Caselli Reserve is not to be excluded and the future capture of additional males and females is necessary to confirm a correct identification of this interesting finding.

The material from trap No. 2 is more abundant in individuals and in species, thus contrasting with the expected effect of the humid zone. This unexpected result can depend on a difference in the vegetation composition, offering a more rich number of host plants around the dry zone or on a higher random vagility of butterflies. 10 species were captured only by trap 1, while 17 were captured only by trap 2 (Table 1).

If an insect population approaches well the lognormal distribution we have evidence that it is next to or has reached a local equilibrium and has not been recently disturbed by some perturbation. The number of captured individuals of butterflies in both sites is sufficiently large to allow a statistical analysis of their structure.

Each species is represented by the number of captured individuals. If we plots this number by using a logarithmic scale in the horizontal axis, the experimental points are well interpolated by a Gaussian function. This Gaussian distribution (known as Lognormal Distribution) of the population is usually observed for undisturbed populations (LUDWIG & REYNOLDS, 1988; KREBS, 1999; MAGURRAN, 2004).

The interpolated lognormal distribution for the butterflies captured by the trap1 and 2 respectively is shown in Fig 5. The nonlinear regression is good: $R^2 = 0.94$ and $R^2 = 0.91$ respectively. The estimated 2016 number of species in the dry site is S=45 and in the humid one S=39, respectively. We observe a preponderance of singletons and doubletons (species represented by one and two individuals respectively) in the captures of Malaise 2. This result suggests the presence of more wandering and occasional species in the dry site. Apparently the most vagile species avoid the humid site for some unknown reason.

Coleoptera Buprestidae

Buprestidae were particularly abundant in spring and ecologically not correlated to butterflies. The traps captured a significant number of individuals. The result is shown in Table 2. Also in this case we observe a prevalence of trap 1 in species and individuals number (Fig. 6).

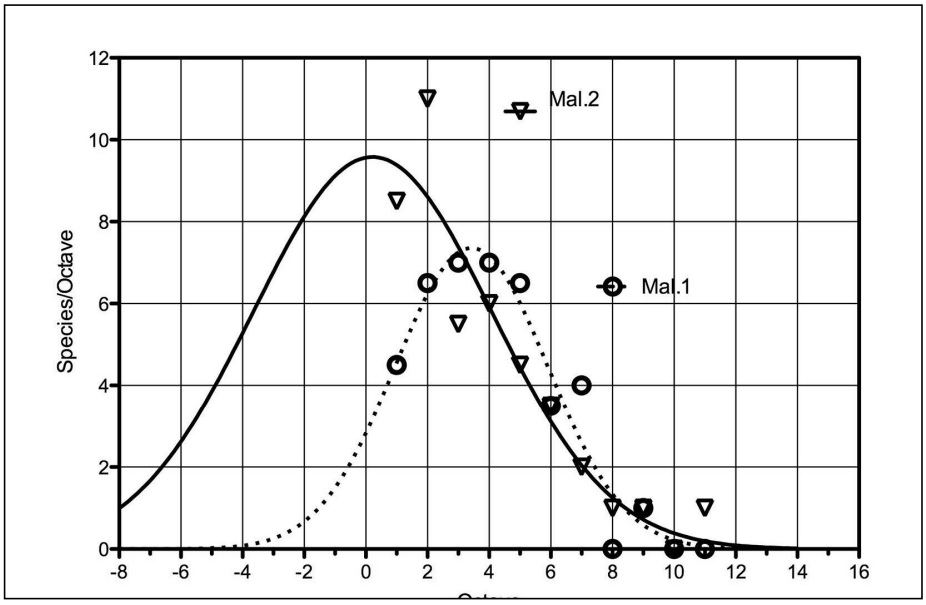

Fig. 5 — Calculated lognormal distribution for the butterflies populations observed in the humid (Mal.1) and dry (Mal.2) zones. In dry zone we observe e prevalence of singletons and doubletons.

Table 2
Coleoptera Buprestidae captured by traps 1 and 2 in 2016 in Caselli Reserve; species=18; No. individuals=91

		Mal.1	Mal.2	Only 1	Only 2
1	*Aricia agestis* (Denis & Schiffermuller, 1775)	1		*	
1	*Acmaeodera (Acmaeodera) pilosellae* (Bonelli, 1812)		1		*
2	*Acmaeodera (Acmaeotethya) quadrifasciata* (Rossi, 1790)	1		*	
3	*Agrilus angustulus* (Illiger, 1803)	1		*	
4	*Agrilus biguttatus* (Fabricius, 1776)	1	1		
5	*Agrilus convexicollis* Redtenbacher, 1849	2	7		
6	*Agrilus elegans elegans* Mulsant & Rey, 1863	2	6		
7	*Agrilus hastulifer* Ratzeburg, 1837	1	1		
8	*Anthaxia (Anthaxia) passerini* (Pecchioli, 1837)	12		*	
9	*Anthaxia (Anthaxia) semicuprea* Kuster, 1852	1		*	
10	*Anthaxia (Anthaxia) thalassophila* Abeille de Perrin, 1900	1	1		
11	*Anthaxia (Cratomerus) hungarica hungarica* (Scopoli, 1772)	6	2		
12	*Anthaxia (Haplanthaxia) confusa confusa* Gory, 1841	2		*	
13	*Anthaxia (Haplanthaxia) croesus* Villier ex *scutellaris* Gené, 1839	9	10		
14	*Anthaxia (Haplanthaxia) millefolii polychloros* Abeille de Perrin, 1894	1	2		
15	*Anthaxia (Melanthaxia) nigritula nigritula* Ratzeburg, 1837	1		*	
16	*Chrysobothris (Chrysobothris) affinis affinis* (Fabricius, 1794)		4		*
17	*Chrysobothris (Chrysobothris) solieri* Laporte & Gory, 1839	1	2		
18	*Coraebus elatus* (Fabricius, 1787)	7	5		
	Total	**49**	**42**	**6**	**2**

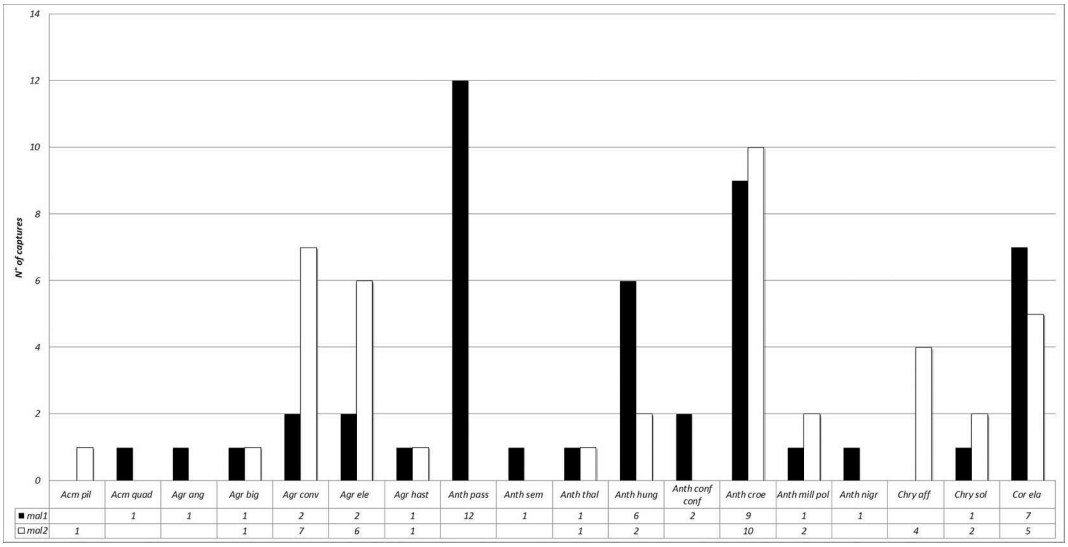

Fig. 6 — Buprestidae captured in humid site (Malaise 1) and in dry site (Malaise 2).

Abbreviations (from the left): Acm pil = *Acmaeodera pilosellae*; Acm quad = *Acmaeodera quadrifasciata*; Agr ang = *Agrilus angustulus*; Agr big = *Agrilus biguttatus*; Agr conv = *Agrilus convexicollis*; Agr ele = *Agrilus elegans*; Agr hast = *Agrilus hastulifer*; Anth pass = *Anthaxia passerini*; Anth sem = *Anthaxia semicuprea*; Anth thal = *Anthaxia thalassophila*; Anth hung = *Anthaxia hungarica*; Anth conf conf = *Anthaxia c. confusa*; Anth croe = *Anthaxia croesus*; Anth mill pol = *Anthaxia millefolii polychloros*; Anth nigr = *Anthaxia n. nigritula*; Chry aff = *Chrysobothris a. affinis*; Chry sol = *Chrysobothris solieri*; Core la = *Coraebus elatus*.

The Buprestidae phenology shows a dominant imago presence in spring: no individuals were captured after the middle July, contrary to Hymenoptera and Lepidoptera (Fig. 7).

Hymenoptera Chrysididae

Hymenoptera Chrysididae are efficient flyers, but the vagility is limited by the need to stay close to the reproduction sites of their hosts (mainly Hymenoptera Apoidea and Spheciformes).

In 2016 Malaise 1 captured 293 individuals and 44 species, Malaise 2 captured 142 individuals and 27 species. Also in this case we observe a prevalence of the humid site in either richness and diversity.

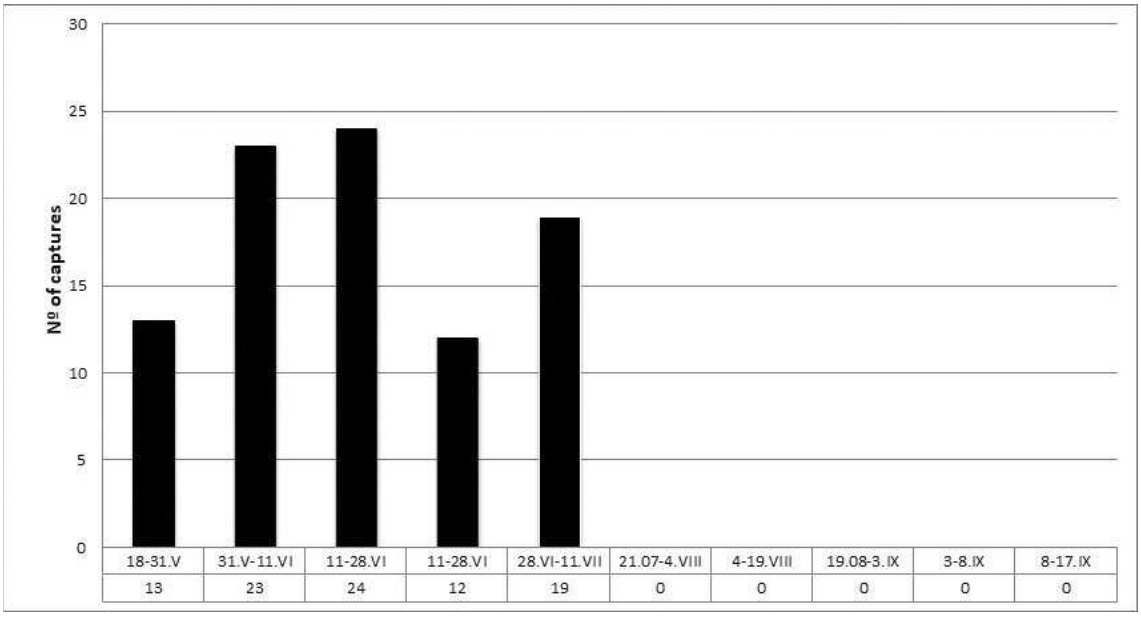

Fig. 7 — Phenology of Buprestidae captured in Caselli Reserve in 2016.

Hymenoptera Gasteruptiidae

Gasteruptiidae are a small family of the Superfamily Evanioidea. All Gasteruptiidae are weak flyer and parasitoid of solitary Apoidea. In Italy only one genus (*Gasteruption* Latreille, 1796) is present, with 20 species (19 species in Tuscany: PAGLIANO & SCARAMOZZINO, 2000; STRUMIA & PAGLIANO, 2013). In Tuscany previous 22 Malaise traps captured a total of 15 species, but always the number of captured individuals was small (STRUMIA & PAGLIANO, 2013).

In 2016 an unusual abundance of Gasteruptiidae was observed in Caselli: 97 individuals belonging to 16 species (Table 3).

The total amount of species captured at Caselli Reserve corresponds to 80% of Italian fauna, thus evidencing the rich fauna of this Reserve. In addition 5 species were found only in site 1, confirming a higher *Gasteruption* richness in the humid zone (Table 3).

Hymenoptera Apoidea

Apoidea fauna of Caselli Reserve resulted very rich: 2228 specimens and 171 species. The captures of Malaise 1 (N=1289 individuals and S=147

Table 3

List of 15 Gasteruption *species captured in 2016 in the Caselli Nature Reserve*

	Gasteruption species captured in Caselli Reserve	Mal.1	Mal.2	Only Mal.1	Only Mal.2
1	*assectator* (Linnaeus, 1758)	2	5		
2	*diversipes* (Abeille, 1879)	2	1		
3	*erythrostomum* (Dahlbom, 1844)	2	1		
4	*floreum* Szepligeti, 1903		1		*
5	*freyi* (Tournier, 1877)		1		*
6	*hastator* (Fabricius, 1804)	25	3		
7	*jaculator* (Linnaeus, 1758)	4	2		
8	*laticeps* (Tournier, 1877)	1		*	
9	*merceti* (Kieffer, 1904)	2	3		
10	*nigrescens* Schletterer, 1885	2		*	
11	*opacum* (Tournier, 1877)	3	2		
12	*pedemontanum* (Tournier, 1877)	22	2		
13	*subtile* Thomson, 1883	1		*	
14	*tournieri* Schletterer, 1885	3	4		
15	*undulatum*(Abeille, 1879)	2		*	
16	*variolosum* (Abeille, 1879)	1		*	
	No. individuals	**72**	**25**	**5**	**2**
	No. species	**14**	**11**		

species) are larger than those of Malaise 2 (N=939 and S=102) and clearly demonstrate a higher diversity associated to the humid zone (145% species increase, 135% individuals increase)

Hymenoptera Mutillidae

Mutillidae are mostly parasitoid of Hymenoptera Apoidea and Spheciformes. Females are wingless while most males are good flyers moving rapidly close to ground in search of females: males have an interesting biphasic circadian biorhythm (STRUMIA, 2011b).

About 70 species of Mutillidae are known from Italy. In 2016 either trap captured only a large number of Mutillidae males (1062 individuals), but no females. Results are shown in Table 4. Also in the case of Mutillidae the humid site captured more individuals and species than the dry one.

Hymenoptera Pompilidae

The family Pompilidae is a cosmopolitan family of Hymenoptera Aculeata. All species are solitary, and most of them capture and paralyze liv-

Table 4
Hymenoptera Mutillidae captured in Caselli Reserve by the traps of 2016; species=22; No. individuals=1062

	Trap2	Trap1	Only trap 1
Cystomutilla ruficeps (Smith, 1855)	5	6	
Krombeinella thoracica (Fabricius, 1793)	88	155	
Myrmilla calva (Villers, 1789)	5	21	
Myrmilla erythrocephala (Latreille, 1792)	2	16	
Myrmilla capitata (Lucas, 1849)	1		
Myrmosa atra Panzer, 1801	6	15	
Nemka viduata (Pallas, 1773)	1		
Paramyrmosa brunnipes (Lepeletier, 1845)		4	*
Physetopoda cingulata (Costa, 1858)		1	*
Physetopoda halensis (Fabricius, 1787)		2	*
Physetopoda lucasii (Smith, 1855)	1	7	
Physetopoda punctata (Latreille, 1792)		1	*
Physetopoda scutellaris (Latreille, 1792)	4	12	
Ronisia ghilianii (Spinola, 1843)	9	58	
Smicromyrme ausonia Invrea, 1950	98	314	
Smicromyrme lutescens Invrea, 1954,		2	*
Smicromyrme ruficollis ruficollis (Fabricius, 1793)	2	26	
Smicromyrme rufipes (Fabricius, 1787)	21	123	
Smicromyrme sicana (De Stefani, 1887)	6	16	
Smicromyrme sulcisia Invrea, 1955	5	25	
Tropidotilla grisescens Lepeletier, 1845		1	*
Tropidotilla litoralis (Petagna, 1787)		3	*
Total	**254**	**808**	**7**

ing spiders to feed their nest. For this ecology the Pompilidae are not associated to Apoidea and probably not influenced by their population richness. Captures of Pompilidae in the humid site decreased in species (94%) and individuals (63%), as reported in Table 5.

Orthoptera

The Malaise traps are less efficient in the capture of Othoptera in comparison with Hymenoptera and butterflies. From the study of our material (Table 6) the Orthoptera preference for the dry zone is highlighted. The species number rise from 7 (humid) to 16 (dry) and individuals number from 13 to 61, with a decrease to 44% (species) and 21% (individuals), respectively.

Table 5

List of Hymenoptera Pompilidae captured in 2016 in the humid (trap 1) and dry site (trap 2), respectively

		Malaise 1	Malaise 2
1	*Agenioideus cinctellus* (Spinola, 1808)	1	
2	*Agenioideus dichrous* (Brullé, 1840)	4	
3	*Agenioideus sericeus* (Vander Linden, 1827)		12
4	*Agenioideus usurarius* (Tournier, 1889)	2	7
5	*Anoplius nigerrimus* (Scopoli, 1763)	1	2
6	*Aporus unicolor* Spinola, 1808	2	1
7	*Aporus planiceps* (Latreille, 1809)		3
8	*Aporus unicolor* Spinola, 1808	4	14
9	*Arachnospila anceps* (Wesmael, 1851)	1	
10	*Arachnospila fuscomarginata* (Thomson, 1870)		2
11	*Arachnospila nuda* (Tournier, 1890)		1
12	*Arachnospila opinata* (Tournier, 1890)		1
13	*Arachnospila rufa* (Haupt, 1927)		1
14	*Arachnospila wesmaeli* (Thomson, 1870)	1	3
15	*Auplopus albifrons* (Dalman, 1823)	2	1
16	*Auplopus carbonarius* (Scopoli, 1763)	4	3
17	*Auplopus rectus* (Haupt, 1927)	2	1
18	*Ceropales albicincta* (Rossius, 1790)	1	8
19	*Ceropales cribrata* Costa, 1881	2	
20	*Ceropales helvetica* Tournier, 1889	10	
21	*Ceropales variegata* (Fabricius, 1798)	1	
22	*Cryptocheilus notatus* (Rossius, 1792)	2	12
23	*Cryptocheilus variabilis* (Rossius, 1790)	1	1
24	*Cryptocheilus versicolor* (Scopoli, 1763)	12	14
25	*Dipogon bifasciatus* (Geoffroy, 1875)	2	1
26	*Eoferreola manticata* (Pallas, 1771)		1
27	*Episyron albonotatum* (Vander Linden, 1827)		1
28	*Episyron gallicum* (Tournier, 1889)	4	3
29	*Episyron rufipes* (Linnaeus, 1758)	1	
30	*Evagetes dubius* (Vander Linden, 1827)	3	4
31	*Ferreola diffinis* (Lepeletier, 1845)		1
32	*Priocnemis exaltata* (Fabricius, 1775)	4	
33	*Priocnemis fastigiata* Haupt, 1934		3
34	*Priocnemis fennica* Haupt, 1927	4	7
35	*Priocnemis gracilis* Haupt, 1927	2	3
36	*Priocnemis minuta* (Vander Linden, 1827)		2
37	*Priocnemis parvula* Dahlbom, 1845	3	4
38	*Priocnemis propinqua* (Lepeletier, 1845)	1	
39	*Priocnemis pusilla* (Schioedte, 1837)	2	3
40	*Priocnemis schioedtei* Haupt, 1927	1	
41	*Priocnemis susterai* Haupt, 1927		7
	No. of individuals	**80**	**127**
	No. of species	**29**	**31**

Table 6
List of Orthoptera captured in Caselli Reserve by Malaise traps in 2016

	Trap 1	Trap 2	Only trap 1
Phaneroptera nana Fieber, 1853		2	
Tylopsis lilifolia (Fabricius, 1793)	3	3	
Metaplastes pulchripennis (A. Costa, 1863)		2	
Meconema thalassinum (De Geer, 1773)		2	
Ruspolia nitidula (Scopoli, 1786)		1	
Yersinella raymondi (Yersin, 1860)	3	12	
Rhacocleis germanica (Herrich-Schaeffer, 1840)	1	11	
Rhacocleis neglecta (A. Costa, 1863)		1	
Ephippiger zelleri (Fischer, 1854)		5	
Trigonidium cicindeloides Rambur, 1839	1		*
Oecanthus pellucens (Scopoli, 1763)	1	2	
Mogoplistes brunneus Serville, 1839		1	
Paratettix meridionalis (Rambur, 1838)	1		*
Pezotettix giornae (Rossi, 1794)		5	
Calliptamus siciliae Ramme, 1927		4	
Omocestus haemorrhoidalis (Charpentier, 1825)		6	
Chorthippus brunneus brunneus (Thunberg, 1815)	3	1	
Euchorthippus declivus (Brisout, 1848)		3	
No. individuals	**13**	**61**	
No. of species	**7**	**16**	

Two species were captured only in trap 1. However, Orthoptera are mainly termophilous species and only a few species are linked to humid habitats.

CONCLUSIONS

In the following Table 7 we summarize the observed 2016 data for all the studied groups. We present also the data for the single Apoidea families.

All Apoidea families show a clear preference for the humid site, with an average increase of 144% in species number and of 137% in individuals number with respect to the dry site.

All the studied families of parasitoids Hymenoptera appear to be correlated with their hosts (Apoidea). The "humid zone effect" is observed also for the Pompilidae, with a biology uncorrelated from Apoidea.

Lepidoptera, Orthoptera and Hymenoptera Pompilidae show a moderate preference for the dry zone with a general species and individuals decrease in the humid site. We have no clear explanation for this contrary effect, but it

can be correlated to the ecological behavior of species as well as to seasonal or climatic fluctuations; additional data must be collected in different environmental conditions.

Coleoptera Buprestidae show a preference for the humid site. We have no possible explanation for this effect. It is worth to note that Buprestidae are essentially present in spring when both sites are green and blooming, not having yet suffered from the water deficit of midsummer (Fig. 7).
In conclusion:

1 – Apoidea are positively influenced by the presence of a humid zone.
2 – The same influence is observed for the Hymenoptera families of parasitoids ecologically associated to Apoidea species as hosts.
3 – Pompilidae, a family of Hymenoptera Aculeata not associated to Apoidea, shows a preference for the dry site.
4 – Rhopalocera and Orthoptera show a moderate preference for the dry site.
5 – Our observations suggest that a more efficient pollination could be obtained by the presence of small humid zones purposely distributed in orchards.

Table 7
Comparison between the species and individuals numbers as observed in the captured material of Trap1 (humid site) and Trap2 (dry site) in 2016 in the Caselli Nature Reserve

Order	Family	ratio between Trap1 and Trap2 of captured species (%)	ratio between Trap1 and Trap2 of captured individuals (%)
Coleoptera	Buprestidae	150	117
Hymenoptera	Gasteruptiidae	127	288
Hymenoptera	Chrysididae	163	206
Hymenoptera	Mutillidae	133	318
Hymenoptera	Pompilidae	94	63
Lepidoptera	Rhopalocera	89	66
Hymenoptera	Apoidea all families	145	135
Orthoptera	Orthoptera	44	21
	Average of all groups	**118**	**152**

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