Ecology of the sawfly coenosis of Berici Hills (Veneto, NE Italy), with notes on taxonomy and distributional data of selected species (Hymenoptera)

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Abstract

In the period 2011-18, the entomological fauna of the Berici Hills was sampled using Malaise traps. The present contribution presents the results concerning the Hymenoptera "Symphyta". Overall, 145 species of sawflies have been collected; a table with indication of collecting location and number of specimens is provided. Two species have been found to be new to Italy: *Cladardis hartigi* Liston, 1995, and *Nematus (Paranematus) lonicerae* Weiffenbach, 1957; *Ardis pallipes* (Serville, 1823) and *Pristiphora insularis* Rohwer, 1910 are recorded for the first time for northern Italy; and 54 species have resulted new for the Veneto region. Some specimens of difficult identification are discussed: one Argidae, *Aprosthema* sp., and two Tenthredinidae: *Empria* sp. of the *parvula*-complex which fits well with the features delimiting the critical taxon *Empria kuznetzovi* Dovnar-Zapolskij, 1929; and *Pristiphora* sp. identified as *Pristiphora* cfr. *bohemica* Macek, 2012. The case of two enigmatic Nematine sawflies from Sardinia, *Nematus sardiniensis* Costa, 1886 and *Pristiphora oblita* Costa, 1894, is discussed in detail, advancing the hypothesis that they are respectively the male and the female of a species of the genus *Stauronematus* Benson, and not synonyms of *Nematus wahlbergi* Thomson, 1871 and *Dineura stilata* (Klug, 1816) as it has been supposed for a long time. The high number of species collected confirms the importance of Berici Hills as an area of high naturalistic value. The presence of calcareous xeric grassland seems to be particularly important and the sawfly fauna associated with this habitat is analysed.

Key words: Hymenoptera, Symphyta, Italy, Veneto, Colli Berici, grasslands, insect coenoses, biodiversity.

Riassunto

Ecologia delle cenosi di Sinfiti dei Colli Berici (Veneto, Italia), con note tassonomiche e geonemiche su specie rare o poco conosciute (Hymenoptera)

L'entomofauna dei Colli Berici fu oggetto di campionamenti effettuati mediante trappole Malaise nel periodo 2011-18. Qui vengono presentati i risultati relativi agli Hymenoptera "Symphyta". Nel complesso sono state censite 145 specie di Sinfiti; di esse viene fornita una tabella con indicazione delle località di raccolta e numero di esemplari. Due specie sono risultate nuove per l'Italia: *Cladardis hartigi* Liston, 1995 e *Nematus (Paranematus) lonicerae* Weiffenbach, 1957; di altre due, *Ardis pallipes* (Serville, 1823) e *Pristiphora insularis* Rohwer, 1910, i presenti reperti sono i primi relativi all'Italia settentrionale; inoltre 54 specie sono risultate nuove per la regione Veneto. Alcuni esemplari di difficile identificazione sono oggetto di discussione: un Argidae, *Aprosthema* sp., e due Tenthredinidae: una *Empria* sp. del gruppo *parvula* che corrisponde bene ai caratteri che identificano il taxon critico *Empria kuznetzovi* Dovnar-Zapolskij, 1929; e una *Pristiphora* sp. identificata come *Pristiphora* cfr. *bohemica* Macek, 2012. È discusso in dettaglio il caso di due enigmatici Nematinae descritti di Sardegna, *Nematus sardiniensis* Costa, 1886 e *Pristiphora oblita* Costa, 1894, riguardo ai quali si avanza l'ipotesi che siano rispettivamente il maschio e la femmina di una specie del genere *Stauronematus* Benson, e non sinonimi di *Nematus wahlbergi* Thomson, 1871 e *Dineura stilata* (Klug, 1816) come è stato supposto per molto tempo. Il gran numero di specie raccolte conferma l'importanza dei Colli Berci come area di notevole valore naturalistico. La presenza di praterie xeriche su substrato calcareo sembra essere di particolare importanza e la fauna di Sinfiti associata a tale habitat è analizzata in dettaglio.

Parole chiave: Hymenoptera, Symphyta, Italia, Veneto, Colli Berici, praterie, entomocenosi, biodiversità.

Introduction

Calcareous grasslands are known to be habitats with the highest floral diversity in central Europe (Wallis De Vries *et al.*, 2002). In the past, the spread of this habitat has been favored by human activity, mostly, but not exclusively, associated with sheep breeding. In the last decades, due to the diffusion of a more intensive agriculture, the calcareous grasslands, which are usually located on steep slopes, have been abandoned. As a consequence, in Europe, there has been a reduction and fragmentation of the surface occupied by calcareous meadows. Therefore, these habitats have a significant naturalistic value, and have been included in the list of the Habitats Directive to encourage their conservation. Several researches focused their studies and conservation efforts on calcareous grassland habitats, but mainly from a floral perspective. (Lack, 1982; Fischer & Stöcklin, 1997; Krauss *et al.*, 2004; Zschokke *et al.,* 2000). Research on entomological diversity has been lacking and generally limited to a few taxa such as butterflies and bees (Baur *et al.,* 1996; Niemelä & Baur, 1998; Steffan-Dewenter & Tscharntke, 2000; Zschokke *et al.,* 2000; Van Swaay, 2002). For a better understanding of the overall biodiversity, it is therefore necessary to have research aimed at studying the association between calcareous meadows and different groups of insects.

Berici Hills are a hilly complex that rises in the eastern Po Plain. The naturalistic importance of the Berici Hills has been officially recognized through their inclusion into the list of Sites of Community Importance (SCI IT3220037) of the European Commission Habitats Directive (92/43/EEC). The flora of this area has been widely studied highlighting the presence of a particularly important floristic richness: about 1200 species have been reported on the Berici Hills including the endemic *Saxifraga berica* (Bég.) Webb (Tasinazzo, 2007). The entomological fauna of the Berici Hills received less attention; the few data available are mainly the result of sporadic collections with only two notable exception: Orthoptera (Cogo & Fontana, 2002) and Diptera Syrphidae (Sommaggio, 2017). Cogo & Fontana (2002) reported 65 species of Orthoptera, highlighting the high biodiversity of this area. Comparing the results for this taxon with similar research in Veneto (Fontana, 1999; Cogo *et al.*, 2002) authors found a strong resemblance between the fauna of the Berici and the Euganei Hills. Two group of species are particularly interesting: species associated with xeric areas, well represented on grassland in the southern slopes, and species associated with colder habitats, more common on northern slopes of Hills. Sommaggio (2017) recorded 143 Syrphidae species in this area which denotes a very high biodiversity in the Berici Hills. Also, the group of species associated with xeric environments is particularly rich, including some species whose finding on the Berici Hills is the only record for North Italy. Furthermore, some rare saproxylic species of hoverflies have been found, probably the remnants of populations much more widespread in the eastern Po plain before the large exploitation of this area.

Overall, the sawfly fauna of Italy is far to be thoroughly known (Pesarini F., 2019); although the northern regions of the country are undoubtedly more investigated than others, the lowland sectors remain largely neglected in comparison to the alpine and montane habitats. Concerning the eastern part of the Po Valley, the first studies are those of Contarini (1843) covering the provinces of Padova and Venice, and Disconzi (1865) covering the province of Vicenza. An important, accurate contribution was that of Benzi & Picaglia (1896), concerning, though, the province of Modena, south to the Po river and relatively far away from the study area of the present work. Regarding the recent studies about sawflies, worth to be mentioned are Pesarini C Pesarini C. (1989) on Symphyta of Busatello swamp (Mantua/Verona provinces); Pesarini F. (1995a), an inventory of the Symphyta of the province of Ferrara; Pesarini F. (2002, 2004) on Symphyta of the "Bosco della Fontana" (Mantua province); Pesarini F. & Sommaggio (2012) specifically referring to the eastern part of the Po Valley. Some data concerning the province of Venice and the Veneto region are reported, but not disaggregated from the others, in the catalogue of the Symphyta of the Natural History Museum of Venice (Pesarini F., 1990, 1991, 1997); several others concerning lowland habitats of Romagna, at the extreme south of the mentioned area, are also reported, not disaggregated from montane records, in the noteworthy work of Zangheri (1969) as well as in the catalogue of the Campadelli Collection of the Natural History Museum of Ferrara (Pesarini F., 2006, 2008).

The number of species totalized by the above contributions is undoubtedly low compared to both the numbers totalized for lowland habitats of Central Europe and the number that would be reasonable to expect considering the richness of the sawfly faunas of the Italian Alps and the Apennines. The exiguous number of studies surely can play a role, but it cannot be excluded that the lowland fauna of northern Italy is also impoverished due to the man inducted "steppe landscape" of intensive agrarian exploitation (Pesarini F., 1995) and the extremely valuable reduced habitats remained in the whole area. For this reason, a relatively isolated and undisturbed district as Berici Hills complex is, may prove to be unusually rich and diverse in species despite its small extension.

The aims of this paper are: a) to provide a detailed list of the Symphyta species of the Berici Hills, b) to characterize the Symphyta fauna of calcareous grassland and c) to improve the taxonomic and ecological knowledge of some particularly rare species.

Material and Methods

Study area

The Berici Hills are located in North East Italy and occupy an area of about 200 Km^2, characterized mainly by low elevation: the highest mount is Monte Lungo, 445 m high. The Berici are not completely isolated in the flat landscape of the plain: they border to the North West with the southern reaches of the Lessini Mountains, while a flat stretch of a few kilometers separates them from the Euganei Hills (Fig. 1). Berici Hills originated between Upper Cretaceus and Early Miocene and sedimentary calcareous rocks dominated the substrate. Tasinazzo (2014) reported the vegetation types of Berici Hills, underlying the high number (more than 80) in a limited area. Forest vegetation is dominated by thermophilous oak woods (CORINE biotope: 41.731). In the cooler north-facing slopes, the climax forest vegetation is represented by mesophilous woods, in particular *Quercus* and *Carpinus betulus* (CORINE biotope 41.2A), but man largely exploited these habitats, usually replacing them with *Castanea sativa* woods (CORINE biotope 41.9). In the past the activity of man has also favored the development of calcareous grasslands, mainly belonging to the *Festuco-Brometalia* association (CORINE biotope: 34.75). The abandonment of less fertile land has caused, in recent years, a reforestation of calcareous grasslands, strongly reducing these important habitats. In the period 2010-2013 the European Community approved the Life project Nature+ "Colli Berici" which had among its objectives the restoration and maintenance of calcareous grasslands. In less exposed or north-facing areas, mesophile grasslands are more common, mainly belonging to the *Molinio-Arrhenatheretea* association (CORINE biotope 38.2). Carsism greatly reduces the presence of surface stream, except at the base of valleys. Another important exception is Fimon Lake, located at the north-eastern margin and occupying almost 0.5 km^2, with an average depth of 2 m. In the past, a rich hygrophilous vegetation occupied these wet environments (e.g. Chiesura & Lorenzoni, 1964; Bracco *et al.*, 2004); in this case, also, man has greatly reduced vegetation diversity, favoring the development of few species, such as *Carex acutiformis* Ehrh. and *Phragmites australis* (Cav.) Trin. ex Steud., which become dominant (Tasinazzo, 2014).

Symphyta sampling

During the 2011-2018 period, thirteen sites (Tab. 1) were monitored to evaluate the Syrphidae population, used as bioindicators in Life Project (Sommaggio, 2017). Malaise traps were used as sampling device and Symphyta collected were sorted and identified. When necessary the specimens were dried before identification. All the specimens are preserved in the dry collection of the authors.

For each site two Malaise traps were used per year. Not all the sites were sampled each year in the period that goes from 2010 to 2018, and only five of them were sampled for two or more years. Malaise traps were settled from March / April to October; they were supplied with a 70 % solution of ethanol. Occasional sampling by entomological net is mentioned only where additional species not collected by Malaise trap are present. Species nomenclature follows Lacourt (1999) for Tenthredinidae and Taeger *et al.* (2010) for all other families.

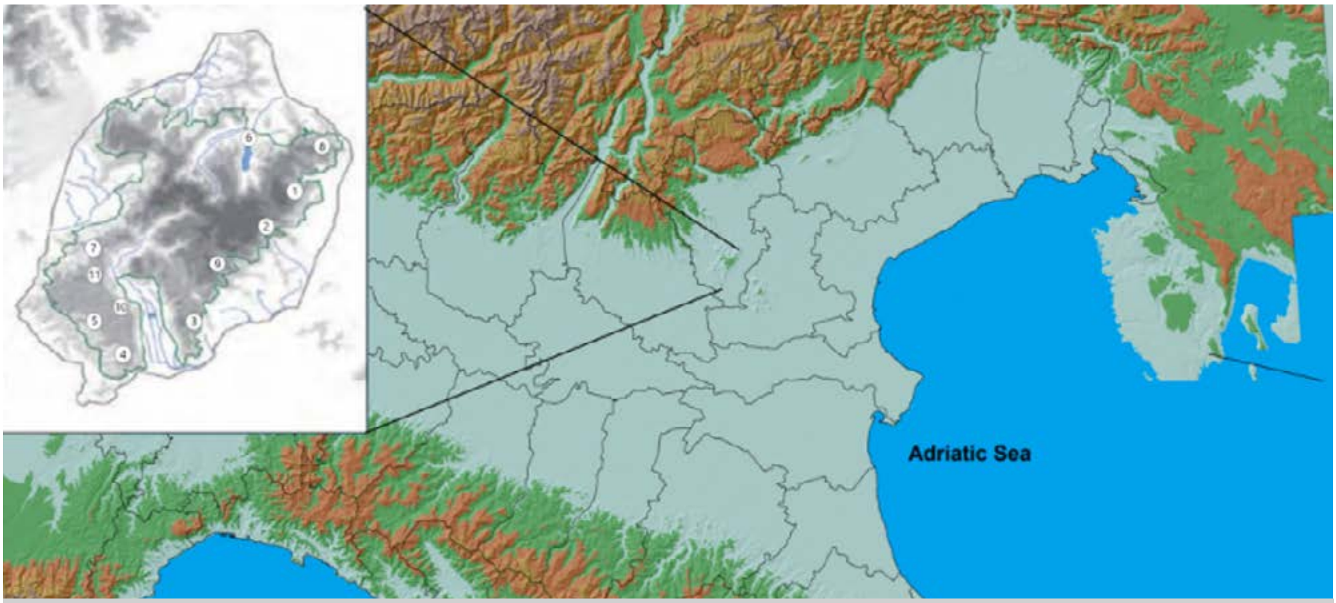

Fig. 1. Location of the study area in Northern Italy.

Locality	Year	Id. Code	Lat.	Lon.	Habitat	Surrounding habitat
Castegnero	2011	Cas11	45°26'41"N	11°34'24"E	Dry grassland	Thermophilous oak wood, with clearings and rural area at the margin of buffer
	2013	Cas13				
Nanto	2011	Nan11	45°26'08"N	11°33'45"E	Dry grassland	Thermophilous oak wood, with clearings and vineyards at the margin of buffer
	2013	Nan13				
M. Riveselle	2011	Toa11	45°23'06"N	11°30'40"E	Dry glassland	Thermophilous oak wood, with clearings and rural area at the margin of buffer
M. Piume	2011	Org11	45°21'20"N	11°27'17"E	Dry grassland	Dry grasslands, thermophilous oak wood, vineyards
	2013	Org13				
M. Piume	2011	Piu11	45°21'14"N	11°27'17"E	Dry grassland	Dry grasslands, thermophilous oak wood, vineyards

Alonte	2012	Alo12	45°22’45”N	11°26’14”E	Clearing in thermophilous oak wood.	Thermophilous oak wood, with clearings and rural area at the margin of buffer
Fimon Lake	2012	Fim12	45°28’47”N	11°32’31”E	Recently introduced pond in alluvional wood	Agroecosystem, mainly cereal fields; wetland and wood at margin of buffer
	2013	Fim13				
Cà Bertoldo	2012	Gra12	45°26’11”N	11°28’38”E	Dry grassland	Grassland and wood
San Rocco	2012	SRo12	45°28’45”N	11°34’59”E	Ravine ash-sycamore forests	Woods with large clearings
San Donato	2013	SDo13	45°24’31”N	11°31’48’E	Dry grassland	Dry grasslands, thermophilous woods, rural areas at margin of buffer
M. Motton	2013	Mot13	45°23’05”N	11°27’21”E	Dry grassland on recently disused vineyard.	Thermophilous oak wood, meadows, vineyards
M. Molinetto	2012	*	45°22’04”N	11°27’53”E	Dry grassland	Thermophilous oak wood, with clearings
M. Prete	2012	Pre12	45°25’35”N	11°26’40”E	Dry grassland and thermophilous oak wood	Vineyards, dry grassland, thermophilous oak woods, mining quarry.
	2013	Pre13				
	2018	Pre18				

Tab. 1. Name of the thirteen sites of monitoring, their Id. Code, location and ecological features.

Data analysis

Individual-based rarefaction curves were calculated to evaluate if the sampling effort was adequate; rarefaction curves were elaborate for each site, pooling the data collected in the two Malaise traps (Gotelli & Colwell, 2011; Colwell *et al.*, 2012). Data analysis were performed using the EstimateS 9.1.0 Software (Colwell, 2013).

Multivariate analysis was applied to abundance matrix of species in sampled sites, eventually excluding those where sampling effort seem to be not adequate according to rarefaction curves. Two different multivariate analysis were applied (Shaw, 2003):

a Cluster Analysis based on Ward’s method;

a Correspondence Analysis to compare which species seem to be more associated with specific sites; the singletons were eliminated from the matrix.

Both analyses were performed using Past 3.04 (Hammer *et al.*, 2001).

To detect if any species is associated with calcareous grassland the “Indicator Value” (IndVal) index has been used. The IndVal index is the product of two parameter as defined in Dufrêne & Legendre (1997) and De Cáceres *et al.* (2009). The two parameters are: 1) specificity or factor A which is the probability that a species belong to a site group (habitat in this research); this parameter is calculated as the mean abundance of the each species in the target site group divided by the sum of species abundance values in all other site groups and 2) fidelity or factor B which is the probability to find a species inside the site group (habitat) and it is calculated as the number of sites of the site group in which the species is present divided by all the sites inside the target site group (Dufrêne & Legendre, 1997; De Cáceres *et al.*, 2009; De Cáceres, 2013). A permutational test (n = 999) is applied to reject the null hypothesis that the IndVal square root for each species is casual. The IndVal values and its statistical significance has been calculated in R (De Cáceres, 2013).

Results

In the four years of sampling, 4084 specimens, belonging to 145 species has been collected (Tab. 1). Several data have resulted of special interest. Records of *Cladardis hartigi* Liston, 1995, and *Nematus (Paranematus) lonicerae* Weiffenbach, 1957, are the first records for Italy, and those of *Ardis pallipes* (Serville, 1823) and *Pristiphora insularis* Rohwer, 1910, are the first for the northern regions of the country. Besides, 53 species have resulted new for the Veneto region (Tab. 2).

Some of the above-mentioned species are of major interest, for instance those which have resulted new to Italy, or other ones that have been so rarely collected in the country to be considered, in some cases, possibly extinct south of the Alps. In other cases, the interest is the discussion on the taxonomical position of the taxon. The respective records for each species are discussed here.

Pamphiliidae

Pamphilius alternans (Costa, 1869)
Very rare species, Pesarini (2019) reported it only from six places in Italy; before the recent ones from Piedmont, Emilia, Abruzzi and Puglia, the only Italian records dated back to Nineteenth century and were the type of Costa ("S. Severino" [Lucano?]) and one specimen from the Modena province. *Pamphilius alternans* is distributed in Central and Southern Europe; its larva and biology are unknown.

Argidae

Aprosthema tardum (Klug, 1814)
Aprosthema tardum is one of the polyvoltine species of *Aprosthema* that Vikberg (2004), who gives also a key for their identification, dealt with. The two morphs, spring and summer respectively, are quite dimorphic, in particular for the different proportions of the head. One female collected in M. Prete in Berici Hills belongs to the spring generation, all the others to the summer one. Further details on both forms are reported by Liston et al. (2018), who give also a detailed description of the life history of the species. *Lathyrus latifolius* L. (Fabaceae) is the host plant of *A. tardum* larvae. *A. tardum* is perhaps the less infrequent species of *Aprosthema* in Italy; in literature, it was reported, but only on single specimens, in Lombardy, Friuli-Venezia Giulia, Liguria, Tuscany and Calabria.

Aprosthema sp. (Fig. 1A)
Additional specimen: Pozzolo in Villaga, 45°21'N, 11°30'E, 8.VI.2010, 1 ♀.
Two females of *Aprosthema* sp. have been collected in the present research (Tab. 2). The additional female from Pozzolo in Villaga is entirely ochreous except for the blackish antennae; head and mesosternum are strongly darker than the great part of thorax and abdomen, whereas legs are barely lighter (Fig. 1A). The Nan 11 specimen is distinctly darker than the former, having head almost black except for the brown clypeus and largely darkened mesonotum; the mesosternum is darker than in the other specimen and the dark colour is spread to the lower part of pleurae; on the whole, however, both specimens should belong to the same species. Both have wings subhyaline uniformly suffused of a yellowish-ochreous tinge, with venation dark brown except for Costa (C), distinctly lighter (especially in the first specimen), and for the dirty yellow stigma. In both specimens, moreover, sawsheath is sub-rectangular (in lateral view) with subtruncate apex and yellowish-ochreous coloured (uniformly in the former and with only the median commissure and the extreme upper angle of the valves darkened in the latter). Such features may recall those of *Aprosthema desertum* (Forsius, 1921), which is known, however, only of Central Asia (Turkmenistan, Uzbekistan) (Gussakovskij, 1935). The possibility that the above specimens could be identified with this species must not be excluded *a priori*, considering that another Central Asian species, *A. pallidulum* Gussakovskij, 1935, has been reported also from Yugoslavia (see Liston, 1995).

Tenthredinidae

Tenthredininae
Tenthredopsis nassata (Linnaeus, 1758)
Additional specimens: Monte del Prete 6-21.V.2011, 1 ♀;
Tenthredopsis nassata (L.) is a common species distributed across the Palearctic (except North Africa) and very frequently collected also in Italy from the Alps to Sicily. The specimens from the Berici Hills are all females of the typical form (almost completely yellowish brown) and are remarkable for the unusual variation of the shape of medial projection of hypopygium, which covers the whole range of variability of such feature known for this species. In the female from Monte del Prete, for instance, the medial projection is small and not excised apically, and so resembling to that of *T. scutellaris* (Fabricius) or *T. dubia* Konow, whereas one of the specimens from ORG has a much larger projection apically excised which recalls that of *T. litterata* (Geoffroy, 1785) (which is, however, even larger and more deeply excised apically). All intermediate conditions occur in the series. This fact deserved to be mentioned, because the shape of hypopygium, owing to the great variability in coloration of these as well as other species of the genus *Tenthredopsis* Costa, is the only affordable character for discriminating the females of *T. nassata* from those of the other species.

Emphytinae
Empria parvula-complex sp.
Empria parvula (Konow, 1892) is a European species of *Empria* Lepeletier & Serville whose distribution covers almost all Europe (data are lacking substantially only for the Iberian Peninsula and Ireland) including the European part of Russian Federation. It is a localized and not a common species; in Italy it is known on few records in the northern sector of the country and Tuscany. Its real distribution is difficult to state due to the uncertain identity and status of several specimens of various provenance which may extend its area to West Asia and the Far East (see Prous *et al.*, 2011). The case of *Empria kuznetzovi* Dovnar-Zapolskij, 1929, also discussed by Prous *et al.* (2011), regard instead Europe and Italy. Described for the Volga region of Russia, *E. kuznetzovi* was then synonymized with *E. parvula* by Conde (1940) together with another taxon collected in the same place of the former and described by the Russian author in the same paper, *Empria pseudo-klugii* (recte *pseudoklugii*) Dovnar-Zapolskij, 1929. Prous *et al.* (2011), who confirmed the synonymy established by Conde for *E. pseudoklugii*, have expressed a different opinion concerning *E. kuznetzovi*, which may be the same of a «clearly distinct species» [from *E. parvula*] they have identified on several specimens from France, Germany, Greece, Hungary, Russia (Ulyanovsk oblast) and, most likely, Czech Republic. This can be said also for some material from Italy and, in particular, for all the above specimens collected in Berici Hills. They are different in the postocellar area shape ratio from the other specimens of *Empria parvula* from Italy and, regarding males, their *valvae penis* look quite similar to that pictured by Prous *et al.* (2011).

N	Species	Cas 11	Cas 13	Nan11	Nan13	Org 11	Org 13	Piu 11	Toa 11	Alo 12	Fim 12	Fim 13	Gra 12	SRo12	SDo13	Mot13	Pre 12	Pre 13	Pre 18
1	Abia aenea (Klug, 1829)	1	0	2	1	24	0	7	0	0	0	0	0	0	0	0	0	0	0
2	Abia mutica Thomson, 1871	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0
3	Aglaostigma aucupariae (Klug, 1817)	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
4	Allantus togatus (Panzer, 1801)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
5	Allantus viennensis (Schrank, 1781)	0	0	1	0	0	0	4	0	0	0	0	0	1	0	0	1	1	1
6	Ametastegia albipes (Thomson, 1871)	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
7	Ametastegia carpini (Hartig, 1837)	0	0	0	0	1	0	3	1	0	0	0	0	0	0	0	0	0	0
8	Ametastegia equiseti (Fallén, 1808)	0	0	1	0	0	0	0	1	0	13	79	0	0	0	0	0	0	0
9	Ametastegia lacteilabris (Costa, 1894)	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
10	Ametastegia pallipes (Spinola, 1808)	0	0	1	1	2	1	3	3	1	0	0	1	1	1	1	0	0	3
11	Ametastegia tenera (Fallén, 1808)	2	0	0	0	0	0	6	1	0	1	0	0	0	0	1	0	0	0
12	Aneugmenus coronatus (Klug, 1818)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
13	Aprosthema sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
14	Aprosthema tardum (Klug, 1814)	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	1
15	Ardis pallipes (Serville, 1823)	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
16	Ardis sulcata (Cameron, 1882)	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
17	Arge cyanocrocea (Forster, 1771)	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0
18	Arge melanochra (Gmelin, 1790)	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
19	Arge nigripes (Retzius, 1783)	0	0	2	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0
20	Arge ochropus (Gmelin, 1790)	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
21	Arge pagana (Panzer, 1798)	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
22	Arge rustica (Linnaeus, 1758)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Athalia bicolor Serville, 1823	0	0	0	5	15	1	23	0	1	0	3	0	0	16	6	0	0	0
24	Athalia cordata Serville, 1823	3	8	2	4	7	9	9	2	54	2	3	0	0	4	4	0	1	4
25	Athalia cornubiae Benson, 1931	0	2	0	0	0	0	1	0	0	0	0	0	1	0	2	0	0	0
26	Athalia liberta (Klug, 1815)	2	0	0	0	0	2	2	0	0	1	4	1	6	3	3	0	0	0
	Athalia liberta/cornubiae mas	0	0	0	0	1	0	0	0	0	1	9	0	6	2	2	0	0	0
27	Athalia lugens (Klug, 1815)	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
28	Athalia rosae (Linnaeus, 1758)	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0
29	Athalia scutellariae Cameron, 1880	0	0	0	0	0	0	0	0	0	18	13	0	0	0	0	0	0	0

30	Birka cinereipes (Klug, 1816)	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
31	Blennocampa phyllocolpa Viitasaari & Vikberg, 1985	4	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5
32	Calameuta pallipes (Klug, 1803)	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	1
33	Caliroa annulipes (Klug, 1816)	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0
34	Caliroa cerasi (Linnaeus, 1758)	1	1	1	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0
35	Caliroa cinxia (Klug, 1816)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	Caliroa cothurnata (Serville, 1823)	1	2	11	4	0	7	1	0	0	0	2	2	0	0	3	1	2	1
37	Caliroa varipes (Klug, 1816)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
38	Cephus nigrinus Thompson, 1871	1	0	0	0	3	1	3	1	0	6	1	0	0	0	0	0	0	0
39	Cephus pygmeus (Linnaeus, 1767)	0	0	1	0	0	0	0	2	0	0	0	0	0	3	2	0	0	0
40	Cephus spinipes (Panzer, 1800)	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
41	Cladardis elongatula (Klug, 1817)	0	2	2	2	0	0	1	0	1	0	1	0	1	0	0	0	1	0
42	Cladardis hartigi Liston, 1995	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1
43	Cladius pectinicornis (Geoffroy, 1785)	48	113	60	19	337	44	62	7	0	29	31	3	2	17	106	34	15	32
44	Claremontia alternipes (Klug, 1816)	0	0	0	0	1	0	0	0	2	0	0	0	1	0	0	0	0	0
45	Claremontia brevicornis (Brischke, 1883)	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
46	Claremontia puncticeps (Konow, 1886)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
47	Claremontia tenuicornis (Klug, 1816)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48	Claremontia waldheimii (Gimmerthal, 1847)	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0
49	Corynis obscura (Fabricius, 1775)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
50	Cytisogaster picta (Klug, 1817)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0
51	Dineura stilata (Klug, 1816)	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
52	Dineura testaceipes (Klug, 1816)																		
53	Dolerus germanicus (Fabricius, 1775)	0	0	0	0	0	0	0	0	0	11	15	0	0	0	0	0	0	0
54	Dolerus puncticollis Thomson, 1871	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
55	Dolerus vestigialis (Klug, 1818)	0	0	0	0	0	0	0	0	0	3	55	0	0	0	0	0	0	0
56	Emphytus calceatus (Klug, 1818)	0	0	0	0	0	0	0	0	0	11	10	0	0	0	2	0	0	0
57	Emphytus cinctus (Linnaeus, 1758)	10	26	7	13	67	176	27	5	1	5	12	9	2	23	25	5	21	21
58	Emphytus cingulatus (Scopoli, 1763)	2	0	4	0	7	10	8	1	0	1	0	0	0	0	0	0	0	2
59	Emphytus didymus (Klug, 1818)	2	1	17	8	199	57	163	22	0	0	0	3	0	27	30	3	2	13
60	Emphytus melanarius (Klug, 1818)	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0

61	Emphytus xanthopygus (Klug, 1818)	0	0	3	0	2	0	1	0	1	0	0	2	0	1	0	0	0	0
62	Empria excisa (Thomson, 1871)	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0
63	Empria ?parvula (Konow, 1892)	0	1	0	0	1	3	1	0	4	0	0	0	0	1	0	0	0	3
64	Empria sexpunctata (Serville, 1823)	0	0	0	0	0	0	2	0	13	0	0	0	0	0	0	0	0	0
65	Empria tridens (Konow, 1896)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
66	Endelomyia aethiops (Gmelin, 1790)	0	0	1	1	1	0	0	0	0	0	1	0	0	0	1	0	0	1
67	Eutomostethus ephippium (Panzer, 1798)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
68	Eutomostethus luteiventris (Klug, 1816)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
69	Euura atra (Jurine, 1807)	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
70	Fenella nigrita Westwood, 1839	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
71	Halidamia affinis (Fallén, 1807)	1	0	1	0	22	3	18	3	0	0	0	0	0	0	2	0	0	2
72	Hoplocampa chrysorrhoea (Klug, 1816)	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
73	Hoplocampa crataegi (Klug, 1816)	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
74	Hoplocampa pectoralis Thompson, 1871	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
75	Janus cynosbati (Linnaeus, 1758)	0	0	0	1	0	2	0	0	0	0	6	0	0	0	2	0	0	0
76	Janus luteipes (Lepeletier, 1823)	0	0	0	0	0	0	0	0	0	3	7	0	0	0	0	0	0	0
77	Macrophya albicincta (Schrank, 1776)	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1
78	Macrophya alboannulata Costa, 1859	2	1	0	1	0	1	0	0	0	0	2	0	0	3	3	0	0	0
79	Macrophya annulata (Geoffroy, 1785)	4	1	11	3	9	9	4	4	0	0	0	4	0	0	3	0	0	11
80	Macrophya blanda (Fabricius, 1775)	4	0	8	1	0	0	0	2	0	0	0	0	0	0	3	0	0	0
81	Macrophya crassula (Klug, 1817)	0	1	3	0	0	0	0	0	0	1	0	0	0	3	0	0	0	0
82	Macrophya diversipes (Schrank, 1782)	7	3	22	7	13	5	11	9	0	0	0	1	0	1	3	3	0	5
83	Macrophya duodecimpunctata (Linnaeus, 1758)	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
84	Macrophya erythrocnema Costa, 1859	1	0	19	2	3	0	1	1	0	3	1	1	0	0	0	1	0	2
85	Macrophya militaris (Klug, 1817)	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
86	Macrophya montana (Scopoli, 1763)	0	4	12	6	3	0	6	0	0	0	0	0	0	0	6	0	0	1
87	Macrophya punctumalbum (Linnaeus, 1767)	0	3	3	2	0	0	0	2	0	0	0	0	0	0	0	0	0	10
88	Macrophya ribis (Schrank, 1781)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	Megalodontes panzeri (Leach, 1817)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
90	Mesoneura opaca (Fabricius, 1775)	0	1	2	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0
91	Metallus pumilus (Klug, 1816)	0	0	0	0	1	0	0	0	2	0	2	0	0	0	0	0	1	0

92	Monardis plana (Klug, 1817)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
93	Monoctenus juniperi (Linnaeus, 1758)	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
94	Monophadnoides ruficruris (Brullé, 1832)	2	0	0	0	7	0	0	0	1	0	1	0	0	2	0	0	0	2
95	Monophadnus latus Costa, 1894	1	0	0	0	0	0	0	0	3	0	0	0	10	0	0	0	0	0
96	Monophadnus pallescens (Gmelin, 1790)	0	0	0	0	1	0	0	0	0	2	0	0	0	1	0	0	0	0
97	Monophadnus spinolae (Klug, 1816)	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
98	Monostegia abdominalis (Fabricius, 1798)	0	0	0	0	0	0	0	0	0	10	31	0	0	0	0	0	0	0
99	Nematus hypoxanthus Förster, 1854	0	0	0	0	0	0	0	0	0	9	98	0	0	0	0	0	0	0
100	Nematus lonicerae (Weiffenbach, 1957)	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
101	Nematus lucidus (Panzer, 1801)	7	3	8	5	47	6	30	2	18	0	2	6	0	1	3	30	0	10
102	Nematus miliaris (Panzer, 1797)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
103	Nematus myosotidis (Fabricius, 1804)	1	1	2	0	1	0	0	0	0	1	3	1	0	1	3	1	0	0
104	Nematus tibialis Newman, 1837	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
105	Nematus wahlbergi Thomson, 1871	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
106	Nesoselandria morio (Fabricius, 1781)	0	0	0	0	0	0	0	0	0	2	56	0	1	0	0	0	0	0
107	Pachynematus vagus (Fabricius, 1781)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
108	Pamphilius alternans (Costa, 1860)	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
109	Pareophora pruni (Linnaeus, 1758)	7	0	4	3	4	2	0	0	2	0	2	0	0	5	0	0	0	1
110	Periclista albida (Klug, 1816)	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0
111	Periclista lineolata (Klug, 1816)	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
112	Phylloecus niger (Harris, 1776)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
113	Phylloecus xanthostoma (Eversmann, 1847)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	4
114	Priophorus brullei Dahlbom, 1835	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
115	Priophorus compressicornis (Fabricius, 1804)	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
116	Priophorus pilicornis (Curtis, 1833)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
117	Priophorus rufipes (Serville, 1823)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
118	Pristiphora aphantoneura (Förster, 1854)	0	0	0	0	0	0	0	0	0	2	17	0	0	0	0	0	0	0
119	Pristiphora armata (Thomson, 1863)	1	0	2	1	0	2	0	0	0	0	1	1	3	1	0	1	1	7
120	Pristiphora cfr. bohemica Macek, 2012	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
121	Pristiphora insularis Rohwer, 1910	0	0	0	0	4	0	3	0	1	0	0	0	0	1	0	0	0	0
122	Pristiphora monogyniae (Hartig, 1840)	0	0	0	0	0	0	1	0	6	0	0	0	0	10	0	0	0	1

123	Pristiphora pallidiventris (Fallén, 1808)	0	0	0	0	2	1	2	0	2	11	22	2	3	0	0	0	0	1
124	Pristiphora tetrica (Zaddach, 1883)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
125	Pristiphora thalictri (Kriechbaumer, 1884)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
126	Pseudodineura mentiens (Thomson, 1817)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
127	Rhadinoceraea micans (Klug, 1816)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
128	Stauronematus platycerus (Hartig, 1840)	0	0	0	0	0	0	0	0	0	0	7	0	0	0	1	0	0	0
129	Sterictiphora angelicae (Panzer, 1799)	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
130	Sterictiphora geminata (Gmelin, 1790)	0	1	0	0	7	1	0	0	0	0	1	4	0	1	2	1	0	0
131	Stethomostus fuliginosus (Schrank, 1781)	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0
132	Strongylogaster multifasciata (Geoffroy, 1785)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
133	Taxonus agrorum (Fallén, 1808)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
134	Tenthredo mesomela Linnaeus, 1758	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
135	Tenthredo zona Klug, 1817	2	1	3	2	39	9	29	1	0	0	0	0	0	0	0	0	0	2
136	Tenthredopsis sp.	0	1	1	0	2	0	0	1	0	0	0	0	0	0	0	0	0	1
137	Tenthredopsis litterata (Geoffroy, 1785)	2	14	3	21	8	15	5	4	0	1	0	2	0	2	15	1	2	12
138	Tenthredopsis nassata (Linnaeus, 1767)	0	1	0	1	3	7	0	0	0	0	0	0	0	0	0	0	0	0
139	Tenthredopsis scutellaris (Fabricius, 1804)	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
140	Tenthredopsis sordida (Klug, 1817)	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0
141	Tenthredopsis stigma (Fabricius, 1798)	0	0	0	0	11	0	1	0	0	0	0	0	0	0	0	0	0	0
142	Tenthredopsis tessellata (Klug, 1817)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
143	Zonuledo amoena (Gravenhorst, 1807)	0	0	3	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0
144	Zonuledo distinguenda (Stein, 1885)	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	N. Species	35	26	42	28	48	32	44	25	23	31	45	16	17	26	28	11	14	39
	N. Individuals	136	196	233	125	873	376	450	79	130	129	524	39	48	134	237	68	54	121

Tab. 2. List of species of the sawfly coenosis of Colli Berici. Generic names are listed in alphabetical order as well as the specific names of each genus. Figures indicate the number of specimens collected in each place of collecting; those of the last column (right) indicates the total number of specimens for each species. According to a recent revision of the subfamily Nematinae (Prous *et al.*, 2014), the species of Nematine sawfly reported under the subgenus *Pteronidea* Rohwer (of *Hypolaepus* Kirby or *Nematus* Panzer) and under the genus *Pachynematus* Konow in the catalogues edited by Lacourt (1999) and Taeger *et al.* (2006, 2010) should be treated as species of the genus *Euura* Newman sensu latissimo. In Table 2, however, they are listed respectively as pertaining to the genera *Nematus* Panzer and *Pachynematus* Konow as in most of literature previous to Prous *et al.* (2014).

The authors of this last paper have not removed formally *Empria kuznetzovi* Dovnar-Zapolskij from the synonymy with *Empria parvula* (Konow, 1892) as a *species revocata* since they could not check the type of the former, which they did not find in the Zoological Institute of St. Petersburg; the solution of the problem, therefore, is still pending.
In Table I the *Empria parvula*-complex sp. is listed as *Empria ?parvula* (Klug, 1892).

Blennocampinae
More than eighteen tenthredinid species, developing on *Rosa* shrubs have been found in Berici Hills. Among them there is a fair amount of Blennocampini species with specialized life history, some of which are infrequent to very rare or even not yet reported from Italy. Six species in total, namely: *Cladardis elongatula* (Klug, 1814), *Cladardis hartigi* Liston, 1995, *Monardis plana* (Klug, 1814), *Ardis pallipes* (Serville, 1823), *Ardis sulcata* (Cameron, 1882), and *Blennocampa phyllocolpa* (Viitasaari & Vikberg, 1985), of which only the latter is common and two other (*Cladardis elongatula* and *Ardis pallipes*) not rare. The other three species, considered the most interesting, are briefly discussed here.

***Cladardis hartigi* Liston, 1995 (Fig. 1B, C)**
(= *semicincta* (Hartig, 1837), preocc. in *Tenthredo*)
New to Italy. Absent from the great part of Western Europe, *Cladardis hartigi* has a wide North-Palearctic distribution: in Europe it is present from Sweden in the North to Austria, Hungary and Romania in the South; to the east it has been recorded in Korea and Japan. Its larva and life history are unknown. A species of the same genus, *Cladardis elongatula* (Klug, 1814), common in Berici Hills (Tab. 1), has larvae developing within swellings of leaf stalks of *Rosa* spp. (Scheibelreiter, 1973; Fenili, 1975). In Germany *C. hartigi* has been found in warm and xerothermic places or in their neighbourhoods (Blank & Taeger, 1998); Taeger *et al.* (1998) consider it rare and localized.

***Monardis plana* (Klug, 1814)**
Very rare species whose larvae develop in buds of *Rosa* spp., preferably on cultivated races (Scheibelreiter, 1973). Distributed almost all over Europe, it is present also in Transcaucasia and in the Canary Islands (Lacourt, 1999), perhaps introduced. Taeger *et al.* (1998) supposed that it is more frequent in the southern area of its distributional range, since in Germany this species is known only on very few records. In Italy it seems to be very rare: it has not been recorded since Costa (1894), who reported it (sub *Monophadnus planus*) from Piedmont, Lombardy and Emilia. For this reason, Golfieri (1995) supposed that *Monardis plana* became extinct south of the Alps.

***Ardis pallipes* (Serville, 1823)**
(= *brunniventris* (Hartig, 1837))
Species with very wide distribution (Holarctic), nevertheless infrequent. Its presence in Italy was attested by very few records: three very old concerning Campania and Basilicata (Ghigi, 1904; Zombori, 1985, on old material) and only one relatively recent concerning the environs of L'Aquila (Abruzzi) (Pesarini F. & Osella, 1997). The larvae of *Ardis pallipes* develops in young shoots of *Rosa*, mainly (or exclusively) *Rosa pendulina* (Pschorn-Walcher & Altenhofer, 2000; quoted also in Liston, 2007a). The close *Ardis sulcata* (Cameron, 1882), associated to *Rosa* spp. of the *canina*-group and found in Berici Hills during this study, was synonymized with *A. brunniventris* (= *A. sulcata*) by Koch (1987) because of the slight differences among the two taxa, concerning only the colour of pronotum and, at most, the tegulae and femurs. In Taeger *et al.* (1998) the former as well as the latter was considered valid species, both univoltine, *Ardis pallipes* with late summer imagos, and *A. sulcata* with adults on fly in spring. Pschorn-Walcher & Altenhofer (2000), however, regard only *A. sulcata* as univoltine, whose spring phenology of adults need to be confirmed, whereas, according to their data from Switzerland and Austria, *A. pallipes* seems to be bivoltine with a spring (from the end of April to the middle of May) and a summer (in August) generations. The existence of a spring generation of *A. pallipes* is confirmed by the present study also for North Italy, particularly for Berici Hills, where it is present together with *A. sulcata*.

Nematinae
***Pseudodineura mentiens* (Thomson, 1871)**
All species of the genus *Pseudodineura* Konow, 1885 (= *Pelmatopus* Hartig, 1837 nec Waldheim, 1824) have endophytic larvae which develop in leaves of Ranunculaceae of various genera; those of *P. mentiens* in leaves of *Hepatica nobilis* (Altenhofer & Pschorn-Walcher, 2006). The species is distributed across North and Central Europe including the Alps; Taeger et al. (1998) considered the species very rare in Germany. In Italy it was known on a single record from Alto Adige (Southern Tyrol) (Altenhofer *et al.*, 2001).

***Dineura stilata* (Klug, 1816)**
Species distributed all over Europe except Iberian Peninsula, Greece and Bulgaria (for Romania there are no data, but it is present in neighbouring Ukraine and Hungary) (Taeger *et al.*, 2018). Its larvae feed externally on leaves of *Crataegus* spp. (Liston *et al.,* 2019). In Italy *Dineura stilata* has been reported from Lombardy and Romagna only. Older records referred to *"Dineura nigroflava"* actually concern *D. stilata*; the synonymy of *Dineura nigroflava* Magretti, 1886 with *D. stilata* has been confirmed by Blank *et al.* (2009) examining the type series. The species is new for the Veneto region, where has been collected independently in another place (Caprino Veronese loc. Pradonego) as stated in De Togni & Pesarini F. (in press).
The record referred (with doubt) to *Dineura stilata* by Turrisi (2011) and, concerning Sardinia, it is referred to the single female specimen collected by Costa on willows along the shore of Coghinas River and describedas *Pristiphora oblita* Costa, 1894. It must not be considered as regarding *Dineura stilata*. See below ("The identity of *Nematus sardiniensis* Costa, 1886 and *Pristiphora oblita* Costa, 1894").

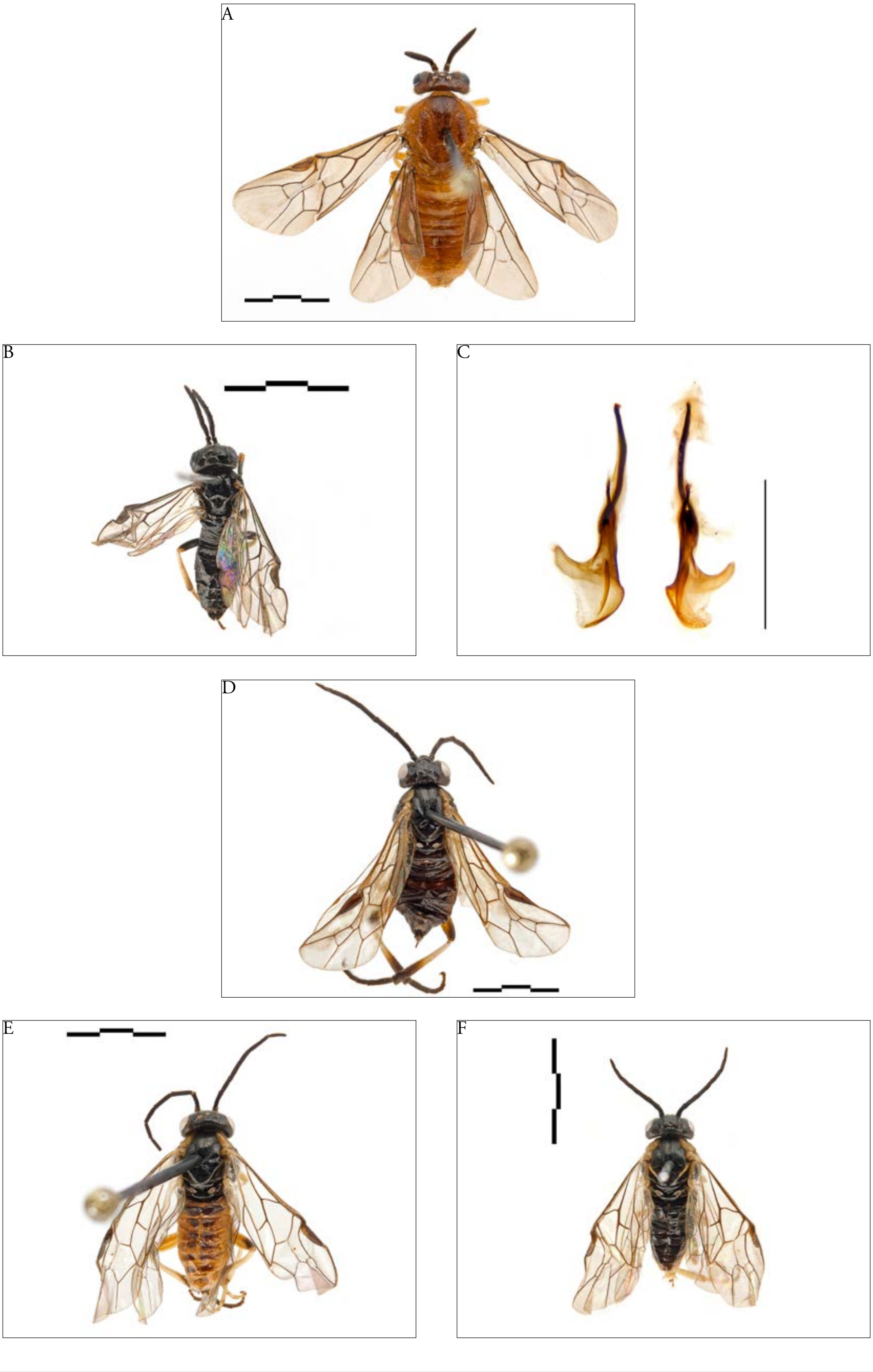

Fig. 1. A, *Aprosthema* sp., ♀. B, *Cladardis hartigi* Liston, ♂. C, idem, valvae penis. D, *Nematus (Paranematus) wahlbergi wahlbergi* Thomson, ♀. E, *Pristiphora* cfr. *bohemica* Macek, ♀. F, *Pristiphora insularis* Rohwer, ♀. Photographs by Davide Vallotto.

Dineura testaceipes **(Klug, 1816)**
Additional specimens: Monte Molinetto, 5.IV-2.V.2013, 1 ♀. Species with a distribution covering North and Central Europe including the Alps and extending eastward to East Siberia; it has been reported for Italy only recently on a single female from Maritime Alps (Norbiato & Pesarini, 2017). Until recently *D. testaceipes* was confused with a close species with a similar distribution but not yet reported for Italy, *D. parcivalvis* (Konow, 1901); Liston et al. (2019) provided detailed characters for the separation of the two species. Liston et al. (2019) reported *Sorbus aucuparia* as the main host of this species, even if occasionally it seems to feed upon other species of *Sorbus*, *Crataegus* spp. and *Cotoneaster* sp.

Nematus **(*Paranematus*) *lonicerae*** **(Weiffenbach, 1957)**
New to Italy. Described from Germany (Kassel) as *Pachynematus lonicerae* by Weiffenbach (1957), this species was transferred by Vikberg (1972) to the genus *Nematus* Panzer, 1801 together with others considered closely related and developing on *Lonicera* spp. (Caprifoliaceae), as well. This set of species was then divided by the same author in two sub-sets, the *lonicerae*-group, with the nominal species only, and the *wahlbergi*-group that he considered formed by three species including the nominal one, *N. wahlbergi* Thomson, 1871. Later Zinovjev (1979) erected, only for the species of the *wahlbergi*-group, the subgenus *Paranematus*, in which he included, in a second time (in Zhelochovtsev, 1988, in footnote), also *N. lonicerae*.
At present, the subgenus *Paranematus* Zinovjev, 1979 amounts to six species (Taeger *et al.*, 2018), all present in Europe (some of them with a distributional area extending eastward to East Siberia and Japan) and two of them known for Italy as well (*N. glaphyropus* Dalla Torre, 1882 and the above mentioned *N. wahlbergi*). Up to now, the established distribution of *Nematus lonicerae* covered North (Finland, Russia) and Central Europe as far as the northern slope of the Alps (Germany, The Czech Republic, Switzerland, Austria, Slovenia). The above records, the first for Italy, extends the known distributional area of the species to the south.
Nematus lonicerae larvae feed externally on leaves of *Lonicera xylosteum* (Weiffenbach, 1957; Vikberg, 1982); artificially they have been reared also on other Caprifoliaceae as *Symphoricarpos albus* (Weiffenbach, 1957, sub *S. racemosus*).

Nematus **(*Paranematus*) *wahlbergi wahlbergi*** **Thomson, 1871 (Fig. 1D)**
Nematus wahlbergi Thomson is a European species of *Nematus* Panzer, 1801, included in the subgenus *Paranematus* Zinovjev, 1978 as the previous one. Its larvae feed on *Lonicera* spp. (Vikberg, 1972 states "the larva probably feeds on *Lonicera*"; most AA. report *Lonicera xylosteum*; Lacourt, 1999 indicates also *L. peryclimenum* and *L. tatarica*). The distributional data of *Nematus wahlbergi* cover almost all Europe except for the western sector (British Isles and Iberian Peninsula) and the South-East (the Balkans and Greece; it is reported however from Hungary and Romania) (Taeger *et al.*, 2018). In Finland and North-Western Russia, the nominal form is substituted by the subspecies *Nematus wahlbergi tavastiensis* Vikberg, 1972.
The presence of *Nematus wahlbergi* in Italy was testified, before its finding in Berici Hills, on two records both of more than one century old: one by Berlese (1889) from Tuscany: Firenze (Florence), and the other by Konow (1904, sub *N. glaphyropus* Thomson, misid.) who indicates "Monte Baldo bei Turin" (sic!). Its presence in Sardinia, reported with doubt by Turrisi (2011), is based on a very old record by Costa (1886), a single male specimen which he described as a new species, *Nematus sardiniensis* Costa, 1886. It must not be considered as regarding *Nematus wahlbergi*. See below ("Identity and status of *Nematus sardiniensis* Costa, 1886 and *Pristiphora oblita* Costa, 1894").
It is not clear whether the above specimen of *Nematus wahlbergi* has to be considered the first for the Veneto region or not: the mentioned record by Konow (1904) of "Monte Baldo bei Turin" is ambiguous, since Monte Baldo is a massif belonging partly to Trentino and partly to the Veneto region, NE Italy, much far away from Turin and Piedmont; Vikberg (1972), however, after checking that specimen, identify its locality as "Torino".

Pristiphora armata **(Thomson, 1862)**
A European species whose larva feed externally on leaves of *Crataegus* sp. (Prous *et al.*, 2017). Its distribution in Italy is still to define, although it should be considered common north of the Alps (cfr. Taeger et al., 1998 for Germany): the only data were two very old records concerning Lombardy and some recent ones regarding Sicily (Liston *et al.*, 2013). In Berici Hills this species is present almost everywhere and common.
Pristiphora armata is hardly distinguishable from the sibling species *P. leucopus* (Hellén, 1948), which has also a similar distribution; for the shape of penis valve, however, the male specimens from Berici Hills fit better with that of *P. armata*, pictured in Prous et al. (2017).

Pristiphora **cfr. *bohemica*** **Macek, 2012 (Fig. 1E)**
Pristiphora bohemica Macek, 2012 has been described recently on a series of both sexes, whose larvae develop on *Spiraea salicifolia* (Rosaceae), from the southern part of Bohemia (western Czech Republic) (Macek, 2012). An additional host plant is *Spiraea chamaedryfolia* (Prous *et al.*, 2017), which is the host plant of *Pristiphora angulata* Lindqvist, 1974, considered as the closest relative of *P. bohemica* (Macek, 2012; Prous *et al.*, 2017).
The two females from Berici Hills are morphologically very similar to *P. bohemica*, to which they resemble more in the shape of sawsheath and conformation of scopa than to *P. angulata*; the specimen from ORG, however, is distinctly paler than *P. bohemica* especially on abdomen, having only the mid of terga brownish black, and both specimens have the apex of hind femurs darkened. At the state of art, it is hazardous, therefore, to decide on their correct identification.
Neither *P. bohemica* nor *P. angulata* are reported from Italy: the former is still known on the type series only from Bohemia, where it is supposed to be vicariant to the latter, a species restricted to Northern Europe and Germany.

Pristiphora insularis **Rohwer, 1910 (Fig. 1F)**
(= *paedida* auctt., nec (Konow, 1904))
(= *amelanchieris* Takeuchi, 1922)
(= *kamtschatica* Malaise, 1931)
(= *luteiventris* Koch, 1989, new name for *paedida* auctt. nec (Konow))
Pristiphora insularis Rohwer, 1910, has been called for a long time with the erroneous name of *P. paedida* (Konow) (sensu auctorum, nec *Lygaeonematus paedidus* Konow, 1904). It is a variable species, also in external morphological features, which has been described with several synonyms (see above and Prous *et al.*, 2017). The female from ORG has a sawsheath almost identical to that pictured by Prous *et al.* (2017: 134, figg. 86-87); it resembles much that drawed by Koch (1989) for his *P. luteiventris* n. sp., then synonymized with *P. kamtchatica* Malaise, 1931 by Liston (1995); according to Haris (2006) and Prous *et al.* (2017), *P. kamtchatica* should be just the same of *P. insularis*.
This species is widely distributed across the Holarctic; it is present in almost all Europe where it is fairly common at least to the north of the Alps (cfr. Taeger *et al.*, 1998 for Germany). Regarding Italy, it was known only on a single record from Tuscany (S. Miniato), reported by Zombori (1980: 16)as *Pristiphora paedila* (sic!; recte *paedida* Kw. [misid.]).
Pristiphora insularis has larvae feeding externally on leaves of shrubs of the Rosaceae: *Rosa majalis*, *R. pimpinellifolia,* the oriental *R. onoei, Amelanchier asiatica* and the introduced in Europe (in gardens) *Chaenomeles japonica* (Prous *et al.*, 2017).

Pristiphora tetrica **(Zaddach, 1883)**
(= *nievesi* Haris, 2004)
The synonymy of *Pristiphora nievesi* Haris, 2004 with *P. tetrica* has been stated by Liston *et al.* (2015) and confirmed by Prous *et al.* (2017). *Pristiphora tetrica* has a wide European distribution (it is present also in Morocco), but in Italy has been reported only from Piedmont, Valle d'Aosta and, recently, from Sicily by Liston *et al.* (2013, sub *Pristiphora nievesi* Haris). The specimen from Berici Hills has femurs III partly yellow as in the lighter forms from southern part of the distribution area.
Pristiphora tetrica belongs to the *subbifida*-group of *Pristiphora* Latreille, whose species have larvae feeding on leaves of *Acer* spp.; those of *P. tetrica* are reported from *Acer pseudoplatanus* and *A. sempervirens* (Prous *et al.*, 2017).

Identity and status of the critical *Nematus sardiniensis* Costa, 1886 and *Pristiphora oblita* Costa, 1894
Nematus sardiniensis Costa, 1886, was described by Costa (1886) on a male specimen from Sardinia; later the species was transferred by the same author to the genus *Pristiphora* Latreille, 1810 (Costa, 1894). This was soon disclaimed by Konow (1896), who considered that the type specimen of Costa, which he had not seen, was not actually a *Pristiphora*. Afterwards Konow (1904) argued that the male type of *Nematus sardiniensis* Costa had to be identified with the unknown male of *Nematus glaphyropus* Dalla Torre, 1882, the name that he used, because of misinterpretation, for *Nematus wahlbergi* Thomson, 1871.
The Konow's arguments for synonymizing *Nematus sardiniensis* Costa with *N. glaphyropus* auctt. nec Dalla Torre = *N. wahlbergi* Thomson was unfounded. *Nematus sardiniensis* certainly does not belong to *Nematus* of the subgenus *Paranematus*. All species of this subgenus develop on Caprifoliaceae, mainly on *Lonicera* spp., less frequently on *Symphoricarpos*, and such genera definitely are not present in Sardinia. Moreover, Costa (1894) states that he collected the type specimen on willows near the shore of a river (the Coghinas River, in central Sardinia). The same Author, re-describing the species as a member of *Pristiphora*, indicates that the type, a male specimen, has antennae as long as the body, with joints 3-7 compressed and dentate apically, and the 3rd joint with lower margin sinuate: *«antennis corpore parum longioribus, validis, articulis 3-7 compressis, angulo apicali interno producto dentiformi,* […] *art. tertio margine infero sinuato»*.
The association with *Salix* sp. and the conformation of antennae of the male are quite consistent with the hypothesis that *Nematus sardiniensis* belongs to the genus *Stauronematus* Benson, 1953. *Stauronematus* has been associated in the past with the genus *Pristiphora*, having both genera a Costa vein (C) widely expanded toward the apex and a subtruncate clypeus. The belonging of the species described by him to the genus *Stauronematus* has been argued (checking the type) by Schedl in Schedl & Ritzau (1995). The same was implicitely supposed by Costa (l. c.) himself, with his following *Osservazione*: *«Per la fattezza delle antenne simiglia molto al cebrionicornis»* (« In the conformation of antennae, [the species] is strikingly similar to *cebrionicornis* » [*Nematus cebrionicornis* Costa, 1859 = *Nematus platycerus* Hartig, 1840, type species of *Stauronematus* Benson]). In spite of that facts, and that Masutti (in Masutti & Pesarini F., 1995) stated *Nematus sardiniensis* Costa as a "species inquirenda" in the light of the weakness of Konow's arguments on that matter, in most of recent catalogues *Nematus sardiniensis* Costa has been reported (with doubt in some cases) as a synonym of *Nematus wahlbergi* Thomson (Lacourt, 1999, sub *Hypolaepus (Paranematus) wahlbergi*; Taeger et al., 2006; Taeger et al., 2010). Only in the recently revised version of EcatSym (Taeger et al., 2018), *Nematus sardiniensis* Costa has been removed from synonymy with *N. wahlbergi*, and the binomial *Pristiphora sardiniensis* (Costa, 1886) proposed by Costa (1894) is stated as valid in absence of major evidences.
Considering *Nematus sardiniensis* Costa as a *Stauronematus* species, it must be considered as the same of the recently described *Stauronematus saliciphilus* Liston, 2007 from Sardinia and Corsica (Liston, 2007b). The male specimens of the latter from Corsica (no male specimens are known from Sardinia) has a yellowish abdomen instead almost black as in *N. sardiniensis* (Costa, 1894, writes only: *"ano fulvo"*); but Liston (2007b), concerning the females, says that those from Sardinia are conspicuously darker than those from Corsica, and the same probably regards males.
Concerning *Pristiphora oblita* Costa, 1894, it was mentioned for the first time by Costa (1886) as an unidentified *Pristiphora* species, the reason why it gets the specific name *oblita* when it was described in Costa (1894). This newly described spe-

cies was soon synonymized (using inappropriate, ridiculous arguments and without having seen the specimen) by KONOW (1896) with *Dineura stilata* (Klug). *Dineura stilata* develops on *Crataegus* and similar shrubs of the Rosaceae, whereas *Pristiphora oblita* was swept by Costa on *Salix* sp. along the shores of the Coghinas River together with the male of *Nematus sardiniensis*, and it is quite arbitrary to think, as Konow did, that Costa was so unskilled to mistake a hawthorn for a willow. Schedl in SCHEDL & RITZAU (1995) stated that the female type of *Pristiphora oblita* Costa, 1894, which he had the care of checking, was actually a *Pristiphora*, perhaps the same species of the females he had listed in the same paper as "*Pristiphora* spec.". Nevertheless, in the most recent catalogues, the wrong opinion of Konow has been followed (LACOURT, 1999; TAEGER et al., 2006; TAEGER et al., 2010) except for the recently revised version of EcatSym (TAEGER et al., 2018), where *Pristiphora oblita* Costa, 1894, figures as valid.

As COSTA (1894) himself did, it should be supposed that *Pristiphora oblita* is nothing else than the female of the latter, *P. sardiniensis* (Costa), which was described (as *Nematus sardiniensis*) on a single male collected in the same place, time and circumstances of *P. oblita*. Since *P. sardiniensis* is most likely a representative of the genus *Stauronematus* Benson, 1953, and perhaps the same species of the recently described *Stauronematus saliciphilus* Liston, 2007 (see above), *P. oblita* could also result to be the female of the same *Stauronematus saliciphilus*.

CEPHIDAE

Phylloecus xanthostoma **(Eversmann, 1847)**

A fairly common species with wide European distribution, extending south to Algeria; it is probably present all over Italy, although it is known only for Piedmont and, on very old records, for Basilicata and Sicily (COSTA, 1894, sub *Phylloecus major* Eversmann). Already known as *Hartigia xanthostoma*, also in *Phylloecus* the specific name of this taxon remains unvaried, *xanthostoma*, as it is a noun and not an adjective. The synonymy of *Hartigia* Schiødte, 1839, with *Phylloecus* Newman, 1838, has been established only recently by LISTON & PROUS (2014).

ECOLOGICAL CONSIDERATIONS

Fig. 2 reports the rarefaction curves applied to Symphyta collected in the twelve sites divided according to different years. The number of specimens collected is different according to site and year. For examples Fig. 2D compares the rarefaction curve in the same site (PRE) in three different years. Due to the particular low number of specimens collected in TOA11, SRO12, PRE12, GRA12 and PRE13, these sites have been excluded from the following analysis. For the remaining sites, although they still show differences in the number of specimens found, the sampling effort appears to have been appropriate to provide a sufficiently detailed picture of population.

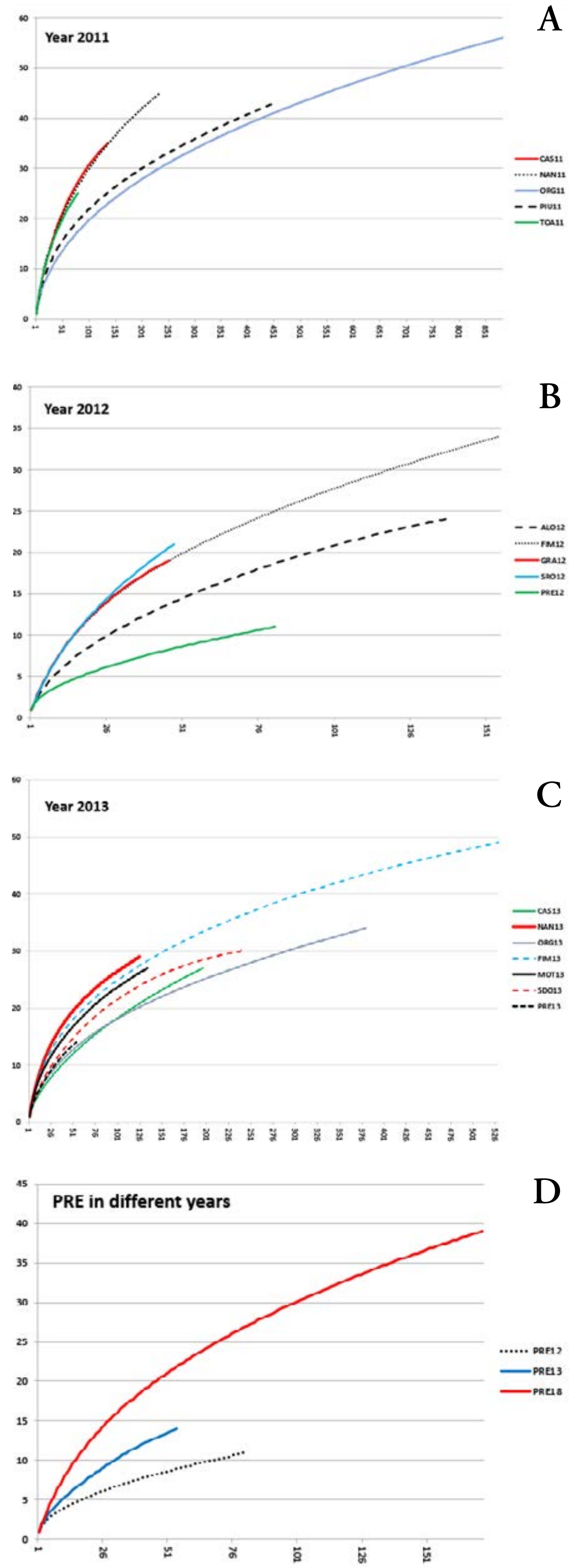

Fig. 2. Rarefaction curves calculated for each sampled site separated according to year (A = 2011; B = 2012; C = 2013) and for Monte del Prete (D) sampled in three different years.

The cluster analysis applied to the abundance matrix of species collected clearly separates four groups (Fig. 3):

- the ALO12 site which is a small clearing in oak forest;
- the FIM site sampled in two different year (2012 and 2013); this site is a lowland grassland, periodically submerged, in an alluvional wood;
- the sites ORG (in years 2011 and 2013) and PIU: these sites are xeric grassland on calcareous substrates particularly well conserved, as also underlined by Syrphidae fauna (Sommaggio, 2017);
- the sites NAN and CAS (both sampled in years 2011 and 2013), PRE and MOT: these sites are xeric grasslands not well preserved, usually with a large development of shrubs.

The correspondence analysis (Fig. 4 and 5) confirms the results obtained by cluster analysis. The CA applied to all sites clearly separates the xeric grasslands from FIM site on the main axis and from ALO site on second axis (Fig. 4). The CA applied only to xeric grasslands separates the two well preserved grasslands (PIU and ORG but the last one only in 2011) from all other xeric grasslands except MOT and ORG sampled in 2013 (Fig. 5).
The application of CA to the abundance matrix of Symphyta detects a list of species which seems to characterize each of the four types of habitat. Following the multivariate analysis and in agreement with vegetational information and entomological reports on Syrphidae in the same sites (Sommaggio, 2017) we recognized four types of habitat: 1) xeric grassland in well condition of preservation, 2) xeric grassland degraded by shrub development, 3) periodically submerged grasslands in alluvional forest and 4) small clearings in oak forest. The IndVal for each species has been calculated accordingly to Dufrêne and Legendre (1997) and De Cáceres & Legendre (2009). Tab. 3 reports the list of species significantly associated to one type of habitat following a permutation test (De Cáceres, 2013).

Tenthredo zona is particularly interesting; its larvae develop on *Hypericum perforatum* L. and it has been reported as associated with dry grassland (Benson, 1952). This species is considered as uncommon, but on Berici hills is present in grasslands with high abundance. *Halidamia affinis*, *Macrophyia albicincta* and *Tenthredopsis litterata* are common species, that in the present research seem to be more associated with xeric grasslands. *Macrophya diversipes, Emphytus didymus* and *Calameuta pallipes* are not rare species, present in Central and mainly South Europe. The larvae of *E. didymus* develops on *Rosa* plant; not less than eighteen species collected in the present research develop on *Rosa* plants, including some rare species such as *Ardis sulcata, Cladardis hartigi, Endelomyia aethiops* and *Monardis plana*.

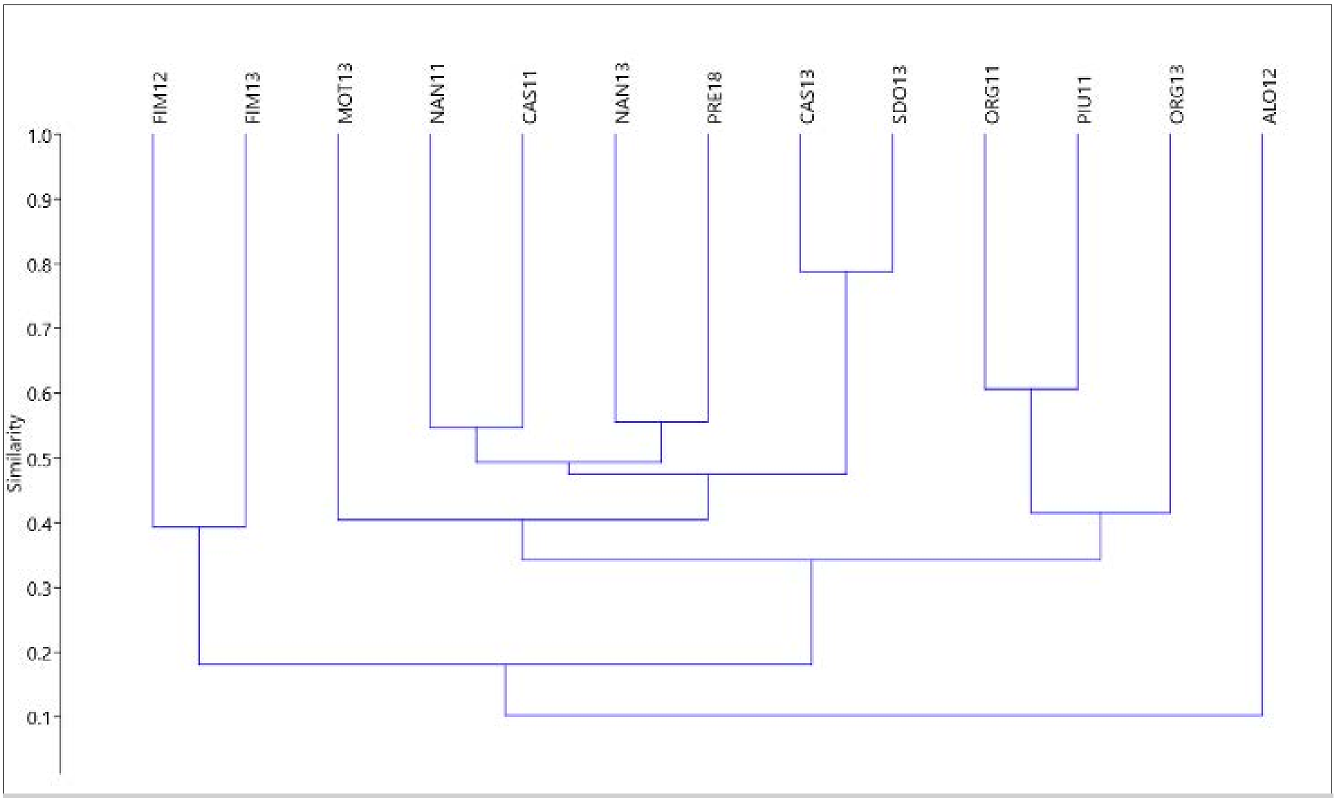

Fig. 3. Cluster analysis applied to abundance matrix based on Bray-Curtis dissimilarity index and Ward's method.

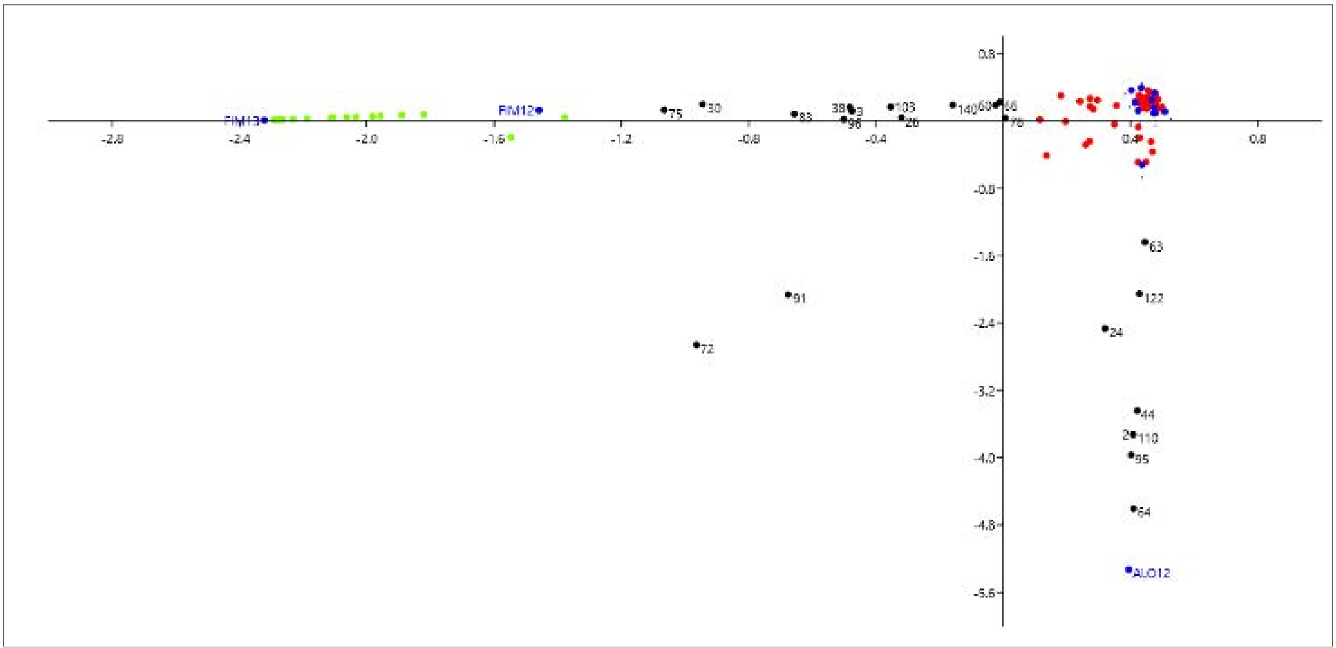

Fig. 4. Correspondence analysis applied to abundance matrix of Symphyta.
Legend: Red circles are species associated with xeric grasslands (blue circles without legend: CAS11, CAS13, NAN11, NAN13, ORG11, ORG13, PIU11, MOT13, PRE18) and correspond to the species numbered 1, 5, 7, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25, 31, 32, 34, 36, 39, 40, 41, 42, 43, 51, 57, 58, 59, 60 , 61, 66, 71, 73, 77, 78, 79, 80, 81, 82, 83, 84, 86, 87, 89, 90, 93, 94, 100, 101, 108, 109, 113, 114, 119, 121, 129, 130,132, 135, 136, 137, 138, 139, 141, 143 in Tab. 2. Green circles are species associated with FIM12 and FIM13 and corresponding to those numbered 8, 9, 28, 29, 33, 53, 55, 56, 62, 76, 98, 99, 106, 118, 123, 128, 131. The species are numbered as in Tab. 2

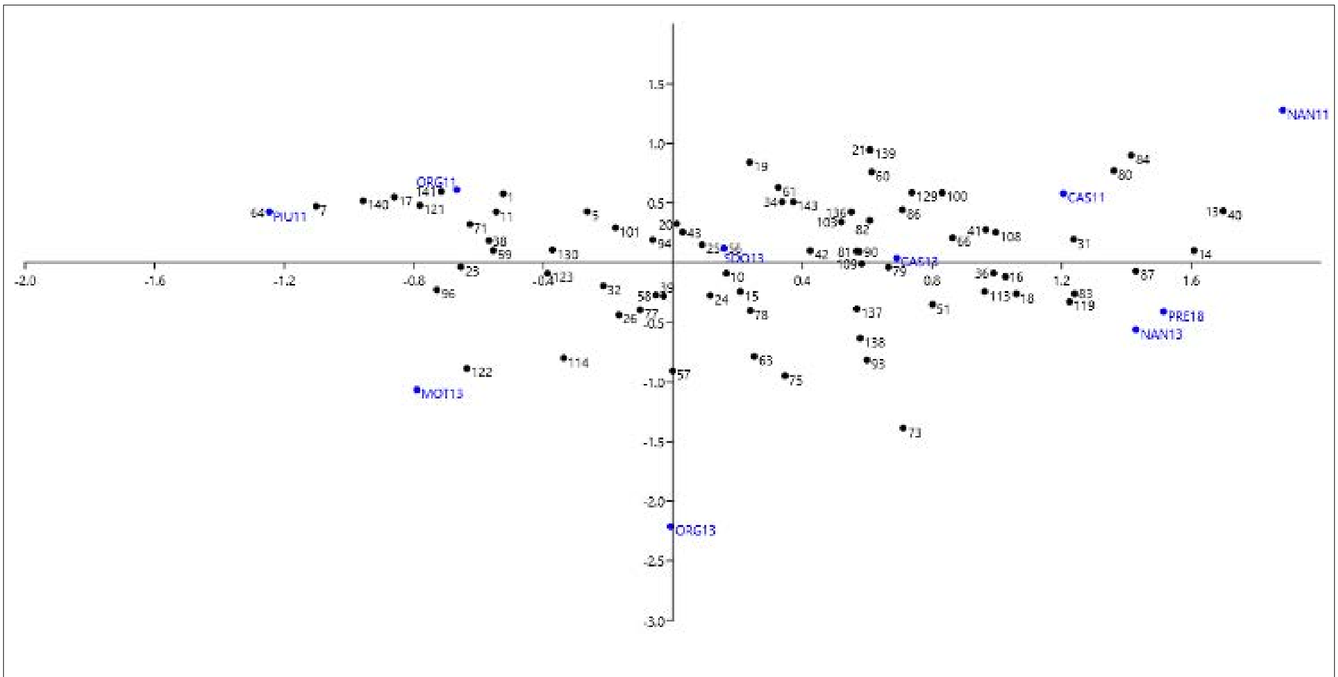

Fig. 5. Correspondence analysis applied only to xeric grassland as separated by general CA (Fig. 4). The number of species are the same as in Tab. 2

Type of habitat	Sites	Species	IndVal	p-value
Well preserved xeric grassland	ORG, PIU	*Tenthredo zona*	0.973	0.038 *
		Halidamia affinis	0.971	0.033 *
		Calameuta pallipes	0.950	0.023 *
		Macrophya albicincta	0.935	0.027 *
Periodically submerged grasslands in alluvional forest	FIM	*Ametastegia lacteilabris*	1.000	0.008 **
		Athalia scutellariae	1.000	0.008 **
		Caliroa annulipes	1.000	0.008 **
		Dolerus germanicus	1.000	0.008 **
		Dolerus vestigialis	1.000	0.008 **
		Empria excisa	1.000	0.008 **
		Janus luteipes	1.000	0.008 **
		Monostegia abdominalis	1.000	0.008 **
		Nematus hypoxanthus	1.000	0.008 **
		Nesoselandria morio	1.000	0.008 **
		Pristiphora aphantoneura	1.000	0.008 **
		Stethomostus fuliginosus	1.000	0.008 **
		Ametastegia equiseti	0.998	0.012 *
		Emphytus calceatus	0.987	0.013 *
Well preserved xeric grassland + xeric grassland with shrubs development	CAS, NAN, PRE, SDO, MOT	*Emphytus didymus*	1.000	0.010 **
		Macrophya diversipes	1.000	0.010 **
		Tenthredopsis litterata	0.987	0.027 *

Tab. 3. List of species significantly associated with different type of habitat according to IndVal index. p-value has been calculate on permutation test. Legend: *: p-value lower than 0.05 and higher than 0.01; **: p-value lower than 0.01.

Discussion

Symphyta specimens collected in the present research confirm the importance of Berici Hills as a site of high biodiversity. The total number of species, 145, is particularly high compared to the biodiversity of surrounding areas. For instance, a survey of the sawfly fauna of the province of Ferrara (Pesarini F., 1995a) yielded a total of 83 species; a further survey of the sawfly fauna of eastern Padania Plain (which however did not consider the Nematinae) (Pesarini F. & Sommaggio, 2013) resulted in a total of 96 species. Similar results have been found in the few other entomological researches on the Berici Hills. For example, the Syrphidae fauna recorded in this area consists of 143 species, against a fauna of eastern Padania Plain of 121 species (Sommaggio, 2010, 2017). The number of hoverfly species recorded in Berici Hills and absent in the surroundings areas is very high: 52 species. Some of these could be present also in the Padania Plain based on the type of habitats present, but probably the highly modified condition due to human activity led to local extinction of species with high environmental requirement. For this reason, Berici Hills can act as a biodiversity reservoir to colonization of adjacent areas.

Beside the finding of two species new for Italy, the present research has provided a very high number of species new for the Veneto region (53). This fact is a clear indication of the poor and incomplete knowledge available on the distribution of this group of insects in Italy, despite some species can be important pest in agriculture and especially in forestry. Some indicators however are significant regardless of his fact. The number of species of Symphyta which have been found exclusively in the Berici Hills district within the whole Padania Plain is equal to 14, i.e. the 11 % of the total, a percentage higher than that of exclusive species of the other districts of eastern Padania Plain previously investigated: 0 % in the Busatello Swamp, a very small area anyway (Pesarini C., 1989); 1.2 % in the province of Ferrara (Pesarini F., 1995a); 4.17 % in the eastern sector of Padania Plain as a whole (Pesarini F.

& Sommaggio, 2013); only the forested area of Bosco Fontana near Mantua (Pesarini F., 2002, 2004), with 9.76 %, shows a percentage of exclusive species comparable, although lower, to that of Berici Hills. Both areas are undoubtedly important refuge districts for faunal components which have probably disappeared or in serious decline elsewhere.
In Europe, the importance of calcareous dry grasslands as habitat of high biodiversity has been underlined in several studies mainly focused on butterflies and bees (Baur *et al.*, 1996; Niemelä & Baur, 1998; Steffan-Dewenter & Tscharntke, 2000; Zschokke *et al.*, 2000; van Swaay, 2002). According to Niemelä & Baur (1998) 22% of species collected in calcareous grasslands and belonging to different taxa (plants, butterflies, grasshoppers, ground beetles and gastropods) are considered as threatened in northern Switzerland. Van Swaay (2002) estimates that 274 butterfly species in Europe are associated with this type of habitat which therefore is the type of habitat with the greatest butterfly biodiversity. In the present research this type of habitat, both well preserved and in a condition of large shrub development, has been sampled in different sites. Symphyta fauna seems to be affected by the presence of xeric grasslands, and a specific selection of species seems to be associated with this habitat. Symphyta fauna seems to be able to separate xeric grasslands from other type of habitats and, even if at a lower level, well preserved dry meadows from those with a large development of shrubs. According to IndVal index the number of species significantly associated with this type of habitat is low, but this may be due to the low number of sites belonging to different type of habitats. According to Correspondence Analysis a large number of species, such as *Aprosthema tardum, Ardis sulcata* and *Cladardis hartigi*, seem to be associated with grassland, some of which with high naturalistic value. More studies are necessary to better understand the association between Symphyta and dry calcareous grasslands, but this research seems to confirm the possible use of Symphyta as bioindicators in this important type of habitat. Other important xeric areas in North Eastern Italy, such as Euganei Hills or South slopes of Lessini Mountains, may represent equally important sites and it is desirable to extend to these and other areas the knowledge of the Symphytan fauna. The present research confirms the importance of conservation actions, both at local (protection of dry calcareous grasslands) and at regional scale (protection of Berici Hills).

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