©Naturwiss. med. Ver. Innsbruck, download unter www.biologiezentrum.at

Ber. nat.-med. Verein Innsbruck	Suppl. 10	S. 197 – 204	Innsbruck, April 1992

8th International Congress of Myriapodology, Innsbruck, Austria, July 15 - 20, 1990

Preliminary Data on Centipede Communities of *Quercetea ilicis* and *Fagetalia sylvaticae* in Central Italy

by

Marzio ZAPPAROLI

Dipartimento di Protezione delle Piante, sez. Entomologia agraria, Università della Tuscia, Via S. Camillo de Lellis, I-01100 Viterbo, Italy

Abstract: Data on centipede communities in mediterranean environments characterized by vegetational associations belonging to *Quercetea ilicis* and to *Fagetalia sylvaticae* is presented and discussed. The aim of this work is the acquisition of information on the ecology of centipedes in Italian habitats and the gaining of useful records for characterization of communities of forestal environments in Central Italy. Samples have been collected by pitfall trapping in 11 sites in Central Italy between 1979 - 1987. 22 species are recorded, 16 in *Quercetea ilicis* (5 sites), 16 in *Fagetalia sylvaticae* (6 sites). In *Quercetea ilicis* the most characteristic species of the centipede communities is *Eupolybothrus fasciatus* (NEWPORT), together with *Lithobius erythrocephalus aleator* VERHOEFF; *Fagetalia sylvaticae* communities are mostly characterized by the presence of *Strigamia acuminata* (LEACH) and *Eupolybothrus grossipes* (C.L. KOCH). Common in both vegetational types investigated are *Lithobius castaneus* NEWPORT and *L. tylopus* LATZEL, often accompanied by *Henia vesuviana* (NEWPORT), especially under more thermophilous conditions, or *Lithobius tricuspis* MEINERT and *Strigamia crassipes* (C.L. KOCH), apparently related to more mesophilic conditions.

1. Introduction:

Actual information on the ecology of centipedes is still very scanty although some specific researches have recently been published. In the case of Italian habitats, these studies have particularly examined some communities from lowland, montane and alpine environments in NE Italy (MINELLI 1981, 1982, 1988) and mid-tyrrhenian coastal habitats (MINELLI & ZAPPAROLI 1986).

A first synthesis of available data on the habitat preferences and taxocenoses of Italian centipedes has recently been published by MINELLI & IOVANE (1987). As it is possible to deduce from this paper, information on the communities inhabiting central and southern areas of the Italian peninsula is very lacunose.

The aims of this work are the acquisition of new data on the ecology of centipedes in Italian habitats and the gaining of useful information for a characterization of the communities of forest habitats in Central Italy. The habitats investigated are referable to two of the most significant vegetation formations of this area: evergreen sclerophyllous woods referable to associations of *Quercetea ilicis* BR.-BL. and deciduous woods belonging to *Fagetalia sylvaticae* PAWL.

2. Sampling Sites:

11 sites have been sampled in 10 localities of Central Italy (Fig. 1): five are characterized by vegetation types assignable to *Quercetea ilicis* (1 - 5) and six to *Fagetalia sylvaticae* (6 - 11).

The main habitat characteristics of each site are summarized below. If the site has been subjected to phytosociological investigations the name of the plant association is given. Sites are listed geographically, from W to E and from N to S.

©Naturwiss. med. Ver. Innsbruck, download unter www.biologiezentrum.at

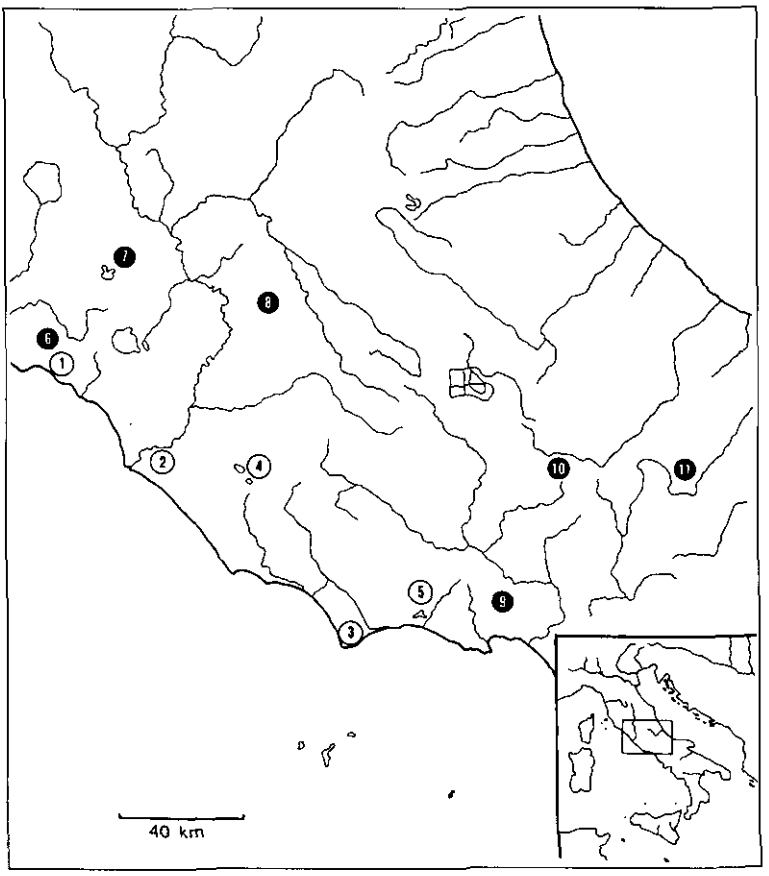

Fig. 1: Localities of sampling sites: 1 - 5 white spots, *Quercetea ilicis* sites; 6 - 11 black spots, *Fagetalia sylvaticae* sites. 1) MTa Tolfa Mountains, Mt. Fagiolano; 2) CP Castelporziano; 3) QF Quarto Freddo, Mt. Circeo; 4) CA Bosco Chigi, Albani Hills; 5) MA Ausoni Mountains, Mt. San Biagio; 6) MTb Tolfa Mountains, Mt. Faggeto; 7) MC Cimino Mountains, Mt. Cimino; 8) MS Sabini Mountains, Mt. Tancia; 9) AU Aurunci Mountains, Mt. Faggeto; 10) VF Valle Fredda; 11) MM Montedimezzo, Isernia (for further explanation see text).

1. MTa Latium, Tolfa Mountains, Mount Fagiolano: 100 m a.s.l., disturbed high shrub (coppiced and pastured) with *Quercus ilex* accompanied by *Pistacia lentiscus, Erica arborea* and *Arbutus unedo;* open areas with *Cistus salvifolius, C. monspeliensis* and *Osyris alba* are also present. The vegetation type of this site must be referred to *Pistacio-Rhamnetalia alaterni* (SPADA 1977, VIGNA TAGLIANTI et al. 1988); substratum composed of schists with limestones and marls; W aspect.

2. CP Latium, Castelporziano: 20 m a.s.l.; *Q. ilex* wood with very scanty undergrowth; sandy substratum; W aspect.

3. QF Latium, Mount Circeo, Quarto Freddo: 50 m a.s.l.; high shrub dominated by *Q. ilex* accompanied by *Arbutus unedo* and *Phillyrea latifolia;* many species of *Pistacio-Rhamnetalia alaterni* are also present (VIGNA TAGLIANTI et al. 1988); limestone substratum; N aspect.

4. CA Latium, Albani Hills, Bosco Chigi: 350 - 450 m a.s.l.; *Q. ilex* wood accompanied by *Fraxinus ornus, Acer obtusatum* and *Ostrya carpinifolia,* the plant communities of this site must be referred to *Orno-Quercetum ilicis* (VIGNA TAGLIANTI et al. 1988). Substratum of volcanic origin; SW aspect.

©Naturwiss. med. Ver. Innsbruck, download unter www.biologiezentrum.at

5. MA Latium, Ausoni Mountains, Monte San Biagio: about 120 m a.s.l.; *Q. ilex* coppiced wood, underwood mainly with *Phillyrea latifolia* and *Pistacia lentiscus*. *Ostrya carpinifolia* and *Ilex aquifolium* are also present. Limestone substratum; SE aspect.

6. MTb Latium, Tolfa Mountains, Mount Faggeto: 500 - 600 m a.s.l.; *Fagus sylvatica* anthropized wood with *Erica arborea, Ruscus aculeatus* in the more thermophilous areas, *Acer pseudoplatanus* and *A. campestre* in the most hygrophilous. *Ilex aquifolium* is also present (*Aquifolio-Fagetum*) (cfr. SPADA 1977, COMANDINI & VIGNA TAGLIANTI 1990). Volcanic substratum; N aspect. It is interesting to note that, in this site, *F. sylvatica* is below its usual Central Apenninic altitudinal level.

7. MC Latium, Cimini Mountains, Mount Cimino: 1050 m a.s.l.; *F. sylvatica* wood with *Acer pseudoplatanus* and *A. obtusatum;* thin undergrowth with *Sambucus nigra*. The beechwood of this site is similar to the *Corydalidi-Fagetum* (BLASI et al. 1990). Volcanic substratum; NE aspect.

8. MS Latium, Sabini Mountains, Mount Tancia: 1190 m a.s.l.; *F. sylvatica* coppiced wood with *A. pseudoplatanus*, scanty undergrowth. Limestone substratum; N aspect.

9. AU Latium, Aurunci Mountains, Campodimele, Mount Faggeto; about 1100 m a.s.l. *F. sylvatica* coppiced wood with *Acer neapolitanum* and *Sorbus aria*. Limestone substratum; N aspect.

10. VF Abruzzi, Opi, Valle Fredda: about 1300 m a.s.l.; *F. sylvatica* wood (the area were the sampling site is located is covered by mainly pure beech forest sometimes accompanied by *Acer pseudoplatanus, Ostrya carpinifolia* and *Fraxinus ornus*). Limestone substratum; NE aspect.

11. MM Molise, Isernia, Montedimezzo: 1140 m a.s.l.; *F. sylvatica* wood with *Acer obtusatum, A. pseudoplatanus, A. lobeli, Ulmus glabra* and *Quercus cerris*. The beechwood of this site is assignable to a variety of *Polysticho-Fagetum aceretosum pseudoplatani* with *Acer lobeli* (ABBATE 1990). Substratum with clays, sandstone and limestone; N aspect.

According to TOMASELLI et al. (1973) the bioclimate of the sites sampled must be summarized as follows:

Sites 1 - 6 and 9 marked mainly by mediterranean climate (with a summer period of aridity). Sites 1 - 3, 5, 6, with the period of aridity 3 - 4 months long, 900 m rainfall/year, precipitation concentrated in winter and autumn. Site 4 with the period of aridity less than 2 months long, over 1000 mm rainfall/ year, precipitation concentrated in winter and autumn. Owing to its altitudinal position, the climate of site 9 is more temperate.

Sites 7, 8, 10 and 11 mainly characterized by temperate climate (without an annual period of aridity). Sites 7, 8, and 11 with the mean temperature of the coldest month between 0 - 10° C, 700 - 1000 mm rainfall/year, precipitation concentrated in spring. Site 10 with 3 - 4 months of frost/year, 1300 - 1800 mm rainfall/year.

3. Methods:

Sampling has been carried out between 1979 - 1988 by pitfall trapping as described in MINELLI & ZAPPAROLI (1986). Six to ten traps with a 4 % solution of formaldehyde in vinegar are positioned in each sampling site for one year. Traps have been located at about ten meters one from another along one or two rows and emptied monthly.

The faunistic similarity between the sampling sites has been calculated using the BARONI URBANI & BUSER (1976) index; the hierarchic classification of the sites was undertaken using the average linkage clustering method.

The matrix in Tab. 1 was arranged exclusively using a "manual" method based on the personal experience of the Author and on comments of MINELLI & IOVANE (1987).

4. Results:

22 species of centipede were recorded in the sampling sites altogether from a total of about 465 specimens (Tab. 1). 16 species were collected in *Quercetea ilicis* woods and the same number in *Fagetalia sylvaticae* woods. The number of species inhabiting the investigated holmoak woods ranged from 3 (site 1) to 5 (sites 2 - 4) whereas in the sampled beechwoods 4 (site 8) to 9 (site 9) species were recorded. The lowest number of species has been recorded in the more disturbed (coppice and pasture) sites. As already stated (MINELLI 1981, MINELLI & ZAPPAROLI 1986), pitfall trap sampling methods give good information on Lithobiomorpha, whilst Scolopendromorpha, Geophilomorpha and Scutigeromorpha are underestimated.

In Fig. 2 the 11 sampling sites clustered according to the similarities of their centipede fauna are shown. On the basis of the calculation of ecophenetic correlation index ($r_{cs} = 0,79$), the signific-

©Naturwiss. med. Ver. Innsbruck, download unter www.biologiezentrum.at

Table 1: Species-samples matrix: Species are grouped according to their ecological affinities. Sampling sites: **1 - 5** *Quercetea ilicis*, **6 - 11** *Fagetalia sylvaticae*. The number of specimens collected in the whole sample is reported for each site. Σ totals for each species; **CH** chorotypes; **E** European s.l.; **En** Endemic (Apenninic); **M** Mediterranean s.l.; **WP** W-Palearctic.

	Sampling sites											Σ	CH
	1	2	3	4	5	6	7	8	9	10	11		
A) Species inhabiting mostly *Quercetea ilicis*													
Eupolybothrus fasciatus (NEWPORT)	1	5	4	60	3	2	-	-	-	-	-	75	En
Lithobius erythrocephalus aleator VERHOEFF	-	2	1	-	-	-	-	-	-	-	-	3	En
B) Species inhabiting mostly *Fagetalia sylvaticae*													
Eupolybothrus grossipes (C.L. KOCH)	-	-	-	-	-	-	-	1	-	10	27	38	E
Strigamia acuminata (LEACH)	-	-	-	-	-	-	1	-	2	1	-	4	E
C) Species inhabiting mostly broad-leaved forests													
Ca) Species with wide habitat preferences (euryforestal species)													
Lithobius castaneus (NEWPORT)	-	3	14	30	9	1	22	35	17	6	11	148	M
L. tylopus LATZEL	-	-	2	29	9	10	16	5	10	7	6	94	En
Cryptops parisi BROLEMANN	1	-	-	1	-	4	-	-	-	-	-	6	E
Clinopodes flavidus C.L. KOCH	-	-	1	-	-	-	-	-	-	-	-	1	E
Schendyla nemorensis (C.L. KOCH)	-	-	1	-	-	-	-	-	-	-	-	1	WP
Cb) Species apparently related to more thermophilous conditions													
Lithobius acuminatus BROLEMANN	-	1	32	-	-	-	-	-	1	2	-	36	En
Henia vesuviana (NEWPORT)	-	1	1	-	1	1	-	-	-	-	-	4	M
Cc) Species apparently related to more mesophilic conditions													
Lithobius tricuspis MEINERT	-	-	-	-	-	-	-	1	10	2	1	14	E
Strigamia crassipes (C.L. KOCH)	-	-	-	1	-	-	1	-	-	-	1	3	E
Lithobius cf. lucifugus L. KOCH	-	-	-	-	-	-	6	-	-	-	-	6	E
Cryptops anomalans NEWPORT	-	-	-	-	-	-	-	-	-	-	2	2	E
Lithobius macilentus L. KOCH	-	-	-	-	-	-	-	-	-	1	-	1	E
D) Open habitat species related to thermophilous conditions													
Scolopendra oraniensis LATREILLE	1	-	-	-	-	-	-	-	-	-	-	1	M
E) Euryoecious species													
Lithobius forficatus (L.)	-	2	-	2	-	-	2	-	-	3	-	9	WP
L. lapidicola MEINERT	-	-	-	-	3	-	-	-	2	8	-	13	WP
Geophilus carpophagus LEACH	-	1	-	-	-	-	-	-	-	-	-	1	WP
G. linearis C.L. KOCH	-	1	-	1	-	-	-	-	-	-	-	2	WP
Himantarium gabrielis (L.)	-	-	-	1	-	2	-	-	-	-	-	3	M
Σ 22 Species	3	8	8	8	5	6	6	4	6	9	6	.	.
Σ Specimens	3	16	56	125	25	20	48	42	42	40	48	465	.

ance level of the cluster must be considered good. Cutting the dendrogram at similarity level S = 0,5, three clusters are shown.

In the first cluster are grouped all the more inland beechwood sites, located between 1000 - 1300 m a.s.l. and mainly with temperate climate.

©Naturwiss. med. Ver. Innsbruck, download unter www.biologiezentrum.at

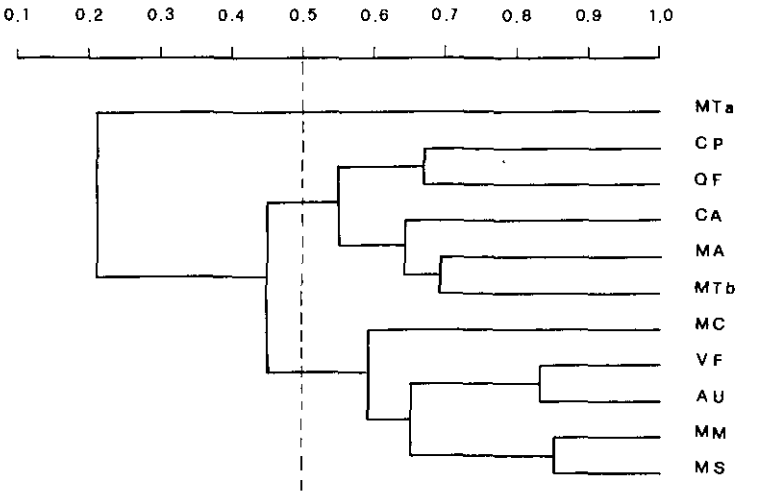

Fig. 2: Dendrogram of hierarchical classification of the eleven sampling sites; AU 9 Aurunci Mountains, Mt. Faggeto; CA 4 Bosco Chigi, Albani Hills; CP 2 Castelporziano; MA 5 Ausoni Mountains, Mt. San Biagio; MC 7 Cimino Mountains, Mt. Cimino; MM 11 Montedimezzo, Isernia; MS 8 Sabini Mountains, Mt. Tancia; MTa 1 Tolfa Mountains, Mt Fagiolano; MTb 6 Tolfa Mountains, Mt. Faggeto; QF 3 Quarto Freddo, Mt. Circeo; VF 10 Valle Fredda (for further explanation see text).

To the second cluster belong all the sampling sites with mediterranean climate. Therefore, most of the sampled holmoak woods are grouped together with the only beechwood site at 600 m a.s.l. (MTb). In this cluster it is also possible to observe two groups: the first is represented by the more mesophilic sites of the Albani Hills and Ausoni Mountains to which is linked the lower level beechwood of the Tolfa Mountains; the second is represented by the more distinctly coastal sites, as Castelporziano and Circeo.

The third cluster is represented only by the holmoak site 1 (MTa), linked to the other 10 sites at S = 0,21 and whose similarity index is probably underestimated.

The sites marked with temperate climate are linked together at S = 0.59, whilst the sites with mediterranean climate show a slightly lower value of similarity, S = 0.55.

In Table 1 is shown the species-sampling site matrix where the species are grouped according to their ecological affinities. In this matrix it is possible to observe five ecological groups A - E.

The first two groups of species must be defined, at least in Central Italy, as characteristic of *Quercetea ilicis* (A), and of *Fagetalia sylvaticae* (B), respectively. Two species are included in group A, *Eupolybothrus fasciatus* and *L. erythrocephalus aleator. E. fasciatus,* an Apenninic element, is present in all the sampled sites referable to *Quercetea ilicis.* This species is one of the most frequent and abundant centipedes in the holmoak woods studied, however, in Central Italy, *E. fasciatus* is also present in pure woods with *Quercus cerris* or *Q. pubescens* and in mixed woods with *Q. cerris* and *Carpinus betulus* (MINELLI & ZAPPAROLI 1986). The presence of *E. fasciatus* also in MTb (a beechwood below the usual altitudinal level) is probably related to the thermophilic character of the station. *L. erythrocephalus aleator* is not abundant and not as frequently recorded as *E. fasciatus* but, according to MINELLI & IOVANE (1987), it seems to be characteristic in thermophiluos habitats of Central Italy. This species is here recorded only in the two most thermophilic sites examined located at lower altitudes (20 - 50 m) near the coast.

Group B includes two European species, *Strigamia acuminata* and *Eupolybothrus grossipes;* neither of these has been recorded in the site MTb, the most thermophilic of the *Fagetalia sylvaticae*

©Naturwiss. med. Ver. Innsbruck, download unter www.biologiezentrum.at

sites sampled. *S. acuminata* seems to be one of the most characteristic species of beechforest in Central Italy; this agrees with data of MINELLI & IOVANE (1987), based especially on N-Italian records. *E. grossipes* appears to be better related to mesophilic conditions and it has been recorded only in the inland beechwood sites (sites AU, VF, MM), mostly with temperate climate. In NE-Italy, however, this species has been recorded, not only in beechwoods but also in many other forestal types, from *Piceetum montanum* to *Querco-Carpinetum boreoitalicum* (MINELLI & IOVANE 1987).

Group C, the largest, is represented by those elements generically definable as woodland dwellers and, in Central Italy, inhabiting most of the broad-leaved vegetation formations represented in this area. More of these species have been sampled in *Quercetea ilicis* than in *Fagetalia sylvaticae* and three sub-groups are recognizable:

Ca) Woodland species with wide habitat preferences (euryforestal species). The most characteristic species of this subgroup is, without doubt, the mediterranean *Lithobius castaneus*. This species is present in most of the sampling sites but it is absent or rarely found in the most thermophilic ones. *L. castaneus* is often accompanied by *L. tylopus*, an Apenninic species, which is also absent or rarely found in the most thermophilic sites. In this group are also included *Cryptops parisi, Schendyla nemorensis* and *Clinopodes flavidus*, here probably underestimated and, even though they are apparently recorded especially in *Quercetea ilicis*, they are also present in other formations of Central Italy.

Cb) Woodland species apparently related to more thermophilic conditions. In this group are included the mediterranean *Henia vesuviana*, particularly recorded from oakwoods but also recorded both in other woodland formations and in mediterranean open habitats (MINELLI & ZAPPAROLI 1986, MINELLI & IOVANE 1987), and *Lithobius acuminatus*, an Apenninic endemic whose thermophilous character has already been recognized (MINELLI & ZAPPAROLI 1982, MINELLI & IOVANE 1987).

Cc) Woodland species apparently related to more mesophilic conditions. This group includes a number of European species here recorded mostly in beechwood sites characterized by temperate climate. However, these species are also present in other woodland habitats although mostly not in *Quercus ilex* woods. The most commonly represented species are *Lithobius tricuspis* and *Strigamia crassipes*, the latter also sampled in the most mesophilous site of *Quercetea ilicis* (CA). *Cryptops anomalans* and *L. macilentus*, poorly known from the ecological point of view, are also included in this group. The group also includes a *Lithobius* sp., only collected in beech forests of Mount Cimini and morphologically close to the European *L. lucifugus*, a species mostly related to montane or alpine open habitats. This population should most likely be considered as an ecological relict.

Group D is represented only by one species, the Mediterranean *Scolopendra oraniensis*, inhabiting mostly open thermophilic habitats and collected only in one *Quercetea ilicis* site (MTa). The presence of open habitat species in *Quercetea ilicis* — as also in other formations — must however be considered rather rare and it is likely to be related to human activities, such as coppice or pasture, which create more of less open areas in the primary structure of the forest.

Group E. Also related to human influence in the habitat is likely to be the presence of the species of the last group, five euryoecious elements, *Lithobius forficatus, L. lapidicola, Himantarium gabrielis, Geophilus carpophagus* and *G. linearis*.

The percentages of the main chorotypes represented in the two communities studied are shown in Table 2 and the following remarks are possible:

In *Quercetea ilicis* centipede communities particularly represented are W-Palearctic and mediterranean species whilst the proportion of European species is low.

In *Fagetalia sylvaticae* centipede communities, the highest percentage is shown by European species and both mediterranean and W-Palearctic species are quite poorly represented.

©Naturwiss. med. Ver. Innsbruck, download unter www.biologiezentrum.at

Table 2: Percentages of species of the main chorological types represented in the two centipede communities: **E** European s.l., **En** Endemic (Appenninic), **M** Mediterranean s.l., **WP** W-Palearctic.

	Quercetea ilicis	*Fagetalia sylvaticae*
WP	31,25	12,50
E	18,75	50,00
M	25,00	18,75
En	25,00	18,75

The different arrangement of the percentages of the european and mediterranean species in the two communities is possibly related to the different general bioclimatic conditions of the areas where the sites are located. The higher frequency of W-Palearctic species in *Quercetea ilicis* communities, sampled in sites mainly between 20 - 100 m a.s.l., compared to *Fagetalia sylvaticae* communities, sampled in sites mainly between 1000 - 1300 m a.s.l., must be explained by considering that the lowest or coastal areas of Central Italy are more influenced by human activities (coppice, pasture, fire) which could favour the colonization of euryoecious and widely distributed species than the higher or inland areas.

4. Concluding Remarks:

The preliminary data on centipede communities of Central Italian woods presented here seems to show good correlation with the habitat characteristics of the two vegetation types investigated. Nevertheless, owing to our still incomplete knowledge, it is not possible to give general indications.

The main results of this study can be briefly summarized in terms of a) the general forestal features of the two communities investigated and, b) their quite clear differences both from faunistical and ecological points of view.

More data is, however, necessary to complete our knowledge of the ecology of centipede communities in Central Italy, particularly in order to use these arthropods in studies of environmental quality definition. With respect to the two vegetation types studied, research in a more extensive series of *Quercus ilex* and *Fagus sylvatica* woods is still required together with comparable records from other vegetational associations present in the area. More detailed information on soil characteristics, such as water storage capacity, and climate of each site investigated is also necessary.

With regard to the methods used, in order to have a complete idea of the species present in each site, pitfall trapping must be accompanied by hand collection. Amongst the difficulties of studies on centipede communities must be remembered also those problems related to inadequate knowledge of the geographical distribution and taxonomy of some species.

5. Acknowledgements:

I wish to thank Prof. A. Vigna Taglianti, Dipartimento di Biologia Animale e dell' Uomo, Università "La Sapienza", Roma, Italy, and his students and collaborators, S. Angeloni, F. Bonavita, F. Cecchetti, A. Ciceroni, F. Comandini, S. De Felici, P. Petrella, C. Vinciguerra, for enabling me to study the collected material, Dr. M. Biondi, Dipartimento di Scienze Ambientali, Università de L'Aquila, for his help in cluster analysis and Dr. G. Abbate, Dipartimento di Biologia Vegetale, Università "La Sapienza", Roma, for her indications on vegetational types.

Research supported by grants of the Italian Ministero della Pubblica Istruzione and the Consiglio Nazionale delle Ricerche.

©Naturwiss. med. Ver. Innsbruck, download unter www.biologiezentrum.at

6. Literature:

ABBATE, G. (1990): Le foreste della Riserva MaB "Collemeluccio - Montedimezzo" (Molise – Italia meridionale). – Doc. Phytosoc. **12:** 289 - 304, 1 tav.

BARONI URBANI, C. & M.W. BUSER (1976): Similarity of binary data. – Syst. Zool. **25:** 251 - 259.

BLASI, C., L. FILESI, G. ABBATE & P. CORNELINI (1990): La vegetazione forestale dei Monti Cimini (Italia centrale). – Doc. Phytosoc. **12:** 305 - 320, 1 tav.

COMANDINI, F. & A. VIGNA TAGLIANTI (1990): Ground beetle communities in a Mediterranean area (Tolfa Mountains, Central Italy). – In: STORK, N. (ed.), The role of ground beetles in ecological and environmental studies. Intercept Ltd., Andover: 171 - 179.

MINELLI, A. (1981): Distribution, Taxonomy and Ecology of some Centipedes from the Provinces of Trento and Bolzano, Northern Italy (Chilopoda). – Stud. Trent. Sc. nat., Acta Biol. **57** (1980): 83 - 93.

– (1982): I Chilopodi nell' ambiente dei boschi planiziali padano – veneti. – Quad. C.N.R. " Struttura delle zoocenosi terrestri". 4. I boschi della pianura padano – veneta. Collana Progr. Fin. "Promozione della qualita dell ambiente". Roma: 125 - 135.

– (1988): Chilopodi di ambiente montani e alpini delle Dolomiti. – Stud. Trent. Sc. nat., Acta Biol. **64** suppl.: 431 - 440.

MINELLI, A. & E. IOVANE (1987): Habitat preferences and taxocenoses of Italian centipedes (Chilopoda). – Boll. Mus. civ. St. nat. Venezia **37** (1986): 7 - 34.

MINELLI, A. & M. ZAPPAROLI (1986): I Chilopodi di alcuni ambienti costieri medio tirrenici, con particolare riguardo al Parco Nazionale del Circeo (Chilopoda). – Atti Conv. Asp. Faun. Probl. Zool. P.N. Circeo (Sabaudia, 1984): 25 - 36.

SPADA, F. (1977): Primi lineamenti della vegetazione del comprensorio Tolfetano – Cerite. – In: "Richerche ecologiche, floristiche e faunistiche nel comprensorio Tolfetano – Cerite – Manziate". – Quad. Acc. Naz. Lincei **227:** 37 - 49.

TOMMASELLI, R., A. BALDUZZI & S. FILIPELLO (1973): Carta bioclimatica d' Italia. – Min. Agric. For. Roma, Coll. Verde **33:** 5 - 24, 1 map.

VIGNA TAGLIANTI, A., F. COMANDINI, P. BONAVITA, S. DE FELICI & A. CICERONI (1988): Primi dati sulle comunità di Coleotteri Carabidi dei Quercetea ilicis nel Lazio. – Atti XV Congr. naz. ital. Ent.: 415 - 422.

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: Berichte des naturwissenschaftlichen-medizinischen Verein Innsbruck

Jahr/Year: 1992

Band/Volume: S10

Autor(en)/Author(s): Zapparoli Marzio

Artikel/Article: Preliminary Data on Centipede Communities of Quercetea ilicis and Fagetalia sylvaticae in Central Italy. 197-204