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Analysis of the ground Coleoptera communities of agro-ecosystems within the Oriented Natural Reserve "Pino d'Aleppo" (Ragusa, Sicily) and their use for assessing the environmental quality

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SUMMARY

ABSTRACT

The agricultural systems that have been established in recent decades are characterized by a high productivity thanks to a series of external factors that raise the efficiency and/or quality. While this practice leads to increase production and make it economically advantageous, the other result is a more substantially simplification of agro-ecosystems and a significant reduction of biodiversity.
Today various authors claim that at a reduction of biodiversity correspond a low level of ecosystem stability; for this reason they propose agronomics management systems based on crops diversification and increase of natural marginal areas neighboring the agro-ecosystems; this practice improve biodiversity, especially for generalist and specific predators, insect pollinators etc., with a possible decrease of human interventions like the use of pesticides.
Most researches in this field aimed to establish the relationship between a certain type of agronomical practice and a specific group of insects, with results that differ in relation to insect species, selected agronomical practice and location. Seldom the attention was focused on a wider scale of biodiversity with reference to landscape mosaic, to understand its effect on agro-ecosystem biocoenosis composition, dynamic and homeostatic.
Recent studies showed that increasing or maintaining a high level of biodiversity in agriculture depend not so much on the reduction of conventional farming practices but rather on other factors, where the most significantly appears to be the patchy structure of landscape.
In the Mediterranean area, human activity has dramatically reversed the relationship between open spaces and forests, reducing the latter to fragments inserted in a matrix profoundly changed: in flatland and hilly areas the extension of the forest has been drastically reduced and they are now comparable to islands more or less large.
The “Pino d’Aleppo” Natural Reserve, where the present research was conducted, shows a typical situation: a mosaic of natural and semi-natural habitats fragmented and isolated at various degree, within an environmental matrix strongly modified by human actions, first of all the intensive use of land for agricultural activities.
This research concerned the study of ground Coleoptera communities of three different agro-ecosystems: Arable land with Carob trees (**AC**), Olive grove (**Ol**) and Citrus grove (**Ci**) and of a residual patch of Mediterranean maquis (**Tk**) investigated by pit-fall traps.
Therefore, the study focused on **Coleoptera**, for which has been developed the examination of **Families**, with particular reference to species of **Carabidae**, **Tenebrionidae** and **Staphylinidae** (excluding **Aleocharinae**).
Inside each station five pit-fall traps have been installed filled with a solution of water, vinegar and table salt in saturation; the gatherings of the pit-fall traps took a year from June 2009 to July 2010.
An amount of **10.402** specimens of Coleoptera (belonging to a total of **42** Families) have been collected, with **2.064** specimens belonging to a total of **38 Carabidae** species, **1.899** specimens belonging to a total of **26 Tenebrionidae** species and **1.026** specimens belonging to a total of **46 Staphylinidae** species (excluding **Aleocharinae**).
The sampling data were standardized according to the unit effort and expressed as value of **CSD** (**Standard Capture Density**). The CSD of Coleoptera, both for Families and species, was analysed during the entire period of sampling and in the different stations, and even in individual trap for each station.
The following biodiversity and similarity indices have been computed:

- Index of Margalef (**d**) to evaluate the richness in taxa among the surveyed places; indices of Simpson (**D**) and Shannon (**H’**) to evaluate the biodiversity of the surveyed places.
- Pielou (**J**) and Simpson’s Dominance (**λ**) indices to evaluate the evenness.
- Index of Sørensen (**QS**) to evaluate similarity rates.

For the comparison between communities was used a multivariate analysis by the method of Non Metric Multidimensional Scaling based on the index of similarity of Bray-Curtis and tested with ANOSIM and SIMPROF.

All the indices and the multivariate analysis of the communities were elaborated for Coleoptera **Families** and for species of **Carabidae**, **Tenebrionidae** and **Staphylinidae** (excluding **Aleocharinae**).
The results obtained have been compared with the data of a previous research conducted from July to December 2007 using the same method within the same area in different habitat typology: 3 natural *Pinus halepensis* woods, 1 maquis, 2 garrigues, 1 meadow, 1 artificial Pine reforestation (BOCCHIERI 2009).
With regard to the single family of Coleoptera Carabidae, it was developed the index for fauna value (**INV**) (in BRANDMAYR et alii, 2005) for each of the 12 patches studied, transferring than the value of this index on computerized cartographic support (GIS platform) to process of thematic maps elaboration.
The study has underline that:

1) **Three species are new for Sicilian fauna**: ***Microlestes fissuralis*** (Reitter 1901), ***Pterostichus* (*Platysma*) *niger niger*** (Schaller 1783) e ***Micropeplus porcatus*** Paykull 1789.

2) **The biodiversity of ground fauna occurs with different aspects depending on the stations and groups considered**.
Biodiversity appears to be in some cases depending on the intrinsic structure of single stations, while in other cases on the group of animals taken into consideration.
Data suggest that the assessment of biodiversity levels for a site, taking into account the component under investigation, generally represents a fraction of the total animal diversity being influenced by bio-ecological characteristics of the component itself. So it is not possible to take conclusion only considering one or a few animal groups, although some areas have intrinsic features that give a strong and homogeneous connotation to the structure and characteristic of the ground fauna. This limitation for the biocenotic analysis can be partially solved by a multi-taxa approach.

3) **Biodiversity is distributed in different temporal domains**.
The asynchrony of captures peak for species of Carabidae, Tenebrionidae and Staphylinidae most abundantly sampled is an additional aspect of the biodiversity. The phenology of the species permit to identify in the summer, characterized by the limiting factors (e.g. temperature and humidity) of primary importance in the mediterranean contest, the critical period for Carabidae and Staphylinidae but not for Tenebrionidae, coherently with the bio-ecological characteristics of these Families. The fraction of ground fauna of agro-ecosystems examined in this study shows a complex structure through which it can occupy the most temporal ambits with different species that follow one another over time.
This diversity is favored by the structure of the landscape mosaic. Actually, the species of Coleoptera Carabidae, Tenebrionidae and Staphylinidae most abundantly sampled during this study show, generally, a clear preference for one station where they recorded high values of CSD, while they are absent, or present with low values of CSD, in the other stations. Their presence is therefore linked to some patches, rather than others, and is thus made possible precisely by the environmental mosaic that characterizes the study area.

4) **The biodiversity of ground fauna observed within the investigated agro-ecosystems is not as high on average, both for Families and for the species complex of Carabidae, Tenebrionidae and Staphylinidae, than that found in natural habitats within the same area.**
The comparison of data obtained in the present research with those of the previous study conducted, using the same method within the same area, in natural environments, shows that biodiversity and evenness indices registered for agro-ecosystems are in most cases lower than that of stations in natural environments, both for Coleoptera **Families** and for species of **Carabidae** and **Tenebrionidae**. As for **Staphylinidae** should be noted that they present a model of biodiversity indices values significantly different from the previous with Shannon and Pielou indices values higher in some agro-ecosystems than in some natural environments. This could be partially

explained with the fact that the most abundant species sampled are ubiquitous and especially phyto- or zoo-saprophytic, connected to temporary microhabitats characterized by strong seasonal fluctuations, and provided with good dispersal ability related to active flight.

5) **The stations differ significantly in community structure at any level they are investigated.**
The examination of the indices of similarity and the Non Metric Muldimensional Scaling, based on the index of Bray-Curtis, show a general more homogeneity between the traps of each of the 4 stations investigated in the present study, than between that 8 stations examined in the previous research. The ANOSIM tests confirms, with values always statistically significant for all groups considered, that traps of a station are more similar to each other than to those of other stations.
This homogeneity is accompanied by a slight similarity between the stations, as evidenced by the qualitative index of Sørensen and the Non Metric Muldimensional Scaling. In particular, the parwise test shows for all groups investigated that the dissimilarities between stations are, with few exceptions, statistically significant.
In conclusion, the study points out that all considered stations differ significantly from each other for the structure of coenosis investigated, both in terms of quality and quantity, and that each has such features able to maintain different fractions of ground fauna, thereby contributing to preserve significant and peculiar portions of biodiversity.

6) **The contribution of this biodiversity, and the stability of agro-ecosystems remains to be defined**.
This study has emphasized the specific zoocoenosis at each station and their contribution for the preservation of biodiversity. However it remains to define the role of biodiversity as ecology-stabilizer of agro-ecosystems.

7) **In prospect of a correct land management, considering that the land investigated is a protected area, the patches should be protected to maintain significant levels of biodiversity.**
The study highlights the strategic role of the environmental mosaic for the preservation of adequate levels of biodiversity of ground fauna in the area in question.
The computation of the faunal value index for habitats (INV), based on species of Coleoptera Carabidae according the methodology proposed by BRANDMAYR et alii (2005), shows that the station with the highest value (medium class) is the agro-ecosystem **AC (Arable land with Carob trees)** followed by stations with medium-low class value, that in decreasing order are: **Mq** (**Maquis**), **Mw** (**Meadow**) and **WD** (**Pine artificial reforestation**), **Ci** (**Citrus grove**) and **Tk** (***P. halepensis* – *Q. calliprinos* thicket**), **WC** (***P. halepensis* wood 3**), **Ga** (**Garrigue 1**) and **WA** (***P. halepensis* wood 1)**, while only three stations: **WB** (***P. halepensis* wood 2)**, **Gb** (**Garrigue 2**) and **Ol** (**Olive grove**) show low class values for fauna quality.
The properties of the natural mosaic at a landscape scale and its significance for the conservation of biodiversity have been recently investigated in order to have a valid scientific basis for the study and the preparation of measures for protection and land management. These studies underline three main properties that affect biocoenosis: the extension of the habitat, the composition of the mosaic and the spatial configuration of the elements. In particular, the extension of the habitat influences the presence of individual species. In our case, the extreme fragmentation, the small size and their relative isolation give to the natural landscape patches of the Pineta di Vittoria a marked ecotonal facies, which affects the structure and stability of the biological communities in the single patch. This could explain, for example, the low affinity found between the four residuals of *Pinus halepensis* forest, or between the two fragments of mediterranean maquis. The extension of such patches of natural landscape would therefore be an important purpose towards the biodiversity conservation and the recovery of a more stable and homogeneous biocoenosis of scrub and forest environments.
Whereas some studies have shown different properties of the environmental mosaic characterized by good or poor ecological connectivity and different responses depending on the groups

investigated (DIEKÖTTER et alii 2008), the conservation strategies should be guided by flexible principles and based on appropriate preliminary studies.

1 INTRODUCTION

The agricultural systems that have been established in recent decades are characterized by a high productivity thanks to a series of external factors that raise the efficiency and / or quality. While this practice leads to increase production and make it economically advantageous, the other result is a more substantially simplification of agro-ecosystems and a significant reduction of biodiversity (HERNÁNDEZ 1997, ALTIERI 1999, BENTON et alii 2003, ALLEN 2003, BUREL et alii 2004, HERZOG et alii 2005, TSCHARNTKE et alii 2005, FIRBANK et alii 2008, GEIGER et alii 2010, SAUTEREAU et alii 2010).

Within an agroecosystem are, conventionally, found two different components of the functional biodiversity: *planned biodiversity*, which depends on the application of agricultural practices (such as plant species used in the field, crop rotation, types of soil tillage, etc.) and *associated biodiversity*, that includes all the components of fauna and flora that colonize the agroecosystem from surrounding environments, becoming part of that in relation to its conduction and structure (BESTELMEYER et alii 2003, CARDINALE et alii 2003, WEIBULL et alii 2003, LETOURNEAU & BOTHWELL 2008, BALOG et alii 2009, YASUDA 2010).

The evaluation of the impact of agricultural practices on biodiversity conservation has long been the subject of many publications (CARCAMO et alii 1995, ALTIERI 1999, PFIFFNER & LUKA 2000, WASCHER 2000, BUGUNA-HOFFMANN 2000, STOATE et alii 2001, LIANG et alii 2001, HADJICHARALAMPOUS et alii 2002, DÖRING & KROMP 2003, WEIBULL & ÖSTMAN 2003, HAYSOM et alii 2004, THORBEK & BILDE 2004), all showing some negative effects, as the most important seems to be the loss of environmental heterogeneity (PURTAUF et alii 2005, HERZOG et alii 2005, HOLE et alii 2005, SCHWEIGER et alii 2005, JACKSON et alii 2007, BRUSSAARD et alii 2007 DE ARANZABAL et alii 2008, BROCK et alii 2010, POWER 2010).

Some agricultural practices, at least potentially, have a direct influence on functional biodiversity, being able to cause either its increase or its decrease. The use of pesticides, for example, while preserving the crops from harmful species, causes a general decrease in diversity and therefore that of those species operating as natural predators of dangerous insects, with the consequently possible increase of these latter (ANDERSEN 1982, ALTIERI 1994, SAMSØE - PETERSEN 1995, SHAH et alii 2003, PRASAD & SNYDER 2004, BALOG & MARKO 2007, BALOG et alii 2009, GIBBS et alii 2009, GEIGER et alii 2010).

According some authors (ALTIERI 1995, ALTIERI 1999, ALTIERI 2002, ALTIERI 2004) an increase in biodiversity promotes sustainable production. The use of “agro-ecological practices”, such as diversification of crops and presence of marginal areas with characteristics of natural or seminatural, helps to reduce ecological simplification resulting in an increase of functional biodiversity that make agro-ecosystems more stable (THIES & TSCHARNTKE 1999, LANDIS et alii 2000, TSCHARNTKE et alii 2005, PRETTY 2008, WEZEL et alii 2009, GABRIEL et alii 2010, GROOT et alii 2010, FAHRIG et alii 2011).

From this point of view, an increase of generalist predator components is considered useful because, directly or indirectly, they can potentially control the populations of phyto-saprophagous species harmful to agriculture (KAREIVA 1990, JONSEN & FAHRIG 1997, HOLLAND & THOMAS 1997, BENGTSSON et alii 2005, GIBSON et alii 2007, BIRKHOFER et alii 2008).

Many studies have been conducted in this context with special reference to predators, both generalist and specialized, like Carabidae, Staphylinidae, Araneidae, etc. (LANDIS et alii 2000, MÄDER et alii 2002, SYMONDSON et alii 2002, PIFFNER & LUKA 2003, SHAH et alii 2003, MEEK et alii 2002, BENGTSSON et alii 2005, BIRKHOFER et alii 2008, LOBLEY et alii 2009).

The results are sometimes contradictory, showing positive, neutral or even negative effects, in relation to the taxon examined or the environmental context (altitude, biogeographic area, etc.) where research was carried out (MOREBY et alii 1994, KROOS & SCHAEFER 1998, ANDERSEN & ELTUN, 2000, WEIBULL et alii 2003, WINDER et alii 2005, CLOUGH et alii 2007, BEST 2008, GABRIEL et alii 2010).

Many of these studies have investigated a single type of agro-ecosystem in relation to different agricultural practices, but they rarely direct their attention to the landscape as larger scale of diversity. However it was proved that in many cases the increase, or maintain a high level, of biodiversity in agriculture depends not so much on the reduction of conventional farming practices, but rather on other factors, where the mosaic structure of the landscape appears as the most significant one (WIENS 1995, ATAURI & DE LUCIO 2001, ÖSTMAN et alii 2001, RENJIFO 2001, WITH et alii 2002, ALTIERI et alii 2003, DAILY et alii 2003, EILU et alii 2003, WEIBULL & ÖSTMAN 2003, BENNETT et alii 2006, ERNOULT et alii 2006, ZAMORA et alii 2007) together with its heterogeneity degree (ROFF 1974a, ROFF 1974b, GERING et alii 2003, PAUSAS et alii 2003, TEWS et alii 2004, FISCHER et alii 2004, LASSAU et alii 2005, STRIJKER 2005, ERNOULT et alii 2006, DE ARANZABAL et alii 2008, PALMER et alii 2010).
That population dynamics of the single cultivated field are directly or indirectly influenced by those established at the wide area level. The agricultural landscape mosaic (farmlands, tree crops, semi-natural and natural areas, etc.) provides suitable conditions to carry out the biological activities (reproduction, feeding, etc.) of many useful species for agriculture. On the contrary, these conditions do not occur in a landscape characterized by extensive monoculture (THOMAS et alii 1991, DUELLI 1997, ALTIERI 1999, SHAH et alii 2003, ZAMORA et alii 2007, BRÜHL & ELTZ 2010).
Many studies show that natural areas and habitats or ecotonal bands between cultivated areas and natural environments, facilitate the dissemination of predatory species, which can play within the single cultivated field the role of potential regulators for populations of destructive species, limiting, consequently, the need of using agricultural pesticides (WITH & CRIST 1995, KAREIVA & WENNERGREN 1995, DUELLI 1997, DUELLI & OBRIST 1998, HADDAD 1999, ALTIERI 1999, TSCHARNTKE et alii 2005, ROSCHEWITZ et alii 2005, DIEKÖTTER et alii 2008).
The mosaic structure of the environment has been for years under investigation, in relation to the structure of populations and communities (NIEMELÄ et alii 1986; NIEMELÄ et alii 1988; KLEIN 1989; BAUER 1989a, BAUER 1989b; SAUNDERS et alii 1991, NIEMELÄ et alii 1992; MARGULES et alii 1994, LAW & DICKMAN 1998, THOMAS 2000, GOLDEN & CRIST 2000, ATAURI & DE LUCIO 2001, MAGURA et alii 2001, NIEMELÄ 2001, MCGARIGAL & CUSHMAN 2002, OLFF & RITCHIE 2002, PARKER & MAC NALLY 2002, BAILEY et alii 2002, STEFFAN-DEWENTER & TSCHARNTKE 2002, FAHRIG 2003, TSCHARNTKE & BRANDL 2004, BENNETT et alii 2006).
The analogy of the patches with the islands was also the starting point for studies aimed at verifying whether their communities are regulated by the balance between extinction and immigration, as appears to characterize the island communities (MACARTHUR & WILSON 1967; SIMBERLOFF 1974; WILLIAMSON 1989, HAILA 2002). A mosaic of environments has been even identified in extensive and apparently uniform areas such as tropical forests (BROKAW 1985), and has been argued that this heterogeneity may account for the extraordinary biodiversity of this biome (HUSTON 1994).
This spatial structure of the landscape has been correlated with that of the populations that constitute the community. It was thus possible to define two main typologies for populations: multi-populations, correlated with wide environments, and metapopulations correlated with single patches (DEN BOER 1979; DE VRIES et alii 1990, BAGUETTE 2004).
The environmental mosaics, and their high heterogeneity, are already largely used to individuate the contexts in which it is possible to hypothesize evolutionary processes, as speciation and variation in space-time structure of biocenosys (HENGEVELD 1994). Actually the definition of an articulated theoretical framework of instruments to apply at various territorial planning levels (FOSTER et alii 2003, ANTROP 2005), with the purpose of maintenance of high biodiversity degree (AHERN 2001, ALTIERI 2004, YOUNG et alii 2005, WEZEL et alii 2009), is possible only through the acquisition and comparison of data on real communities in different environmental contexts. This obviously also applies for the management of agroecosystems.
For this reason, the study of communities of fragmented habitats has now become a necessity, especially in ecological contexts such as those of the mediterranean environments characterized by

a number of articulated limiting factors and where the territory is under continuous transformation (RESCIA et alii 1997, NAGENDRA et alii 2004, CLOUGH et alii 2007, DE ARANZABAL et alii 2008, GERI et alii 2010).
The mosaic structure of the environment is generally determined by natural and / or anthropic disturbance events and its characteristics are highly related to the type and degree of the disturbance (WHITE & PICKETT 1985; SAUNDERS et alii 1991, FAHRIG 2003, GERI et alii 2010).
The natural disturbances which determine a patches structure, have different dynamics: in forest systems, for example, the collapse of old trees produce small extension areas characterized by a dynamic community that tends to reconstitute, in a relatively short time, the previous balance. Rather fires or slush avalanches cause much stronger and perturbing effects; the eruptions, in volcanic environment, determine continuous fragmentation of habitats with consequent effects also on the genetic structure of populations (VRIJENHOEK, 1985; CARSON & TEMPLETON 1984; CARSON et alii 1990, TANAKA et alii 2008).
It is nowadays crucial to understand the structure and dynamics of coenosis for fragmented habitats, to provide both general and detailed information on the management of territory, also in line with Community policies. This is strongly indispensable where the purpose is establishing appropriate policies to protect biodiversity, which cannot be promoted on the basis of simple theoretical considerations.
In the Mediterranean area, human activity has dramatically reversed the relationship between open spaces and forests, reducing the latter to fragments inserted in a matrix profoundly changed: in flatland and hilly areas the extension of the forest has been drastically reduced and they are now comparable to islands more or less large.
The Pino d'Aleppo area, where the present research was conducted, shows a typical situation: a mosaic of natural and semi-natural habitats fragmented and isolated at various degree, within an environmental matrix strongly modified by human actions, first of all the intensive use of land for agricultural activities.
The effects of these radical changes on fauna are evident with regard to vertebrates, with not only the disappearance of species and genera, but also of Orders. But for small size species, such as those of the soil arthropod community, becomes difficult to assess how these changes have affected them. They are not static and presumably vary depending on the community and the sites investigated. Anyway, they are populations whose living space is represented by small portions of territory and whose microhabitats may persist, though with reduced frequency, even in situations of profound changes.
This research concerned the study of ground Coleoptera communities of three different agroecosystems (arable land with Carob trees, olive grove and citrus grove) and of a residual patch of mediterranean maquis.
Therefore, the study focused on Coleoptera, for which has been developed the examination of Families, with particular reference to species of Carabidae, Staphylinidae and Tenebrionidae.
These families of Coleoptera are of great importance for the study of soil fauna, due to their relative abundance, to the number of species, to their ecological specialization and diversification; so the study of these components allows to explore different aspects of changes in space-time structure of the ground fauna.
Regarding the groups investigated, few studies (and mainly concentrated on Carabidae and Staphylinidae) have so far conducted in the mediterranean ambit.
The communities of Carabidae are the subject of numerous investigations in european sphere (see VAN DER BOER et alii 1986), and have been used since time as bioindicators (BRANDMAYR & ZETTO BRANDMAYR 1980, BRANDMAYR 1983, PIZZOLOTTO 1993, PIZZOLOTTO 1997, BRANDMAYR et alii 2005, UEHARA-PRADO et alii 2009), but few studies are that conducted in environments strictly mediterranean (BRANDMAYR et alii 1981a, BRANDMAYR et alii 1981b, BRANDMAYR & PIZZOLOTTO 1988, VIGNA TAGLIANTI et alii 1988, PIZZOLOTTO 1994a, PIZZOLOTTO 1994b, BRANDMAYR et alii,

2002, PIZZOLOTTO et alii 2005) and in Sicily (BRANDMAYR & PIZZOLOTTO 1990, PIZZOLOTTO & BRANDMAYR 1990).

The zoocoenosis of Staphylinidae are even less studied than Carabidae. In the mediterranean area were investigated by OUTELERO DOMINGUEZ (1981), in the italian ambit studies have focused on forest habitats (CHEMINI & ZANETTI 1982, SCHATZ 1988, ZANETTI 1992, ZANETTI et alii 1997, TAGLIAPIETRA & ZANETTI 2002, ZANETTI & MANFRIN 2004, ZANETTI & TAGLIAPIETRA 2005), while the ground biocoenosis of Sicilian forest environments have been studied with regard to Nebrodi (SABELLA & ZANETTI 1991), Etna (ADORNO 1994) and Hyblean (ADORNO & SABELLA 1998). In Sicily ADORNO (2002) has also investigated the effects of soil erosion on communities of Carabidae, Staphylinidae and Tenebrionidae of Etna.

Here, the present study aims to delineate the structure of Coleoptera communities of the 4 patches explored, and then to compare it with that of 8 other patches of natural and semi-natural habitats, still inside the R.N.O. Pino d'Aleppo, studied with the same methodology, from July to December 2007, by BOCCHIERI (2009). The research purpose is to define the role and importance of these landscape patches to maintain, or increase, biodiversity and to imagine as well, on the basis of scientific criteria, models of management and planning for agricultural activities that allow the maintenance of high biodiversity degree at single species and ecosystem levels.

With regard to the single family of Coleoptera Carabidae, it was developed the index for fauna value (**INV**) (in BRANDMAYR et alii 2005) for each of 12 patches studied, transferring than the value of this index on computerized cartographic support (GIS platform) to process of thematic maps elaboration.

2 THE STUDY AREA

2.1 GENERAL FRAMEWORK

The Riserva Naturale Orientata “Pino d’Aleppo” was established by D.A. n.536/90 of Assessorato Territorio e Ambiente of Sicilian Region, with the aim to safeguard the remaining native *Pinus halepensis* formations and restore the pine forest where scrubland areas degraded by human action. The protected area management entrusted to the Provincia Regionale di Ragusa, lies in the municipalities of Victoria, Comiso and Ragusa (figs. 2.1.1 e 2.1.2) and covers approximately 3.000 hectares of integral reserve area (zone A) and pre-reserve area (zone B).

The site is an SCI (Site of Community Importance ITA080003 - Vallata del fiume Ippari) (fig. 2.1.2) established by D.P.R 357/97 and s.m.i., in application of Directive 43/92 CEE. The area of SCI almost completely overlaps that of Reserve and will be used as a reference in the discussion of the study area.

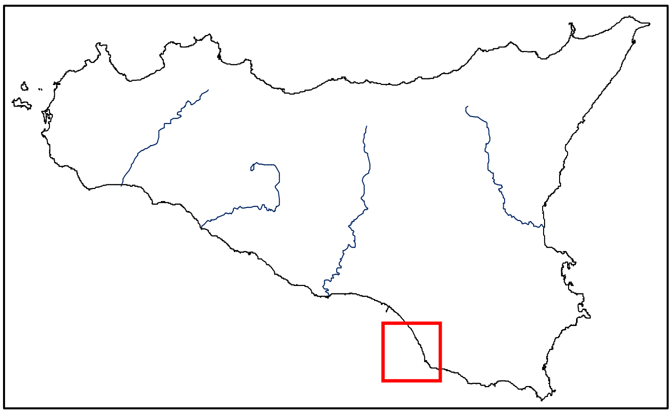


Fig. 2.1.1- Location of the study area (from: www.minambiente.it).

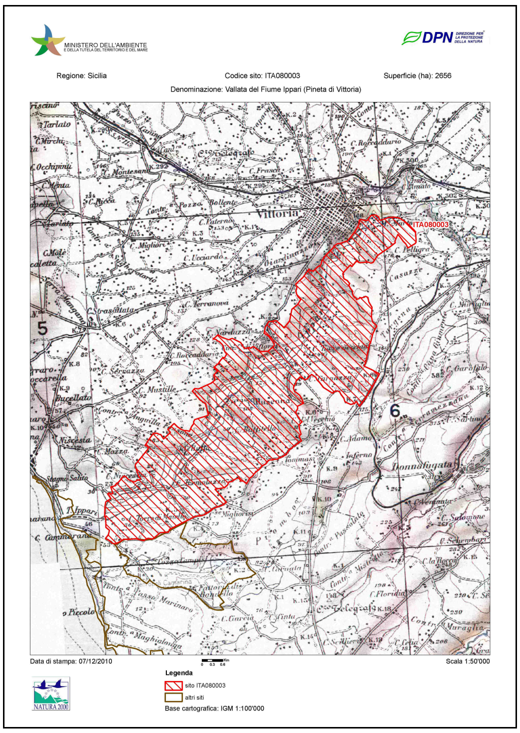


Fig. 2.1.2 – Perimeter of the SCI ITA080003 - Vallata del fiume Ippari (from: www.minambiente.it).

The area lies between in longitude 14° 27’ 13” and 14° 33’ 35”, and in latitude between 36° 27’ 01” and 36° 57’ 4”; it is contained within the Foglio IGM (1:100,000) 275 “Scoglitti” and Foglio IGM 276 “Ragusa”, and within Tavolette IGM (1:25.000) 276 IV N.O. “Victory”, 276 IV S.O. “Donnafugata” and 275 I S.E. “Scoglitti”, occupying the lower part of the river Ippari.

2.2 CLIMATE FRAMEWORK

Based on the information reported in the Atlas of Climatology of Agro-Meteorological Information Service Department of Agriculture and Forestry of the Sicilian Region and in the Plan for the Protection of the Waters of Sicily are identified for the Ippari basin area of interest the following climatological indices:

- Lang's Rain-Factor indicates a steppe climate;
- De Martonne's Index of Aridity is comprised between semiarid and warm-temperate;
- Emberger's pluviometric quotient is comprised between semiarid and sub-humid;
- Thornthwaite's index of moisture reports a climate from semiarid to dry-subhumid;
- Rivas Martinez's bioclimatic index proposes a climate from inferior dry thermo-mediterranean to dry superior thermo-mediterranean.

Looking at the thermopluviometric diagram for Vittoria (fig. 2.2.1) it shows that the annual average temperature is approximately 18°C, with a dry period that extends from April to September.

As for precipitation it shows that the averages range vary from 300/400 mm in coastal areas to 600/700 mm in inner territories, with a monthly distribution typically Mediterranean, and a concentration of rainfall in autumn and winter and a drastic reduction of that in the period spring-summer.

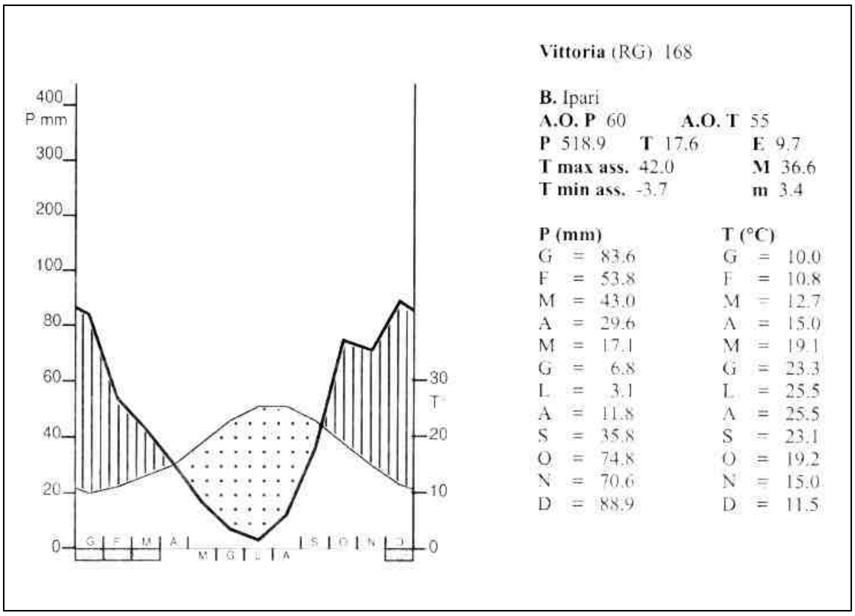
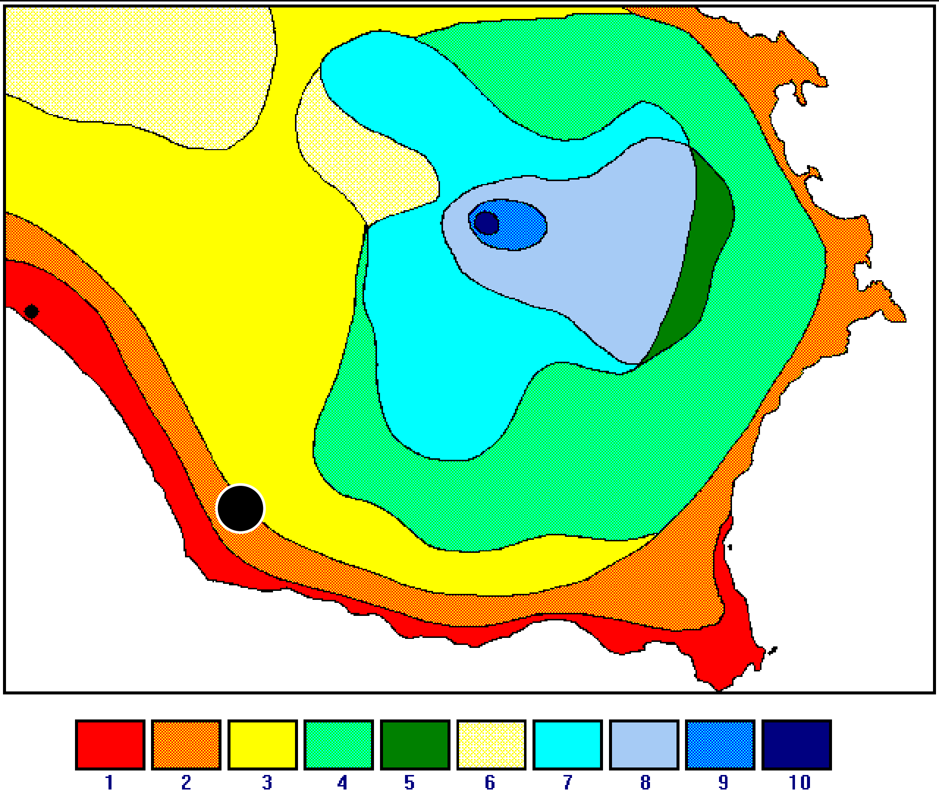


Fig. 2.2.1 –Climate diagram of Vittoria thermopluviometric stations (from ZAMPINO et alii 1997). To the right are reported elevation characteristics of the station, numbers of years of observation (A.O.), the mean annual and monthly temperature and rainfalls.

Based on available data, the study area falls in the bioclimatic range of superior themo-mediterranean thermotype and superior dry ombrotype. By comparing the location of the study area with the neighboring areas (fig. 2.2.2), it is evident that the bioclimatic type in question occupy the coast-hills.

As the distance from the sea and the altitude change, occurs a rapid succession of different types of bioclimatic increasingly fresh and moist. For each type or bioclimatic range corresponds to a different type of natural climaceous vegetation or "climax".

It represents the most advanced natural vegetation for each bioclimatic belt. In the study area, although the deep anthropic changes have resulted in the reduction or disappearance of much of the original natural vegetation, it can be assumed that the original climax vegetation is *Quercus suber* wood, attributable to *Stipo bromoidis-Quercetum suberis*.



Tipi bioclimatici (termotipi e pluviotipi combinati) presenti nella Sicilia sud-orientale (da Scelsi & Spampinato 1998)

TERMOTIPI→ PLUVIOTIPI↓	Termomediterraneo inf. T = 16-18°C It = 400-449	Termomediterraneo sup. T = 16-18°C It = 399-350	Mesomediterraneo T = 13-16°C It = 349-210	Supra-mediterraneo T = 8-13°C It = 209-70
Semiarido P = 350-450 mm	1) Tmed. i. sar.			
Secco P = 450-600 mm	2) Tmed. i. sec.	3) Tmed. s. sec.	6) Mmed. sec.	
Subumido inf. P = 600-800 mm		4) Tmed. subum. i.	7) Mmed. subum. i.	
Subumido sup. P = 800-1000 mm		5) Tmed. subum. s.	8) Mmed. subum. i.	
Umido inf. P =1000-1350			9) Mmed. umido	10) Supra-med. umido

It = indice di termicità (T + M + m)10; T = temperatura media annuale, M = temperatura media delle massime del mese più freddo, m = temeperatura media delle minime del mese più freddo

Fig. 2.2.2 - Bioclimatic types of South-East Sicily (from Scelsi & Spampinato 1998). With black dot (●) is indicated the location of the study area.

2.3 GEOLOGIC FRAMEWORK

The study area represent the south-eastern sector of the wide foothills strip comprised between the Hyblean Plateau and the Erei Mountains; it is a vast sub-flat sector, called Piana di Vittoria, which develops elongated in the direction NE - SW between Chiaramonte Gulfi, Comiso, Vittoria and the Canale di Sicilia, with an altitude generally ranged between 50 m and 300 m a.s.l.

The Piana di Vittoria slopes gently toward the sea, with large undulating forms resulting from the erosive surface water run-off, bringing the outcrop of a substrate consisting of clayey and sandy deposits, showing also sandstone-sandy Pleistocene deposits intercalated with silt-clay layers. Below the Pleistocene deposits are found other land forming the clastic and pelagic Gela foredeep and Hyblean avampaese deposits.

The oldest outcropping deposits are represented by *Trubi*, calcareous marl and marly limestone, generally covered with clay of the deep sea, with the exception of the eastern section of the plain, where they are replaced by bio-calcarenite with an average thick of 40-50 m; the most recent deposits are represented by fine marine sands having a thickness of up to tens of meters.

The main river axes are represented by Dirillo river and Ippari river, both with NE-SW course that border the plain respectively to the west and east.

The particular amplitude of the valley, particularly in the area between the town of Vittoria and the mouth of the Ippari river, has favored the settlement of the man who took advantage from the side portions and the same riverbed, as well as the large areas of alluvial, for agricultural purposes planting varieties in the past also valuable.

Finally, at the mouth the river makes its way through residual ancient dunes almost disappeared due to human activities.

Figure 2.3.1 shows the main geological and geomorphologic characteristics of the study area.

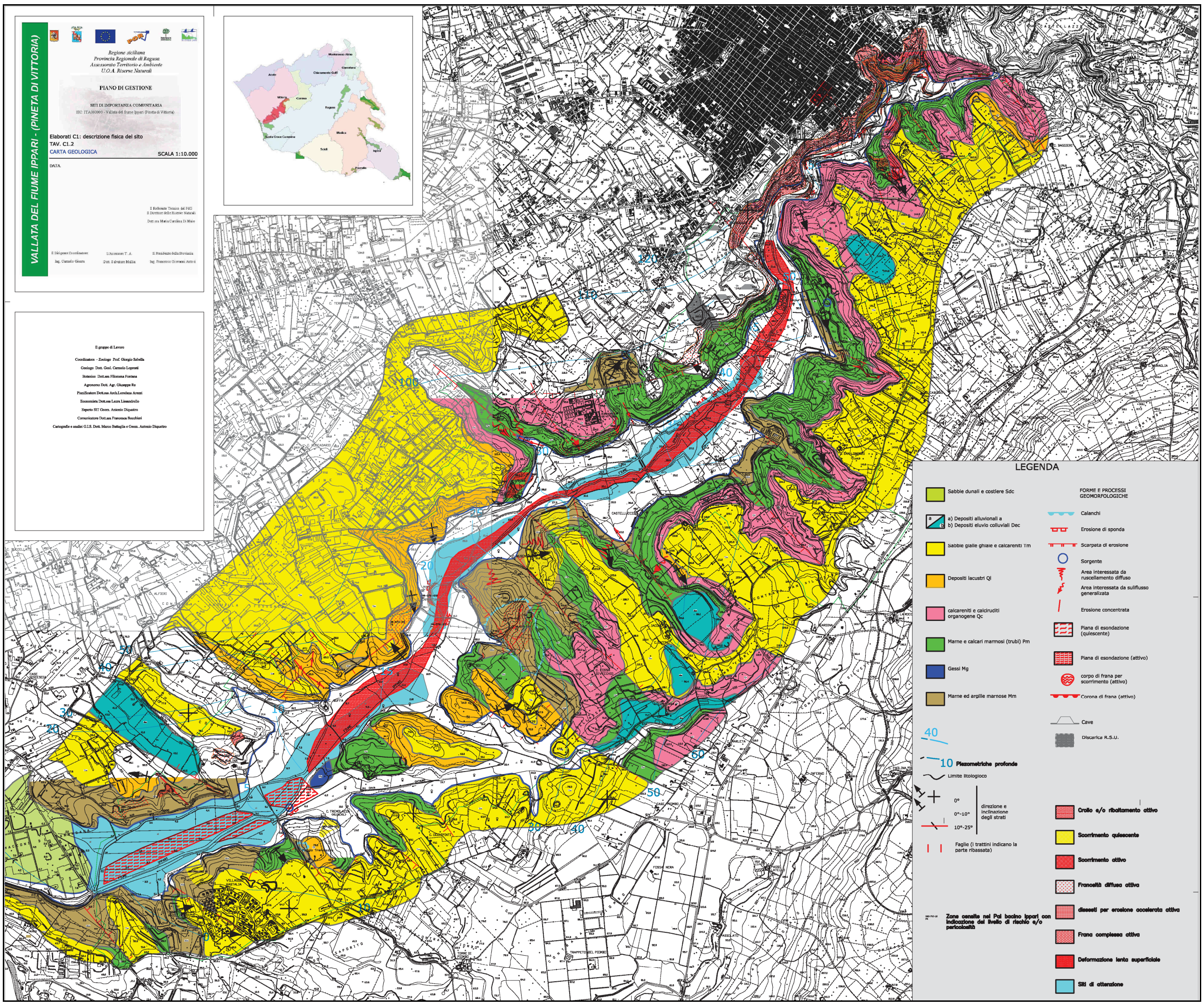


Fig. 2.3.1 – Geological and geomorphologic map of the study area (from PdG del SIC ITA080003 Vallata del fiume Ippari).

2.4 FLORO-VEGETATION FRAMEWORK

The study area is a site of exceptional geobotanic interest as represents one of the few natural *Pinus halepensis* forest in Sicily. It is developed on marly substrates for which the pine is an edafoclimax. The site also features, even in relation to the aridity of the climate, by peculiar scrublands that host a rare flora.

A significant portion of the area is home for real pine-forests, interpenetrating with maquis-scrubland and garigues, and are characterized by large clearings whose origin can be traced back to the felling and fires that in the pastime were common in the area.

The natural plant formations are represented by scrub and garigue with pine trees, scrub and garigue without pines, dry meadows of *Thero-Brachipodietea*.

The maquis-scrub is often attributable to *Chamaeropo-Quercetum calliprini* or *Pistacio-Quercetum ilicis*, or rarely to *Ephedro-Pistacietum lentisci*, while in the garigue dominates the *Rosmarino-Thymetum capitati* abundantly accompanied by *Globularia alypum* in the warmer slopes.

Near the sea, on land predominantly sandy, there are sparse groupings of *Juniperus oxycedrus* subsp. *macrocarpa* and the presence of *Retama raetam* subsp. *gussonei*.

On the sides of the valley dominates the class of *Thero-Brachypodietea* with formations that pervade as mosaic the garigues in *Thimus* and *Rosmarinus*. Where the sand, though incoherent, it manages to retain a good percentage of humus settle *Malcolmietalia* associations.

It's also present the association *Vulpio-Leopoldietum gussonei* with *Muscari gussonei*.

In the districts of Martorina and Passo Piro of the town of Comiso, abound the associations with *Ampelodesmos*.

Where limestone or marl are replaced by clays are present, more or less sporadically, specimens of *Salsola oppositifolia, Salsola agrigentina, Capparis ovata, Asparagus aphyllus*, etc.

Do not miss aspects of vegetation typical of riparian brackish areas with various species of *Juncus* and *Carex*, as well as the rare *Lithrum tribracteatum*.

On limestone rocks settles vegetation dominated by *Euphorbia dendroides* attributable to *Oleo-Euphorbietum dendroidis* (*Quercetea ilicis* class).

The real-river vegetation is very degraded, having been completely eradicated in the past the riparian forest to make place for crops of *Arundo donax*.

Surprising is the number of rare plant species, endemic and with phytogeographic significance: *Loeflingia hispanica*, *Cistus clusii*, *Retama raetam*, *Ophrys calliantha*, together with species of Community interest *Muscari gussonei* and *Ophrys lunulata*.

It should also be noted that many species, even rare, of various genera of Orchidaceae are concentrated in the valley.

From the dynamic point of view, the landscape consists essentially of two edaphophilous series, each characterized by aspects linked together in which any stage is the result of a dynamic evolutionary or regressive process. The first series, *Coridothymo-Pineto halepensis sigmetum*, is characterized by *Coridothymo-Pinetum halepensis* representing the more mature stadium. This vegetation that grows on marly substrates is replaced, due to degradation processes especially through works of cutting and fires, by the aspects of garigue of *Rosmarino-Coridothymetum capitati* or of that *Cistetum salvifolio-clusii*. The further degradation of garigue leads to the *Ampelodesmos mauritanicus* meadows, which are reported for hyblean area to the *Helichryso-Ampelodesmetum mauritanici.*

The second series, *Junipero-Querceto calliprini sigmetum*, is characterized by the more advanced maquis stage of *Junipero-Quercetum calliprini*, which develops in correspondence with sandy substrates; as a result of degradation processes such association is replaced, always above sandy substrates, by coenosis referred to the *Hyparrhenio-Helianthemetum sessiliflorum*. This is followed by a particularly interesting aspect of the area represented by the type of psammophilous vegetation of *Malcolmietalia*: the *Vulpio-Leopoldietum gussonei,* association characterized by *Leopoldia gussonei*.

Among habitats of particular importance are included: natural *Pinus halepensis* pine forest, interesting and special native wood-formation that nowadays represents a small part of that original tree cover that once covered wide areas of the south-eastern Sicily; formations of *Quercus ilex*, also associated with *Pistacia lentiscus, Phyllirea angustifolia, Asparagus acutifolius, Rubia peregrina*, representing residual of a thermophilous forest vegetation physiognomic characterized by *Quercus ilex*; formations of *Euphorbia dendroides*, related to rocky environments, being usually part of xerophilous and pioneer series located along arid and sunny ridges, which sometimes play a minor role, settling on soil substrates impoverished by erosion and landslides, left open by woodlands as a result of degradation processes (cutting, fire, etc.); maquis with elements of *Oleo-Ceratonion* where there are typical elements of *Oleo-Ceratonion* and *Pistacio-Rhamnetalia* such as *Olea europea* var. *sylvestris*, *Pistacia lentiscus, Artemisia arborescens, Anagyris foetida, Teucrium fruticans;* garigues and maquis of evergreen sclerophyll, present on calcarenitic substrates with a strong sandy component, in stations characterized by an extremely xeric microclimate, where it develops a typology of garigue characterized by the presence of *Cistus clusii*, species with an western-Mediterranean distribution, with *Cistus salvifolius, Cistus monspeliens, Cistus creticus, Rosmarinus officinalis, Coridothymus capitatus, Phagnalon rupestris, Calicotome infesta*; thermo-mediterranean and pre-desert shrubs (with *Pistacia lentiscus, Phyllirea angustifolia, Coridothymus capitatus, Cistus monspeliensis, Cistus incanus*), which develop on marly substrates and derive from the degradation process of *Coridothymo-Pinetum halepensis* pine-forest; there the frequent fires especially in the past have affected this area, together with works of cutting and grazing: that has resulted in the disappearance of the tree layer and the development of shrub-type formations. In the territory there is in fact in some areas recently subjected to fires, a transition more or less gradual from dense pine forest to more and more open forest, physiognomy characterized by sparse specimens of Aleppo pine trees, and especially by tree-shrub species favored in their diffusion by the action of fire.
Figure 2.4.1 shows the principal characteristic of vegetation for the study area.

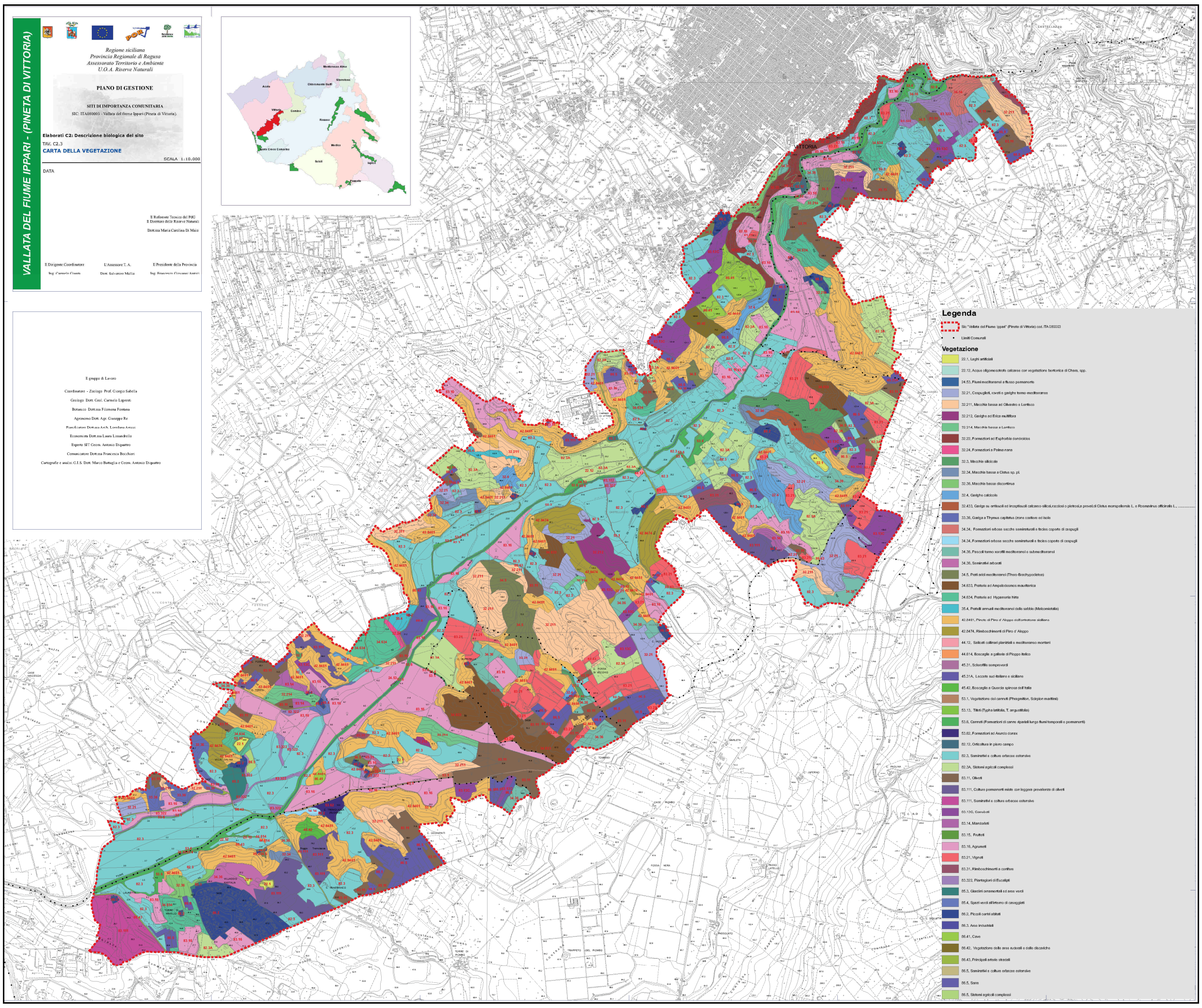


Fig. 2.4.1 – Vegetation map of the study area (from PdG del SIC ITA080003 Vallata del fiume Ippari).

2.5 LAND-USE FRAMEWORK

The whole area is the result of close coexistence between nature and man’s work: in fact, agricultural activities are intense and present since few hundred years ago.

In reference to natural or semi-natural vegetation, those zones covered by forests and semi-natural areas have a total occupancy of around 34% of the total area. The natural areas are therefore characterized by woodlands, garigues and maquis sparse and disconnected with each other; the fragmentation of these areas interrupted in the continuity of their shapes, with extensions of potential habitat often reduced, constitute an element of fragility of the natural system.

In particular, the forested areas (pine, holm oak, willow, poplar) cover an area of approximately 15% of the territory, falling almost entirely in zone A of the reserve and consisting for the main part in Aleppo pine systems.

Areas characterized by shrub vegetation (maquis, scrublands, garigues) or herbaceous (pastures, meadows, dry grasslands) instead compute a covering of about 20%. These habitats are developed mainly by forms of degradation of the forest (e.g. because of fire), or derived from the conquest of space in steep areas due to more or less recent abandonment of land already cultivated.

With regards of agricultural activities, the most common cropping systems are distributed as follow: in the lower valley garden crops in open fields, crops, orchards and vineyards for table grapes, in addition to the omnipresence of reeds *Arundo donax*; in the surrounding plains carob trees, olive groves and crops as traditional cultures, and citrus groves, vineyards and vegetable crops in lands more recently transformed; on the slopes and on areas that are often leveled and terraced insist greenhouses, vineyards and some canopy tree planting, interspersed with wooded areas, garigues, pastures and fallow. In this context the land use for agriculture has a percentage of total site area more than 50%.

If we analyze in more detail the main crop types for the area in question, is the following: simple arable land (subjected to extensive herbaceous cultivation of cereals, leguminous and vegetable crops in field) have an incidence of approximately 5.2 %; arable simple irrigated land (permanently and periodically irrigated through permanent infrastructure, subjected to intensive herbaceous cultivation of cereals, leguminous, vegetable crops in field) have an incidence of approximately 12.4%; extensive arable wooded land (with the same features of the simple arable land, but characterized by the presence of arboreal plants for an accessory agricultural production) have rates of about 1.3%; intensive wooded arable land have an incidence of approximately 1.4%; garden centres for plants, crops and vegetables have an incidence of approximately 2.3%; vineyards have an incidence of around 3.7%; citrus orchards have an incidence of about 10%; olive groves have an incidence of approximately 5%; cropping systems and complexes particles field have an incidence of approximately 6.4%.

Finally, as regards the urban landscape, houses, towns and villages, farms with associated infrastructure, together occupy about 4% of the territory.

Figure 2.5.1. shows different categories of land-use for the study area.

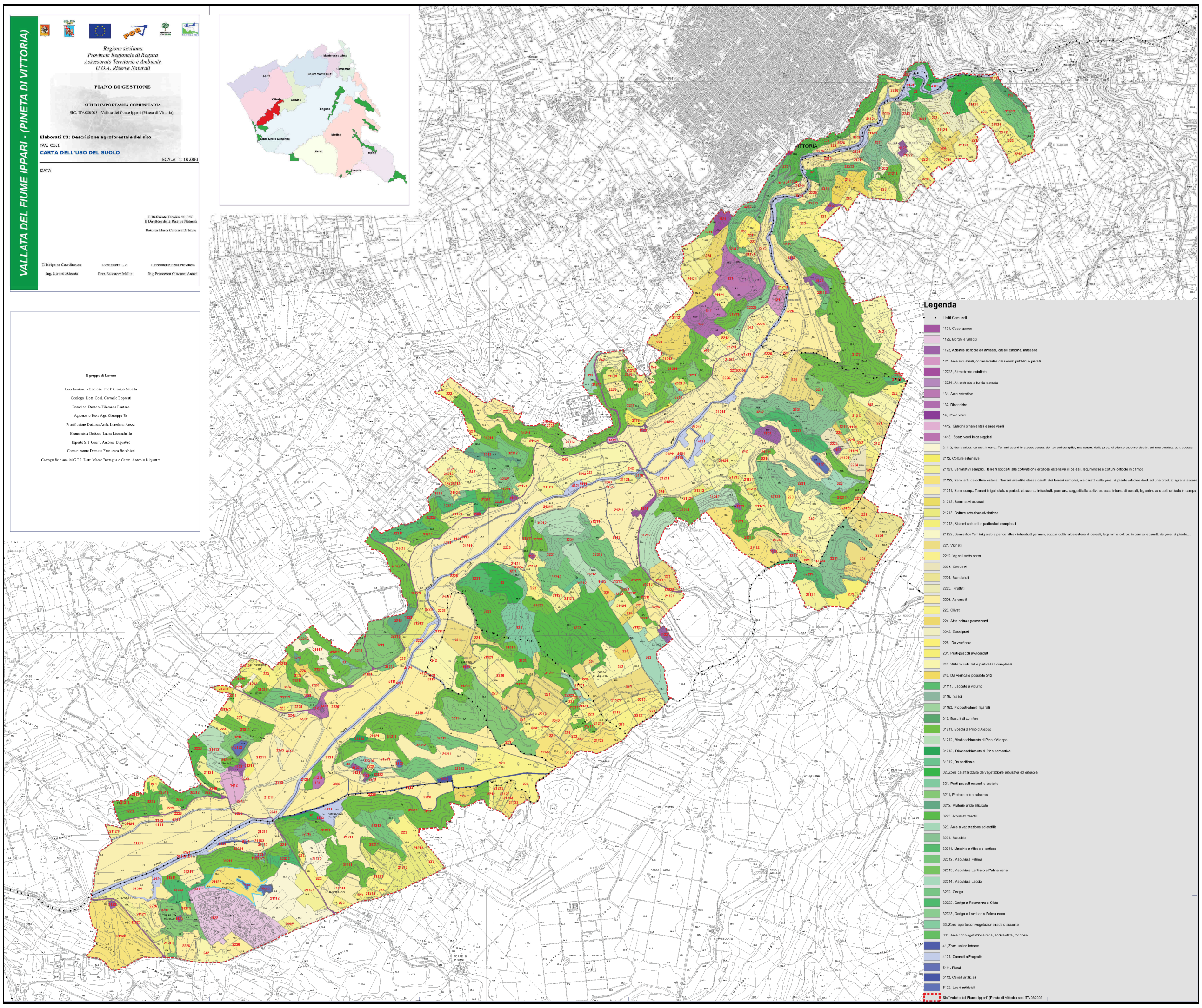


Fig. 2.5.1 – Land-use map of the the study area (from PdG del SIC ITA080003 Vallata del fiume Ippari).

2.6 FAUNAL FRAMEWORK

The wildlife component that characterizes the study area is varied and complex. Following numerous studies have been counted more than 400 different species of vertebrates and invertebrates: Among the mammals are the Oaken mouse (*Eliomys quercinus*), the Porcupine (*Hystrix cristata*), the Hare (*Lepus corsicanus*), the Weasel (*Mustela nivalis*), the Martens (*Martes martes*), the Greater horseshoe bat (*Rhinolophus ferrumequinum*), the Lesser mouse-eared bat (*Myotis blythii*).

The bird class is well represented by the species linked to forest environments such as the Jay (*Coracias garrulus*), the Pigeon (*Columba palumbus*), the Serin (*Serinus canarius*), the Blackbird (*Turdus merula*). In more open areas is present the Hoopoe (*Upupa epops*). Have also been reported the Goldfinches (*Carduelis carduelis*), the Dove (*Streptopelia turtur*), the Cuckoo (*Cuculus canorus*), the Magpie (*Pica pica*), the Common Moorhen (*Gallinula chloropus*), the Grey wagtail (*Motacilla cinerea*), the White wagtail (*Motacilla alba*). Among diurne raptors have been reported the Common buzzard (*Buteo buteo*), the Kestrels (*Falco tinnunculus*), the Marsh harrier (*Circus aeruginosus*); among nocturne raptors is typical the Owl (*Strix aluco*), which feeds on small rodents, the Little owl (*Athene noctua*), the Barn owl (*Tyto alba*), the Scops owl (*Otus scops*). Although the coastal marshes have been dried up by drainage, it is often possible to observe in small ponds that form in ground depressions specimens of migratory birds from nearby Africa: the Knight of Italy (*Himantopus himantopus*), the Gray heron (*Ardea cinerea*), the Little egret (*Egretta garzetta*), the Mallard (*Anas platyrhynchos*), the Garganey (*Anas querquedula*), the Shelduck (*Tadorna tadorna*), the Common sandpiper (*Tringa glareola*), the Kingfisher (*Alcedo atthis*), the Bee-eater (*Merops apiaster*).

As representative of reptiles are to report the Leopard snake (*Zamenis situla*), the Green whip snake (*Hierophis viridiflavus*), the Grass snake (*Natrix natrix*) and the Wagler lizard (*Podarcis wagleriana*).

Among amphibians is important the presence of Painted frog (*Discoglossus pictus*).

Among fishes, when the river conditions were definitely in better ecological conditions, were Tench, Eels and South European Toothcarp. At the mouth of the river to fight malaria at the beginning of the century, was introduced *Gambusia affinis*, a small fish that feed on the larvae of mosquitoes.

Representatives of invertebrate fauna are less garish but nevertheless of considerable ecological and biogeographical interest. All classes of invertebrates are well represented, particularly insects: among Orthoptera is important to indicate the presence of *Brachytrupes megacephalus* as species of high conservation interest, protected under the “Habitats” CE Directive.

Figure 2.6.1 shows those areas of faunal interest within the study region.

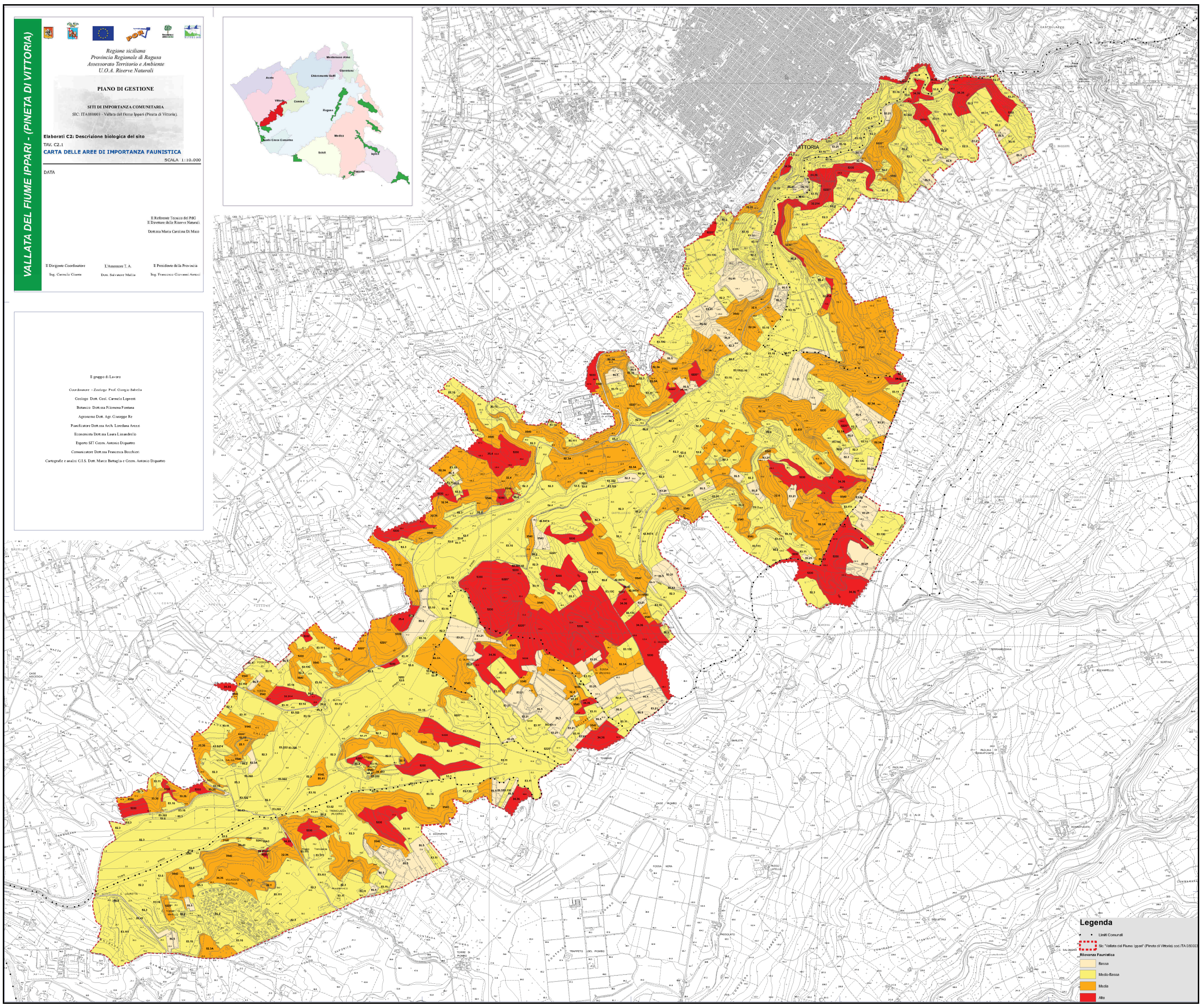


Fig. 2.6.1 – Faunal interest areas of the the study area (from PdG del SIC ITA080003 Vallata del fiume Ippari).

3 MATERIALS AND METHODS

3.1 SAMPLING METHOD

The survey was based on sampling with pit-fall traps. This method, used for many years in researches on ground macro-arthropods, while not being able to provide a complete view of faunal coenosis investigated, has the great advantage of providing comparative qualitative and quantitative data. In addition, the diffusion of its use allows comparisons with the results of a large number of searches.

Within the R.N.O. Pino d'Aleppo were selected 5 researching stations, corresponding to different types of environment: 4 agro-ecosystems (Olive grove, Citrus grove, Arable land with Carob trees, Vineyard) and 1 natural environment (*P. halepensis* - *Q. calliprinos* thicket); figure 3.1.1 shows the location of these stations.

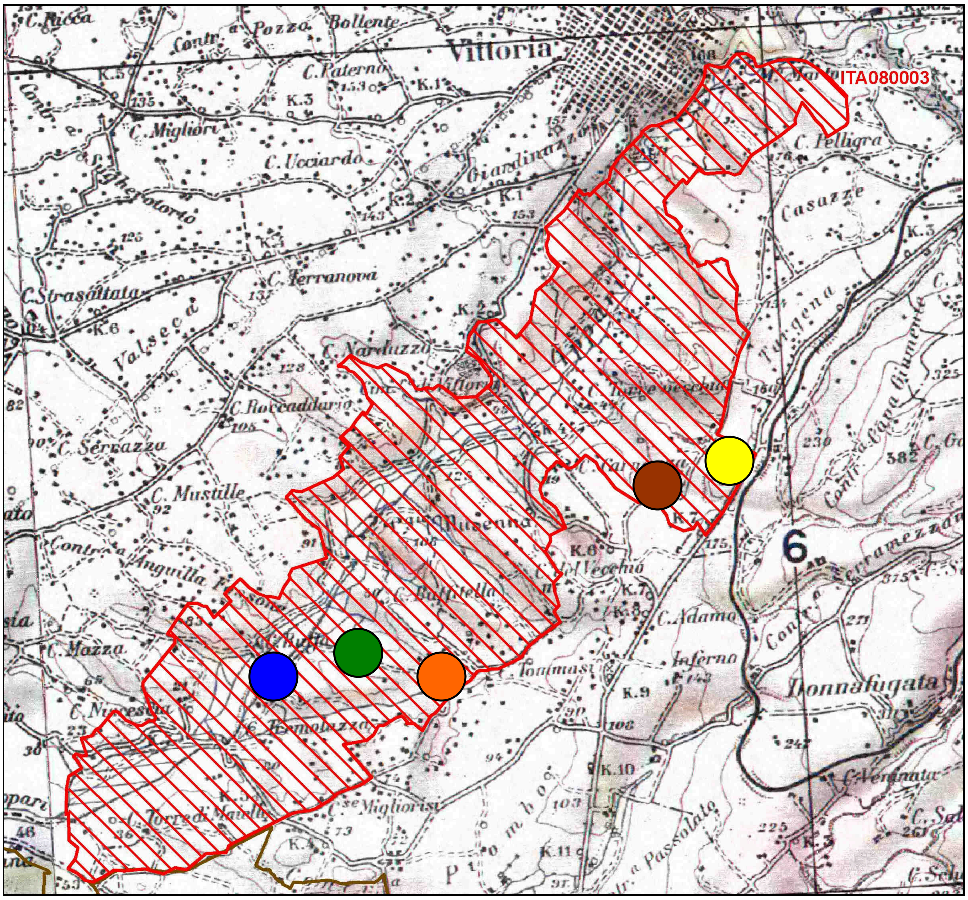


Fig. 3.1.1 – Position of researching stations (Bleu: Citrus grove; Green: *P. halepensis*- *Q. calliprinos* Thicket; Orange: Olive grove; Brown: Vineyard; Yellow: Arable-land with Carob trees).

For the collection of specimens were used pit-fall traps, consisting of plastic cups with 8.5 cm superior diameter and 11 cm profundity, filled for two-thirds of a saturated aqueous solution of sodium chloride and vinegar, worked into the ground (fig. 3.1.2) and spaced at least 10 meters from each other.

For each station were placed five traps, whose control with removal of material has been conducted about every 30 days.

To evaluate the biocenotic structure of the various stations the total duration of sampling was one year (11 sampling sessions), from June 2009 to June 2010.

Fig. 3.1.2 – Pit-fall traps.

With regard to the method of pit-fall traps, it is important to remember that some significant distortions of the densities estimation of species are linked to the sampling method itself (SABELLA & ZANETTI, 1991; ZANETTI, 1992):

a) Since catches a function of mobility and amplitude of species movements, small ones are likely to be underestimated compared to those of large size, so the data should be considered in some way related to the biomass of the populations of different species.
b) Species may be attracted or repelled from the trap in different degrees and therefore the method of sampling involves a selection of species. This represents an insurmountable limit.

c) Estimates of the densities of different species can be related very differently to the real populations density.

d) Density estimations of species linked to temporary microhabitats may have very significant changes that do not correspond to real changes in the density of the population.

These considerations lead to remember that, as with any other method of investigation, experimental data deliver us images of communities that are more or less strongly distorted.

3.2 BRIEF DESCRIPTION OF SAMPLING STATIONS

Within the perimeter of the Reserve were thus identified 5 sampling stations, with different geographic and vegetation characteristics. The stations are described below, specifying:

1. Geographical location according to Gauss-Boaga coordinates;
2. Extension of the patch of vegetation types;
3. Mean altitude;
4. Exposure;
5. Type of substrate;
6. Land-use class according to the Corine Land Cover IV level code (legend in fig. 3.2.1);

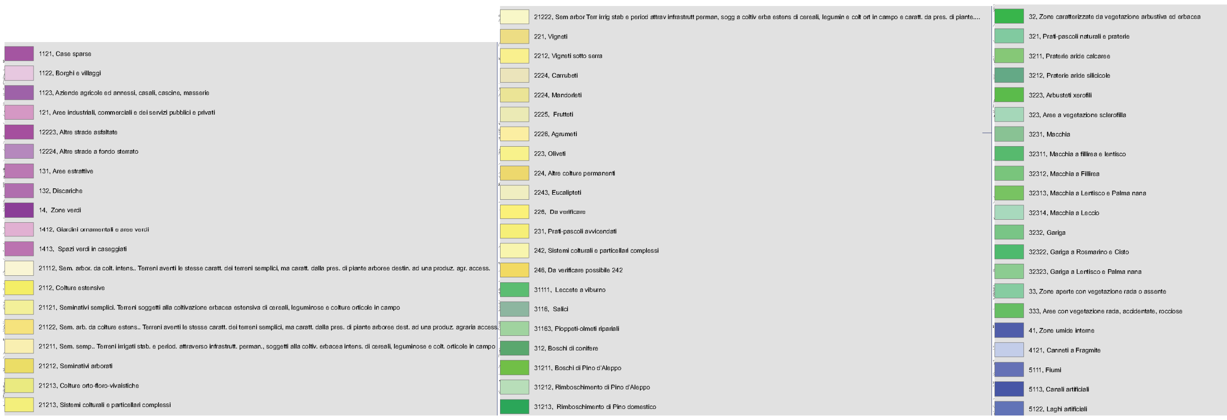


Fig. 3.2.1 – Legend for CLC Land-use code (from PdG del SIC ITA080003 Vallata del fiume Ippari).

7. Vegetation typology according to the Corine Biotopes V level code (legend in fig 3.2.2);

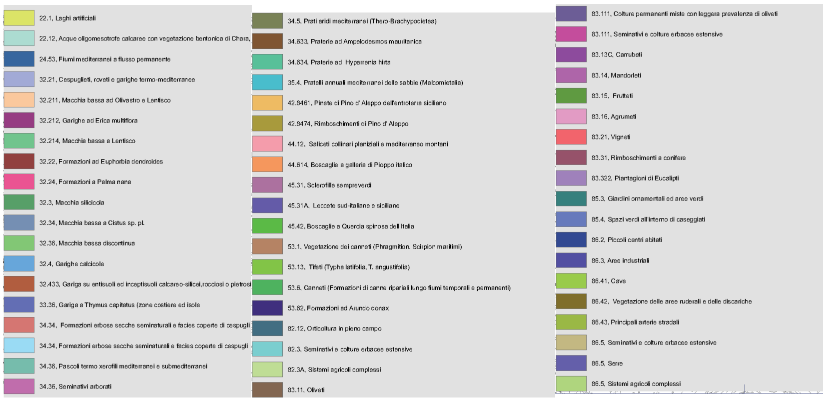
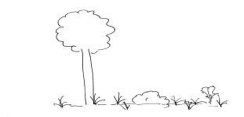
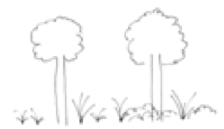
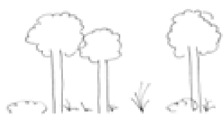


Fig. 3.2.2 – Legend for CB Vegetation code (from PdG del SIC ITA080003 Vallata del fiume Ippari).

8. Canopy coverage degree, according the following table (Tab.3.2.1.);

Habitat density	***Image***	***Description***
Canopy 0-25%		None or very few canopy trees.
Canopy 26-50%		Up to half the quadrant is covered by the canopy.
Canopy 51-75%		Over half the quadrant is covered by the canopy.
Canopy 76–100%		Most of the quadrant is covered by canopy.

Tab. 3.2.1 – Canopy coverage degree classes.

9. Short description of environmental context;

10. Additional information about the modality of farming.

STATION OL (OLIVE-GROVE)

Geographical coordinates (Gauss Boaga): x: 2.475.430; y: 4.082.560

Patch extension: 29 ha

Mean altitude: 41 m

Exposure: E-NE

Type of substrate: yellow sand, gravel and calcarenite

Land-use (Corine Land Cover code): 223 (fig. 3.2.3)

Vegetation typology (Corine Biotopes code): 83.11 (fig. 3.2.3)

Canopy coverage: 26-50%

Short description of the environmental context: Olive groves, together with citrus, represent the prevalent type of tree cultivation in the area. The patch is part of an environmental mosaic made up of other cultivated land (extensive arable land and tree crops) and areas of maquis or woodland. In general the presence of olive groves, like the carob groves, provides a more harmonious aspect to the agricultural-rural landscape, which better integrates with the more and more scarce natural formations.

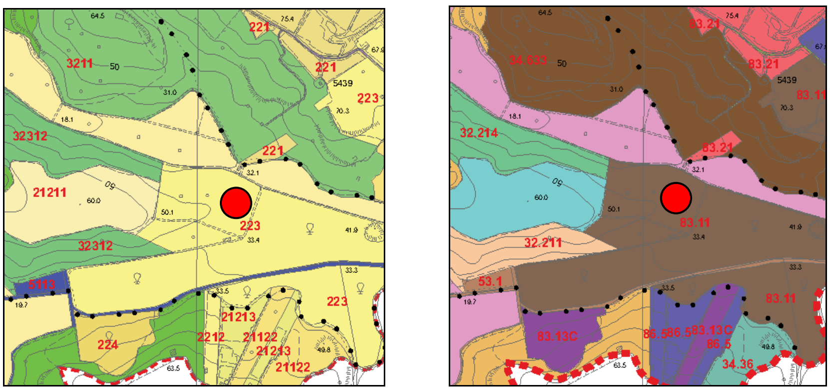


Fig. 3.2.3 – Land-use and Vegetation classes for the surrounding area of station **Ol** (red dot: position of the station).

Modality of farming: Traditional conducting; sown with field bean after the olive harvest and milling in the spring.

STATION AC: ARABLE-LAND WITH CAROB TREES

Geographical coordinates (Gauss Boaga): x: 2.479.360; y: 4.084.870

Patch extension: 28 ha

Mean altitude: 144 m

Exposure: N-NW

Type of substrate: yellow sand, gravel and calcarenite

Land-use (Corine Land Cover code): 2224 (fig. 3.2.4)

Vegetation typology (Corine Biotopes code): 83.13C (fig. 3.2.4)

Canopy coverage: 26-50%

Short description of the environmental context: These areas are planted with crops but carob trees are present, arranged in irregularly spread, which also enrich the landscape aspects of the territory. From the ecological point of view, the fact that the operations of plowing save the immediate vicinity of the trees (in some cases reaching up to 2-3 meters away from the trunk) it is possible to consider these and the portion of the surrounding soil as "islands" where there are still micro-environments suitable for the arthropod fauna and not only: there is for example the possibility of formation of litter from fallen leaves on the ground.

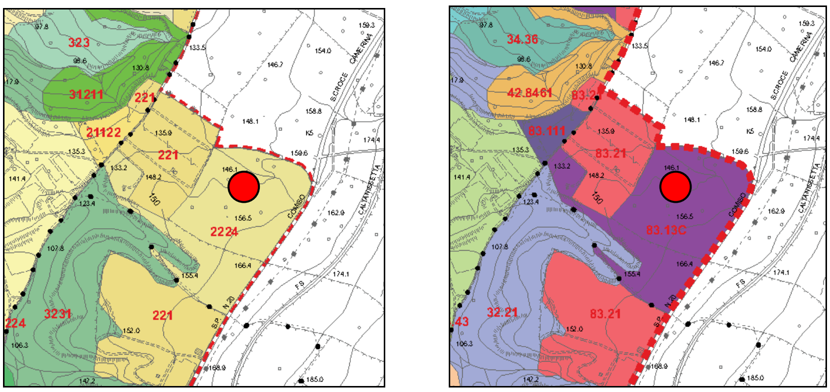


Fig. 3.2.4 – Land-use and Vegetation classes for the surrounding area of station **AC** (red dot: position of the station)

Modality of farming: Annual sown with cereals and milling after harvesting (lack of more precise information).

STATION CI (CITRUS-GROVE)

Geographical coordinates (Gauss Boaga): x: 2.473.750; y: 4.082.640

Patch extension: 28 ha

Mean altitude: 12 m

Exposure: S-SE

Type of substrate: clays and river deposition

Land-use (Corine Land Cover code): 2226 (fig. 3.2.5)

Vegetation typology (Corine Biotopes code): 83.16 (fig. 3.2.5)

Canopy coverage: 51-75%

Short description of the environmental context: Citrus groves, together with cereal and horticultural crops, characterize the area in object. In particular it is an orange grove near the Ippari river placed in a matrix with a high prevalence of farming.

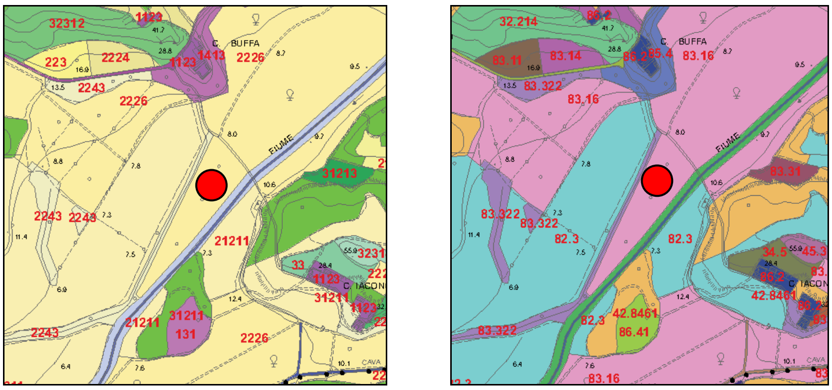


Fig. 3.2.5 – Land-use and Vegetation classes for the surrounding area of station Ci (red dot: position of the station)

Modality of farming: Treatment with organic fertilizer; sown with field bean after orange harvesting and milling of in the spring. During the months of drought is ensured a supply of water by means of a tubes system almost capillary.

STATION VY: VINEYARD

Geographical coordinates (Gauss Boaga): x: 2.479.100; y: 4.085.140

Patch extension: 6 ha

Mean altitude: 131 m

Exposure: W-NW

Type of substrate: yellow sand, gravel and calcarenite

Land-use (Corine Land Cover code): 221 (fig. 3.2.6)

Vegetation typology (Corine Biotopes code): 83.21(fig. 3.2.6)

Canopy coverage: 26-50%

Short description of the environmental context: The patch is part of a matrix with a medium environmental overall value, which sees the presence of natural maquis and pine forest areas but also agricultural areas with wooded crops and olive groves. With regard to the vineyards in the area is to be highlighted that cultivation in pergola of vines is now giving way to the tents and greenhouse cultivation.

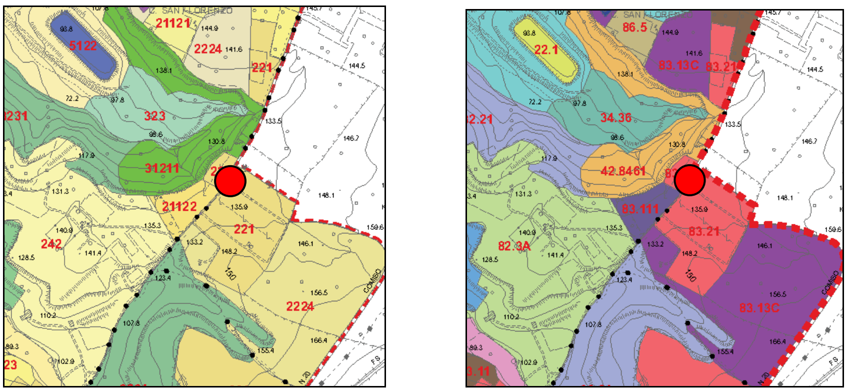


Fig. 3.2.6 – Land-use and Vegetation classes for the surrounding area of station Vy (red dot: position of the station)

Modality of farming: Information not available.

STATION TK: *P. HALEPENSIS* – *Q. CALLIPRINOS* THICKET

Geographical coordinates (Gauss Boaga): x: 2.474620; y: 4.082.890

Patch extension: 25 ha

Mean altitude: 35 m

Exposure: N-NE

Type of substrate: yellow sand, gravel and calcarenite

Land-use (Corine Land Cover code): 31211 (fig. 3.2.7)

Vegetation typology (Corine Biotopes code): 42.8461 (fig. 3.2.7)

Canopy coverage: 76-100%

Short description of the environmental context: Residue of Aleppo pine forest inserted into an environmental matrix heavily populated by the presence of cultivated areas (orchards and herbaceous crops) wide and continuous that isolate natural areas now reduced to maquis and scrub. It has to be emphasized that the Aleppo pine formations have been identified in the EC Directive 92/43 "Habitat" such habitats to protect because of their considerable reduction.

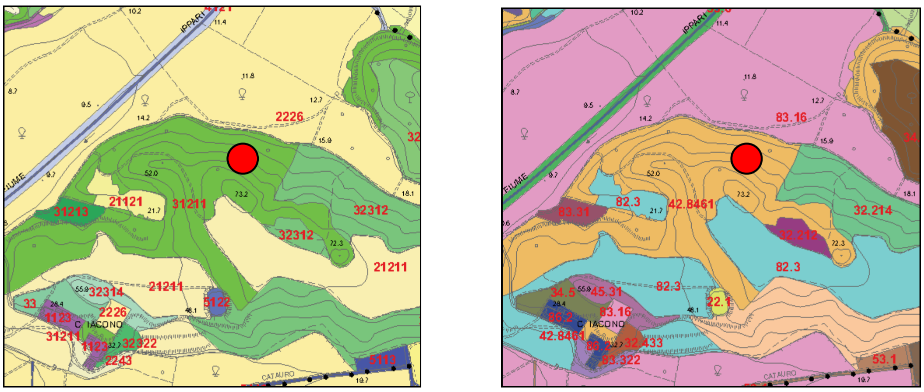


Fig. 3.2.7 – Land-use and Vegetation classes for the surrounding area of station Tk (red dot: position of the station)

3.3 METHOD OF DATA STANDARDIZATION

It appeared appropriate and necessary to standardize the results for a uniform comparison between the stations, eliminating the factors of variability represented by the efficiency of traps (number of "active" traps for sampling) and the number of effective days for each sample: is then proceeded to calculate the Density of Activity (DA) (BRANDMAYR et alii 2005) for each family, as the ratio between the total number of individuals captured during each sampling session and the number of traps found still working, multiplied for the session's days, everything multiplied by 10; this result has applied an additional correction factor (CF) consisting of the ratio between the total of individuals and the DA, thus obtaining the Standard Capture Density (CSD) (ADORNO 1995)

$$DA = [nb.ind. / (nb.trap * dd)] * 10$$

$$FC = nb.TOT.ind. / DA$$

$$CSD = [nb.ind. / (nb.trap * dd)] * 10 * FC$$

In the table below (tab. 3.3.1) provides an overview of the entire sample relative to the total number of trap-days / sampling session for the various stations.

MONTH	DD-Trap AC	DD-Trap Ol	DD-Trap Ci	DD-Trap Vy	DD-Trap Tk
July	150	150	105	108	90
August	120	150	150	105	129
September	102	255	204	255	230
October	205	205	164	-	205
December	165	165	165	-	116
January	125	125	125	-	78
February	185	185	185	-	96
March	140	140	87	-	62
April	165	165	165	-	165
May	110	110	110	-	110
June	141	150	150	-	144

Tab. 3.3.1 - Capture effort relative to each sampling session in each station.

3.4 METHODS OF EVALUATION FOR THE QUALITY AND QUANTITY COMPARISON

The analysis and comparisons were made both on Coleoptera Families that on the complex of species of Carabidae, Staphylinidae and Tenebrionidae. The indices of diversity and similarity (in MAGURRAN 1988) have been elaborated with the software PRIMER 6.

3.4.1 SPECIES RICHNESS AND DIVERSITY INDICES

Margalef's index (d)

This index measures the richness of taxa (in this case families or species) of the stations, calculated as follows:

$$d = (S-1)/\ln N$$

where:

S = number of taxa

N = total amount of specimens collected in the station

The reference interval for this index, which considers a medium to good level in terms of richness, is between 2 and 5, where for values below 2 is considered a low diversity.

Shannon's index (H')

In order to assess the level of biodiversity of the stations, we used the Shannon index calculated as follows:

$$H' = -\sum_{j=1}^{s} p_j \log p_j$$

where:

s = number of taxa;

pj = Nj / N (relative abundance);

Nj = number of specimens belonging to a certain taxon in the station;

N = total amount of specimens in the station.

This is an index that is determined by the number of species and the distribution of their relative abundances in the station. It is strongly influenced by the mean abundances (CHEMINI 1991).
The Shannon's index assumes the interval between 1 and 3.5 as medium values of biodiversity.

Simpson's index (D)

For the evaluation of α-diversity was used Simpson's index, also known as index of species richness, which is often used in conjunction with the previous index. It has been calculated using the following formula:

$$D = 1 - \frac{\sum_{i=1}^{S} n_i(n_i - 1)}{N(N-1)},$$

where:

S = number of taxa;

N = total amount of specimens;

n = number of specimens of a certain taxon.

D can assume values comprised between 0 and 1.

3.4.2 EVENNESS AND DOMINANCE INDICES

Pielou's index (J)

Evenness was estimated using the Pielou's index calculated using the following formula:

$$E = \frac{H'}{log_2 S}$$

where:

H' = Shannon's index;
S = number of taxa present in the community.

In general J varies between 0 and 1.

Simpson's Dominance index (λ):

Dominance was estimated using the following formula:

$$\lambda = \sum Pj$$

where Pj = Nj/N (relative abundance)

with: Nj = number of specimens of each taxon in the station;
N = total amount of specimens in the station.

Te reference interval for that index is between 0 and 1.

3.4.3 SIMILARITY INDEX

Sørensen's index

The Sørensen similarity coefficient is used to measure the level of similarity between two samples. The formula used is as follows:

$$QS = \frac{2C}{A+B}$$

where:

A = total number of taxa from the first sample;
B = total number of taxa from the second sample;
C = number of species in common between the two samples compared.

This is a quality index that considers the number of taxa in relation to the sample; the values vary between 0 and 1.

Bray-Curtis index

The Bray-Curtis index or coefficient of similarity (a semi-quantitative index) estimates the similarity between pairs of samples taking into account not only the presence / absence, but also the abundances of individual taxa. This was calculated using the formula:

$$BC = 100\frac{\sum_{i=1}^{p} 2\min(y_{ij}, y_{ik})}{\sum_{i=1}^{p}(y_{ij} + y_{ik})}$$

where:

p = total number of taxa
i = taxon
y_{ij} = abundance of the taxon (i) in the first sample (j)
y_{ik} = abundance of the taxon (i) in the second sample (k).

This index takes the value 0 if the two samples have no taxa in common, and is equal to 100 if the two samples are identical.

3.4.4 MULTIVARIATE ANALYSIS OF COMMUNITIES

In order to highlight similarities and differences between the traps and the stations have been used also the multivariate analysis of communities using the methodology of Non-Metric Multidimensional Scaling (NMDS).
This technique is considered by CLARKE & WARWICK (2001), at least from the conceptual point of view, the easier to apply; it keeps a clear and direct link with the original data. It is also very flexible as it requires no assumptions about the form of the data distribution.
This methodology has been applied both to Families and species of Coleoptera, after a square-root transformation of abundance data of each taxon. The data thus treated were then used to obtain a Bray-Curtis similarity matrix. Referring to that it was possible to construct a series of plots that allow to show the similarities between the various units of sampling (traps and stations). Each point on the graphs represents a single sampling unit, whose position is determined by all the taxa and the number of specimens collected for each of them.
In this way, homogeneous groups can be observed between the sampling units. Since the graphs projected a multidimensional space in two-dimensions or three-dimensions, the technique provides a measure of "stress" or the "forcing" of the plot. CLARKE & WARWICK (2001) suggest not to consider plots with stress values higher than 0,18 as being unrepresentative.
This sorting technique has been associated with a specific test, ANalysis Of Similarity (ANOSIM), which provides a measure of the significance of differences between the groups identified a priori (CLARKE & WARWICK 2001) The test results is a value, called R, which reflects the difference observed between the distances of the points belonging to each of the groups compared, with respect to the distance of the points belonging to other groups:

$$R = r_b - r_w / 1/4\ [n\ (n-1)]$$

where:

r_b = mean diversity within the group;
r_w = mean diversity with the other groups;
n= total number of sample units.

The value of R (R observed) can vary between -1 and 1 and assumes the value 0 when the null hypothesis (H_0: no difference between the sampling units) is true, and takes the value 1 when all replies of a certain sampling unit are more similar together than to all other replicas of the sampling units. Values less than zero, represent the opposite case.
The ANOSIM test, using a predetermined number of times, recalculates the value of R randomly permuting membership group of each replication. In this way it is obtained a distribution of R simulated with which to compare the value of R observed.
The null hypothesis is rejected when R observed falls outside the distribution of the R simulated: the higher the R observed value is away from that of R simulated values, the more likely that the clusters on the plot of the representations are not random.
Together with the calculation of R is produced an estimation of the significance that allows to evaluate the possibility of making a mistake in interpreting R.
It was also estimated the statistical significance of differences between stations using the Parwise tests, based on the value of R observed between pairs of stations.

4 GENERAL ANALYSIS OF SAMPLING REGARDING THE FAMILIES OF COLEOPTERA

During the sampling period in the whole 5 investigated stations within the Riserva Naturale Orientata "Pino d'Aleppo" where censed **10.402** specimens of Coleoptera, belonging to a total of **42** Families. Table 4.1 shows the capture amount for Coleoptera Families (express as total number of specimens) for each station, with the relative percentage.

13 Families (fig. 4.1): Carabidae (**2.067** specimens), Tenebrionidae (**1.938** specimens), Staphylinidae (**1.728** specimens), Nitidulidae (**1.311** specimens), Ptinidae (**854** specimens), Curculionidae (**382** specimens), Anthicidae (**357** specimens), Melyridae (**270** specimens), Melolonthidae (**262** specimens), Silvanidae (**249** specimens), Cryptophagidae (**224** specimens), Chrysomelidae (**172** specimens) and Aphodiidae (**153** specimens), corresponding to **31%** of Family number represent about the **96%** of the total amount captures, while just Carabidae, Tenebrionidae and Staphylinidae cumulate more than **55%** of the whole capture sum.

FAMILY	*AC*	*Ci*	*Ol*	*Tk*	*Vy*	**TOTAL**
Carabidae	1.465	252	270	77	3	**2.067**
	14,08	*2,42*	*2,60*	*0,74*	*0,03*	*19,87*
Tenebrionidae	465	130	1206	98	39	**1.938**
	4,47	*1,25*	*11,59*	*0,94*	*0,37*	*18,63*
Staphylinidae	490	591	471	169	7	**1.728**
	4,71	*5,68*	*4,53*	*1,62*	*0,07*	*16,61*
Nitidulidae	651	85	500	68	7	**1.311**
	6,26	*0,82*	*4,81*	*0,65*	*0,07*	*12,60*
Ptinidae	82	409	16	346	1	**854**
	0,79	*3,93*	*0,15*	*3,33*	*0,01*	*8,21*
Curculionidae	172	65	120	17	8	**382**
	1,65	*0,62*	*1,15*	*0,16*	*0,08*	*3,67*
Anthicidae	109	45	188	4	11	**357**
	1,05	*0,43*	*1,81*	*0,04*	*0,11*	*3,43*
Melyridae	16	1	200	53		**270**
	0,15	*0,01*	*1,92*	*0,51*		*2,60*
Melolonthidae			262			**262**
			2,52			*2,52*
Silvanidae	16	14	3	214	2	**249**
	0,15	*0,13*	*0,03*	*2,06*	*0,02*	*2,39*
Cryptophagidae	57	46	42	75	4	**224**
	0,55	*0,44*	*0,40*	*0,72*	*0,04*	*2,15*
Chrysomelidae	24	8	119	17	4	**172**
	0,23	*0,08*	*1,14*	*0,16*	*0,04*	*1,65*
Aphodiidae	93		46	4	10	**153**
	0,89		*0,44*	*0,04*	*0,10*	*1,47*
Orthoperidae	9	57	6	2		**74**
	0,09	*0,55*	*0,06*	*0,02*		*0,71*
Lathridiidae	29	25		6		**60**
	0,28	*0,24*		*0,06*		*0,58*
Hysteridae	12		37	1		**50**
	0,12		*0,36*	*0,01*		*0,48*

Scydmaenidae	1	37	4	1		**43**
	0,01	*0,36*	*0,04*	*0,01*		*0,41*
Elateridae	5	6	28	1		**40**
	0,05	*0,06*	*0,27*	*0,01*		*0,38*
Leiodiidae	6	5	8	11		**30**
	0,06	*0,05*	*0,08*	*0,11*		*0,29*
Buprestidae	1		11	7		**19**
	0,01		*0,11*	*0,07*		*0,18*
Coccinellidae	1	6	11		1	**19**
	0,01	*0,06*	*0,11*		*0,01*	*0,18*
Mordellidae			10	2		**12**
			0,10	*0,02*		*0,12*
Anobidae	6	1	2		1	**10**
	0,06	*0,01*	*0,02*		*0,01*	*0,10*
Dermestidae	2		5		1	**8**
	0,02		*0,05*		*0,01*	*0,08*
Colydiidae		6		1		**7**
		0,06		*0,01*		*0,07*
Silphidae	1	6				**7**
	0,01	*0,06*				*0,07*
Bruchidae			4	2		**6**
			0,04	*0,02*		*0,06*
Byrrhidae			4	2		**6**
			0,04	*0,02*		*0,06*
Geotrupidae			1	5		**6**
			0,01	*0,05*		*0,06*
Kateretidae	6					**6**
	0,06					*0,06*
Alleculidae	1	1	1	2		**5**
	0,01	*0,01*	*0,01*	*0,02*		*0,05*
Thorictidae	1		2		2	**5**
	0,01		*0,02*		*0,02*	*0,05*
Trogidae				2	3	**5**
				0,02	*0,03*	*0,05*
Scolitydae			1	3		**4**
			0,01	*0,03*		*0,04*
Corylophidae	2	1				**3**
	0,02	*0,01*				*0,03*
Ptilidae	1	1		1		**3**
	0,01	*0,01*		*0,01*		*0,03*
Cybocephalidae		2				**2**
		0,02				*0,02*
Cebrionidae			1			**1**
			0,01			*0,01*

Cerambycidae				1		**1**
				0,01		*0,01*
Cucujdae			1			**1**
			0,01			*0,01*
Drilidae			1			**1**
			0,01			*0,01*
Phalacridae		1				**1**
		0,01				*0,01*
Total	**3.724**	**1.801**	**3.581**	**1.192**	**104**	**10.402**
	35,80	*17,31*	*34,43*	*11,46*	*1,00*	*100*
Num. Families	***28***	***25***	***32***	***29***	***16***	***42***

Tab. 4.1 - Results trends in catches of Coleoptera Families in each station, expressed as total number of specimens sampled. The percentages refer to the total of the entire sampling.

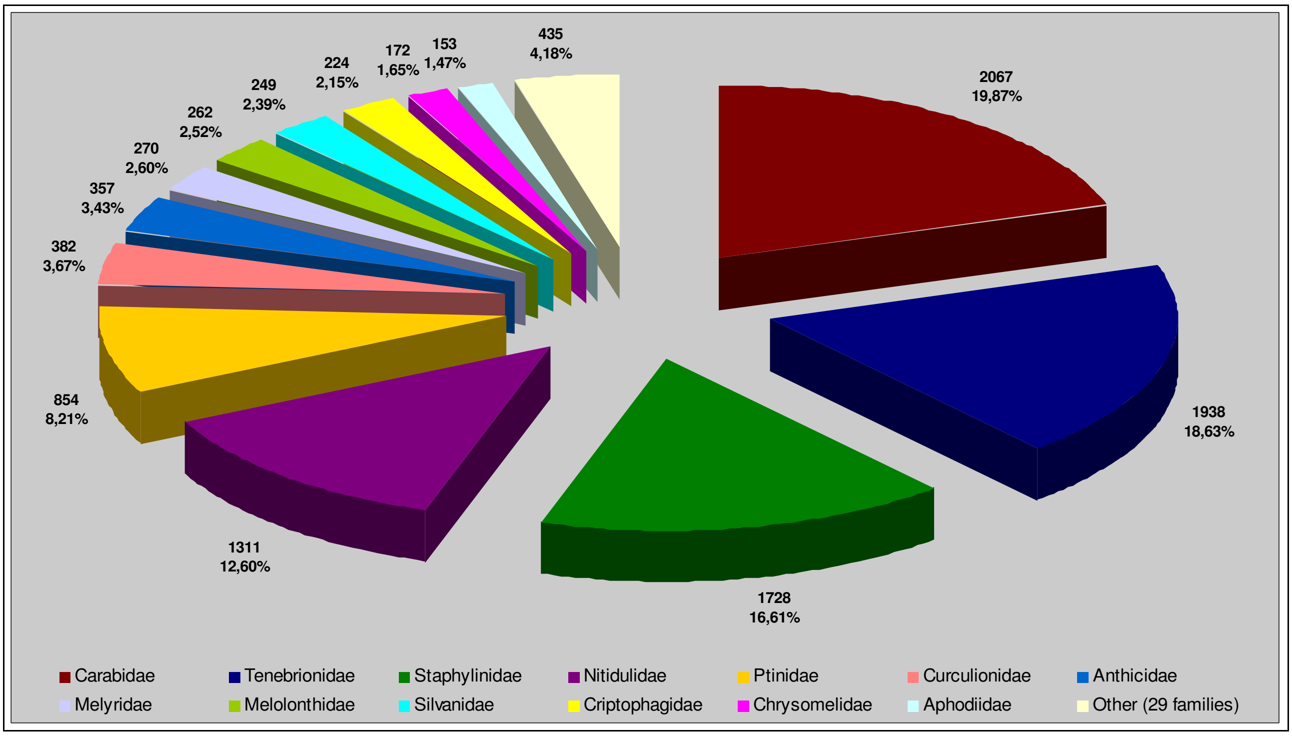


Fig. 4.1- Overall trend (number of individual ad percentage of total) of catches for principal Families.

Table 4.1 clearly shows that Carabidae is the Family with the highest number of surveyed specimens (19,87%), followed by Tenebrionidae, with 18,63%, and Staphylinidae, with 16,61%. Carabidae are tipical predators in the ground fauna, for which the use of pit-fall traps is a well-established and widespread collecting technique. Then, among Tenebrionidae there is a quite number of thermophilic species typical of xeric and sub-xeric environments, so the macro and micro-climatic characteristic of the researching stations areas are coherent with the abundance of captures observed. Lastly Staphylinidae are characterized by species with articulated and varied ecological requirements, being able to inhabit different terrestrial environments. That three Families resulted present in all the five stations.

After Carabidae, Tenebrionidae and Staphylinidae, in order of abundance follow: Nitidulidae, present as well in all the stations with the 12,60% of captured specimens, are saprophytic Coleoptera associated also to temporary micro-habitat such as excrements or decaying substances; Ptinidae, with the 8,21%, generally detritivores that feed on various organic substances.

Other Families that, even though with lower numbers of specimens, were found in all the stations are Curculionidae (3,67%), Anthicidae (3,43%), Silvanidae (2,39%), Cryptophagidae (2,15%) and Chrysomelidae (1,65%).
For subsequent analysis are taken into account the values of CSD (chapter 3), as standardized values that make significant comparisons between stations and traps.
Using the values CSD, the results outlined above varies slightly, but without substantial changes.
Figure 4.2 shows that, utilizing CSD, Tenebrionidae present the highest value (1956,95 equal to 18,81% of the entire sample), followed by Carabidae (1875,26 equal to 18,03%), Staphylinidae (1593,84 equal to 15,32%); Nitidulidae (1403,23 equal to 13,49%), Ptinidae (947,29 equal to 9,11%), Anthicidae (412,13 equal to 3,96%), Curculionidae (365,13 equal to 3,51%), (Melyridae 305,34 equal to 2,94%), Silvanidae (296,68 equal to 2,85%), Melolonthidae (246,32 equal to 2,37%), Cryptophagidae (224,07 equal to 2,15%), Aphodiidae (171,67 equal to 1,65%), Chrysomelidae (164,47 equal to 1,58%); the other 29 Families with a CSD cumulative value of 439,54 cover the 4,23% of total.

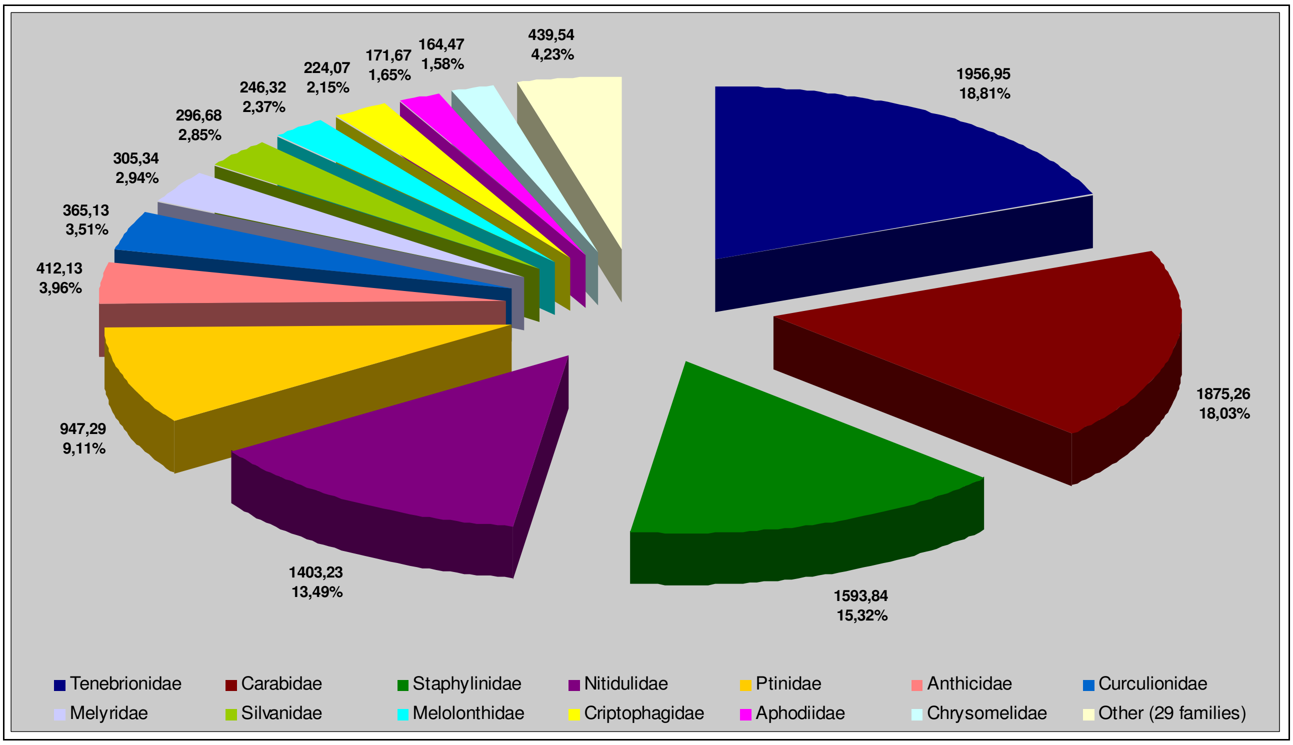


Fig. 4.2 - Overall trend (number of individual ad percentage of total, uniformed with CSD) of catches for principal Families.

The sum of the CSD values just for Tenebrionidae, Carabidae and Staphylinidae (fig. 4.3) stands at 52,16% of the total.

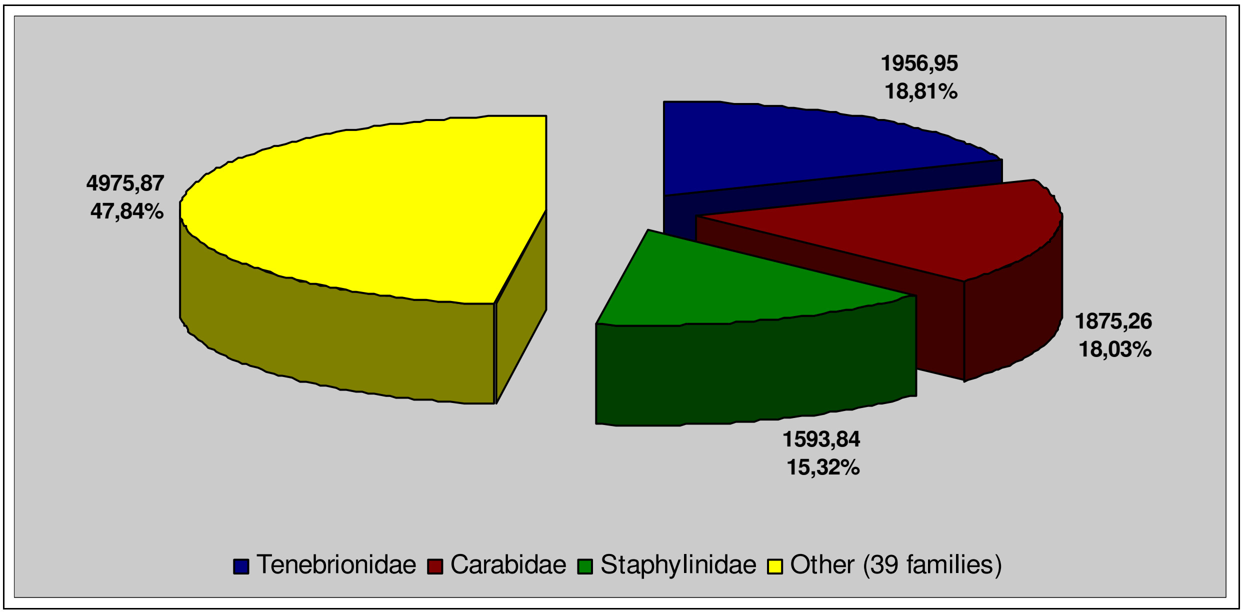


Fig. 4.3 - Overall trend (number of individual ad percentage of total, uniformed with CSD) of catches for Tenebrionidae, Carabidae and Staphylinidae.

It should be emphasized, as noted in Materials and methods section, the Station Vineyard (**Vy**) was monitored for only three months to twelve months unlike the other four stations. Therefore, this station will not be considered in subsequent calculations and considerations. However, removing the **Vy** station the values of the CSD in the remaining stations do not change in substance (tab. 4.2).

FAMILY	AC	Ci	Ol	Tk	TOTAL
Tenebrionidae	473,47	137,91	1.202,73	106,41	**1.920,52**
	4,60	*1,34*	*11,68*	*1,03*	*18,65*
Carabidae	1.332,48	239,18	232,10	68,50	**1.872,26**
	12,94	*2,32*	*2,25*	*0,67*	*18,18*
Staphylinidae	425,69	574,21	421,01	166,19	**1.587,10**
	4,13	*5,58*	*4,09*	*1,61*	*15,41*
Nitidulidae	693,89	88,91	525,47	85,31	**1.393,58**
	6,74	*0,86*	*5,10*	*0,83*	*13,53*
Ptinidae	77,18	422,52	18,33	427,26	**945,29**
	0,75	*4,10*	*0,18*	*4,15*	*9,18*
Anthicidae	131,68	44,27	216,88	5,42	**398,26**
	1,28	*0,43*	*2,11*	*0,05*	*3,87*
Curculionidae	167,00	65,57	109,49	15,86	**357,92**
	1,62	*0,64*	*1,06*	*0,15*	*3,48*
Melyridae	19,92	1,33	226,76	57,11	**305,13**
	0,19	*0,01*	*2,20*	*0,55*	*2,96*
Silvanidae	18,02	15,54	3,28	257,68	**294,51**
	0,17	*0,15*	*0,03*	*2,50*	*2,86*
Melolonthidae			246,16		**246,16**
			2,39		*2,39*
Criptophagidae	53,81	48,01	35,67	81,02	**218,51**
	0,52	*0,47*	*0,35*	*0,79*	*2,12*
Aphodiidae	124,38		37,93	3,50	**165,82**

	1,21		*0,37*	*0,03*	*1,61*
Chrysomelidae	22,97	8,70	109,48	20,13	**161,28**
	0,22	*0,08*	*1,06*	*0,20*	*1,57*
Orthoperidae	9,30	52,87	5,39	1,43	**68,98**
	0,09	*0,51*	*0,05*	*0,01*	*0,67*
Lathridiidae	31,95	24,82		5,76	**62,54**
	0,31	*0,24*		*0,06*	*0,61*
Hysteridae	11,14		37,65	1,33	**50,12**
	0,11		*0,37*	*0,01*	*0,49*
Scydmaenidae	0,89	39,90	3,86	0,71	**45,35**
	0,01	*0,39*	*0,04*	*0,01*	*0,44*
Elateridae	5,86	4,72	30,97	0,89	**42,44**
	0,06	*0,05*	*0,30*	*0,01*	*0,41*
Leiodiidae	5,63	4,78	6,69	15,34	**32,43**
	0,05	*0,05*	*0,06*	*0,15*	*0,31*
Buprestidae	0,89		12,04	10,15	**23,07**
	0,01		*0,12*	*0,10*	*0,22*
Coccinellidae	0,89	6,44	10,17		**17,50**
	0,01	*0,06*	*0,10*		*0,17*
Mordellidae			10,18	2,21	**12,40**
			0,10	*0,02*	*0,12*
Silphidae	1,04	5,95			**7,00**
	0,01	*0,06*			*0,07*
Anobidae	4,71	0,97	1,29		**6,97**
	0,05	*0,01*	*0,01*		*0,07*
Dermestidae	1,95		4,94		**6,89**
	0,02		*0,05*		*0,07*
Colydiidae		5,59		0,89	**6,47**
		0,05		*0,01*	*0,06*
Kateretidae	5,88				**5,88**
	0,06				*0,06*
Bruchidae			4,43	1,35	**5,78**
			0,04	*0,01*	*0,06*
Alleculidae	0,89	0,97	0,97	2,66	**5,49**
	0,01	*0,01*	*0,01*	*0,03*	*0,05*
Byrrhidae			3,04	2,16	**5,19**
			0,03	*0,02*	*0,05*
Scolitydae			0,57	4,38	**4,95**
			0,01	*0,04*	*0,05*
Geotrupidae			0,89	3,41	**4,30**
			0,01	*0,03*	*0,04*
Ptilidae	0,89	1,39		1,26	**3,54**
	0,01	*0,01*		*0,01*	*0,03*
Thorictidae	0,71		2,21		**2,93**
	0,01		*0,02*		*0,03*

Corylophidae	1,77	0,89			**2,66**
	0,02	*0,01*			*0,03*
Cybocephalidae		1,77			**1,77**
		0,02			*0,02*
Cebrionidae			1,33		**1,33**
			0,01		*0,01*
Cerambycidae				1,33	**1,33**
				0,01	*0,01*
Cucujdae			1,33		**1,33**
			0,01		*0,01*
Trogidae				1,27	**1,27**
				0,01	*0,01*
Drilidae			0,89		**0,89**
			0,01		*0,01*
Phalacridae		0,72			**0,72**
		0,01			*0,01*
Total	3624,86	1797,95	3524,10	1350,92	**10297,83**
	35,20	*17,46*	*34,22*	*13,12*	*100*
Num. Families	***28***	***25***	***32***	***29***	***42***

Tab. 4.2 - Trends in catches of the Families of Coleoptera at each station, except station **Vy**, expressed as CSD. The percentages refer to the total of the entire sampling.

With regard to the values of CSD there is a marked preponderance of stations **AC** (35,20%) and **Ol** (34,22%) than **Ci** (17,46%) and **Tk** (13,12%) (fig. 4.4).

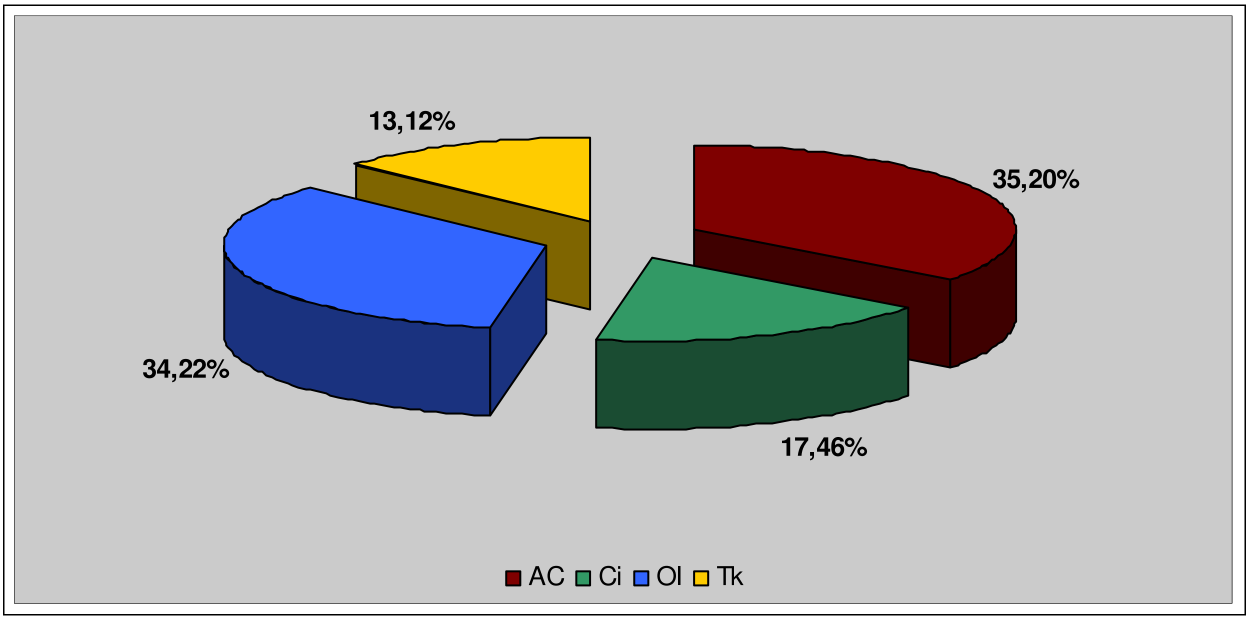


Fig. 4.4 - Overall trend (number of individual ad percentage of total, uniformed with CSD) of Coleoptera catches for station.

Table 4.3 shows the results for the 16 Families of Coleoptera found in all stations.

FAMILY	AC	Ci	Ol	Tk	TOTAL
Tenebrionidae	473,47	137,91	1.202,73	106,41	**1.920,52**
	4,60	*1,34*	*11,68*	*1,03*	*18,65*
Carabidae	1.332,48	239,18	232,10	68,50	**1.872,26**
	12,94	*2,32*	*2,25*	*0,67*	*18,18*
Staphylinidae	425,69	574,21	421,01	166,19	**1.587,10**
	4,13	*5,58*	*4,09*	*1,61*	*15,41*
Nitidulidae	693,89	88,91	525,47	85,31	**1.393,58**
	6,74	*0,86*	*5,10*	*0,83*	*13,53*
Ptinidae	77,18	422,52	18,33	427,26	**945,29**
	0,75	*4,10*	*0,18*	*4,15*	*9,18*
Anthicidae	131,68	44,27	216,88	5,42	**398,26**
	1,28	*0,43*	*2,11*	*0,05*	*3,87*
Curculionidae	167,00	65,57	109,49	15,86	**357,92**
	1,62	*0,64*	*1,06*	*0,15*	*3,48*
Melyridae	19,92	1,33	226,76	57,11	**305,13**
	0,19	*0,01*	*2,20*	*0,55*	*2,96*
Silvanidae	18,02	15,54	3,28	257,68	**294,51**
	0,17	*0,15*	*0,03*	*2,50*	*2,86*
Criptophagidae	53,81	48,01	35,67	81,02	**218,51**
	0,52	*0,47*	*0,35*	*0,79*	*2,12*
Chrysomelidae	22,97	8,70	109,48	20,13	**161,28**
	0,22	*0,08*	*1,06*	*0,20*	*1,57*
Orthoperidae	9,30	52,87	5,39	1,43	**68,98**
	0,09	*0,51*	*0,05*	*0,01*	*0,67*
Scydmaenidae	0,89	39,90	3,86	0,71	**45,35**
	0,01	*0,39*	*0,04*	*0,01*	*0,44*
Elateridae	5,86	4,72	30,97	0,89	**42,44**
	0,06	*0,05*	*0,30*	*0,01*	*0,41*
Leiodiidae	5,63	4,78	6,69	15,34	**32,43**
	0,05	*0,05*	*0,06*	*0,15*	*0,31*
Alleculidae	0,89	0,97	0,97	2,66	**5,49**
	0,01	*0,01*	*0,01*	*0,03*	*0,05*

Tab. 4.3 - Families present in all stations investigated with relative values of CSD. Are highlighted in dark orange highest values of CSD, while in light orange values higher secondary.

Regarding the number of Families surveyed the peak recorded in the station **Ol** (32 Families) and the minimum in the station **Ci** (25 Families), passing through the station **Tk** (29 Families) and the station **AC** (28 Families) (fig. 4.5). The general trend of the catches of Coleoptera in the stations sampled and the number of families do not seem to be correlated, as demonstrated by the regression curve (fig. 4.6) showing a value of r (0,48) not significant.

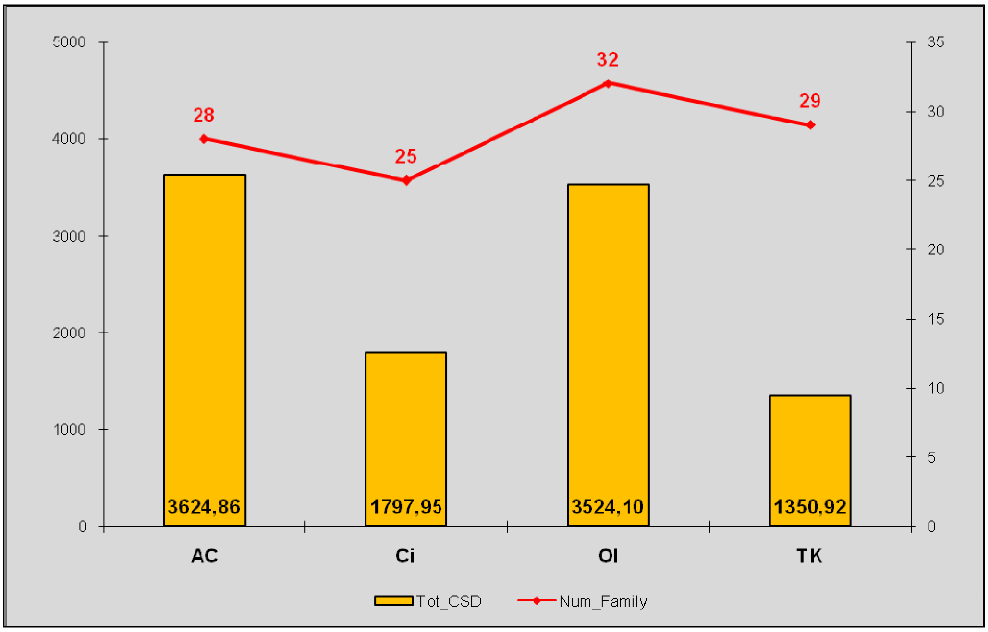


Fig. 4.5 - Overall trend of catches of Coleoptera (Tot_CSD) and number of Families (Num_Family) sampled at each station.

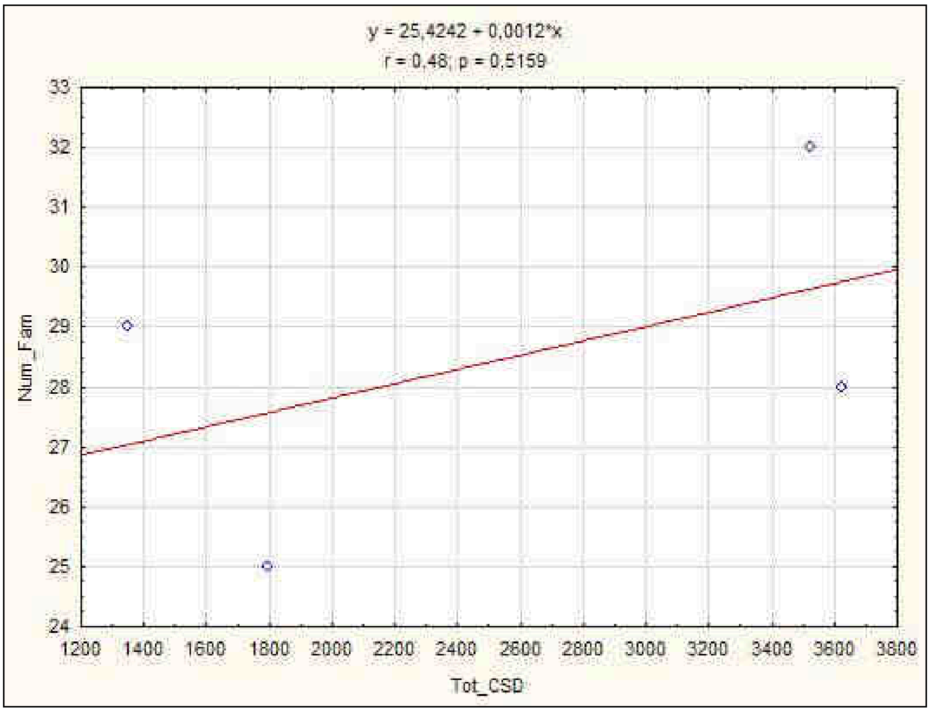


Fig. 4.6 – Regression curve between the overall trend of the catches of Coleoptera (Tot_CSD) and number of Families (Num_Fam) sampled at each station.

Moving on to the examination of capture frequency trend for the Families of Coleoptera in single months of the sampling period (tab. 4.4 and fig. 4.7) it is evident that the 30,68% of them are concentrated in the months of December and January, and the 29,48% in the months of April and May. The months with the lowest values of catches are February-March (7,62%), and August-September (7,75%). Even in this case there is no correlation between the frequency of capture and the number of Families sampled, as shown by the regression curve (fig. 4.8) with a value of r (0,37) not significant.

FAMILY	Jul	Aug	Sep	Oct	Dec	Jan	Feb	Mar	Apr	May	Jun	Tot_CSD
Tenebrionidae	261,54	194,70	100,68	64,32	24,79	17,08	14,22	24,93	176,21	498,07	543,98	1920,52
Carabidae	3,57		14,43	345,47	855,98	323,57	101,81	36,42	84,12	92,97	13,90	1872,26
Staphylinidae	26,58	11,51	32,64	339,06	309,91	229,61	134,25	104,34	253,24	90,32	55,64	1587,10
Nitidulidae	49,67	37,76	25,40	30,47	252,61	873,70	12,57	5,22	54,90	38,52	12,76	1393,58
Ptinidae	119,80	64,01	22,62	63,61	36,43	26,51	100,60	42,66	115,11	199,23	154,73	945,29
Anthicidae	22,08	33,85	3,87	4,99	5,31	16,36	5,53	9,68	34,53	229,78	32,29	398,26
Curculionidae	5,15	3,17	30,62	39,38	43,77	16,36	46,59	31,49	84,12	41,17	16,10	357,92
Melyridae		0,97							106,25	197,90		305,13
Silvanidae	62,57	60,54	7,96	1,43					13,28	96,96	51,79	294,51
Melolonthidae									203,65	42,50		246,16
Cryptophagidae	6,17	1,95	0,64	36,70	27,58	23,26	26,55	7,94	33,65	34,53	19,54	218,51
Aphodiidae			113,28	21,38	0,89		1,52		16,82	7,97	3,96	165,82
Chrysomelidae	5,15	1,22	3,99	13,72	35,42	9,35	11,85	13,57	29,22	31,88	5,93	161,28
Orthoperidae		2,92	0,57	3,03				4,81	45,16	6,64	5,84	68,98
Lathridiidae			3,50	2,14		1,17		2,73	15,94	25,24	11,83	62,54
Hysteridae				3,56	5,31	11,69	9,48	1,04	4,43	14,61		50,12
Scydmaenidae				9,62	0,89	1,17	2,37	5,45	4,43	14,61	6,82	45,35
Elateridae	1,95		4,87	0,71		1,17			11,51	21,25	0,97	42,44
Leiodiidae				1,60	2,66	1,17	10,87	5,50	2,66	7,97		32,43
Buprestidae	8,12								5,31	6,64	3,00	23,07
Coccinellidae	2,37	3,90	2,29						2,66	5,31	0,97	17,50
Mordellidae									7,08	5,31		12,40
Silphidae			0,72	1,78	0,89			2,73	0,89			7,00
Anobidae	0,97		0,57	3,56	0,89						0,97	6,97
Dermestidae	2,92							1,04			2,92	6,89
Colydiidae		4,87	0,72						0,89			6,47
Kateretidae							1,58	2,09	0,89	1,33		5,88
Bruchidae			0,64	0,71					1,77	2,66		5,78
Alleculidae	0,97	0,97							0,89	2,66		5,49
Byrrhidae			1,21				3,10		0,89			5,19
Scolitydae	3,25	1,13	0,57									4,95
Geotrupidae			1,27	2,14					0,89			4,30
Ptilidae	1,39				1,26				0,89			3,54
Thorictidae				0,71					0,89	1,33		2,93
Corylophidae				0,89	1,77							2,66
Cybocephalidae					0,89				0,89			1,77
Cebrionidae										1,33		1,33
Cerambycidae										1,33		1,33
Cucujdae										1,33		1,33
Trogidae			1,27									1,27
Drilidae									0,89			0,89
Phalacridae			0,72									0,72
Total_CSD	***584,21***	***423,46***	***375,05***	***990,99***	***1607,23***	***1552,17***	***482,89***	***301,65***	***1314,90***	***1721,32***	***943,96***	***10.297,83***
Num. Families	**18**	**15**	**24**	**23**	**18**	**14**	**15**	**17**	**33**	**29**	**19**	**42**

Tab. 4.4 - Trends in capture frequencies (CSD) of the Families of Coleoptera during the sampling period. In orange those Families present in at least 90% of the months of sampling. In green, blue and yellow, the first three values of CSD, in descending order, recorded in the month.

Families present in at least 90% of the capture occasions are 9 to 42 (about 21% of total): Tenebrionidae, Carabidae, Staphylinidae, Nitidulidae, Ptinidae, Anthicidae, Curculionidae, Cryptophagidae and Chrysomelidae.
As for the three Families that show the highest monthly values of CSD is as follows: July – Tenebrionidae, Ptinidae, Silvanidae; August – Tenebrionidae, Ptinidae, Silvanidae; September – Aphodiidae, Tenebrionidae, Staphylinidae; October – Carabidae, Staphylinidae, Ptinidae; December – Carabidae, Staphylinidae, Nitidulidae; January – Nitidulidae, Carabidae, Staphylinidae; February – Staphylinidae, Carabidae, Ptinidae; March - Staphylinidae, Ptinidae, Carabidae; April – Staphylinidae, Melolonthidae, Tenebrionidae; May – Tenebrionidae, Ptinidae, Anthicidae; June – Tenebrionidae, Ptinidae, Staphylinidae.

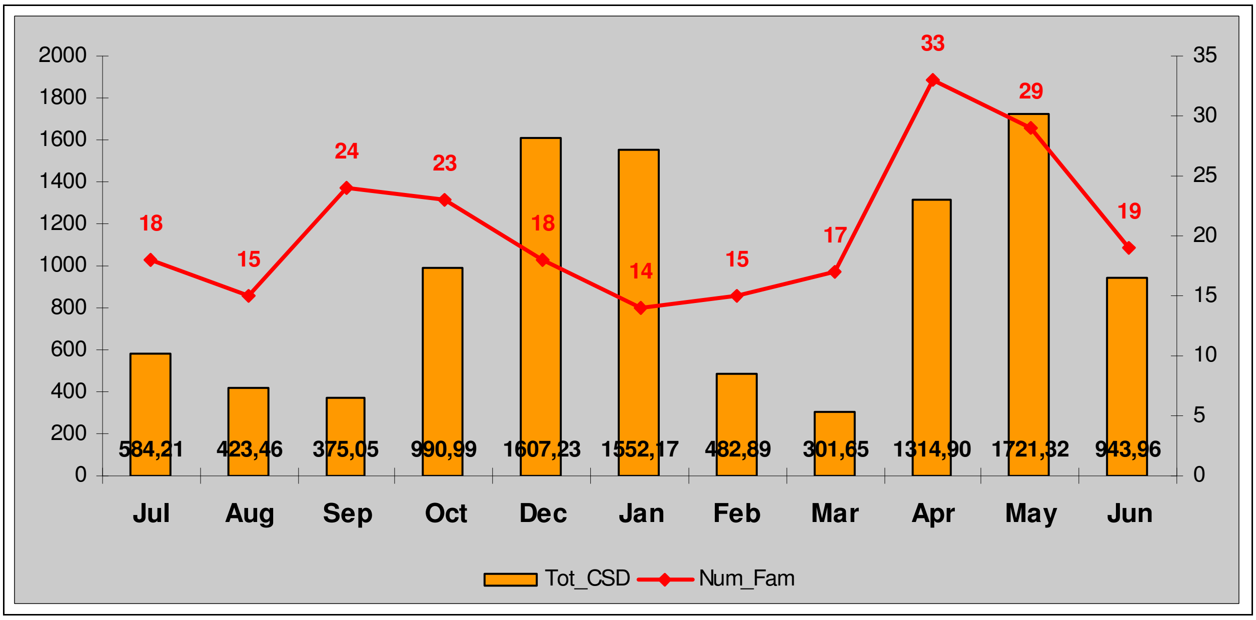


Fig. 4.7 – Overall trend of the capture frequencies (CSD) and number of Families of Coleoptera sampled in each period.

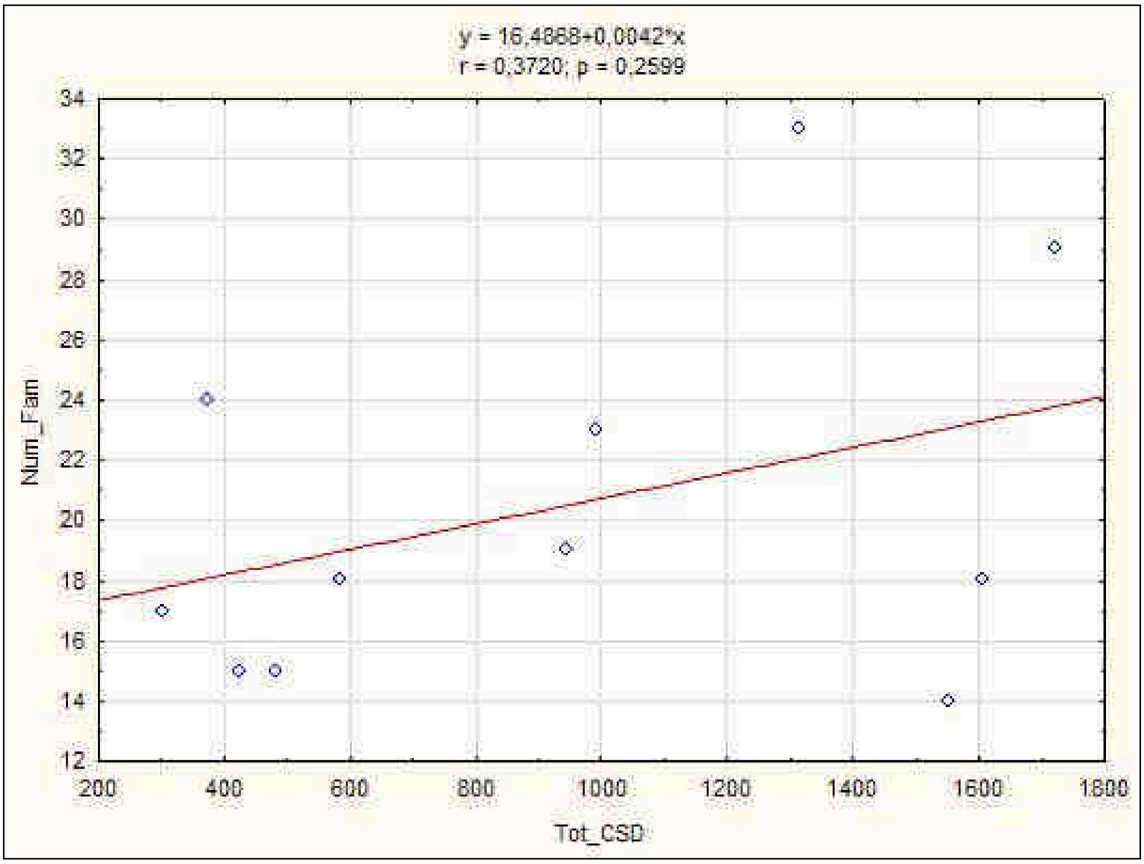


Fig. 4.8 – Regression curve between the overall trend of the catches of Coleoptera (Tot_CSD) and number of Families (Num_Fam) sampled in each month of sampling.

Tenebrionidae were found throughout the year with trapping frequencies concentrated especially in the spring and summer period, peaking in May and June and with the minimum in January and February; Carabidae are counted in all months of the year with the exception of August: they are dominant in the month of December and abundant in autumn and winter months; Staphylinidae, also sampled throughout the year, show predominant activity in autumn and winter and early spring (fig. 4.9).

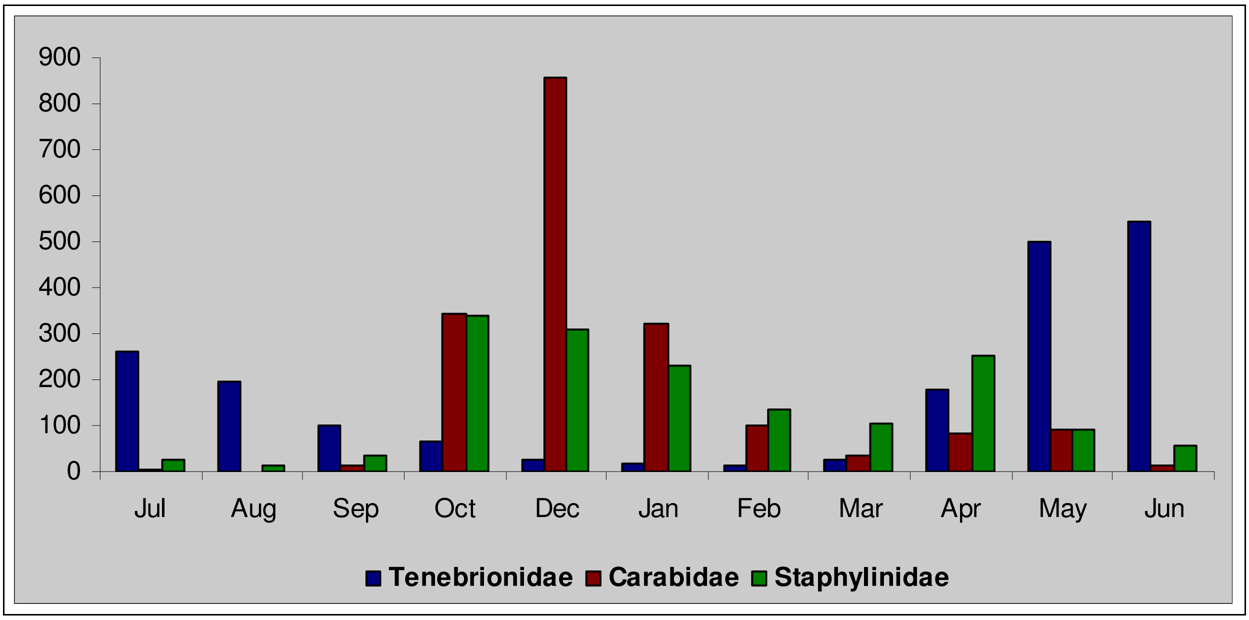


Fig. 4.9 – Trends in capture frequencies (CSD) of Coleoptera Tenebrionidae, Carabidae and Staphylinidae in individual sampling months.

Nitiduludae, Ptinidae and Anthicidae were present throughout the year. Nitidulidae show a concentration of trapping frequencies especially in December and January, while Ptinidae and Anthicidae show a more homogeneous trend of CSD values with slight increases in spring-summer (fig. 4.10).

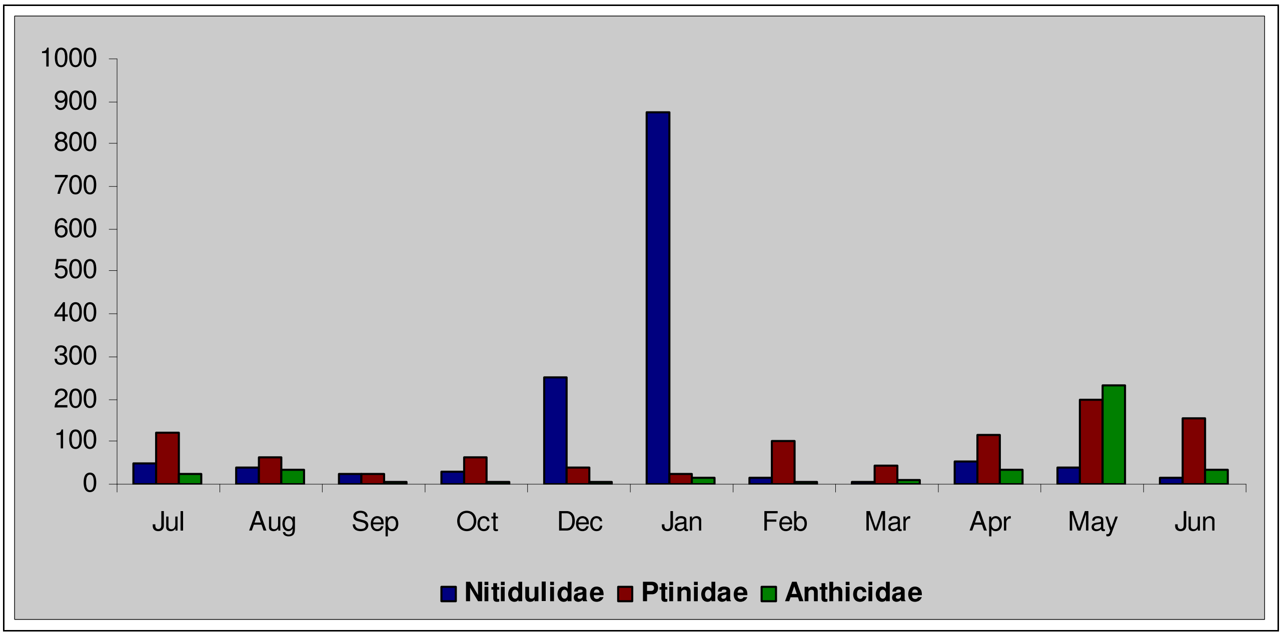


Fig. 4.10 – Trends in capture frequencies (CSD) of Coleoptera Nitidulidae, Ptnidae and Anthicidae in individual sampling months.

Curculionidae were also present throughout the whole sampling period, with higher CSD values between September and December and between February and May. The frequency of capture of Melyridae are concentrated between April and May, while they result absent in the other months of the year, except August that however shows CSD values little significant. The Silvanidae show significant values of CSD in the months from April to August, with a peak in May; they are absent or with very low CSD values in the other months of the year (fig. 4.11).

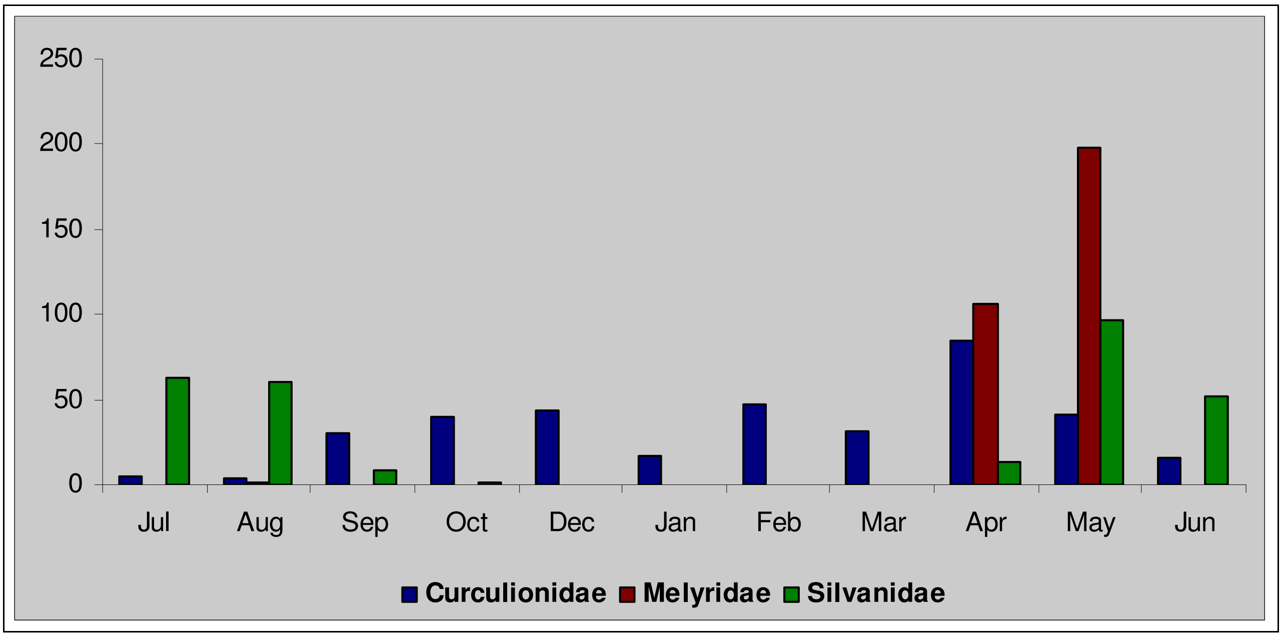


Fig. 4.11 – Trends in capture frequencies (CSD) of Coleoptera Curculionidae, Melyridae and Silvanidae in individual sampling months.

Melolonthidae show a marked concentration of CSD values in April and values significantly lower in May, being absent in other months. Cryptophagidae and Chrysomelidae were registered throughout the year, but with significantly lower CSD values in the summer months. Aphodiidae show a concentration of trapping frequencies in September and October, but lower from December to March; slightly higher values are shown from April to June, while they are absent in July and August (fig. 4.12).

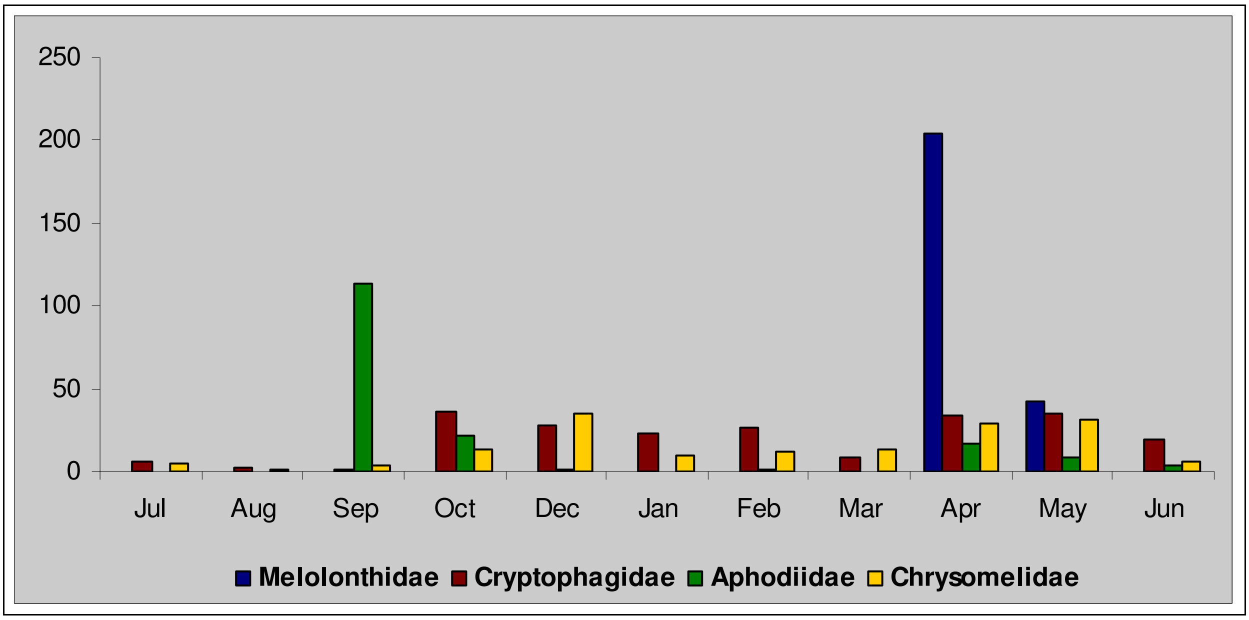


Fig. 4.12 – Trends in capture frequencies (CSD) of Coleoptera Melolonthidae, Cryptophagidae, Aphodiidae and Crysomelidae in individual sampling months.

4.1 ANALYSIS OF THE STATIONS FOR COLEPTERA FAMILIES

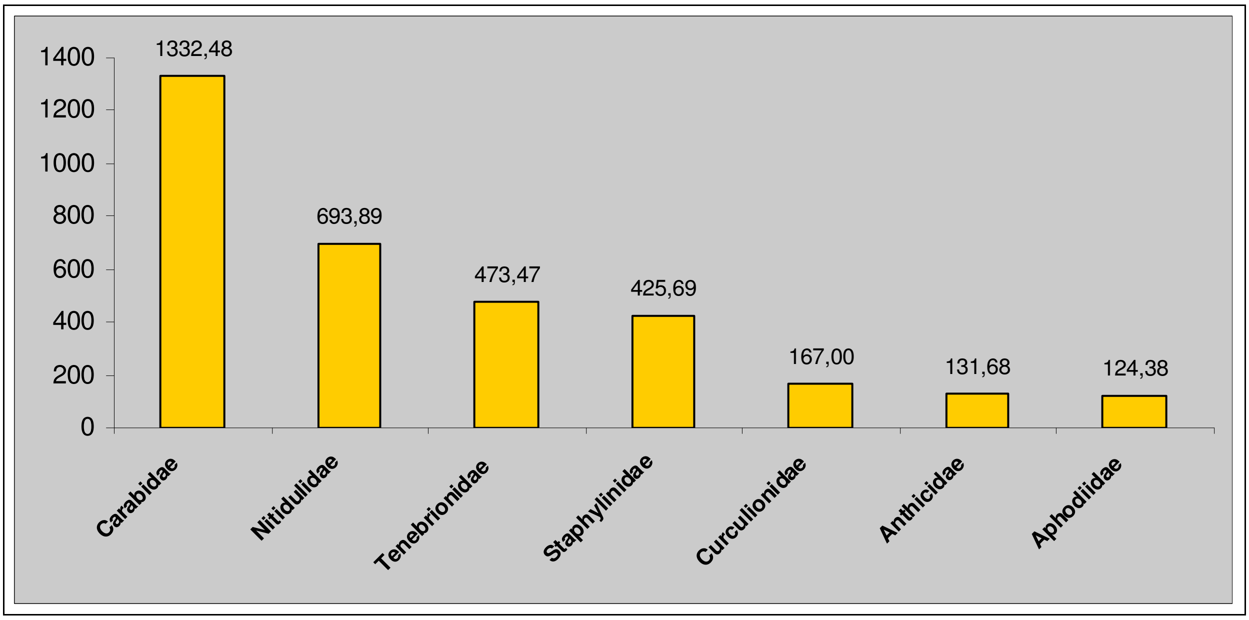
Station AC (Arable land with Carob trees)

The trend in the frequency of capture for Coleoptera Families in the 5 **AC** station's traps is shown in table 4.1.1. This is the station with the highest value of CSD than the other 4.

FAMILY	AC-1	AC-2	AC-3	AC-4	AC-5	Tot_CSD
Carabidae	259,23	226,79	321,38	160,38	364,69	1.332,48
Nitidulidae	145,96	172,12	148,01	92,69	135,10	693,89
Tenebrionidae	64,59	96,79	123,86	34,03	154,19	473,47
Staphylinidae	68,51	76,18	67,39	88,54	125,07	425,69
Curculionidae	33,14	64,65	41,26	3,25	24,70	167,00
Anthicidae	2,30	85,42	10,90	5,91	27,14	131,68
Aphodiidae		1,33	92,89	2,14	28,03	124,38
Ptinidae	22,21	36,91	2,21	9,82	6,03	77,18
Cryptophagidae	3,83	14,13	12,44	5,93	17,48	53,81
Lathridiidae		10,28	3,26	3,21	15,20	31,95
Chrysomelidae	2,93	4,70	3,20	1,22	10,93	22,97
Melyridae	1,33	13,28	5,31			19,92
Silvanidae	1,33	5,00	1,43	6,27	3,98	18,02
Hysteridae	4,01	3,02	2,34		1,77	11,14
Orthoperidae		2,21	1,77	1,33	3,98	9,30
Kateretidae	1,33	0,79	2,97		0,79	5,88
Elateridae	2,21	1,33	2,32			5,86
Leiodiidae			0,79		4,84	5,63
Anobidae		3,11			1,60	4,71
Dermestidae	1,95					1,95
Corylophidae		1,77				1,77
Silphidae					1,04	1,04
Alleculidae			0,89			0,89
Buprestidae					0,89	0,89
Coccinellidae			0,89			0,89
Ptilidae			0,89			0,89
Scydmaenidae				0,89		0,89
Thorictidae			0,71			0,71
Tot_CSD	**614,86**	**819,82**	**847,12**	**415,61**	**927,45**	**3.624,86**
Num_Fam	**15**	**19**	**22**	**14**	**19**	**28**

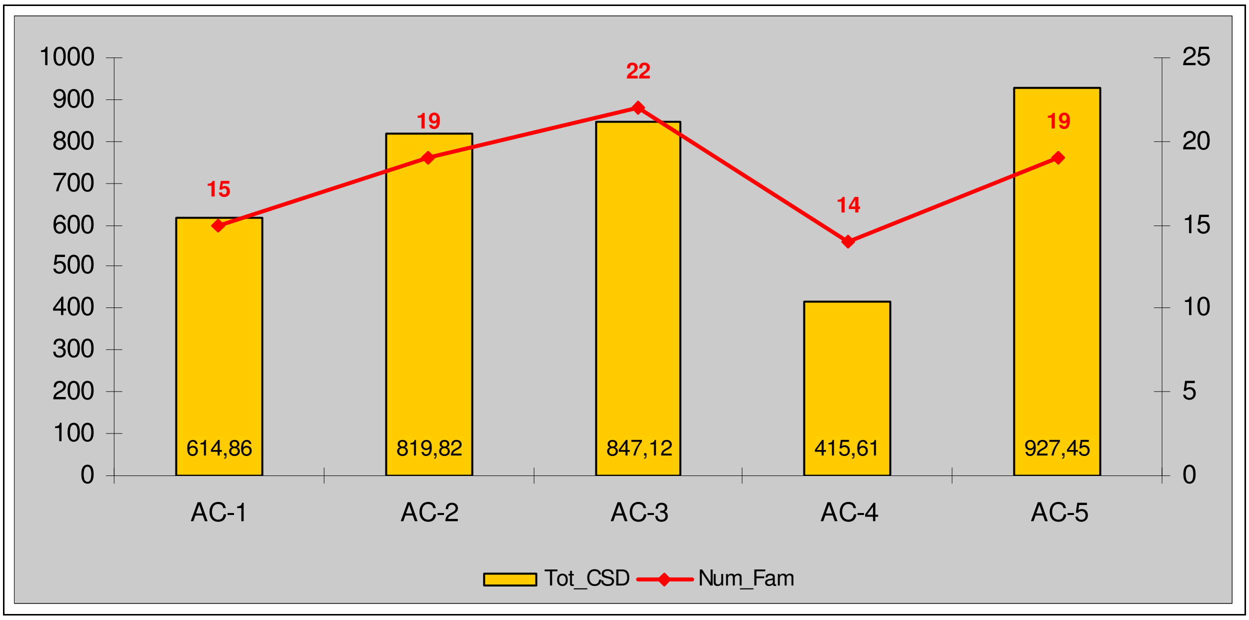
Tab. 4.1.1 - Trends in capture frequencies (CSD) of Coleoptera Families in the traps of station **AC.**

Here were sampled 28 of 42 Families, but no trap has captured all the 28 Families, though the more abundantly sampled are present in all the traps, with the exception of Aphodiidae missing in the **AC-1** trap.
For a summary of the capture frequency for those Coleoptera Families more abundantly sampled at the station **AC** refer to the graph. 4.1.1.
The examination of the graph shows how Carabidae strongly characterize this station. They include the 36,76% of the CSD values and represent the Family the most abundant in all traps (see tab. 4.1.1). In order of frequency of capture follow Nitidulidae (19,14% of CSD values), Tenebrionidae (13,06%) and Staphylinidae (11,74%).



Graph. 4.1.1 - Frequency of capture (CSD) of Coleoptera Families more abundantly sampled in **AC** station.

Moving on to the trend of frequency of capture for Families in relation to individual traps (graph. 4.1.2) must be pointed out that the trap **AC-5** shows the values of CSD significantly superior to all others, while the **AC-4** trap records capture frequencies far below all others. The number of Families sampled does not seem to correlate positively with the measured values of CSD.



Graph. 4.1.2 - Frequency of capture (CSD) of Coleoptera in the traps of the station **AC** and number of sampled Families.

The statistical comparison between the 5 traps of the station in terms of number of specimens caught (χ^2_4 = 238,28, p = 0,000000) has recorded significant differences among them. Instead, the statistical comparison between the 5 traps of the station in terms of number of Families surveyed (χ^2_4 = 2,40, p = 0,66) shows a high homogeneity among them. From this it appears that the number of Families is not influenced by the number of total catches.

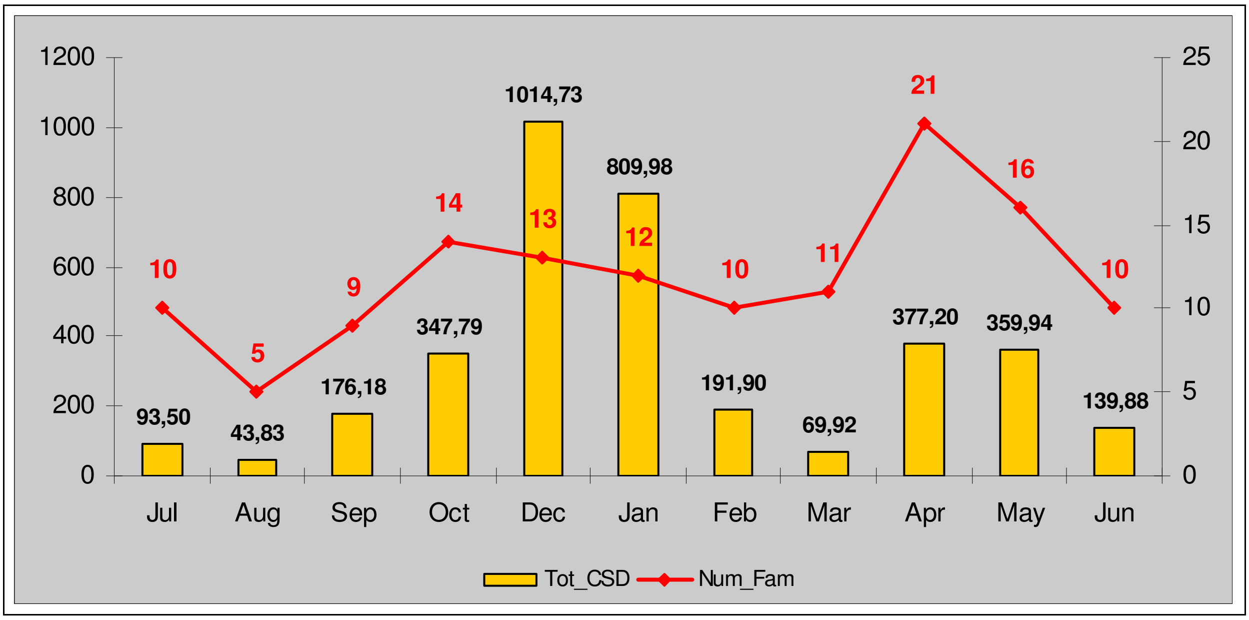
The comparison by pairs of traps (χ^2_1) gives the following results: p = 0,000000 for AC-1/AC-2, AC-1/AC-3, AC-1/AC-4, AC-1/AC-5, AC-2/AC-4, AC-3/AC-4, AC-4/AC-5; p = 0,5 for AC-2/AC-3; p = 0,01 for AC-2/AC-5; p = 0,6 for AC-3/AC-5.

Looking at the trend of the capture relative frequency for Families for the traps during the months of sampling (tab. 4.1.2 and graph. 4.1.3), it is clear that about 50% of catches is concentrated in the months of December and January, the lower CSD values are recorded instead in the months of March and August.
April is the month in which was recorded the highest number of Families (21), and August is the one with the lowest number of censed families (5).

MONTH	*AC-1*	*AC-2*	*AC-3*	*AC-4*	*AC-5*	*Tot_CSD*	*Num_Fam*
Jul	13,64	23,38	24,35	11,69	20,45	93,50	10
Aug	3,65	12,18	12,18	4,87	10,96	43,83	5
Sep			144,67		31,51	176,18	9
Oct	94,79	52,74	50,60	67,70	81,96	347,79	14
Dec	211,62	172,66	207,20	107,14	316,11	1.014,73	13
Jan	148,44	181,16	204,54	123,89	151,94	809,98	12
Feb	30,01	75,81	31,59	23,69	30,80	191,90	10
Mar	8,35	17,74	15,65	13,57	14,61	69,92	11
Apr	62,87	89,43	89,43	23,02	112,45	377,20	21
May	33,20	173,99	45,16	26,56	81,02	359,94	16
Jun	8,29	20,72	21,76	13,47	75,64	139,88	10
Tot_CSD	**614,86**	**819,82**	**847,12**	**415,61**	**927,45**	**3.624,86**	**28**

Tab. 4.1.2 - Trends of capture frequencies (CSD) for Coleoptera Families in respect of each trap during the sampling in **AC** station. Highlighted in green are the highest CSD values and the greatest number of Families sampled, in light blue the lowest CSD values and the lowest number of Families sampled.

The month of December shows the peak for CSD values for traps **AC-1**, **AC-2** and **AC-5**, January for traps **AC-2** and **AC-4**, while a clear reduction of CSD is registered for **all traps** in August.



Graph. 4.1.3 - Trends in capture frequencies (CSD) for Coleoptera in **AC** station in the months of sampling and number of Families sampled.

Station Ol (Olive-grove)

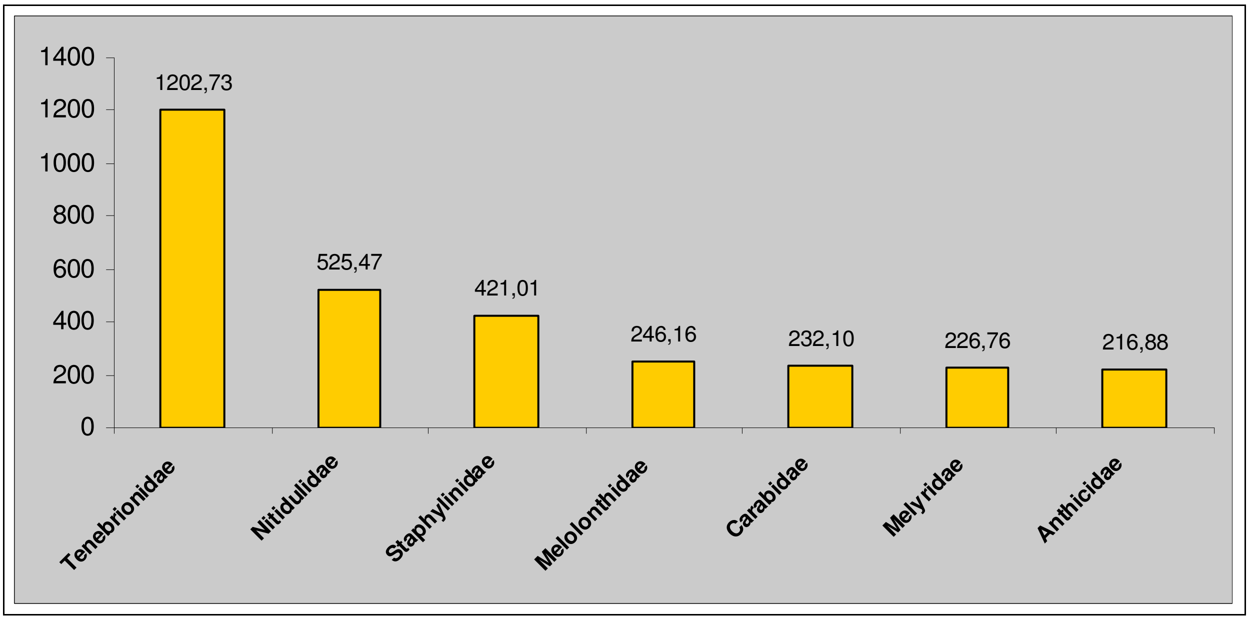
The trend in the frequency of capture for Coleoptera Families in the 5 **Ol** station's traps is shown in table 4.1.3.

FAMILY	Ol-1	Ol-2	Ol-3	Ol-4	Ol-5	Tot_CSD
Tenebrionidae	94,29	257,27	170,58	121,44	559,15	1.202,73
Nititulidae	126,82	162,91	58,29	85,40	92,05	525,47
Staphylinidae	150,42	75,21	47,03	51,41	96,95	421,01
Melolonthidae	13,72	20,81	111,12	71,72	28,78	246,16
Carabidae	61,30	63,83	14,04	61,50	31,43	232,10
Melyridae	32,32	54,46	55,43	28,78	55,78	226,76
Anthicidae	32,16	94,48	24,75	6,88	58,61	216,88
Curculionidae	23,85	17,17	15,44	29,03	24,00	109,49
Chrysomelidae	20,03	14,10	24,25	13,19	37,91	109,48
Aphodiidae	34,37	2,85			0,71	37,93
Hysteridae	24,72	3,63	6,83		2,46	37,65
Cryptophagidae	16,67	4,54	5,58	4,28	4,60	35,67
Elateridae	1,33	4,52	12,08	0,97	12,06	30,97
Ptinidae	4,20	4,96	2,37	5,82	0,97	18,33
Buprestidae		5,31	0,89	2,30	3,54	12,04
Mordellidae			2,66	7,53		10,18
Coccinellidae	3,85	0,57	2,52	2,66	0,57	10,17
Leiodiidae	3,60			1,58	1,50	6,69
Orthoperidae	2,66	1,04		0,71	0,97	5,39
Dermestidae		0,97	2,92		1,04	4,94
Bruchidae	2,21	0,89	1,33			4,43
Scydmaenidae	3,86					3,86
Silvanidae	1,95		1,33			3,28
Byrrhidae	0,79	1,36			0,89	3,04
Thorictidae		0,89	1,33			2,21
Cebrionidae			1,33			1,33
Cucujdae				1,33		1,33
Anobidae		0,57	0,71			1,29
Alleculidae					0,97	0,97
Drilidae		0,89				0,89
Geotrupidae		0,89				0,89
Scolitydae	0,57					0,57
Tot_CSD	**655,70**	**794,11**	**562,81**	**496,51**	**1.014,97**	**3.524,10**
Num_Fam	**22**	**24**	**22**	**18**	**21**	**32**

Tab. 4.1.3 - Trends in capture frequencies (CSD) for Coleoptera Families in the traps of station **Ol**.

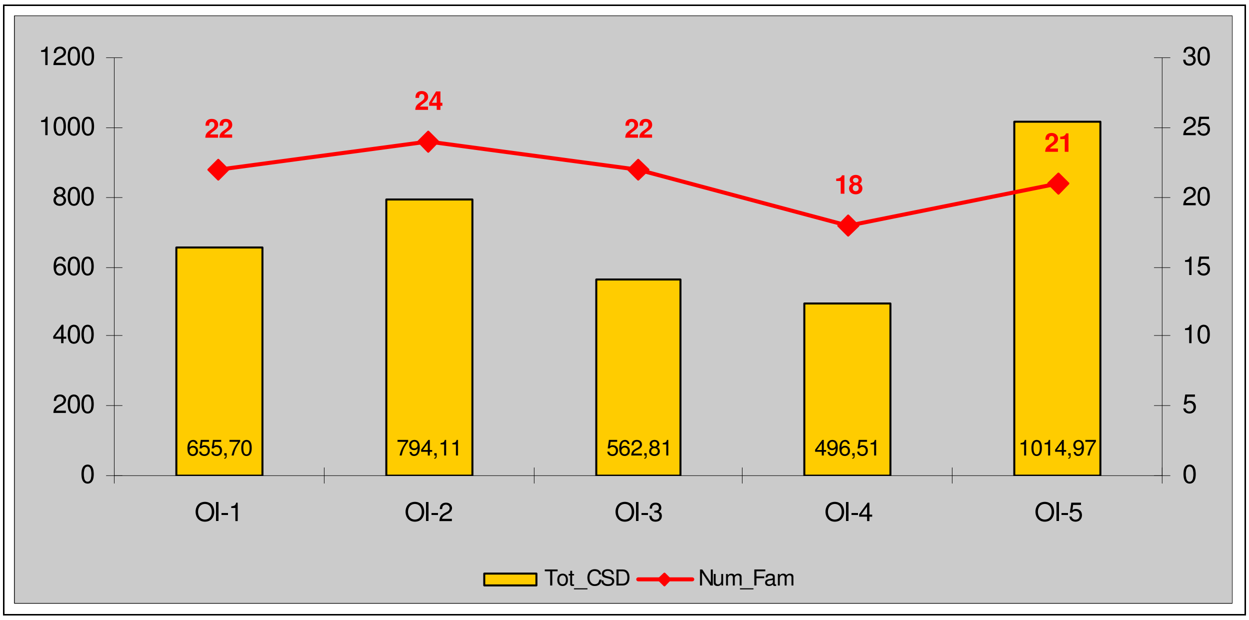
This is the station that has recorded the highest number of families (32 of 42). However, not any trap has collected all the sampled Families in the station, although those more abundantly surveyed are present in all the traps.
For a summary of the capture frequency for those Coleoptera Families more abundantly sampled at the station **Ol**, refer to the graph. 4.1.4.
The examination of the graph shows how Tenebrionidae characterize this station. They include the 34,13% of the CSD total value and they represent the Family the most sampled in all traps except the **Ol-1**, where the family the most represented is Staphylinidae. (see tab. 4.1.3). In order of frequency of capture follow Nitidulidae (14,91% of the CSD values), Staphylinidae (11,95%),

Melolonthidae (6,99%) and Carabidae (6,59%). It has to be noted that the station **Ol** was the only one that has recorded the Family of Melolonthidae.



Graph. 4.1.4 - Frequency of capture (CSD) for Coleoptera Families more abundantly sampled in **Ol** station.

Moving on to the trend of capture frequency for Families of the single traps (fig. 4.1.5) it shows that the trap **Ol-5** shows CSD values significantly superior to all others, while the other traps show similar captures frequencies. The number of Families sampled does not seem to correlate positively with the measured values of CSD.



Graph. 4.1.5 - Frequency of capture (CSD) of Coleoptera in the traps of the station **Ol** and number of sampled Families.

The statistical comparison between the 5 traps of the station in terms of number of specimens caught (χ^2_4 = 241,39 con p = 0,000000) has recorded significant differences among them. Instead, the statistical comparison between the 5 traps of the station in terms of number of Families surveyed (χ^2_4 = 0,90 con p = 0,92) shows a high homogeneity among them. From this it appears that the number of Families is not influenced by the number of total catches.

The comparison by pairs of traps (χ^2_1) gives the following results: p = 0,000000 for Ol-1/Ol-5, Ol-2/Ol-3, Ol-2/Ol-4, Ol-2/Ol-5, Ol-3/Ol-5, Ol-4/Ol-5; p = 0,0003 for Ol-1/Ol-2; p = 0,008 for Ol-1/Ol-3; p = 0,000003 for Ol-1/Ol-4; p = 0,042 for Ol-3/Ol-4.

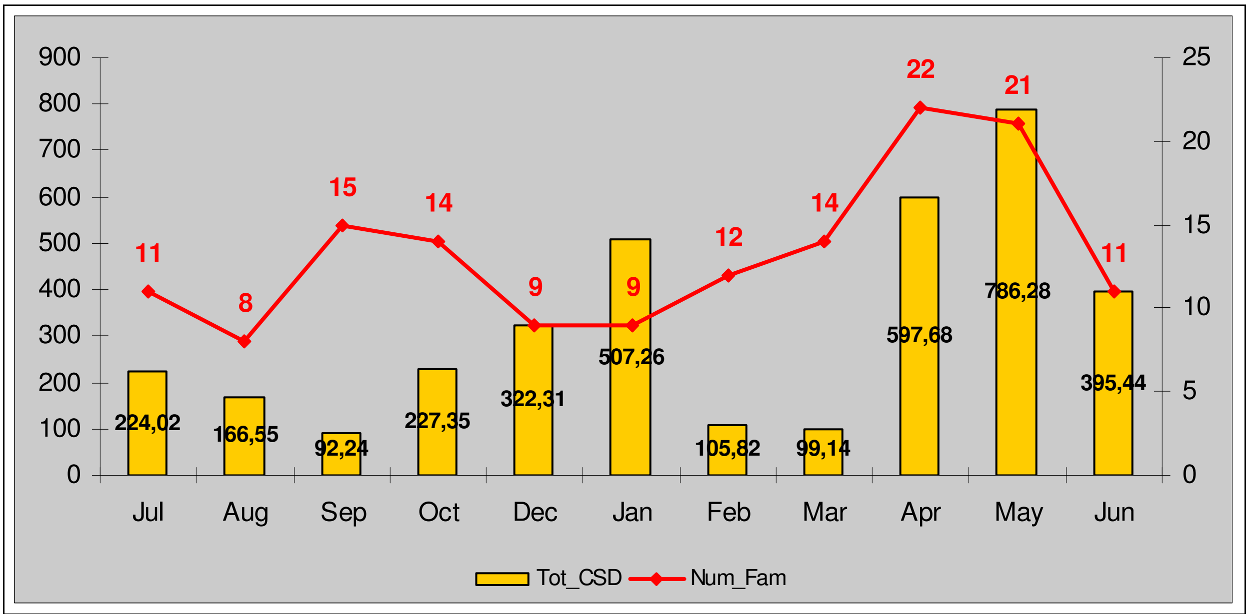
Looking at the trend of the capture relative frequency for Families for the traps during the months of sampling (tab. 4.1.4 and graph. 4.1.6), it is clear that the 39.27% of catches is concentrated in the months of April and May, followed by 23.54% of December and January. Lower CSD values are recorded instead in the months of September and March.

April is the month in which was recorded the highest number of Families (22) followed by May (21), and August is the one with the lowest number of censed families (8) followed by December and January (9).

MONTH	*Ol-1*	*Ol-2*	*Ol-3*	*Ol-4*	*Ol-5*	*Tot_CSD*	*Num_Fam*
Jul	28,25	66,23	13,64	33,12	82,79	224,02	11
Aug	15,58	38,96	27,27	36,04	48,70	166,55	8
Sep	8,59	13,75	36,10	10,89	22,92	92,24	15
Oct	56,30	57,73	24,23	55,59	33,50	227,35	14
Dec	82,35	55,78	26,56	65,52	92,09	322,31	9
Jan	160,13	162,46	50,26	68,96	65,45	507,26	9
Feb	36,33	11,85	7,11	21,32	29,22	105,82	12
Mar	26,09	16,70	14,61	14,61	27,13	99,14	14
Apr	111,57	85,00	159,38	115,11	126,62	597,68	22
May	116,88	187,27	120,86	59,77	301,50	786,28	21
Jun	13,64	98,37	82,79	15,58	185,06	395,44	11
Tot_CSD	**655,70**	**794,11**	**562,81**	**496,51**	**1014,97**	**3524,10**	**32**

Tab. 4.1.4 - Trends of capture frequencies (CSD) for Coleoptera Families in respect of each trap during the sampling in **Ol** station. Highlighted in green are the highest CSD values and the greatest number of Families sampled, in light blue the lowest CSD values and the lowest number of Families sampled.

The month of April shows the peak for CSD values for traps **Ol-3** and **Ol-4**, May for traps **Ol-2** and **Ol-5**, and January for trap **Ol-1**, while a clear reduction of CSD is registered for traps **Ol-1**, **Ol-4** and **Ol-5** in September and for traps **Ol-2** e **Ol-3** in February.



Graph. 4.1.6 - Trends in capture frequencies (CSD) for Coleoptera in **Ol** station in the months of sampling and number of Families sampled.

Station Ci (Citrus-grove)

The trend in the frequency of capture for Coleoptera Families in the 5 **Ci** station's traps is shown in table 4.1.5.

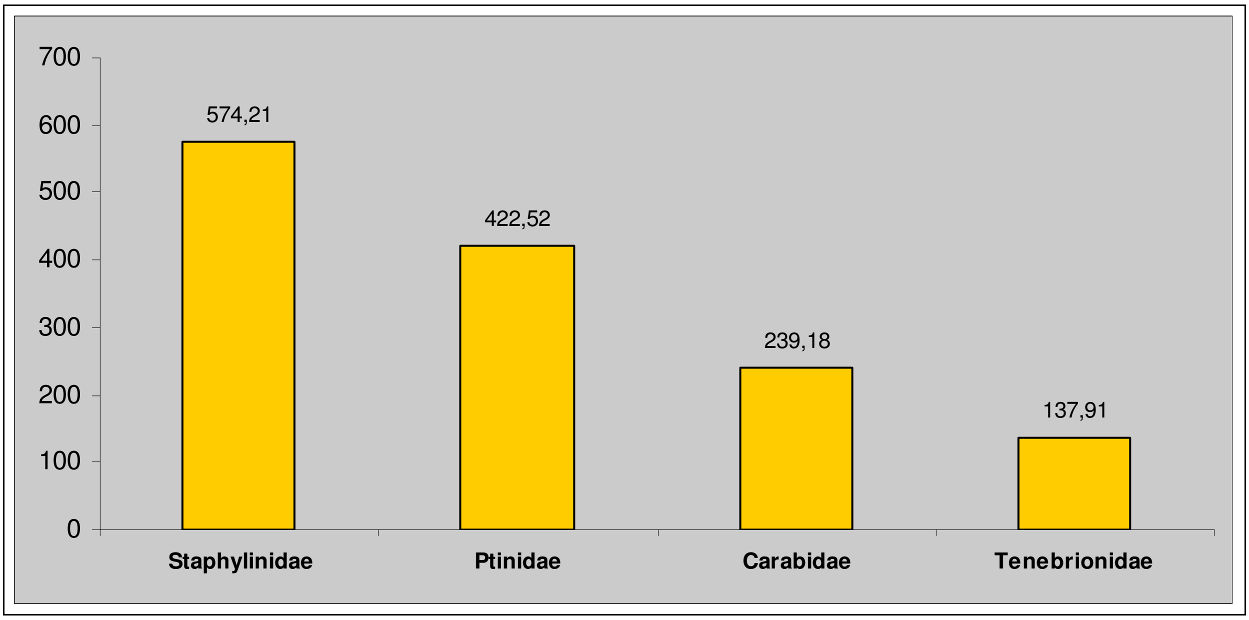
FAMILY	Ci-1	Ci-2	Ci-3	Ci-4	Ci-5	Tot_CSD
Staphylinidae	105,75	82,81	80,14	155,02	150,49	574,21
Ptinidae	199,11	40,19	49,91	48,31	85,01	422,52
Carabidae	74,21	13,85	13,28	62,65	75,20	239,18
Tenebrionidae	39,42	31,88	24,70	28,08	13,82	137,91
Nitidulidae	23,73	15,08	14,30	14,51	21,29	88,91
Curculionidae	34,17	6,14	0,89	5,58	18,79	65,57
Orthoperidae	34,09	8,15		4,43	6,20	52,87
Cryptophagidae	10,18	14,27	11,33	7,97	4,25	48,01
Anthicidae	19,50	10,55	1,95	9,61	2,66	44,27
Scydmaenidae		1,77	6,89	18,80	12,44	39,90
Lathridiidae	5,22	5,76	6,20	0,89	6,76	24,82
Silvanidae	0,97		11,18	1,95	1,43	15,54
Chrysomelidae	1,61		1,39	2,92	2,78	8,70
Coccinellidae		1,33	4,14	0,97		6,44
Silphidae		0,89	1,68	0,89	2,50	5,95
Colydiidae			0,97	1,69	2,92	5,59
Leiodiidae			1,33	2,56	0,89	4,78
Elateridae	2,32	2,41				4,72
Cybocephalidae		0,89		0,89		1,77
Ptilidae			1,39			1,39
Melyridae	1,33					1,33
Alleculidae			0,97			0,97
Anobidae		0,97				0,97
Corylophidae					0,89	0,89
Phalacridae					0,72	0,72
Tot_CSD	**551,63**	**236,94**	**232,64**	**367,70**	**409,04**	**1.797,95**
Num_Fam	**14**	**16**	**18**	**18**	**18**	**25**

Tab. 4.1.5 - Trends in capture frequencies (CSD) for Coleoptera Families in the traps of station **Ci**.

In the station were surveyed 25 Families of 42 of the total sample. Not any trap has collected all the sampled Families in the station, although those more abundantly surveyed are present in all the traps, with the exception of Scydmenidae missing in the trap **Ci-1**.

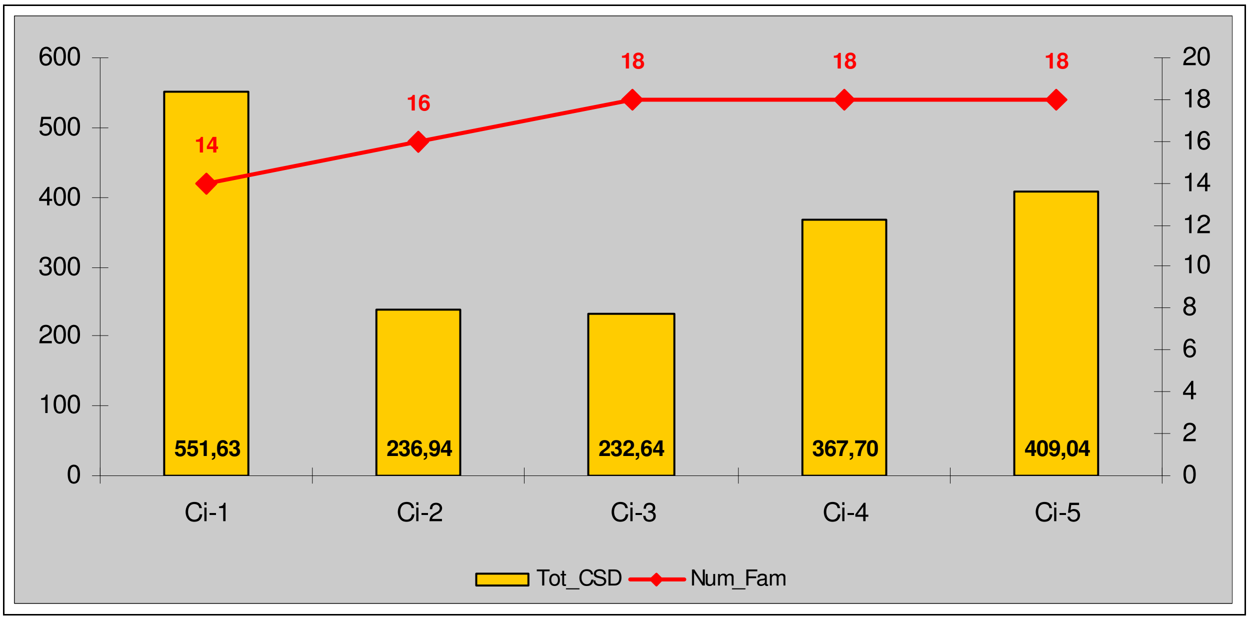
For a summary of the capture frequency for those Coleoptera Families more abundantly sampled at the station **Ci** refer to the graph. 4.1.7.

The examination of the graphic shows that in this station are Staphylinidae to show higher values of CSD, with 31,94% of the total and they represent the family more abundantly sampled in all traps except **Ci-1** where Ptinidae is the Family the most represented. In order of frequency of capture follow Ptinidae (23,50%), Carabidae (13,30%) and Tenebrionidae (7,67%).



Graph. 4.1.7 - Frequency of capture (CSD) for Coleoptera Families more abundantly sampled in **Ci** station.

Moving on to the trend of capture frequency for Families in the single traps (fig. 4.1.8) it shows that the trap **Ci-1** has CSD values significantly higher than all the others, while the traps **Ci-2** and **Ci-3** show significantly lower frequencies of capture. The number of families sampled does not seem to correlate positively with the measured values of CSD



Graph. 4.1.8 - Frequency of capture (CSD) of Coleoptera in the traps of the station **Ci** and number of sampled Families.

The statistical comparison between the 5 traps of the station in terms of number of specimens caught (χ^2_4 = 196,19 con p = 0,000000) has recorded significant differences among them. Instead, the statistical comparison between the 5 traps of the station in terms of number of Families surveyed (χ^2_4 = 0,76 con p = 0,94) shows a high homogeneity among them. From this it appears that the number of Families is not influenced by the number of total catches.

The comparison by pairs of traps (χ^2_1) gives the following results: p = 0,000000 for Ci-1/Ci-2, Ci-1/Ci-3, Ci-1/Ci-4, Ci-2/Ci-4, Ci-2/Ci-5, Ci-3/Ci-4, Ci-3/Ci-5; p = 0,000004 for Ci-1/Ci-5; p = 0,84 for Ci-2/Ci-3; p = 0,14 for Ci-4/Ci-5.

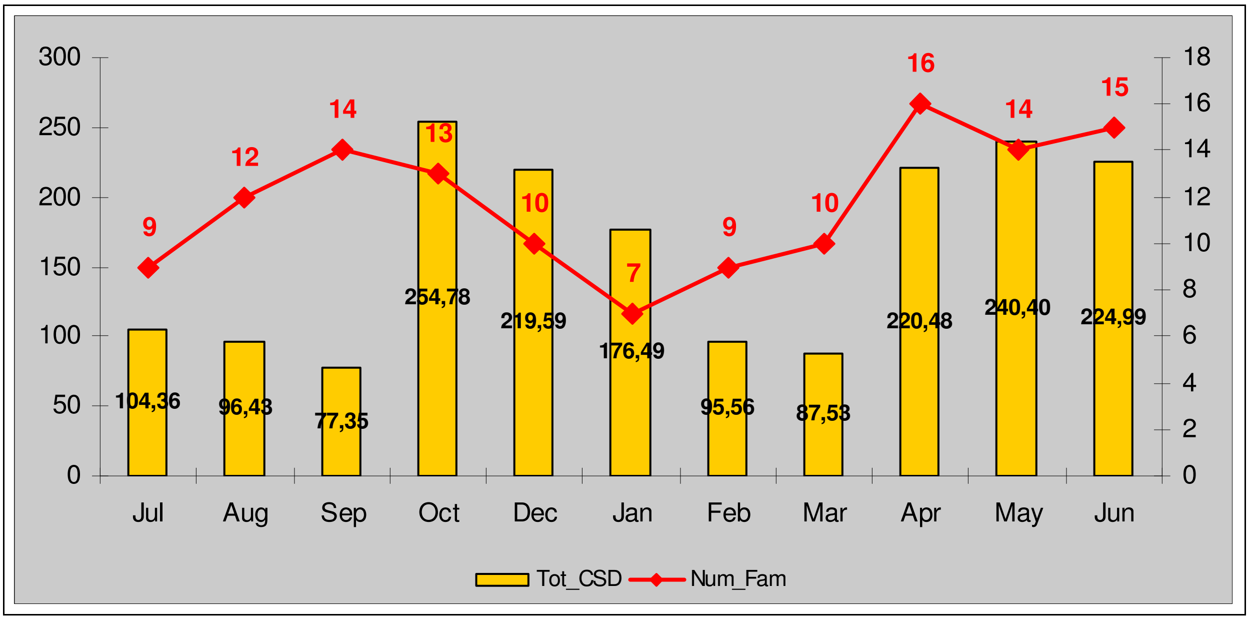
Looking at the trend of the capture relative frequency for Families for the traps during the months of sampling (tab. 4.1.6 and graph. 4.1.9), it is clear that about 38,15% of the catches is concentrated

in the months of April, May and June, followed by 36.20% of December and January, despite the higher value of CSD register in October. Lower CSD values are recorded instead in the months of September and March.
April is the month in which was recorded the highest number of Families (16) followed by June (15), and January is the one with the lowest number of censed families (7) followed by July (9).

MONTH	*Ci-1*	*Ci-2*	*Ci-3*	*Ci-4*	*Ci-5*	*Tot_CSD*	*Num_Fam*
Jul	34,79	4,17	38,96		26,44	104,36	9
Aug	9,74	9,74	22,40	23,38	31,17	96,43	12
Sep	12,89	12,89		17,90	33,66	77,35	14
Oct	39,20	26,73		79,29	109,58	254,78	13
Dec	90,32	31,88	19,48	25,68	52,24	219,59	10
Jan	68,96	15,19	36,23	28,05	28,05	176,49	7
Feb	13,43	2,37	18,16	47,38	14,22	95,56	9
Mar	55,54	3,37	8,42	15,15	5,05	87,53	10
Apr	119,54	15,05	18,59	36,30	30,99	220,48	16
May	91,64	27,89	41,17	33,20	46,49	240,40	14
Jun	15,58	87,66	29,22	61,36	31,17	224,99	15
Tot_CSD	**551,63**	**236,94**	**232,64**	**367,70**	**409,04**	**1.797,95**	**25**

Tab. 4.1.6 - Trends of capture frequencies (CSD) for Coleoptera Families in respect of each trap during the sampling in **Ci** station. Highlighted in green are the highest CSD values and the greatest number of Families sampled, in light blue the lowest CSD values and the lowest number of Families sampled.

April shows the peak for CSD values for trap **Ci-1**, June for trap **Ci-2**, May for trap **Ci-3**, and October for traps **Ci-4** e **Ci-5.** A clear reduction of CSD is registered for **all traps** in March with exception of trap **Ci-1** showing the minimum in August.



Graph. 4.1.9 - Trends in capture frequencies (CSD) for Coleoptera in **Ci** station in the months of sampling and number of Families sampled.

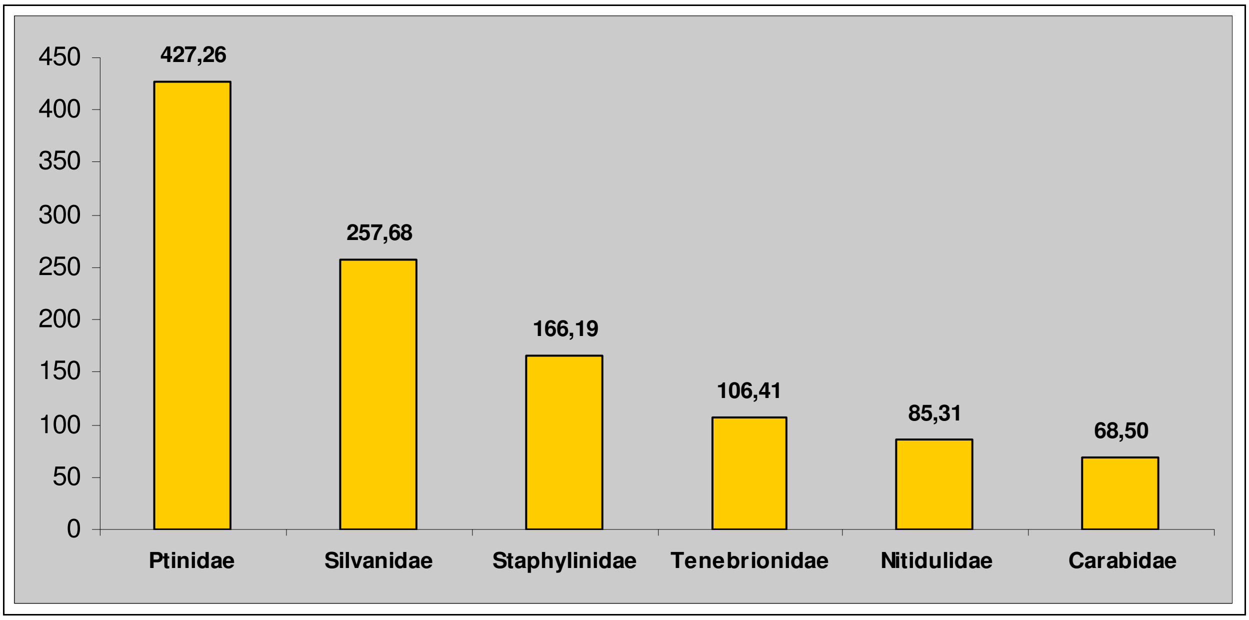
Station Tk (*Pinus halepensis-Quercus calliprinos* Thicket)

The trend in the frequency of capture for Coleoptera Families in the 5 **Tk** station's traps is shown in table 4.1.7.

FAMILY	Tk-1	Tk-2	Tk-3	Tk-4	Tk-5	Tot_CSD
Ptinidae	91,29	220,44	84,76	4,49	26,28	427,26
Silvanidae	42,43	129,41	52,04	1,33	32,48	257,68
Staphylinidae	42,72	34,47	65,88	12,81	10,31	166,19
Tenebrionidae	9,96	15,83	12,71	37,76	30,15	106,41
Nitidulidae	10,39	40,25	13,62	9,02	12,02	85,31
Cryptophagidae	46,10	23,71	7,62	1,96	1,62	81,02
Carabidae	10,91	4,04	35,95	6,71	10,91	68,50
Melyridae	0,89			46,49	9,74	57,11
Chrysomelidae		4,69	2,66	5,51	7,28	20,13
Curculionidae	1,27	5,12	5,83		3,64	15,86
Leiodiidae		7,27	6,55	1,52		15,34
Buprestidae					10,15	10,15
Lathridiidae		2,98	2,79			5,76
Anthicidae	2,37	1,62	1,43			5,42
Scolitydae	4,38					4,38
Aphodiidae				2,87	0,64	3,50
Geotrupidae			1,35	2,06		3,41
Alleculidae				1,33	1,33	2,66
Mordellidae		1,33	0,89			2,21
Byrrhidae				2,16		2,16
Orthoperidae			1,43			1,43
Bruchidae	0,64				0,71	1,35
Cerambycidae	1,33					1,33
Hysteridae					1,33	1,33
Trogidae			1,27			1,27
Ptilidae				1,26		1,26
Colydiidae		0,89				0,89
Elateridae		0,89				0,89
Scydmaenidae			0,71			0,71
Tot_CSD	**264,67**	**492,92**	**297,48**	**137,27**	**158,58**	**1.350,92**
Num_Fam	**13**	**15**	**17**	**15**	**15**	**29**

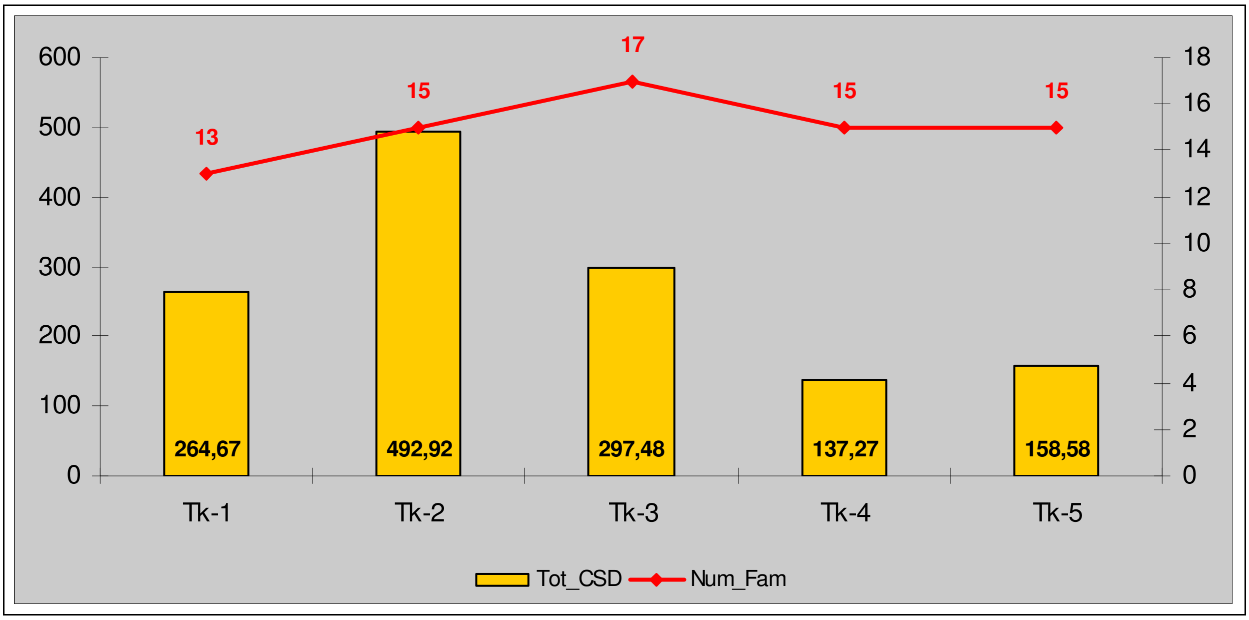
Tab. 4.1.7 - Trends in capture frequencies (CSD) for Coleoptera Families in the traps of station **Tk**.

This is the station that recorded the lowest frequencies of capture; that is perhaps due, at least partially, to the relatively high number (quantity) of not-active or partially damaged traps in the sessions form December to March. Nevertheless, this station has recorded the second highest value (after **Ol**) for number of families censed (29 of 42). However, not any trap has collected all the sample families in the station, although those more abundantly surveyed are present in all traps except Melyridae, absent in traps and **Tk-2** and **Tk-3**, and Chrysomelidae absent in trap **Tk-1**.
For a summary of the frequency of capture for those Coleoptera Families more abundantly sampled at the station **Tk**, refer to the graph. 4.1.10.
The examination of the graphic shows that in this station are Ptinidae to show higher values of CSD, with 31,63% of the total, representing the family more abundantly sampled in traps **Tk-1**, **Tk-2** and **Tk-3**, while Melyridae are the Family with the largest number of specimens counted in trap **Tk-4**, and Silvanidae in **Tk-5**. In order of frequency of total catches follow Silvanidae (19,07%), Staphylinidae (12,30%), Tenebrionidae (7,88%), Nitidulidae (6,31%) and Carabidae (5,07%).



Graph. 4.1.10 - Frequency of capture (CSD) for Coleoptera Families more abundantly sampled in **Tk** station.

Moving on to the trend of capture frequency for Families in the single traps (graph. 4.1.11) it is evident that trap **Tk-2** shows significantly higher values of CSD respect all the others, while traps **Tk-4** and **Tk-5** show significantly lower frequencies of capture. The number of families sampled does not seem to correlate positively with the measured values of SSC.



Graph. 4.1.11 - Frequency of capture (CSD) of Coleoptera in the traps of the station **Tk** and number of sampled Families.

The statistical comparison between the 5 traps of the station in terms of number of specimens caught (χ^2_4 = 297,98 con p = 0,000000) has recorded significant differences among them. Instead, the statistical comparison between the 5 traps of the station in terms of number of Families surveyed (χ^2_4 = 0,53 con p = 0,97) shows a high homogeneity among them. From this it appears that the number of Families is not influenced by the number of total catches.

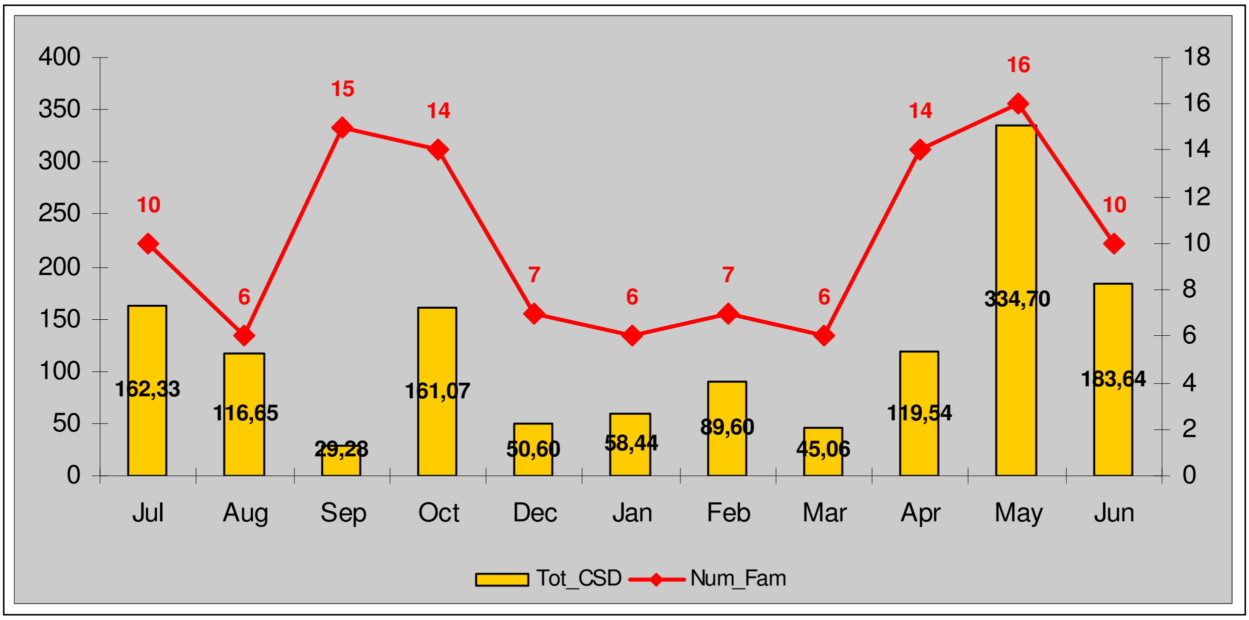
The comparison by pairs of traps (χ^2_1) gives the following results: p = 0,000000 for Tk-1/Tk-2, Tk-1/Tk-4, Tk-1/Tk-5, Tk-2/Tk-3, Tk-2/Tk-4, Tk-2/Tk-5, Tk-3/Tk-4, Tk-3/Tk-5; p = 0,17 for Tk-1/Tk-3; p = 0,21 for Tk-4/Tk-5.

Looking at the trend of the capture relative frequency for Families for the traps during the months of sampling (tab. 4.1.8 and graph. 4.1.12), it is clear that about 47.22% of catches is concentrated in the months of April, May and June, followed by 20.65% of July and August. Lower CSD values are recorded instead in the months of September and March.
May is the month in which was recorded the highest number of Families (16) followed by September (15), while January, March and August those with the lowest number of censed families (6).

MONTH	*Tk-1*	*Tk-2*	*Tk-3*	*Tk-4*	*Tk-5*	*Tot_CSD*	*Num_Fam*
Jul	56,82	64,93	1,62		38,96	162,33	10
Aug	28,31	49,83	22,65	2,27	13,59	116,65	6
Sep	4,46	8,28	6,37	7,64	2,55	29,28	15
Oct	33,50	11,40	104,76	5,70	5,70	161,07	14
Dec	10,12	26,56	6,32	3,79	3,79	50,60	7
Jan	20,74	22,62	5,66	5,66	3,77	58,44	6
Feb	7,59	72,90	1,52	6,07	1,52	89,60	7
Mar	21,35	7,12	4,74	7,12	4,74	45,06	6
Apr	19,48	34,53	24,79	23,02	17,71	119,54	14
May	31,88	94,30	91,64	59,77	57,11	334,70	16
Jun	30,44	100,44	27,39	16,23	9,13	183,64	10
Tot_CSD	**264,67**	**492,92**	**297,48**	**137,27**	**158,58**	**1.350,92**	**29**

Tab. 4.1.8 - Trends of capture frequencies (CSD) for Coleoptera Families in respect of each trap during the sampling in **Tk** station. Highlighted in green are the highest CSD values and the greatest number of Families sampled, in light blue the lowest CSD values and the lowest number of Families sampled.

July shows the peak for CSD values for trap **Tk-1**, June for traps **Tk-2**, October for trap **Tk-3**, and May for traps **Tk-4** and **Tk-5**. A clear reduction of CSD is registered in September for trap **Tk-1**, in March for trap **Tk-2**, in February and July for trap **Tk-3**, in August for trap **Tk-4** and in February for trap **Tk-5**.



Graph. 4.1.12 - Trends in capture frequencies (CSD) for Coleoptera in **Tk** station in the months of sampling and number of Families sampled.

5 GENERAL ANALYSIS OF SAMPLING FOR SPECIES OF CARABIDAE, TENEBRIONIDAE AND STAPHYLINIDAE

The analysis of species of Coleoptera has focused on families Carabidae, Tenebrionidae and Staphylinidae (excluding Aleocharinae). These three families, as already mentioned in chapter 4, represent more than 52% of specimens amount of coleopters collected during the entire sampling period. Their taxonomy is quite well known as well as their biology. These families also, as noted in the introduction, are widely used for biocenotic studies, both in Europe and Mediterranean, and that makes possible any comparisons with previous research conducted using the methodology of the pit-fall traps.

5.1 COLEOPTERA CARABIDAE

In total were surveyed a total of **38** species and subspecies of Coleoptera Carabidae that are reported in table 5.1.1.
For the nomenclature, reference is made to the checklist of the Italian fauna (VIGNA TAGLIANTI 1993) modified according to VIGNA TAGLIANTI 2005 (in BRANDMAYR et alii 2005) and updated to January 2011 according to the Checklist of Carabidae of Fauna Europaea Project (VIGNA TAGLIANTI 2011) (www.faunauer.org).
For chorological categories it was referred to VIGNA TAGLIANTI et alii 1992 and VIGNA TAGLIANTI 2005 (in BRANDMAYR et alii 2005). The distribution in Italy is taken from the checklist of the Italian fauna (VIGNA TAGLIANTI 1993) updated according to VIGNA TAGLIANTI (in BRANDMAYR et alii 2005).

Two taxa, *Carabus faminii sabellai* Sparacio 2007 and *Platyderus lombardii* Straneo 1959 are sicilian endemism.

***Carabus* (*Eurycarabus*) *faminii sabellai* Sparacio 2007**
Interesting and rare subspecies discovered and described in 2007. The new station is added to those already known of Monti Erei (Monte Rossomanno in woods of *Pinus* and *Eucalyptus* and Bosco di Niscemi in cork wood).

***Platyderus* (*Platyderus*) *lombardii* Straneo 1959**
Species described as rare and very localized, limited to the western foothills of Etna near Catania. Actually his presence at medium and low altitudes in forests of oak and other broadleaves is not rare and its distribution is much wider than suspected, concerning much of eastern Sicily.

Two species resulted as new for sicilian fauna: *Microlestes fissuralis* (Reitter 1901) and *Pterostichus niger niger* (Schaller 1783).

***Microlestes fissuralis* (Reitter 1901)**
Widely distributed in Europe (Albania, Austria, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, France and Corsica, Germany, Greece, Hungary, Italy, Macedonia, Moldova Republic, Southern Russia, Serbia and Montenegro, Slovakia, Slovenia, Spain, Ukraine and Turkey) and central Asia (Iran, Kyrgyzstan, Kazakhstan, Lebanon, Syria, Turkmenistan, Turkey, Uzbekistan). It was known so far just for mainland Italy.

***Pterostichus* (*Platysma*) *niger niger* (Schaller 1783)**
The subspecies is largely distributed in Europe (Albania, Austria, Azerbaijan, Belgium, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France and Corsica, Germany, Great Britain, Greece, Hungary, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxenbourg, Macedonia, Moldova, Norway, Poland, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Netherland, Ukraine, Yugoslavia) and Central Asia (Iran, Kyrgyzstan,

Kazakhstan, W-Siberia Tazikistan, Turkey, Uzbekistan). Other subspecies are known for Azerbaigian, Armenia, Georgia, Est Siberia, far-East Russia and Mongolia. The subspecies in object was so far known just for mainland Italy and Sardinia.

	Species	**Chorology**	**Italy**
	Amara (Celia) montana Dejean 1828	MED	N S Si Sa
	Asaphidion curtum curtum (Heyden 1870)	WME	S Si Sa
	Asaphidion rossii (Schaum 1857)	MED	N S Si Sa
	Broscus politus (Dejean 1828)	NAF	Si
	Calathus (Neocalathus) cinctus Motschulsky 1850	WPA	N S Si Sa
	Calathus (Bedelinus) circumseptus Germar 1824	WME	N S Si Sa
	Calathus (Calathus) fuscipes graecus Dejean 1831	EUM	N S Si Sa?
	Calathus (Neocalathus) mollis (Marsham 1802)	WPA	Si Sa
E	*Carabus (Eurycarabus) faminii sabellai* Sparacio 2007	NAF	Si
	Carabus (Macrothorax) morbillosus alternans Palliardi 1825	WME	S, Si
	Chlaenius (Claeinus) velutinus auricollis Gené 1839	EUM	N S Si Sa
	Cymindis (Cymindis) laevistriata Lucas 1846	NAF	Si
	Dixus sphaerocephalus (Olivier 1795)	WME	Si Sa
	Harpalus (Harpalus) distinguendus distinguendus (Duftschmid 1812)	PAL	N S Si Sa
	Laemostenus (Pristonychus) algerinus algerinus (Gory 1833)	WME	N S Si Sa
	Laemostenus (Laemostenus) barbarus (Lucas 1846)	NAF	S Si
	Licinus (Licinus) punctatulus (Fabricius 1792)	MED	S Si Sa
	Metallina (Neja) ambigua (Dejean 1831)	WME	S Si Sa
N	***Microlestes fissuralis* (Reitter 1901)**	TUE	N S **new for Si**
	Microlestes luctuosus Holdhaus in Apfelbeck 1904	TUM	N S Si Sa
	Notiophilus geminatus Dejean & Boisduval 1830	MED	N S Si Sa
	Ocys harpaloides (Audinet-Serville 1821)	EUM	N S Si Sa
	Olisthopus elongatus Wollaston 1854	WME	Si Sa
	Ophonus (Ophonus) ardosiacus (Lutshnik 1922)	EUM	N S Si Sa
	Paradromius (Manodromius) linearis (Olivier 1795)	EUM	N S Si Sa
	Paranchus albipes (Fabricius 1796)	EUM (OLA)	N S Si Sa
	Philorhizus melanocephalus (Dejean 1825)	TEM	N S Si Sa
E	*Platyderus (Platyderus) lombardii* Straneo 1959	SEU (SICI)	Si
	Platytarus faminii faminii (Dejean 1826)	AFM	S Si Sa
	Poecilus (Poecilus) cupreus cupreus (Linné 1758)	ASE	N S Si Sa
	Pseudomasoreus canigoulensis (Fairmaire & Laboulbène 1854)	WME	S Si
	Pseudoophonus (Pseudoophonus) rufipes (De Geer 1774)	PAL (OLA)	N S Si Sa
	Pterostichus (Feronidius) melas italicus (Dejean 1828)	EUR	N S Si
N	***Pterostichus (Platysma) niger niger* (Schaller 1783)**	ASE	N S Sa **new for Si**
	Syntomus barbarus (Puel 1938)	NAF	Si
	Syntomus fuscomaculatus (Motschulsky 1844)	TUM	Si Sa
	Trechus (Trechus) quadristriatus (Schrank 1781)	TEM	N S Si Sa
	Trechus (Trechus) rufulus Dejean 1831	WME	Si Sa

Tab. 5.1.1 – List of species and subspecies of Carabidae surveyed. In the first column with letter **E** are indicated the endemic sicilian taxa, and with letter **N** those new for sicilian fauna. For each taxon is also reported the chorological category and distribution in Italy following the symbology used in the checklist of the Italian fauna. For further explanations and clarifications please refer to the text.

Some other species deserves a brief comment in relation to its distribution and / or relative rarity.

***Broscus politus* (Dejean 1828)**
Widely distributed in North Africa, in Europe it is present only in Sicily. It frequents open areas of clay soils, unlike its congeneric *B. cephalotes* (Linné 1758) that replaces it in the rest of Europe in damp sandy soil.

***Cymindis* (*Cymindis*) *laevistriata* Lucas 1846**
Another species with a North-African distribution, so far known in Europe only for the islands of Lampedusa and Linosa; this is the first record for Sicily.

***Laemostenus* (*Laemostenus*) *barbarus* (Lucas 1846)**
Present in large part of North Africa and Malta, in Europe is known only for Calabria, Sicily, and islands of of Ustica and Pantelleria. This species is often found with *L. algerinus algerinus*, respect of which it reveals a lower frequency.

***Pseudomasoreus canigoulensis* (Fairmaire & Laboulbene 1854)**
The distribution of this species is highly discontinous. Widely distributed in North Africa, it is also known for the French Pyrenees, but not for the Spanish ones, for continental, central and southern Italy and Sicily. Considered for a long time a very rare species, in more recent times has been found on several occasions, but always very localized, typically on arid and sandy lands.

***Syntomus barbarus* (Puel 1938)**
Species with North-African geonemy, reported by VIGNA TAGLIANTI (1995) for the island of Linosa as the first finding for Italy and Europe. This is the first report for Sicily. The species frequents open areas especially in mountainous and submontane zones.

***Syntomus fuscomaculatus* (Motschulsky 1844)**
Species distributed in Asia Minor and North Africa, it was known for Italy with certainty only in Pelagie Islands and Sicily, for which there is only one record of LUIGIONI (1929) for Licata (Agrigento). To Monzini (*in verbis*) is also known for Hyblean Mountains (Adorno collection). This capture represents a confirmation of its presence in Sicily.

The sampled species and subspecies of Carabidae and the number of specimens collected in the 5 stations are shown in table 5.1.2.

SPECIE	*AC*	*Ci*	*Ol*	*Tk*	*Vy*	Tot_Nb_specimens
Calathus (Neocalathus) cinctus	1.203	48	251	3	2	**1.507**
	58,26	*2,32*	*12,15*	*0,15*	*0,10*	*72,98*
Laemostenus (Pristonychus) algerinus algerinus	134	29	3	24	1	**191**
	6,49	*1,40*	*0,15*	*1,16*	*0,05*	*9,25*
Pterostichus (Feronidius) melas italicus		111		39		**150**
		5,38		*1,89*		*7,26*
Metallina (Neja) ambigua	40					**40**
	1,94					*1,94*
Licinus (Licinus) punctatulus	25	2				**27**
	1,21	*0,10*				*1,31*
Microlestes luctuosus	14		1	2	1	**18**
	0,68		*0,05*	*0,10*	*0,05*	*0,87*

Carabus (Macrothorax) morbillosus alternans	2	8		5		**15**
	0,10	*0,39*		*0,24*		*0,73*
Syntomus barbarus	7		6	2		**15**
	0,34		*0,29*	*0,10*		*0,73*
Asaphidion curtum curtum		14				**14**
		0,68				*0,68*
Pterostichus (Platysma) niger niger		14				**14**
		0,68				*0,68*
Platyderus (Platyderus) lombardii	3	3		1		**7**
	0,15	*0,15*		*0,05*		*0,34*
Calathus (Neocalathus) mollis	3		3			**6**
	0,15		*0,15*			*0,29*
Laemostenus (Laemostenus) barbarus	5			1		**6**
	0,24		*0,00*	*0,05*		*0,29*
Microlestes fissuralis	4		1		1	**6**
	0,19		*0,05*		*0,05*	*0,29*
Asaphidion rossii	1	4				**5**
	0,05	*0,19*				*0,24*
Ocys harpaloides		4				**4**
		0,19				*0,19*
Pseudoophonus (Pseudoophonus) rufipes		4				**4**
		0,19				*0,19*
Amara (Celia) montana	3					**3**
	0,15					*0,15*
Harpalus (Harpalus) distinguendus distinguendus	3					**3**
	0,15					*0,15*
Notiophilus geminatus	3					**3**
	0,15					*0,15*
Platytarus faminii faminii		3				**3**
		0,15				*0,15*
Calathus (Bedelinus) circumseptus	1	1				**2**
	0,05	*0,05*				*0,10*
Calathus (Calathus) fuscipes graecus	2					**2**
	0,10					*0,10*
Carabus (Eurycarabus) faminii sabellai	2					**2**
	0,10					*0,10*
Ditomus sphaerocephalus			2			**2**
			0,10			*0,10*
Olisthopus elongatus			2			**2**
			0,10			*0,10*
Trechus (Trechus) quadristriatus	2					**2**
	0,10					*0,10*
Trechus (Trechus) rufulus		2				**2**
		0,10				*0,10*

Broscus politus	1					**1**
	0,05					*0,05*
Chlaenius (Claeinus) velutinus auricollis		1				**1**
		0,05				*0,05*
Cymindis (Cymindis) laevistriata			1			**1**
			0,05			*0,05*
Ophonus (Ophonus) ardosiacus	1					**1**
	0,05					*0,05*
Paradromius (Manodromius) linearis	1					**1**
	0,05					*0,05*
Paranchus albipes		1				**1**
		0,05				*0,05*
Philorhizus melanocephalus		1				**1**
		0,05				*0,05*
Poecilus (Poecilus) cupreus cupreus		1				**1**
		0,05				*0,05*
Pseudomasoreus canigoulensis	1					**1**
	0,05					*0,05*
Syntomus fuscomaculatus	1					**1**
	0,05					*0,05*
Tot_Nb_specimens	**1.462**	**251**	**270**	**77**	**5**	**2.065**
	70,80	*12,15*	*13,08*	*3,73*	*0,24*	*100,00*
Tot_Nb_species	**24**	**18**	**9**	**8**	**4**	**38**

Tab. 5.1.2 - Trends in catches of Coleoptera Carabidae at each station expressed as total number (top row) and percentage (bottom row) of specimens sampled. The percentages refer to the total of the entire sample of Carabidae.

During the sample period in the 5 stations investigated within the Riserva Naturale Orientata “Pineta di Vittoria” were surveyed a total of **2.065** specimens of Carabidae, which, as mentioned, are representative of **38** species.

The most abundant species resulted: *Calathus* (*Neocalathus*) *cinctus* (**1.507** specimens), which alone accounts for about 70% of the total catch of, *Laemostenus* (*Pristonychus*) *algerinus algerinus* (**191** specimens), *Pterostichus* (*Feronidius*) *melas italicus* (**150** specimens), *Metallina* (*Neja*) *ambigua* (**40** specimens), *Licinus* (*Licinus*) *punctatulus* (**27** specimens), *Microlestes luctuosus* (**18** specimens), *Carabus* (*Macrothorax*) *morbillosus alternans* (**15** specimens), *Syntomus barbarus* (**15** specimens), *Asaphidion curtum curtum* (**14** specimens) and *Pterostichus* (*Platysma*) *niger niger* (**14** specimens), representing the **26%** of the total sampled specimens of Coleoptera and about the **96%** of the total sampled Carabidae.

In fig. 5.1.1 are shown the percentages of specimens surveyed for the more abundantly sampled species of Tenebrionidae compared to the total sample of the Family.

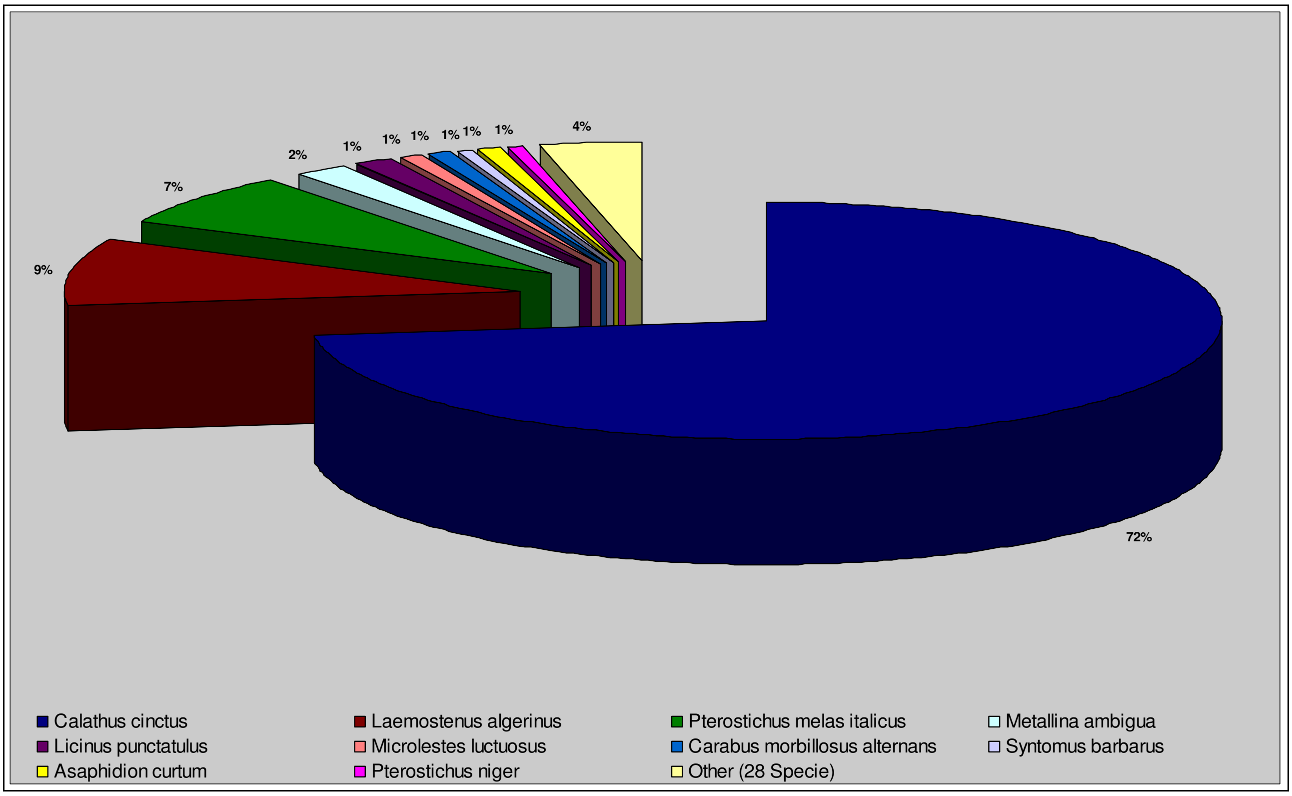


Fig. 5.1.1 - Overall trend (number of individual and percentage of total) of catches for more abundant species of Carabidae.

For the reasons previously discussed, was eliminated from further analysis the station **Vy,** and the capture value was recalculated as CSD.
Table 5.1.3 shows the values of CSD for species counted within the individual stations.

SPECIE	AC	Ci	Ol	Tk	Tot_CSD
Calathus (Neocalathus) cinctus	1.200,46	49,70	235,12	4,39	1.489,68
Laemostenus (Pristonychus) algerinus algerinus	128,39	29,24	2,91	25,44	185,98
Pterostichus (Feronidius) melas italicus		116,60		30,63	147,23
Metallina (Neja) ambigua	46,43				46,43
Licinus (Licinus) punctatulus	24,53	1,96			26,49
Microlestes luctuosus	19,04		0,79	2,58	22,40
Syntomus barbarus	8,78		7,21	2,58	18,57
Carabus (Macrothorax) morbillosus alternans	1,66	9,17		6,39	17,22
Asaphidion curtum curtum		16,12			16,12
Pterostichus (Platysma) niger niger		13,74			13,74
Platyderus (Platyderus) lombardii	2,63	3,45		2,08	8,16
Asaphidion rossii	0,98	5,66			6,64
Laemostenus (Laemostenus) barbarus	4,98			1,39	6,37
Calathus (Neocalathus) mollis	2,93		2,93		5,85
Microlestes fissuralis	3,90		1,07		4,98
Ocys harpaloides		4,22			4,22
Harpalus distinguendus	3,48				3,48
Notiophilus geminatus	3,24				3,24
Pseudoophonus (Pseudoophonus) rufipes		3,16			3,16
Amara (Celia) montana	2,55				2,55
Olisthopus elongatus			2,44		2,44
Trechus (Trechus) quadristriatus	2,44				2,44
Trechus (Trechus) rufulus		2,44			2,44
Platytarus faminii faminii		2,37			2,37
Carabus (Eurycarabus) faminii sabellai	2,26				2,26
Ditomus sphaerocephalus			2,15		2,15
Calathus (Bedelinus) circumseptus	0,98	0,98			1,95
Ophonus (Ophonus) ardosiacus	1,58				1,58
Calathus fuscipes graecus	1,57				1,57
Paradromius (Manodromius) linearis	1,46				1,46
Cymindis (Cymindis) laevistriata			1,15		1,15
Paranchus albipes		0,98			0,98
Philorhizus melanocephalus		0,98			0,98
Poecilus (Poecilus) cupreus cupreus		0,98			0,98
Syntomus fuscomaculatus	0,98				0,98
Broscus politus	0,79				0,79
Chlaenius (Claeinus) velutinus auricollis		0,79			0,79
Pseudomasoreus canigoulensis	0,79				0,79
Tot_CSD	1.466,81	262,50	255,77	75,49	2.060,57
Nb species	**24**	**18**	**9**	**8**	**38**

Tab. 5.1.3 - Trends in catches of Coleoptera Carabidae at each station expressed as CSD.

The analysis of the table 5.1.4 and fig. 5.1.2 shows how the station **AC** present a very sharp peak frequencies of capture (equivalent to 71.18% of total), while the station **Ci** and **Ol** show similar value of about 12% of the total, and the station **Tk** show the lowest values with 3,66%.

Regarding the table 5.1.3 one can observe that just 2 species, *Calathus* (*Neocalathus*) *cinctus* and *Laemostenus* (*Pristonychus*) *algerinus algerinus,* resulted present in all the stations; 4 species are present in three stations: *Carabus* (*Macrothorax*) *morbillosus alternans* and *Platyderus* (*Platyderus*) *lombardii* in **AC**, **Ci** and **Tk**, *Microlestes luctuosus* and *Syntomus barbarus* in **AC**, **Ol** and **Tk**. The other species are present in only one or two stations.

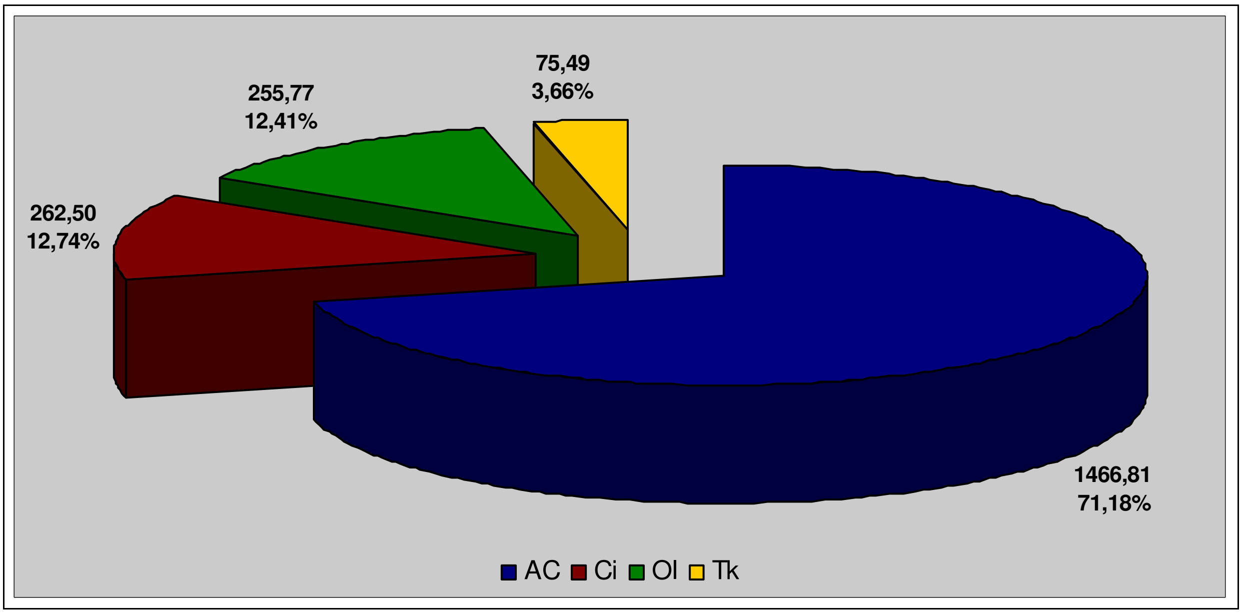
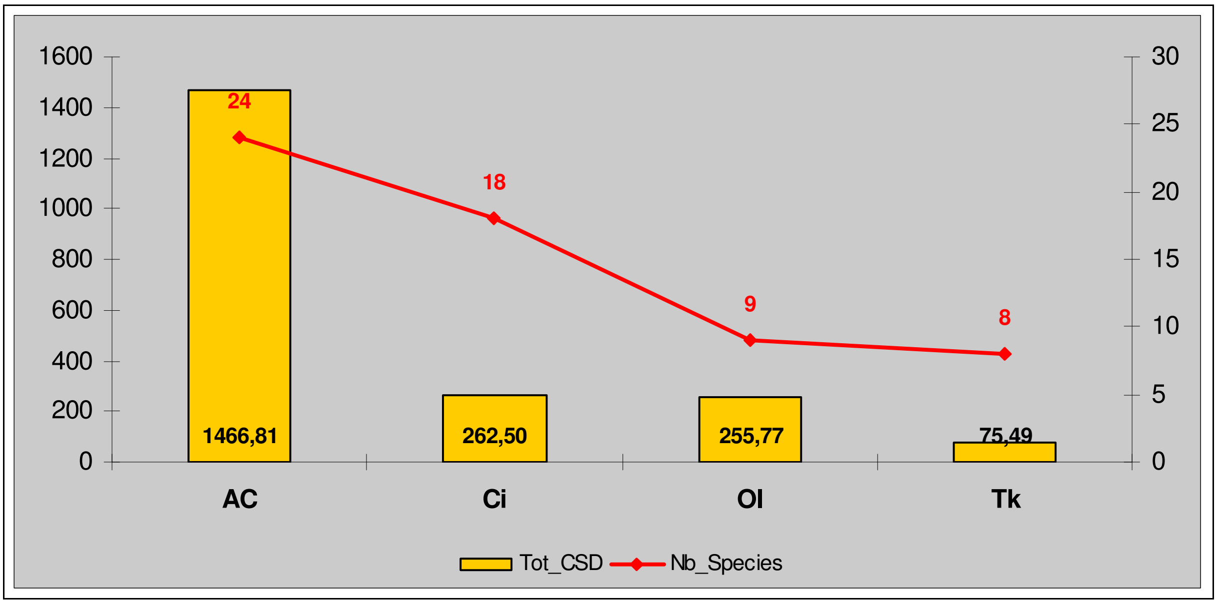


Fig. 5.1.2 – Frequency of capture of Coleoptera Carabidae in the stations and their percentage of the total value of CSD.

Considering the general trend of the capture frequency of Coleoptera Carabidae within the stations and the number of species sampled (graph. 5.1.1) is observed that the greatest number of species (**24**) has been surveyed in the **AC** station and the minimum (**8**) in **Tk** station, passing through the stations **Ci** (**18**) and **Ol** (**9**).



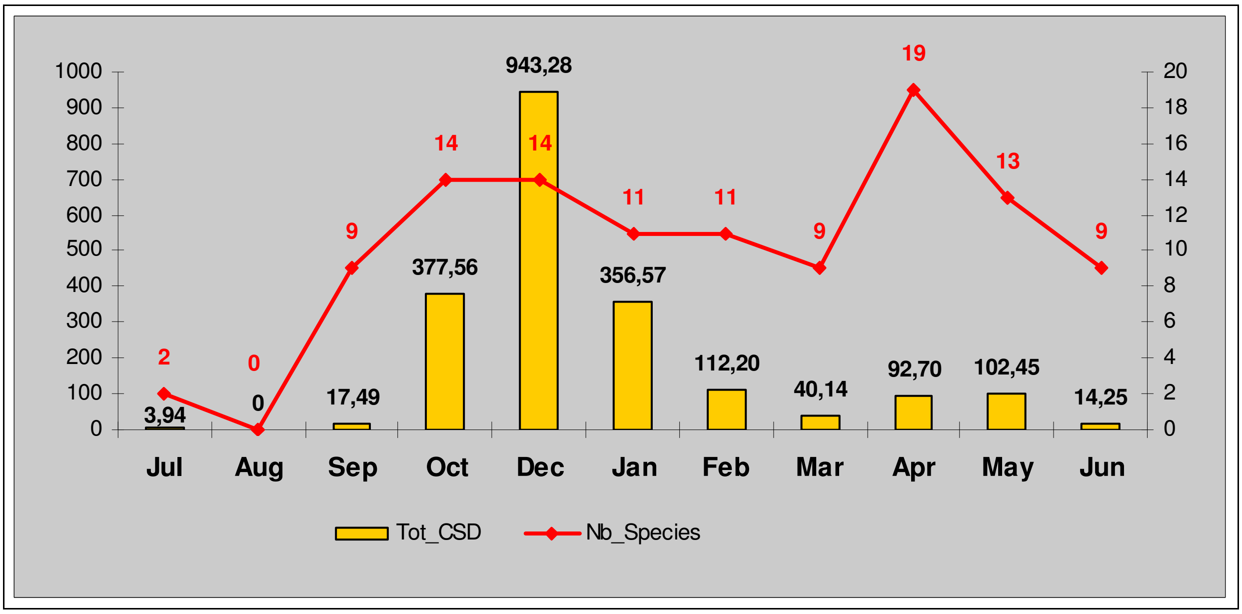
Graph. 5.1.1 - Overall trend of catches of Coleoptera Carabidae (Tot_CSD) and number of species (Nb_species) sampled at each station.

Looking at the trend of frequency of capture of species (reported without the subgenus) distributed in the single sampling periods (tab. 5.1.4 and graph. 5.1.2), we observe that the 81.4% of catches is concentrated in the months of October and January. The period between June and September registers the minimum values for CDS; to notice is that in August was not recorded any specimen of Carabidae.

Regarding the number of species, the highest (**19** of **38**) is recorded in April. In the other months the number of species is much lower with the minimum, excluding August, in July

SPECIE	Jul	Aug	Sep	Oct	Dec	Jan	Feb	Mar	Apr	May	Jun	Tot_CSD
Calathus cinctus	2,15		2,84	211,26	852,81	288,51	65,27	14,95	27,32	23,42	1,14	1.489,68
Laemostenus algerinus			2,10	45,94	50,04	41,51	30,39	4,60	5,85	4,39	1,14	185,98
Pterostichus melas italicus			1,58	91,50	16,59	7,73	2,61	7,42	7,81	8,78	3,22	147,23
Metallina ambigua				2,36					19,52	23,42	1,14	46,43
Licinus punctatulus				5,69	9,76	5,15	2,61	2,30	0,98			26,49
Microlestes luctuosus			1,58	0,79			0,87		1,95	16,10	1,12	22,40
Syntomus barbarus					0,98	1,29	0,87	1,15	2,93	10,25	1,12	18,57
Carabus morbillosus alternans	1,79		1,49	0,79			2,61	3,71	3,90	2,93		17,22
Asaphidion curtum						2,58	2,61		2,93	5,85	2,15	16,12
Pterostichus niger				12,76	0,98							13,74
Platyderus lombardii				0,79		4,65	1,74		0,98			8,16
Asaphidion rossii								3,71	2,93			6,64
Laemostenus barbarus					2,37	1,29	1,74		0,98			6,37
Calathus mollis									5,85			5,85
Microlestes fissuralis									3,90		1,07	4,98
Ocys harpaloides				0,98	1,95	1,29						4,22
Harpalus distinguendus							0,87	1,15		1,46		3,48
Notiophilus geminatus					1,95	1,29						3,24
Pseudoophonus rufipes			3,16									3,16
Amara montana				1,57	0,98							2,55
Olisthopus elongatus									0,98	1,46		2,44
Trechus quadristriatus					0,98					1,46		2,44
Trechus rufulus									0,98	1,46		2,44
Platytarus faminii			2,37									2,37
Carabus faminii sabellai					0,98	1,29						2,26
Ditomus sphaerocephalus											2,15	2,15
Calathus circumseptus					1,95							1,95
Ophonus ardosiacus			1,58									1,58
Calathus fuscipes graecus				1,57								1,57
Paradromius linearis										1,46		1,46
Cymindis laevistriata								1,15				1,15
Paranchus albipes									0,98			0,98
Philorhizus melanocephalus					0,98							0,98
Poecilus cupreus									0,98			0,98
Syntomus fuscomaculatus									0,98			0,98
Chlaenius velutinus auricollis			0,79									0,79
Broscus politus				0,79								0,79
Pseudomasoreus canigoulensis				0,79								0,79
Tot_CSD	**3,94**		**17,49**	**377,56**	**943,28**	**356,57**	**112,20**	**40,14**	**92,70**	**102,45**	**14,25**	**2.060,57**
Nb_species	**2**	**0**	**9**	**14**	**14**	**11**	**11**	**9**	**19**	**13**	**9**	**38**

Tab. 5.1.4 - Trends in capture rates of species of Coleoptera Carabidae spread over the individual sampling periods.

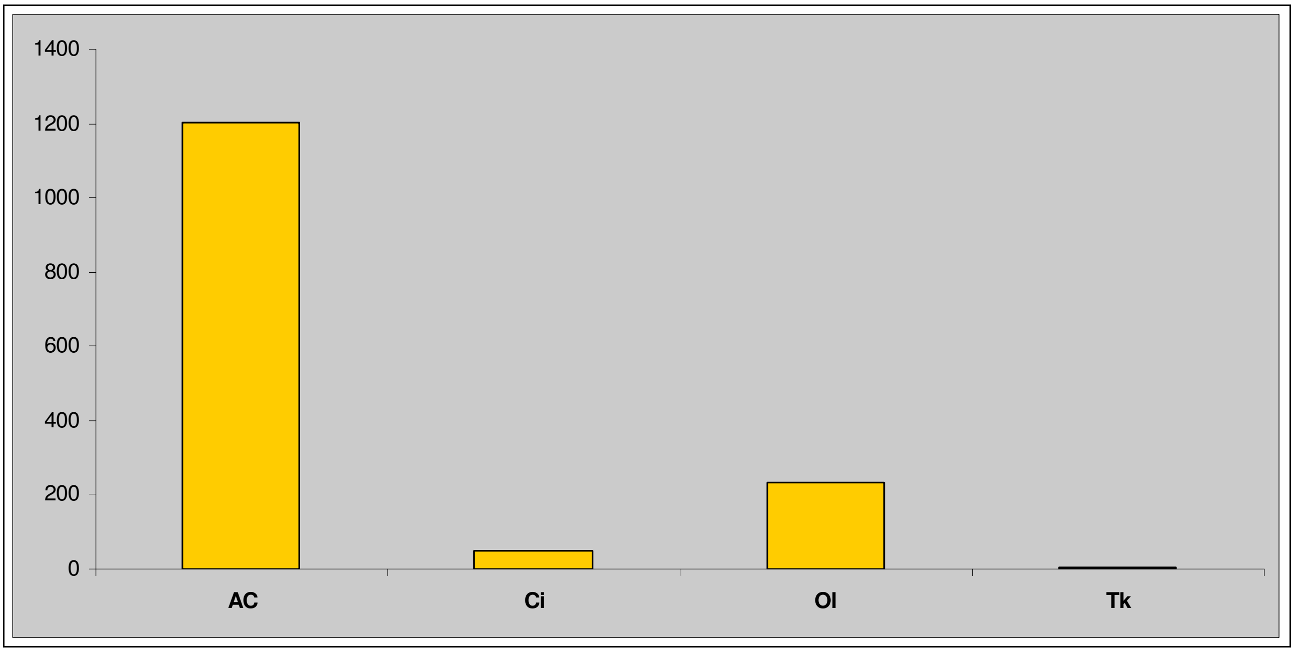


Graph. 5.1.2 - Trends in capture frequencies (CSD) of Coleoptera Carabidae in individual sampling periods and number of species sampled.

The Spearman rank correlation analysis for these series (number of catches per month and number of species per month) returns a value of $r_s = 0,82$ with $p < 0,05$, which suggests a positive relationship between the trend of the two sequences.
Below are considered the most abundant sampled species of Carabidae in relation to their distribution in the stations and their frequency of capture during the sampling year.

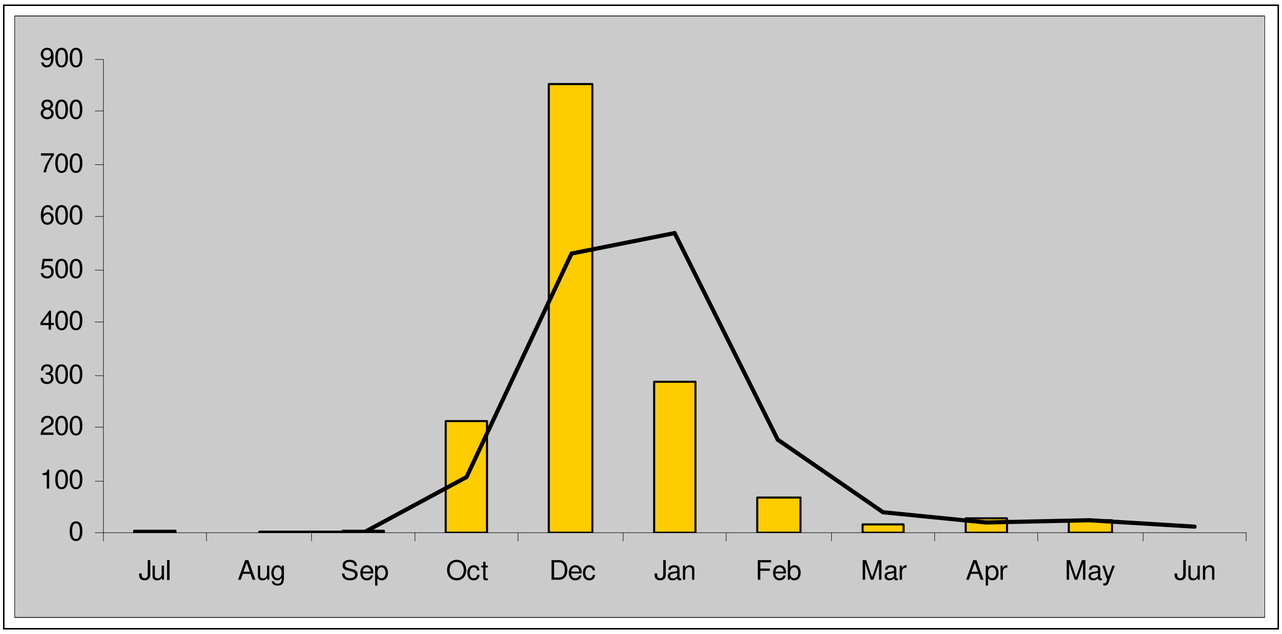
Calathus (*Neocalathus*) *cinctus*

This is the species with the highest value of CSD, which represents just over 72% of the entire sample of Coleoptera Carabidae. Were surveyed specimens of this species in all stations, but 80,5% of the catch was recorded in the **AC** station, while a clear minimum (0,3% of total) is found in the station **Tk** (graph. 5.1.3).



Graph. 5.1.3 - Trend of capture frequency (CSD) for *Calathus* (*Neocalathus*) *cinctus* within the single station.

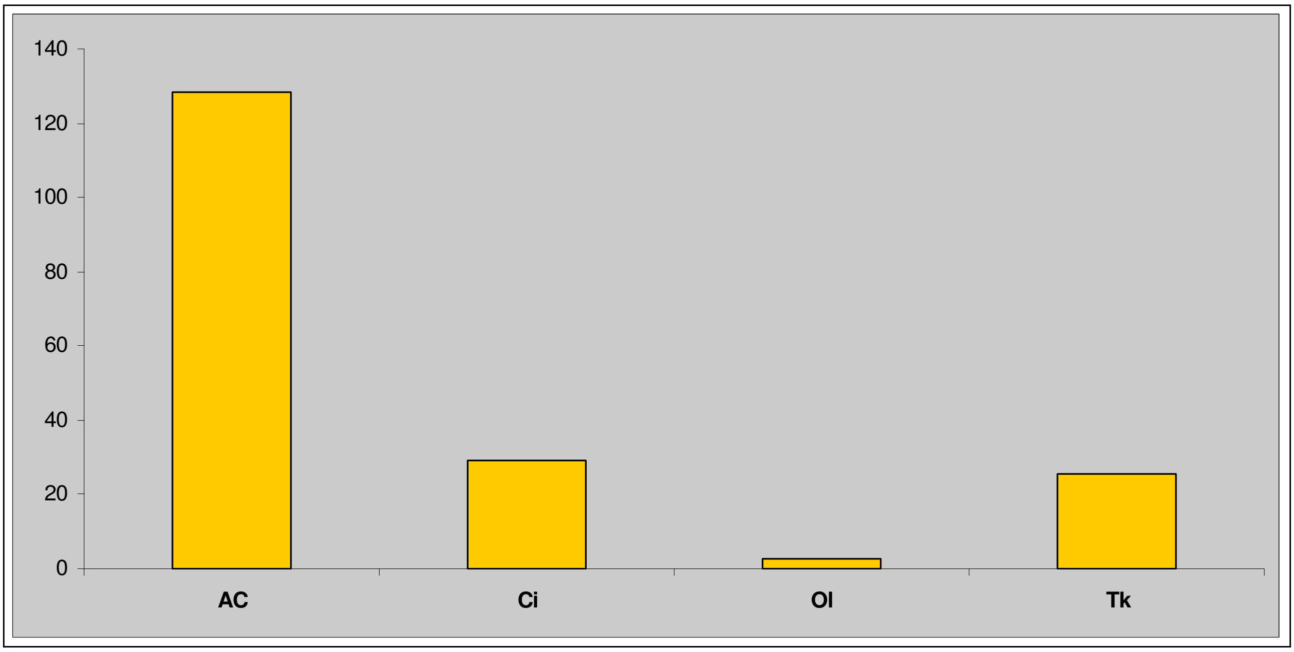
The frequency trend of its capture in the sampling period (graph. 5.1.4) shows that more than 90% of them are concentrated between October and January, with a sharp peak in the month of December (57,2%) and that are significantly lower in other months, with little or null value (August) in the months between June and September.



Graph. 5.1.4 - Trends in capture frequencies (CSD) of *Calathus* (*Neocalathus*) *cinctus* in individual sampling periods.

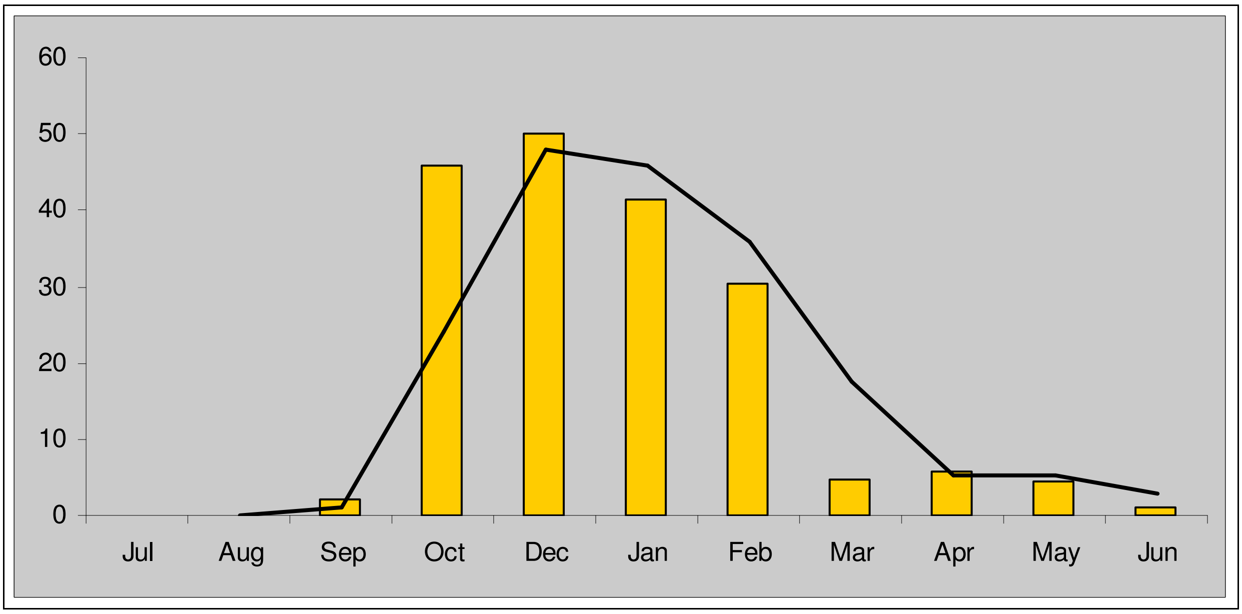
Laemostenus* (*Pristonychus*) *algerinus algerinus

This is the species with the second value of CSD, which represents more than 9% of the Coleoptera Carabidae sampling. Were surveyed specimens of this species in all stations, but 69% of captures was recorded in station **AC**, while the minimum is found in the station **Ol** (1,5%) (graph. 5.1.5).



Graph. 5.1.5 - Trend of capture frequency (CSD) for *Laemostenus* (*Pristonychus*) *algerinus algerinus* the single station.

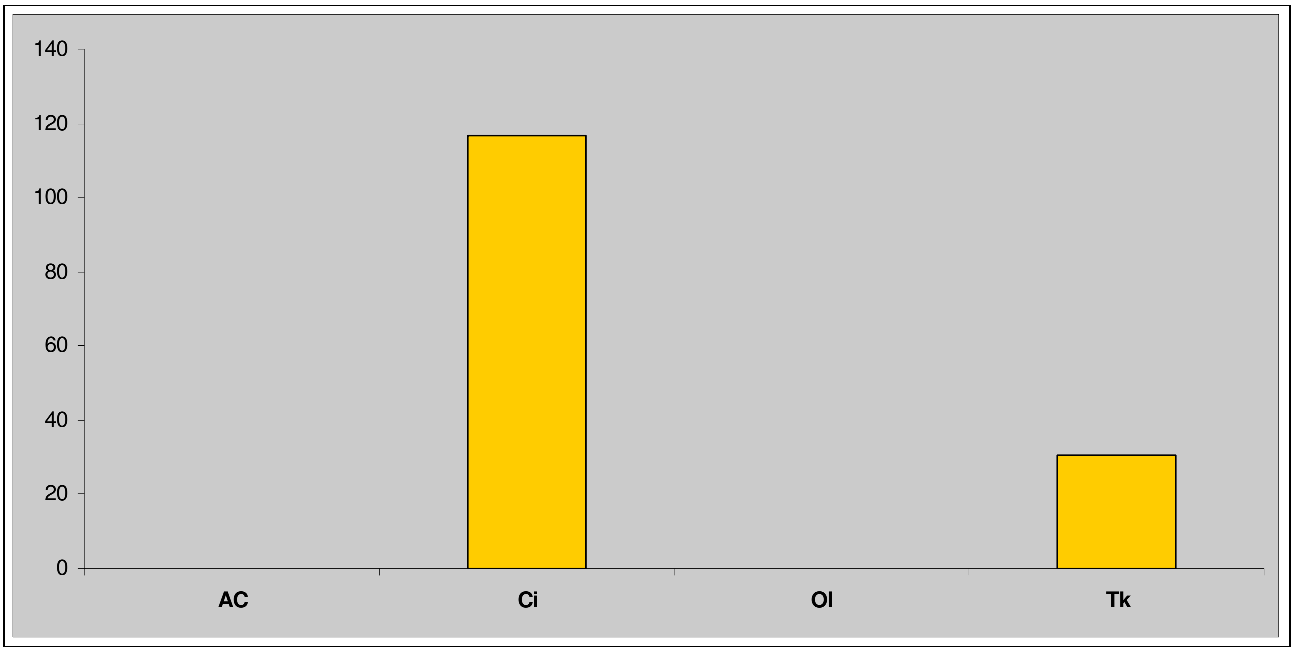
The frequency trend of its capture in the sampling period (graph. 5.1.6) shows that more than 90% of them are concentrated between October and February, with a maximum value in the month of December (27%) and that are significantly lower in the other months with little or null (July and August) value in the months between June and September.



Graph. 5.1.6 - Trends in capture frequencies (CSD) of *Laemostenus* (*Pristonychus*) *algerinus algerinus* in individual sampling periods.

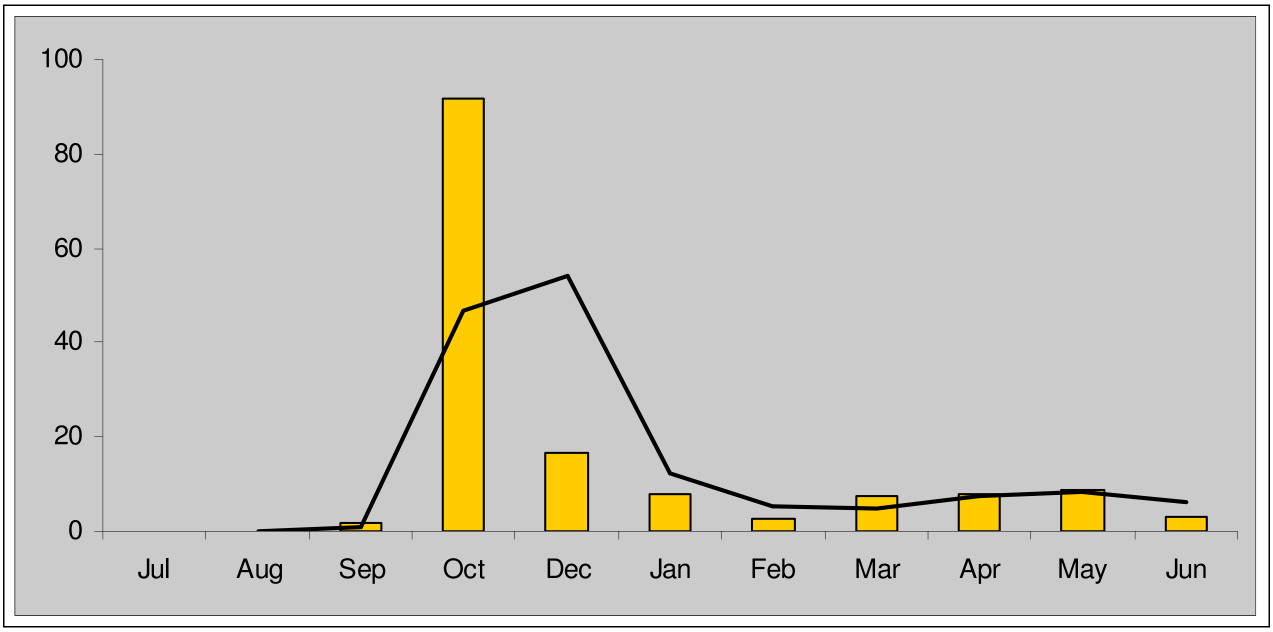
Pterostichus* (*Feronidius*) *melas italicus

This is the species with the third value of CSD, which represents about 7,1% of the entire sample of Coleoptera Carabidae. Specimens of this species have been registered only in stations **Ci** (79% of capture frequencies) and **Tk** (graph. 5.1.7).



Graph. 5.1.7 - Trend of capture frequency (CSD) for *Pterostichus* (*Feronidius*) *melas italicus* within the single station.

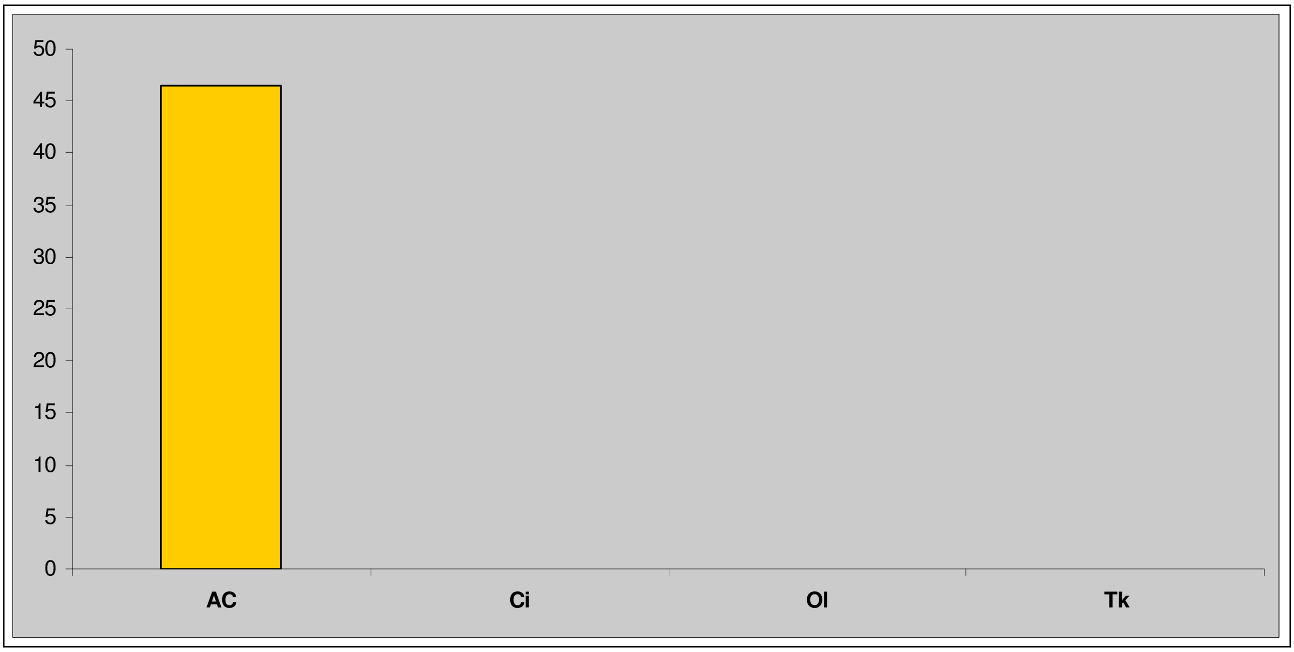
The frequency trend of its capture in the sampling period (graph. 5.1.8) shows that more than 62% of them are concentrated in October and that are significantly lower in other months and null in July and August.



Graph. 5.1.8 - Trends in capture frequencies (CSD) of *Pterostichus* (*Feronidius*) *melas italicus* in individual sampling periods.

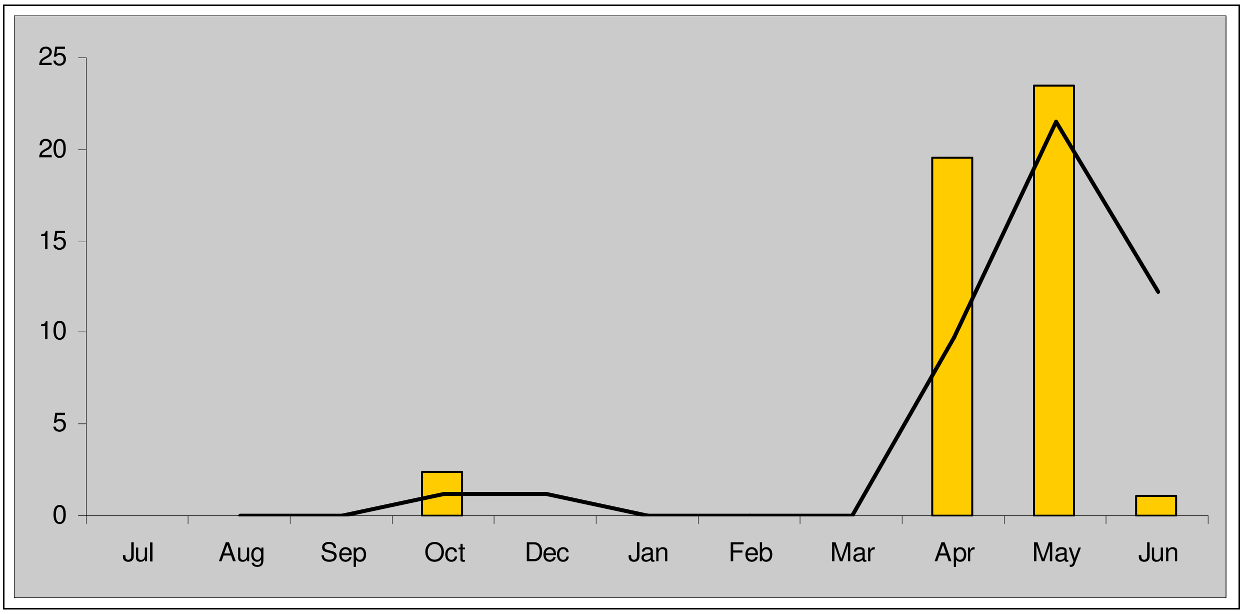
Metallina (*Neja*) *ambigua*

It presents the fourth CSD value, which corresponds to more than 2,2% of the entire sample of Coleoptera Carabidae. The species was recorded just for **AC** station (graph. 5.1.9).



Graph. 5.1.9 - Trend of capture frequency (CSD) for *Metallina* (*Neja*) *ambigua* within the single station.

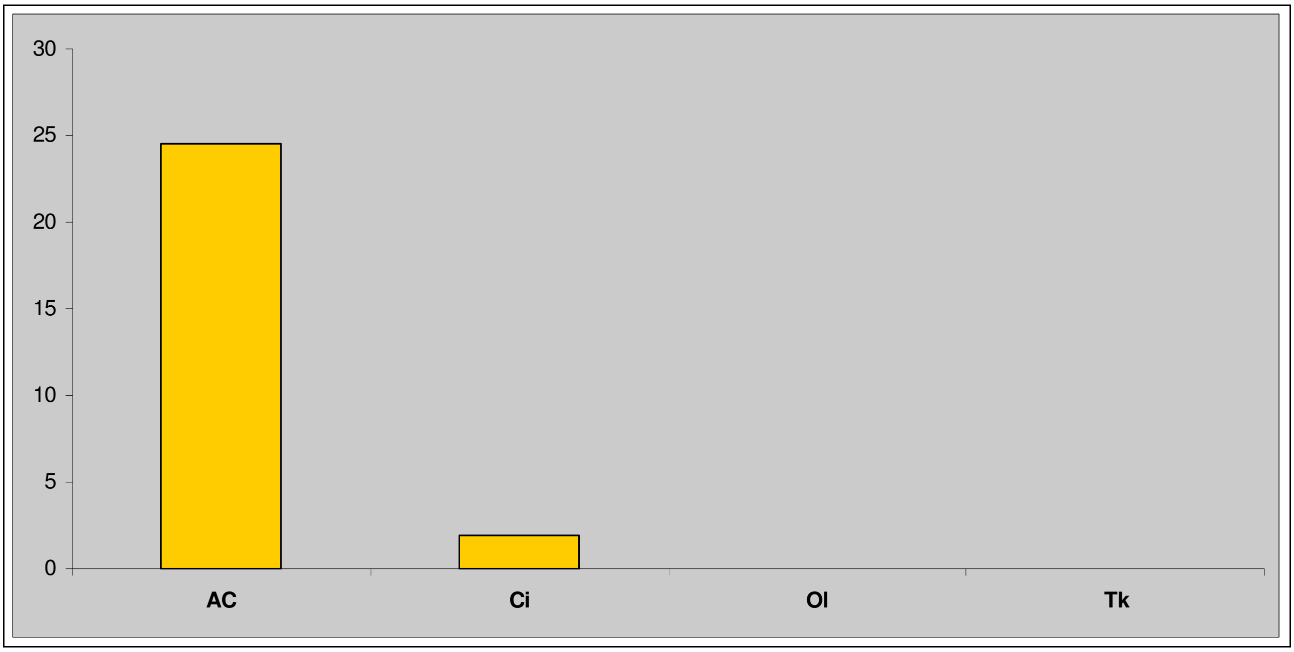
The trapping frequencies in the sampling period are concentrated (92%) in April and May (graph. 5.1.10). The species is absent in all other months except for June and October, in which there are, however, not significant values of CDS.



Graph. 5.1.10 - Trends in capture frequencies (CSD) of *Metallina* (*Neja*) *ambigua* in individual sampling periods.

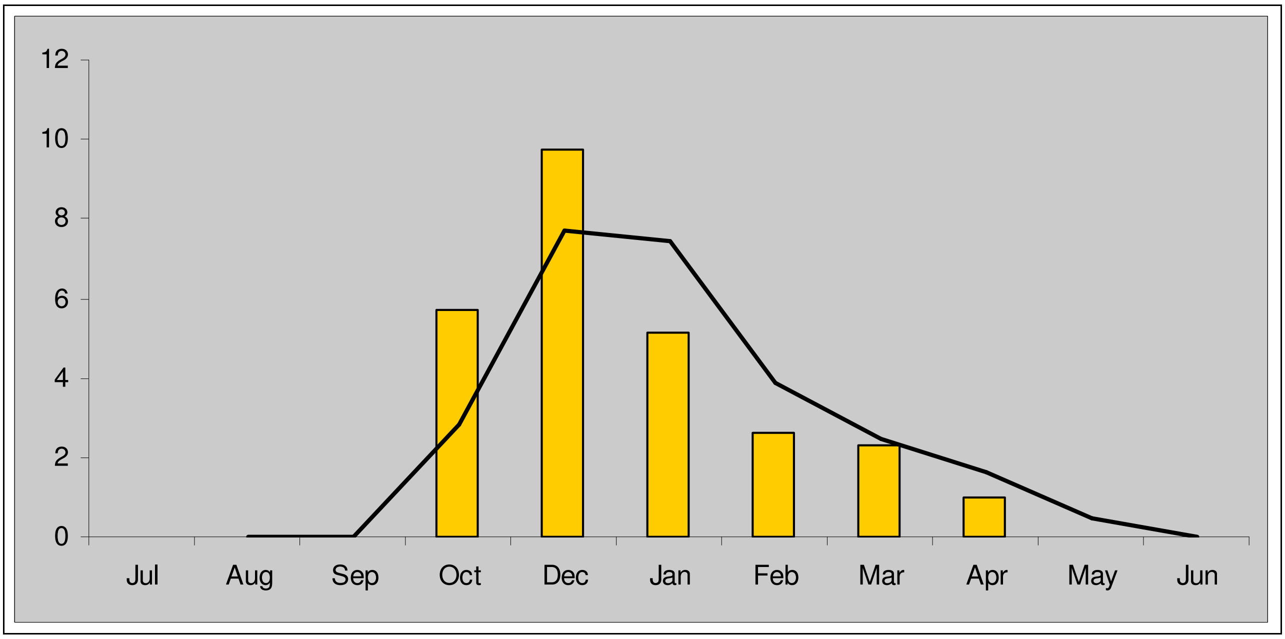
Licinus (*Licinus*) *punctatulus*

It presents the fifth CSD value, which corresponds to 1,28% of the entire sample of Coleoptera Carabidae. The species was recorded just for **AC** and **Ci** stations (graph. 5.1.11), with a clear CSD peak (92,6%) in **AC** station.



Graph. 5.1.11 - Trend of capture frequency (CSD) for *Licinus* (*Licinus*) *punctatulus* within the single station.

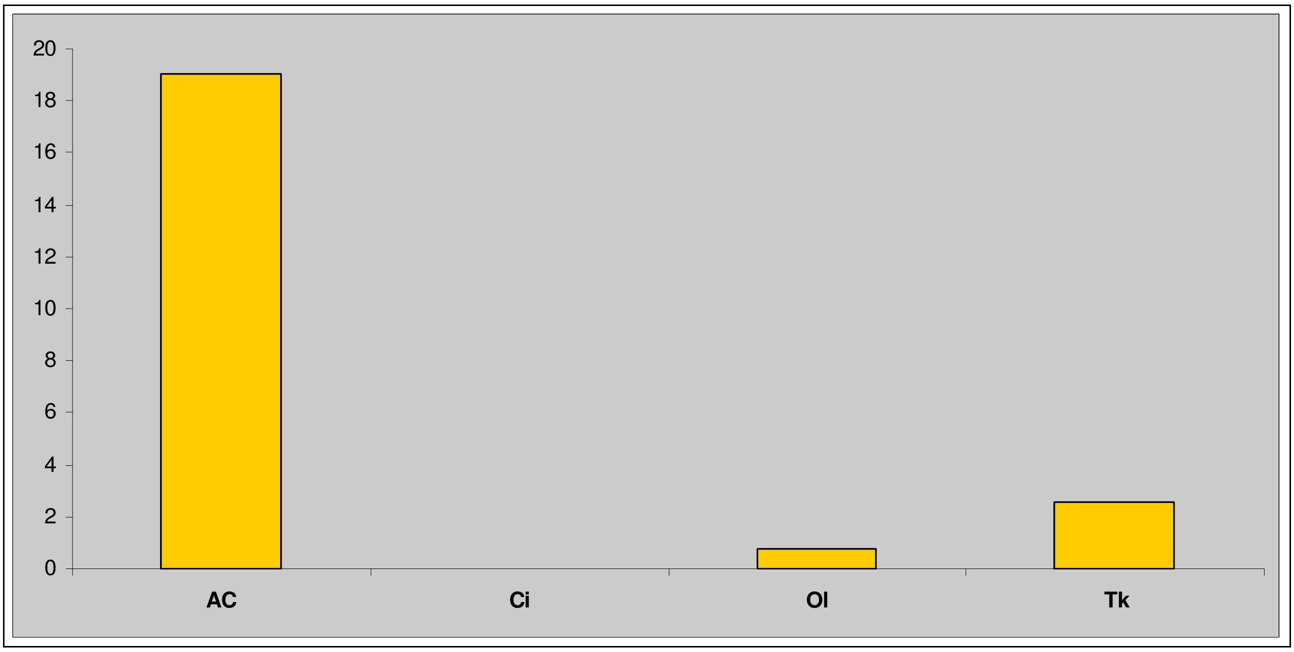
The frequency trend of its capture in the sample period (graph. 5.1.12) shows that more than 90% of them are concentrated between October and February, with the highest value in the month of December (27%) and that are significantly lower in other months, with null values in the months between May and September.



Graph. 5.1.12 - Trends in capture frequencies (CSD) of *Licinus* (*Licinus*) *punctatulus* in individual sampling periods.

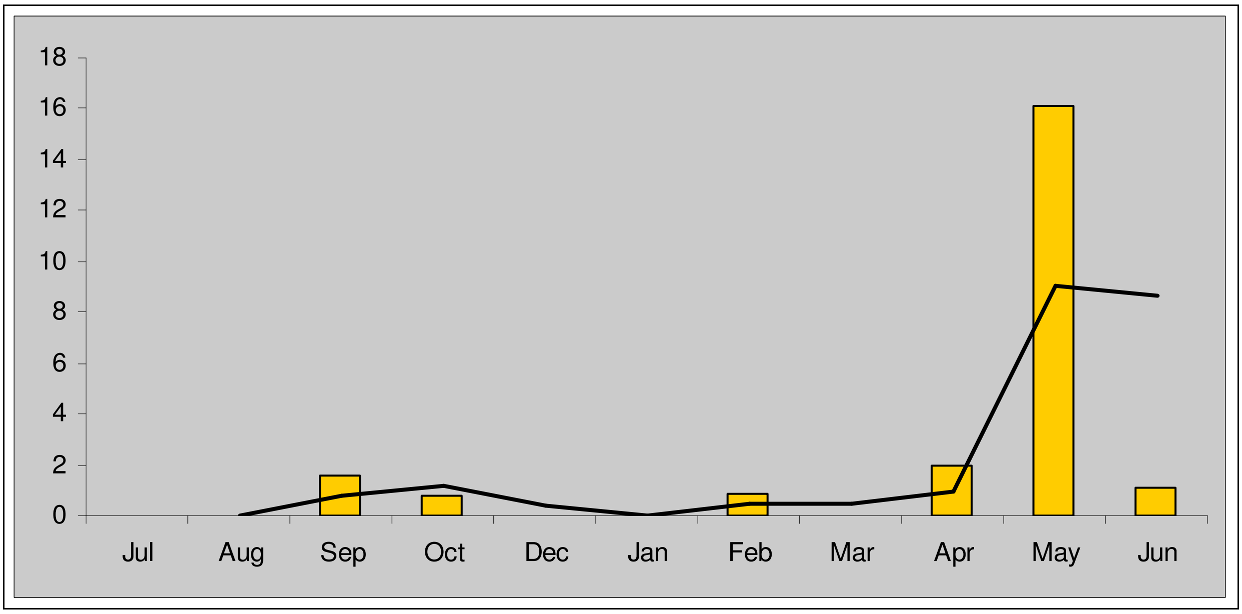
Microlestes luctuosus

It presents the sixth CSD value, which corresponds to 1,1% of the entire sample of Coleotteri Carabidae. The species was not recorded in **Ci** stations (graph. 5.1.13). It shows a clear peak of CSD value (85%) in **AC** station.



Graph. 5.1.13 - Trend of capture frequency (CSD) for *Microlestes luctuosus* within the single station.

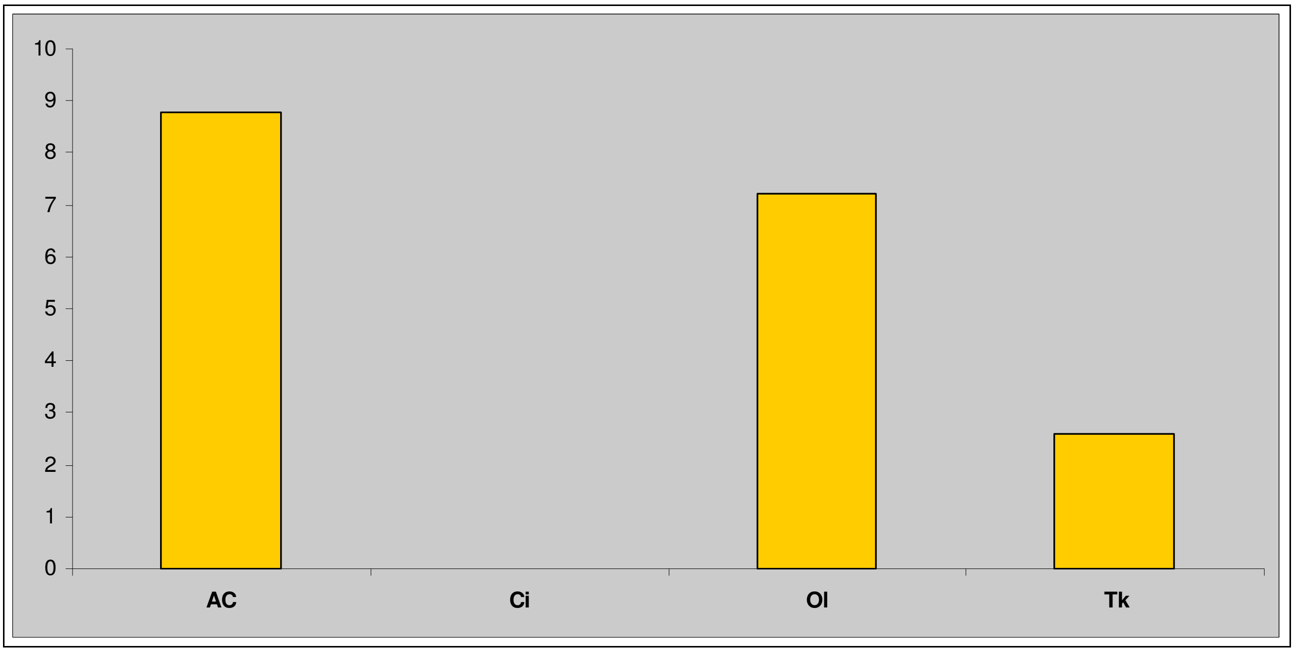
The frequency trend of its capture in the sample period (graph. 5.1.14), shows that more than 71% of them are concentrated in May and that are significantly lower in other months, with null values in the months of January, March, July , August and December.



Graph. 5.1.14 - Trends in capture frequencies (CSD) of *Microlestes luctuosus* in individual sampling periods.

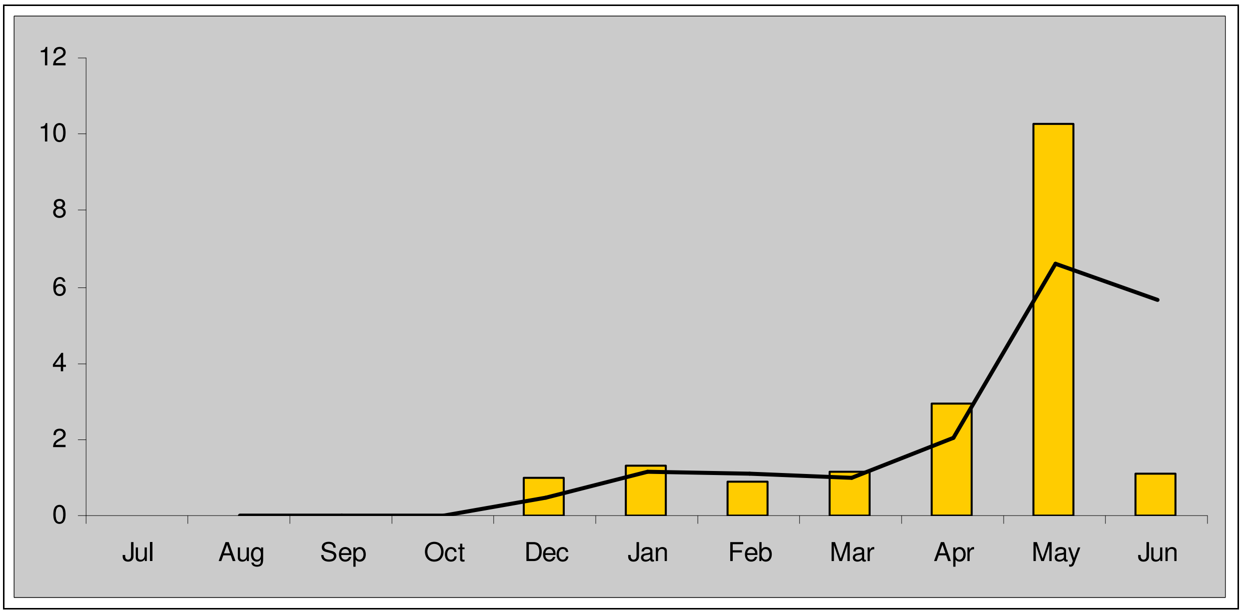
Syntomus barbarus

It presents the seventh CSD value, which represents approximately 0,9% of the entire sample of Coleoptera Carabidae. The species was not sampled in **Ci** station (graph. 5.1.15), while in other stations shows significant values of CSD with the highest value (47,2% of total) in the station **AC**.



Graph. 5.1.15 - Trend of capture frequency (CSD) for *Syntomus barbarus* within the single station.

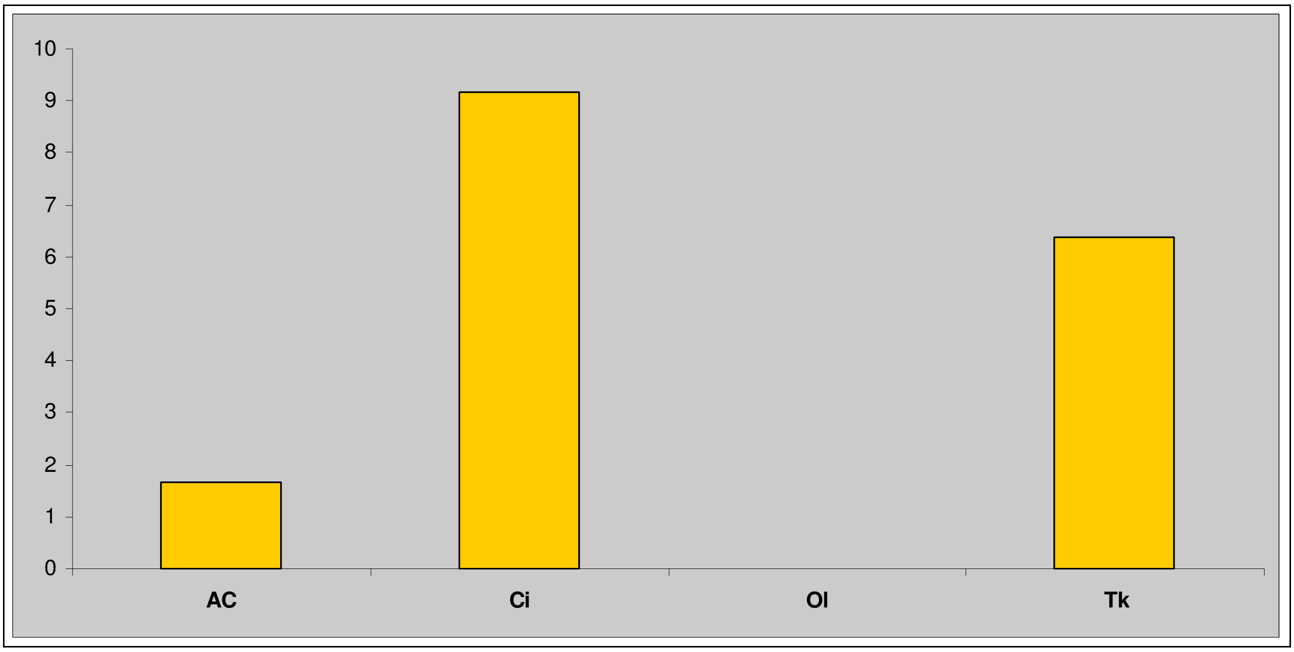
The frequency trend of its capture in the sample period (graph. 5.1.16), shows that more than 55,1% of them are concentrated in May and that are significantly lower in other months, with null values between July and October.



Graph. 5.1.16 - Trends in capture frequencies (CSD) of *Syntomus barbarus* in individual sampling periods.

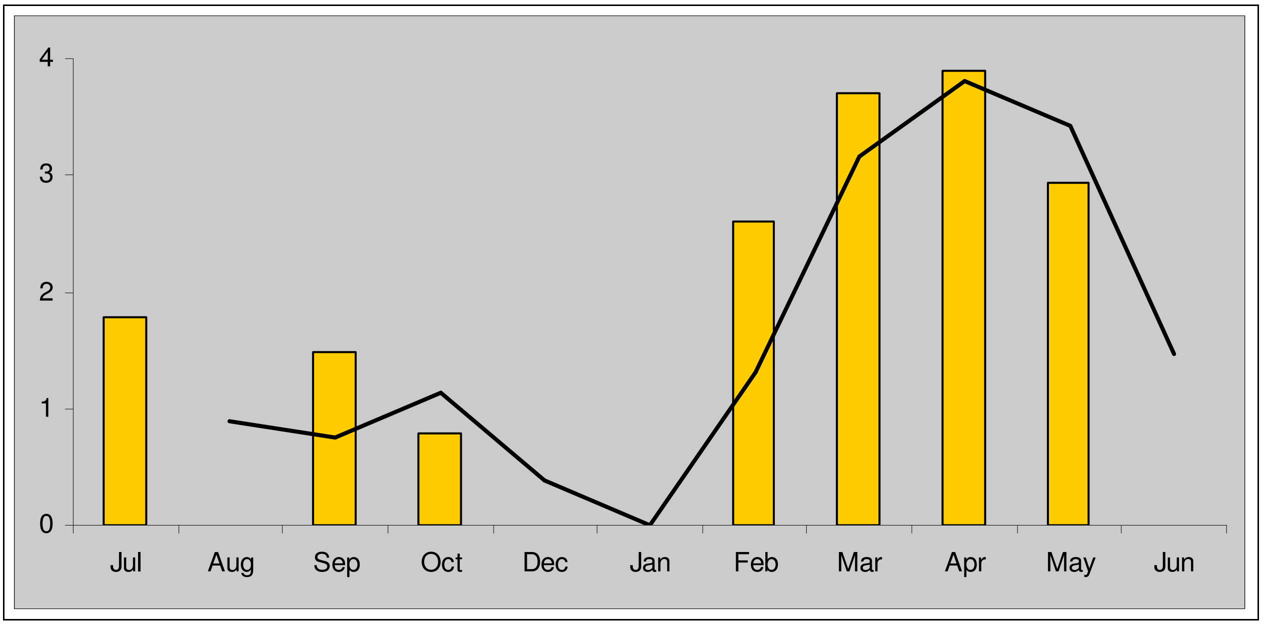
Carabus (*Macrothorax*) *morbillosus alternans*

It presents the eighth value of CSD, which represents more than 0,8% of the entire sample of Coleoptera Carabidae. The species was not sampled in **Ol** station, while it shows significant values of CSD in stations **Ci** (53,2% of total) and **Tk** (37,1% of total) (graph. 5.1.17).



Graph. 5.1.17 - Trend of capture frequency (CSD) for *Carabus* (*Macrothorax*) *morbillosus alternans* within the single station.

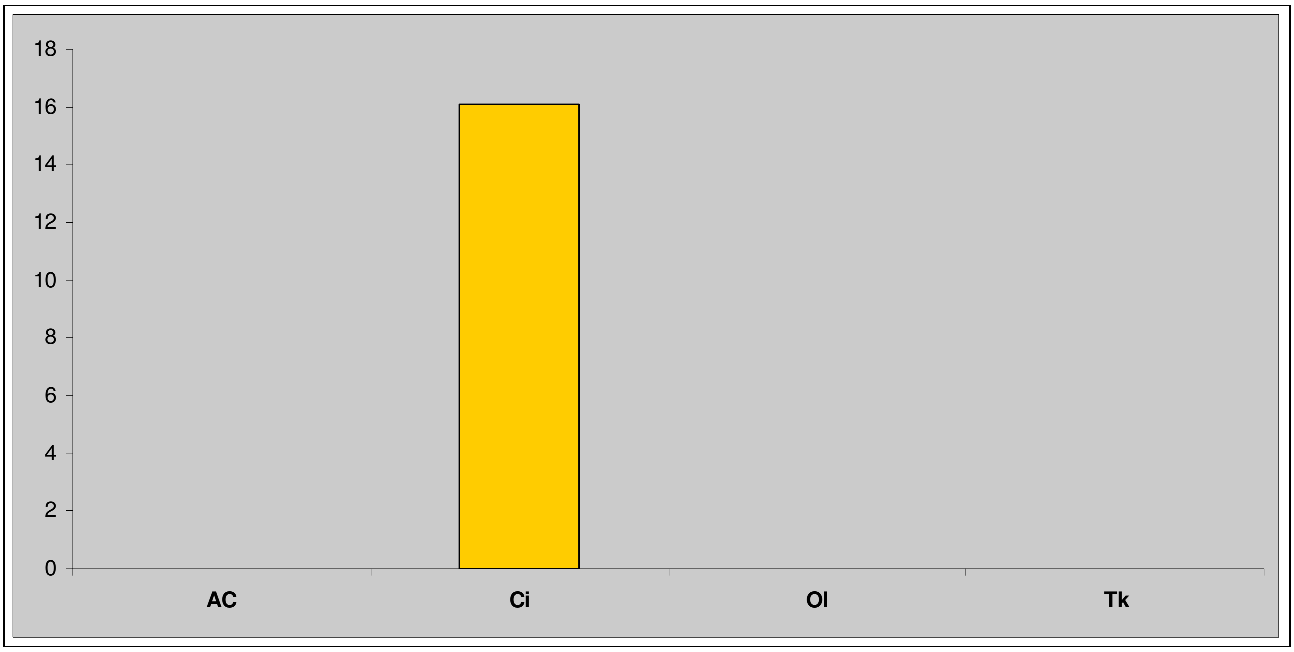
The trend of the capture frequencies in the sample period (graph. 5.1.18) shows that more than 76,3% is concentrated between February and May, with the highest value in April, and are lower in the other months, with null values in January, June, August and December.



Graph. 5.1.18 - Trends in capture frequencies (CSD) of *Carabus* (*Macrothorax*) *morbillosus alternans* in individual sampling periods.

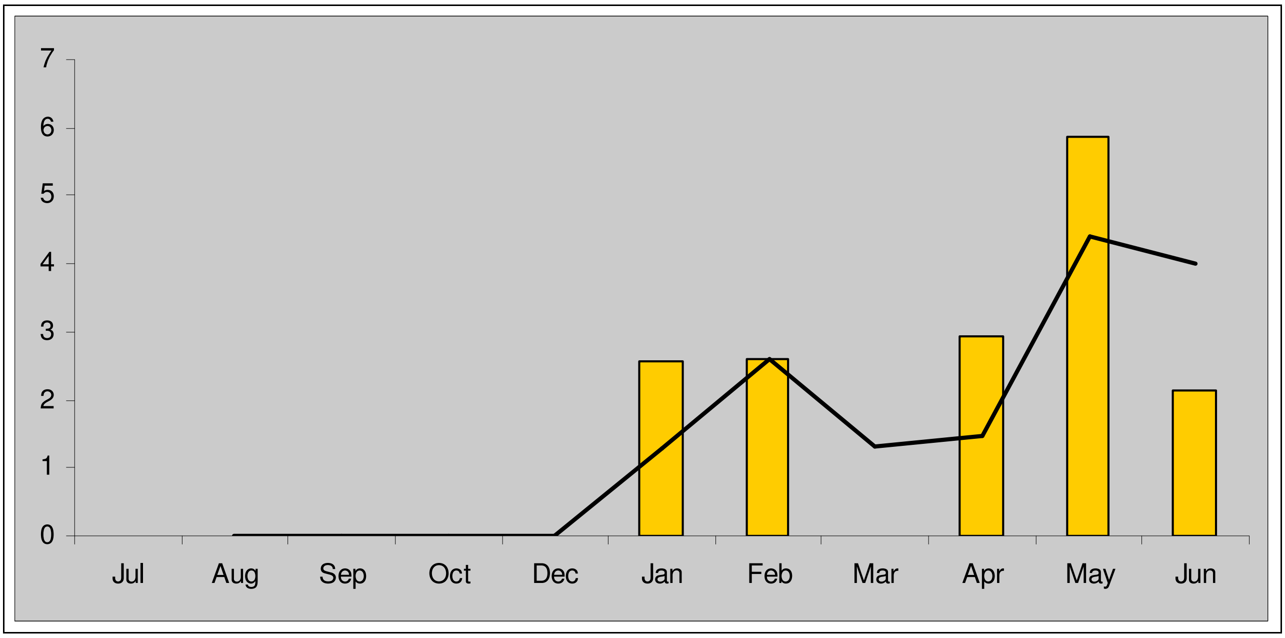
Asaphidion curtum curtum

It shows the ninth CSD value, with 0,78% of the entire sample of Coleoptera Carabidae. The species was sampled just at the station **Ol** (graph. 5.1.19).



Graph. 5.1.19 - Trend of capture frequency (CSD) for *Asaphidion curtum curtum* within the single station.

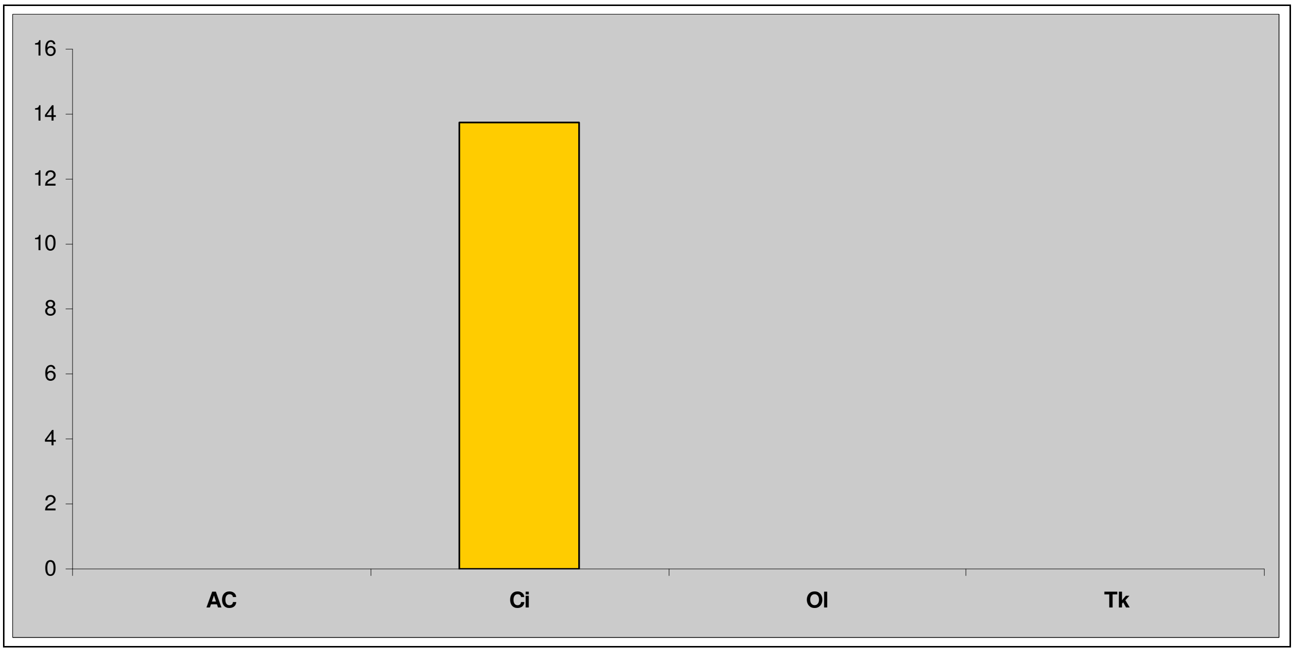
The trend of the capture frequencies in the sample period (graph. 5.1.20) shows that they are concentrated between April and June, with the highest value in May. The species is absent in the other months except January and February.



Graph. 5.1.20 - Trends in capture frequencies (CSD) of *Asaphidion curtum curtum* in individual sampling periods.

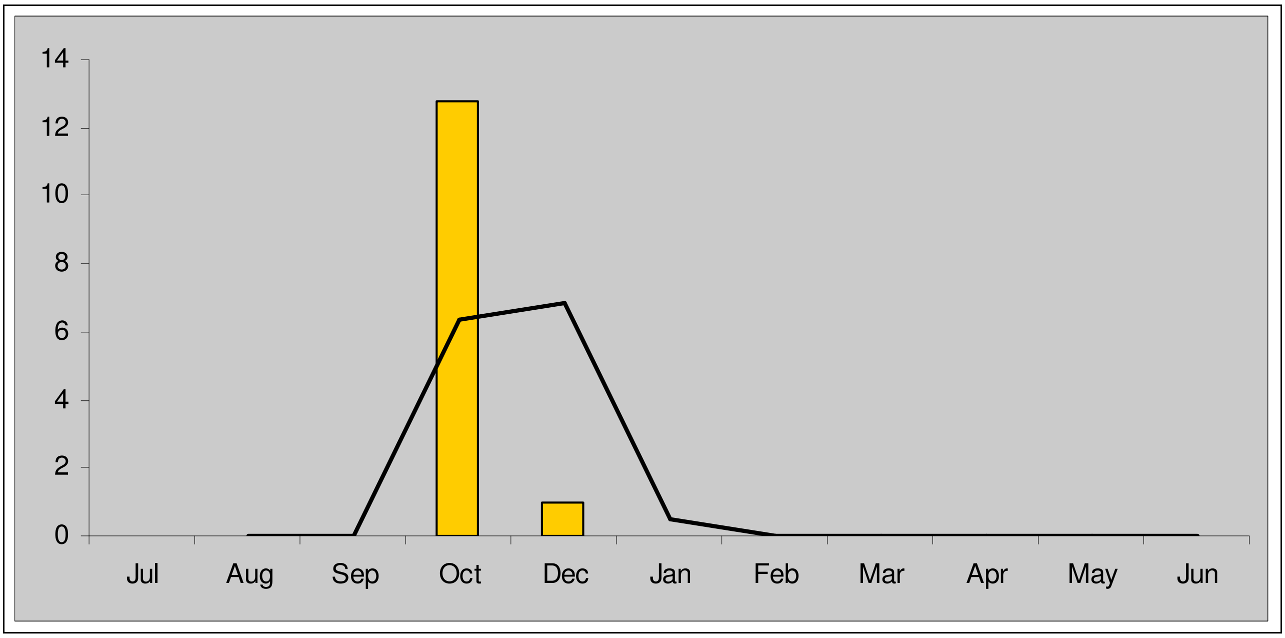
Pterostichus (*Platysma*) *niger niger*

It shows the tenth CSD value, with 0,65% of the entire sample of Coleoptera Carabidae. The species was sampled just at the station **Ci** (graph. 5.1.21).



Graph. 5.1.21 - Trend of capture frequency (CSD) for *Pterostichus* (*Platysma*) *niger niger* within the single station.

The trend of the capture frequencies in the sample period (graph. 5.1.22) shows that the species has been sampled only in October, with approximately 93% of the total value of the CDS, and in December.



Graph. 5.1.22 - Trends in capture frequencies (CSD) of *Pterostichus* (*Platysma*) *niger niger* in individual sampling periods.

5.2 COLEOPTERA TENEBRIONIDAE

In total were surveyed a total of **26** species and subspecies of Coleoptera Tenebrionidae that are reported in table 5.2.1.

For the nomenclature, reference is made to the checklist of the Italian fauna (GARDINI 1995) modified according ALIQUÒ & SOLDATI (2010) and updated to January 2011 according to the Checklist of Tenebrionidae of Fauna Europaea Project (FATTORINI 2011).

For chorological categories it was referred to VIGNA TAGLIANTI et alii 1992 and ALIQUÒ & SOLDATI (2010). The distribution in Italy is taken from the checklist of the Italian fauna (GARDINI 1995) updated according to the project CKmap (GARDINI 2004).

	Species	**Chorology**	**Italy**
	Akis spinosa spinosa (Linnaeus 1864)	EME	S Si
	Allophylax picipes (Olivier 1811)	WME	S Si
E	*Alphasida grossa sicula* (Solier 1836)	WME (end. SE-sic.)	Si
	Catomus consentaneus (Kuster 1851)	MED	S Si Sa
	Catomus rotundicollis (Guérin-Méeneville 1825)	WME	N S Si Sa
	Cnemeplatia atropos atropos A. Costa 1847	SCO	N S Si
	Crypticus gibbulus (Quensel 1806)	MED	S Si Sa
	Dendarus lugens (Mulsant & Rey 1854)	WME	S Si
	Dichillus pertusus (Kiesenwetter 1861)	EME	S Si
E	*Dichillus socius* Rottenberg 1870	WME (end. sic.)	Si
E	*Erodius siculus siculus* Solier 1834	EME (end. sic.)	Si
	Gonocephalum rusticum (Olivier 1811)	TUM	N S Si Sa
	Nalassus aemulus aemulus (Kuster 1850)	WME	S Si
	Opatroides punctulatus punctulatus Brullé 1832	AFI	S Si Sa
	Pachychila dejeani dejeani Besser 1832	NAF	S Si
	Pedinus helopioides Ahrens 1814	EME	S Si
E	*Pimelia rugulosa sublaevigata* Solier 1836	WME (end. sic.)	Si
E	*Probaticus tomentosus* Reitter 1906	WME (end. sic.)	Si
	Scaurus atratus Fabricius 1775	WME	N S Si Sa
	Scaurus striatus Fabricius 1792	SEU	N S Si Sa
	Scaurus tristis Olivier 1795	MED	S Si Sa
E	*Stenosis melitana* Reitter 1894	WME (end. sic.)	Si
	Stenosis sardoa sardoa (Kuster 1848)	WME	N S Si Sa
	Tentyria grossa grossa Besser 1832	MED	S Si
	Tentyria laevigata laevigata Steven 1829	WME (end. sic-appenn.)	S Si
	Zophosis punctata punctata Brullé 1832	CEM	S Si Sa

Tab. 5.2.1 – List of species and subspecies of Tenebrionidae surveyed. In the first column with letter E are indicated the endemic sicilian taxa. For each taxon is also reported the chorological category and distribution in Italy following the symbology used in the checklist of the Italian fauna. For further explanations and clarifications please refer to the text.

Six taxa, *Alphasida grossa sicula* (Solier 1836), *Dichillus socius* Rottenberg 1870, *Erodius siculus siculus* Solier 1834, *Pimelia rugulosa sublaevigata* Solier 1836, *Probaticus tomentosus* Reitter 1906 *Stenosis melitana* Reitter 1894 are sicilian endemism.

Alphasida grossa sicula (Solier 1836)

The subspecies is endemic in eastern Sicily, while the nominal subspecies is reported for southern Calabria, northern and western Sicily, Aeolian Islands (Lipari, Stromboli, Panarea, Salina), island of Ustica, Egadi Islands and island of Pantelleria, while for the Maltese Islands is reported *Alphasida grossa melitana* Reitter 1894 (ALIQUÒ & LEO 1999; ALIQUÒ & SOLDATI 2010).

Dichillus socius Rottenberg 1870

Rare species known only for few locations in southern Sicily (Agrigento, Marina di Ragusa, Foce del fiume Belice) (ALIQUÒ & SOLDATI 2010).

***Erodius siculus siculus* Solier 1834**
The subspecies is widely distributed in all the sandy coasts of Sicily. For the Tyrrhenian coast from Tuscany to Calabria and the Aeolian islands is reported *Erodius siculus neapolitanus* Solier, while for the island of Malta is endemic *Erodius siculus melitensis* Reitter. On the Adriatic and Ionian coasts of the Italian peninsula, Dalmatia, Albania and the island of Corfu is present *Erodius siculus dalmatinus* Kraatz.

***Pimelia rugulosa sublaevigata* Solier 1836**
The subspecies is endemic of Sicily with exception of north-estern territories where is present the nominal subspecies, known as well for Campania, Calabria and Eolian Islands. Other subspecie are present in Basilicata and Puglia (*Pimelia rugulosa apula* Gridelli 1950), Malta (*Pimelia rugulosa melitana* Reitter 1915) and island of Pelagosa Piccola (*Pimelia rugulosa pelagosana* G. Mueller 1912).

***Probaticus tomentosus* Reitter 1906**
Rare species, saproxilophagous and subcorticicolous known for few places in Sicily (Caltagirone, Comiso, Messina, Monte Disueri, Cammarata, Etna: Macchia e Regalbuto).

***Stenosis melitana* Reitter 1894**
Sicilian-Maltese endemism known mainly for the southern and eastern coastal.

Some other species deserve a brief comment in relation to its distribution and/or relative rarity.

***Dichillus pertusus* (Kiesenwetter 1861)**
Species mainly myrmecophilous with a geonemy Eastern Mediterranean, known for Turkey, Greece, Island of Malta, southern Italy and Sicily, where it is rare.

***Nalassus aemulus aemulus* (Kuster 1850)**
This subspecies is distributed in northern Africa (Algeria, Tunisia, Libia and with doubt reported also for Morocco and Balearic Islands), eastern Spain, Gozo Island, Sicily and southern Italy. In Sardinia is present *Nalassus aemulus calaritanus* Leo 1985. Psammophilous and halobious element, ever rare in Sicily.

***Tentyria laevigata laevigata* Steven 1829**
The subspecies is endemic of Sicily, Calabria and Ischia Island. In Malta is present *Tentyria laevigata leachii* Baudi di Selve 1874. In Sicily is localised.

The species and subspecies of sampled Tenebrionidae and the number of specimens collected in the 5 stations are shown in table 5.2.2.

SPECIES	*AC*	*Ci*	*Ol*	*Tk*	*Vy*	**Tot_Nb_specimens**
Zophosis punctata punctata	70		701			**771**
	3,62		*36,23*			*39,84*
Tentyria grossa grossa	16		234	6		**256**
	0,83		*12,09*	*0,31*		*13,23*
Alphasida grossa sicula	151	11	53	8	2	**225**
	7,80	*0,57*	*2,74*	*0,41*	*0,10*	*11,63*
Stenosis sardoa sardoa	55	92	12	7	2	**168**
	2,84	4,75	0,62	0,36	0,10	8,68
Pimelia rugulosa sublaevigata	1		161	2		**164**
	0,05		*8,32*	*0,10*		*8,48*
Stenosis melitana	79			4		**83**
	4,08			*0,21*		*4,29*
Akis spinosa spinosa	25	22	5	12		**64**
	1,29	*1,14*	*0,26*	*0,62*		*3,31*
Scaurus striatus	16		16	16		**48**
	0,83		*0,83*	*0,83*		*2,48*
Allophylax picipes	3		3		21	**27**
	0,16		*0,16*		*1,09*	*1,40*
Dendarus lugens	3			19		**22**
	0,16			*0,98*		*1,14*
Scaurus tristis			8	14		**22**
			0,41	*0,72*		*1,14*
Tentyria laevigata laevigata	18					**18**
	0,93					*0,93*
Erodius siculus siculus			7	9		**16**
			0,36	*0,47*		*0,83*
Opatroides punctulatus punctulatus	7		1		7	**15**
	0,36		*0,05*		*0,36*	*0,78*
Cnemeplatia atropos atropos	5	4				**9**
	0,26	*0,21*				*0,47*
Scaurus atratus	6					**6**
	0,31					*0,31*
Dichillus pertusus	4				1	**5**
	0,21				*0,05*	*0,26*
Probaticus tomentosus	3		2			**5**
	0,16		*0,10*			*0,26*
Crypticus gibbulus	1				1	**2**
	0,05				*0,05*	*0,10*
Pachychila dejeani dejeani					2	**2**
					0,10	*0,10*
Pedinus helopioides			2			**2**
			0,10			*0,10*
Catomus consentaneus	1					**1**
	0,05					*0,05*
Catomus rotundicollis	1					**1**
	0,05					*0,05*
Dichillus socius			1			**1**
			0,05			*0,05*

Gonocephalum rusticum		1				**1**
		0,05				*0,05*
Nalassus aemulus aemulus				1		**1**
				0,05		*0,05*
Tot_Nb_specimens	465	130	1206	98	36	**1935**
	24,03	*6,72*	*62,33*	*5,06*	*1,86*	*100,00*
Tot_Nb_species	19	5	14	11	7	**26**

Tab. 5.2.2 - Trends in catches of Coleoptera Tenebrionidae at each station expressed as total number (top row) and percentage (bottom row) of specimens sampled. The percentages refer to the total of the entire sample of Tenebrionidae.

During the sample period in the 5 stations investigated within the Riserva Naturale Orientata "Pineta di Vittoria" were surveyed a total of **1.935** specimens of Tenebrionidae, which, as mentioned, are representative of **26** species.

The most abundant species resulted: *Zophosis punctata punctata* (**771** specimens) which alone accounts for about 40% of the total catch of Tenebrionidae, *Tentyria grossa grossa* (**256** specimens), *Alphasida grossa sicula* (**225** specimens), *Stenosis sardoa sardoa* (**168** specimens), *Pimelia rugulosa sublaevigata* (**164** specimens), *Stenosis melitana* (**83** specimens), *Akis spinosa spinosa* (**64** specimens), *Scaurus striatus* (**48** specimens), representing the **17%** of the total sampled specimens of Coleoptera and about the **92%** of the total sampled Tenebriobidae.

In fig. 5.2.1 are shown the percentages of specimens surveyed for the more abundantly sampled species of Tenebrionidae compared to the total sample of the Family.

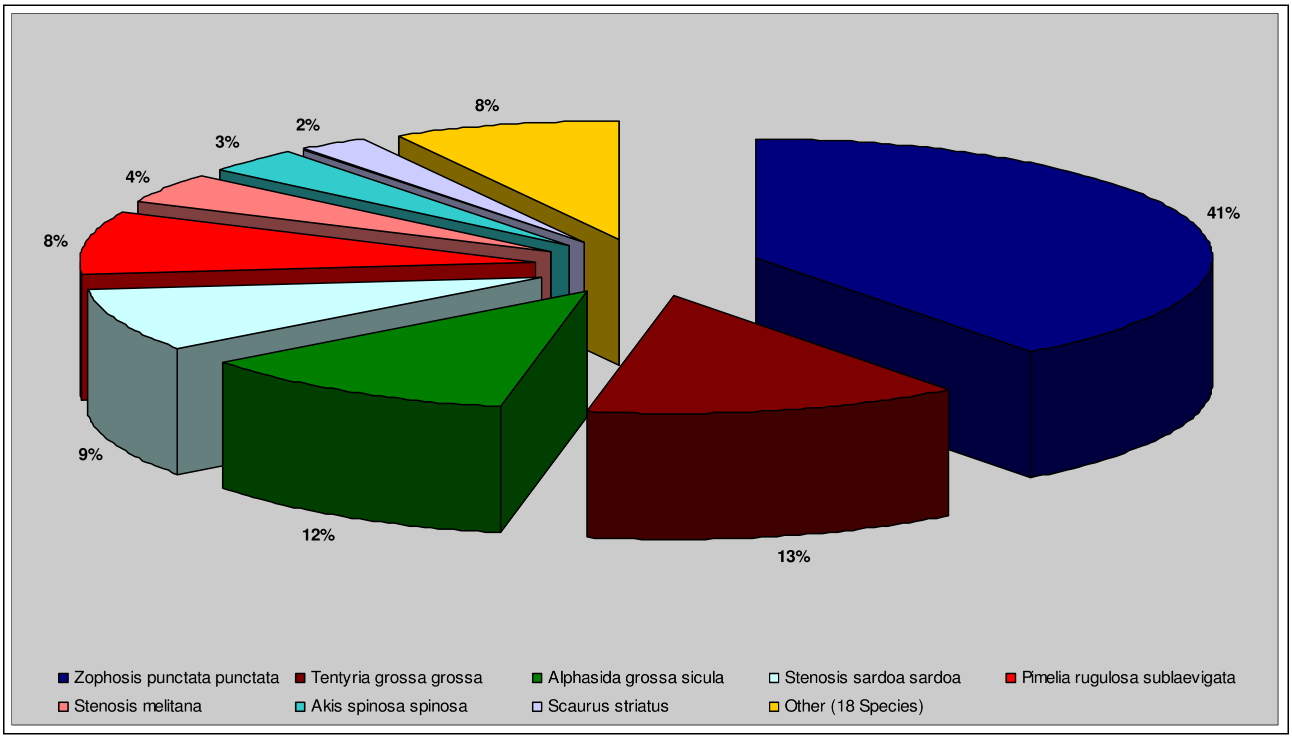


Fig. 5.2.1 - Overall trend (number of individual and percentage of total) of catches for more abundant species of Tenebrionidae.

For the reasons previously discussed, was eliminated from further analysis the station **Vy**; but it has to be highlighted that the species ***Pachychila dejeani dejeani*** resulted exclusive of the **Vy** station, thus eliminating the station from further analysis we will refer to **25** species.

The capture value was recalculated as CSD.

Table 5.2.3 shows the values of CSD for species counted within the individual stations.

SPECIE	AC	Ci	Ol	Tk	Tot_CSD
Zophosis punctata punctata	74,09		727,10		801,19
Tentyria grossa grossa	19,69		200,18	7,30	227,17
Alphasida grossa sicula	136,15	13,17	43,76	7,75	200,83
Stenosis sardoa sardoa	61,74	97,09	14,75	6,62	180,21
Pimelia rugulosa sublaevigata	0,71		158,85	3,36	162,92
Stenosis melitana	79,44			5,27	84,71
Akis spinosa spinosa	26,08	21,24	4,13	13,07	64,52
Scaurus striatus	16,41		16,20	14,89	47,50
Dendarus lugens	3,12			19,83	22,95
Scaurus tristis			6,45	14,01	20,46
Erodius siculus siculus			7,11	11,54	18,66
Tentyria laevigata laevigata	17,18				17,18
Cnemeplatia atropos atropos	5,69	4,31			10,00
Opatroides punctulatus punctulatus	8,42		1,32		9,74
Scaurus atratus	7,26				7,26
Allophylax picipes	3,07		2,99		6,06
Probaticus tomentosus	2,96		1,93		4,89
Dichillus pertusus	4,65				4,65
Nalassus aemulus aemulus				1,87	1,87
Catomus consentaneus	1,16				1,16
Catomus rotundicollis	1,16				1,16
Pedinus helopioides			1,14		1,14
Dichillus socius			0,97		0,97
Gonocephalum rusticum		0,97			0,97
Crypticus gibbulus	0,71				0,71
Tot_CSD	**469,69**	**136,78**	**1.186,87**	**105,54**	**1.898,87**
Nb species	***19***	***5***	***14***	***11***	***25***

Tab. 5.2.3 - Trends in catches of Coleoptera Tenebrionidae at each station expressed as CSD.

The analysis of the table and fig. 5.2.2 shows how the station **Ol** present a very sharp peak frequencies of capture (equivalent to 62,50% of total), while the station **AC** shows a value of 24,74% of the total, and the stations **Ci** and **Tk** show lower values with respectively 7,20% and 5,56% of the total.

Examining the table 5.2.3 we observe that only 3 species, *Alphasida grossa sicula, Stenosis sardoa sardoa* and *Akis spinosa spinosa* were found in all stations; 3 species are present in three stations: *Tentyria grossa grossa*, *Pimelia rugulosa sublaevigata* and *Scaurus striatus* all in **AC**, **Ol** and **Tk.** The other species are present in only one or two stations.

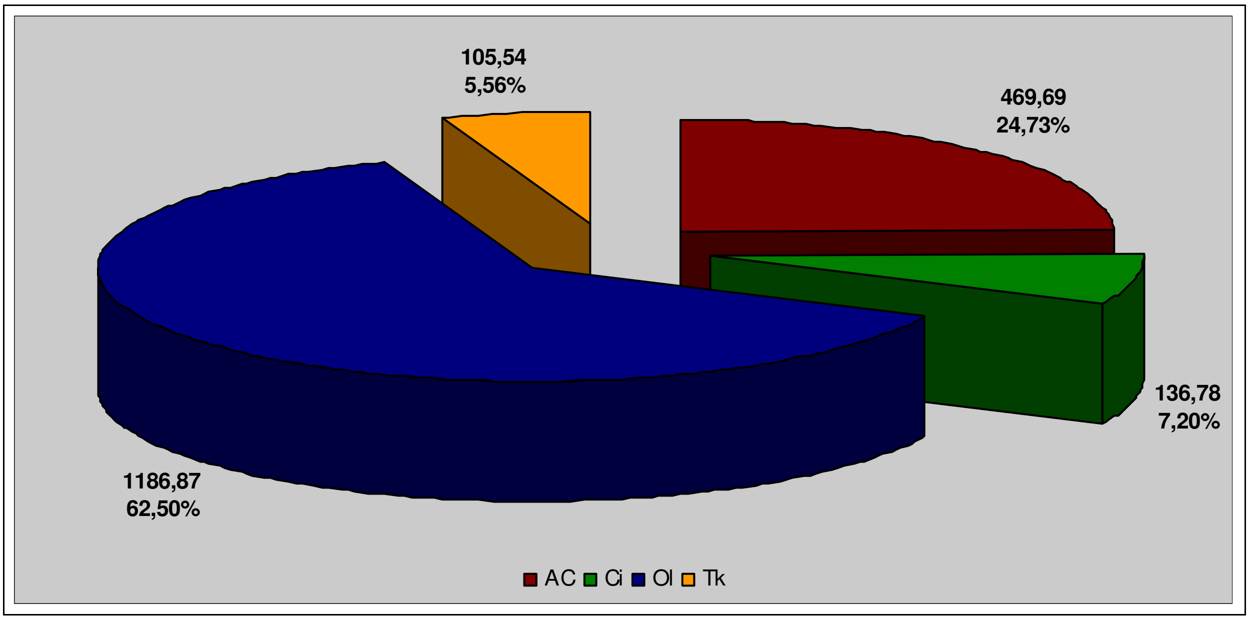
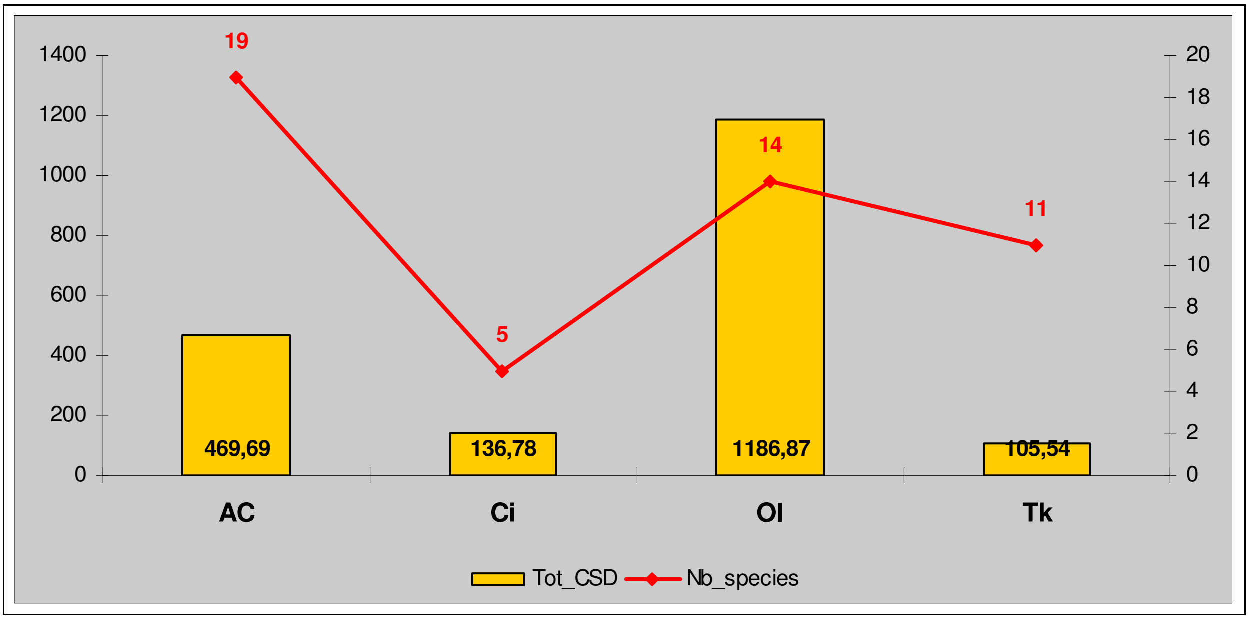


Fig. 5.2.2 – Frequency of capture of Coleoptera Tenebrionidae in the stations and their percentage of the total value of CSD.

Considering the general trend of the capture frequency of Coleoptera Tenebrionidae within the stations and the number of species sampled (graph. 5.2.1) is observed that the greatest number of species (**19**) has been surveyed in the **AC** station and the minimum (**8**) in **Tk** station, passing through the stations **Ci** (**18**) and **Ol** (**9**).

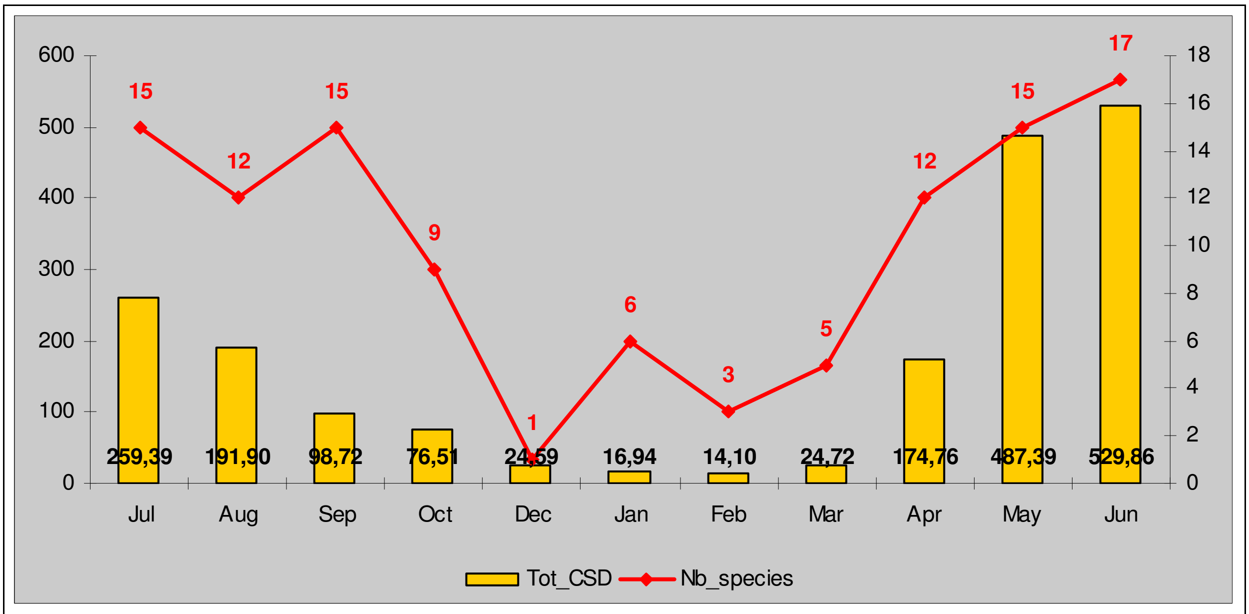


Graph. 5.2.1 - Overall trend of catches of Coleoptera Tenebrionidae (Tot_CSD) and number of species (Nb_species) sampled at each station.

Looking at the trend of frequency of capture of species distributed in the single sampling periods (tab. 5.2.4 and graph. 5.2.2), we observe that the 53,57% of catches is concentrated in the months of May and June, while for the months of January and February were recorded the minimum values for CDS.
Regarding the number of species, the highest (**17** of **25**) is recorded in June. In the months between October and March the number of species is much lower, even with the month of December that features a **single** species. In the remaining months these values amounted between **12** and **15**.

SPECIE	Jul	Aug	Sep	Oct	Dec	Jan	Feb	Mar	Apr	May	Jun	Tot_CSD
Zophosis punctata punctata	91,77	87,42	12,22						3,51	212,08	394,19	801,19
Tentyria grossa grossa	75,03	54,08	39,21	4,24			2,35	5,18	10,54	31,61	4,93	227,17
Alphasida grossa sicula	4,83		12,00	41,70	24,59	8,11	10,97	14,09	61,47	21,08	1,99	200,83
Stenosis sardoa sardoa	3,54	18,35	4,97	2,83					22,83	90,89	36,79	180,21
Pimelia rugulosa sublaevigata	16,42	4,83	3,41	19,08				3,39	48,30	64,55	2,94	162,92
Stenosis melitana	35,74	3,62								5,27	40,08	84,71
Akis spinosa spinosa	10,49	9,66	5,24	3,00				1,04	6,15	17,12	11,82	64,52
Scaurus striatus	8,37	5,23	6,91	3,53		2,32			0,88	13,17	7,09	47,50
Dendarus lugens	1,61	1,21	1,26					1,04	3,51	5,27	9,06	22,95
Scaurus tristis	0,97	2,90	1,70						3,51	1,32	10,06	20,46
Erodius siculus siculus	4,83									11,86	1,97	18,66
Tentyria laevigata laevigata	1,93	2,42	1,42						11,42			17,18
Cnemeplatia atropos atropos			0,71	0,71						6,59	1,99	10,00
Opatroides punctulatus punctulatus	0,97		4,26			2,32			0,88	1,32		9,74
Scaurus atratus	0,97	1,21	1,42							2,63	1,03	7,26
Allophylax picipes				0,71					1,76	2,63	0,97	6,06
Probaticus tomentosus	1,93										2,96	4,89
Dichillus pertusus			2,84				0,78				1,03	4,65
Nalassus aemulus aemulus						1,87						1,87
Catomus consentaneus						1,16						1,16
Catomus rotundicollis						1,16						1,16
Pedinus helopioides			1,14									1,14
Dichillus socius		0,97										0,97
Gonocephalum rusticum											0,97	0,97
Crypticus gibbulus				0,71								0,71
Toto_CSD	**259,39**	**191,90**	**98,72**	**76,51**	**24,59**	**16,94**	**14,10**	**24,72**	**174,76**	**487,39**	**529,86**	**1898,87**
Nb_species	**15**	**12**	**15**	**9**	**1**	**6**	**3**	**5**	**12**	**15**	**17**	**25**

Tab. 5.2.4 - Trends in capture rates of species of Coleoptera Tenebrionidae spread over the individual sampling periods.

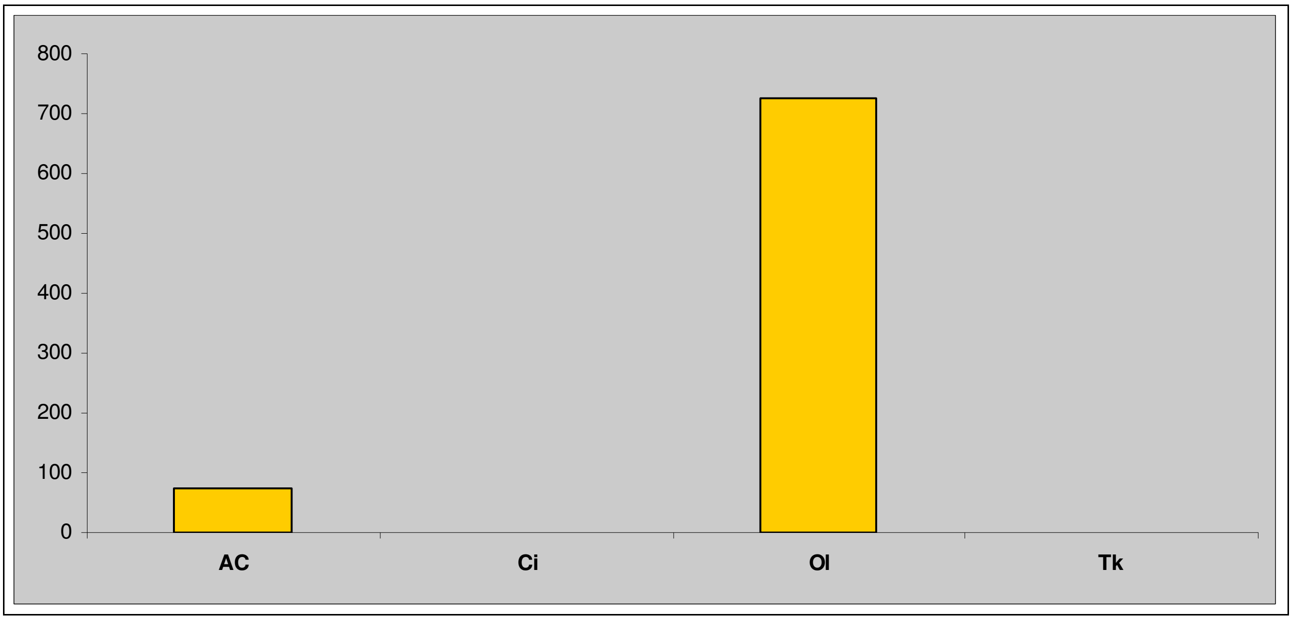


Graph. 5.2.2 - Trends in capture frequencies (CSD) of Coleoptera Tenebrionidae in individual sampling periods and number of species sampled.

The Spearman correlation analysis for these series (number of catches per month and number of species per month) returns a value of $r_s = 0{,}90$ with $p < 0.05$, which suggests a positive relationship between the trend of the two sequences.
Below are considered the most abundant sampled species of Tenebrionidae in relation to their distribution in the stations and their frequency of capture during the sampling year.

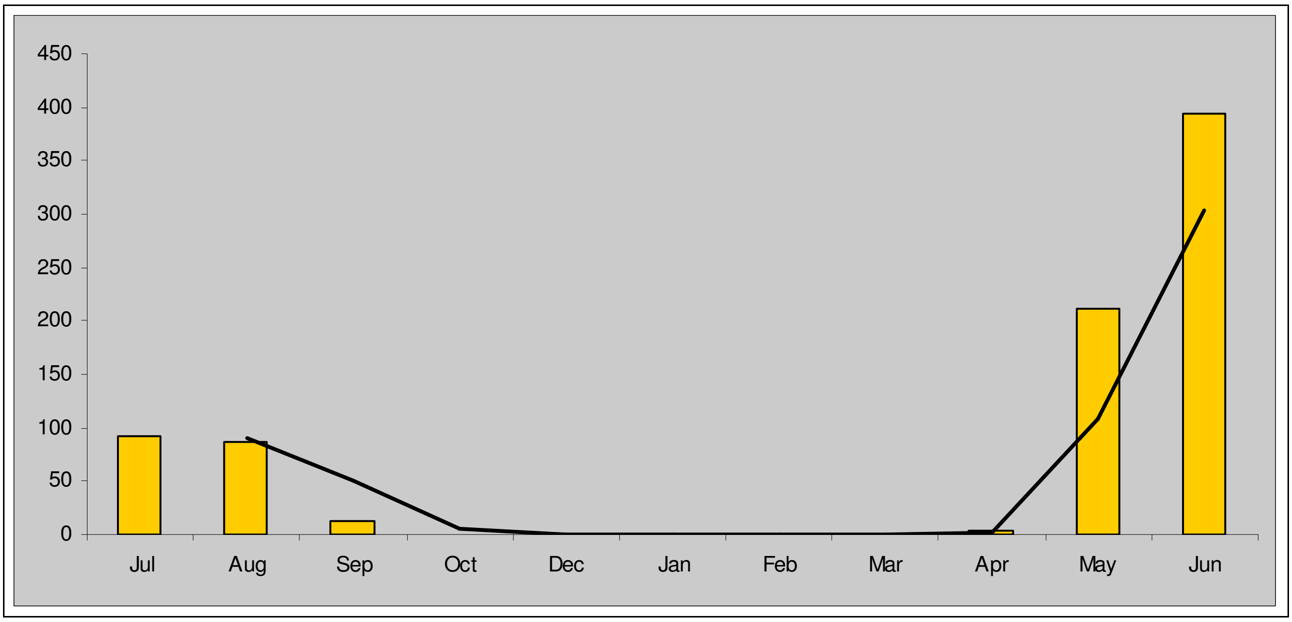
Zophosis punctata punctata

This is the species with the highest value of CSD, which represents just over 42% of the entire sample of Coleoptera Tenebrionidae. Were surveyed specimens of this species only at stations **AC** and **Ol**, with 90,75% of the catches concentrated in this last (graph. 5.2.3).



Graph. 5.2.3 – Trend of capture frequency (CSD) for *Zophosis punctata punctata* within the single station.

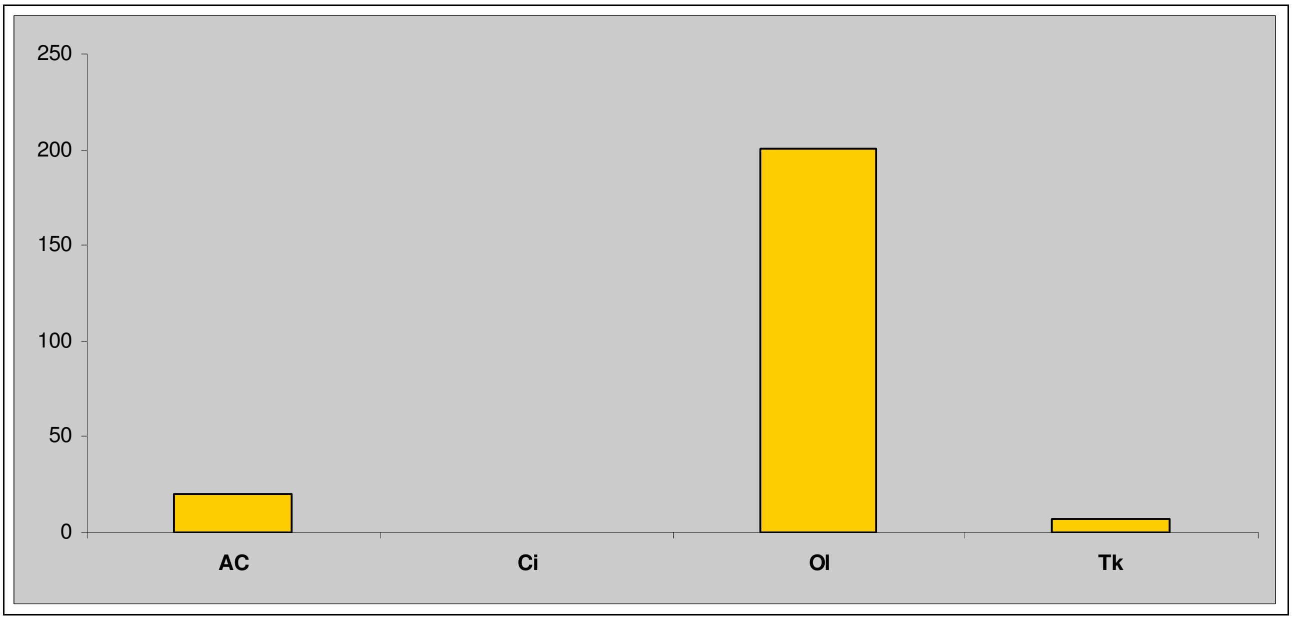
The frequency trend of its capture in the sampling period (graph. 5.2.4) shows that more than 98% of them are concentrated in the summer months, with a sharp peak in the month of June (49,2%) and result significantly lower in the other months, with minimum values (September and April) or null in the months between October and March.



Graph. 5.2.4 - Trends in capture frequencies (CSD) of *Zophosis punctata punctata* in individual sampling periods.

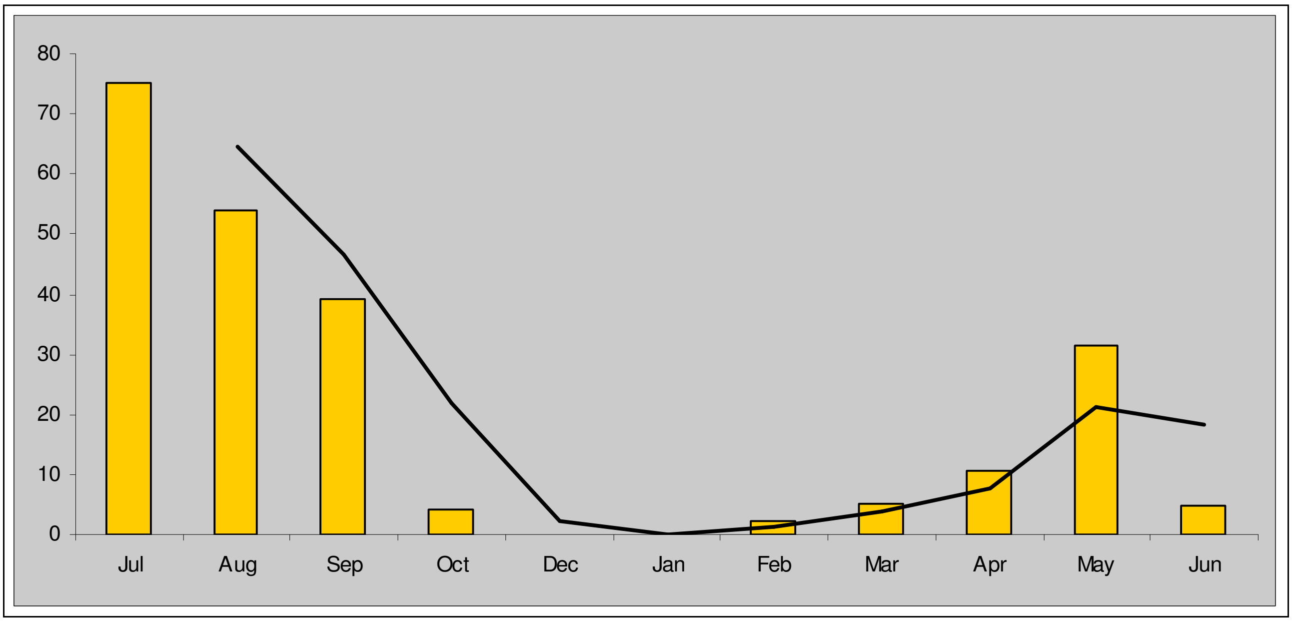
Tentyria grossa grossa

This is the species with the second value of CSD, which represents about 12% of the entire sample of Coleoptera Tenebrionidae. Were surveyed specimens of this species in stations **AC**, **Ol** and **Tk**, with 88% of the catches recorded in the **Ol** station, while the minimum is found in the station **Tk** (3,21%) (graph. 5.2.5).



Graph. 5.2.5 - Trend of capture frequency (CSD) for *Tentyria grossa grossa* within the single station.

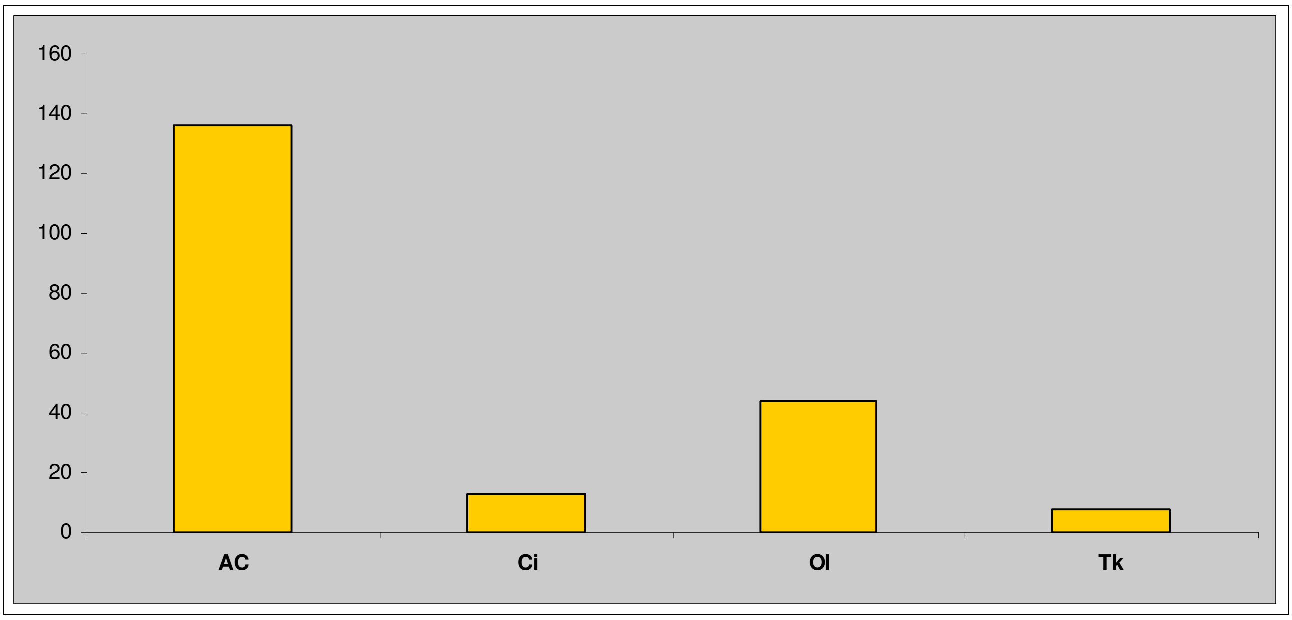
The frequency trend of its capture in the sampling period (graph. 5.2.6) shows that, following high values in summer months (July - September with 74,09% of the total CSD) the species present low or null values between October and February, with a further increase of presences from March.



Graph. 5.2.6 - Trends in capture frequencies (CSD) of *Tentyria grossa grossa* in individual sampling periods.

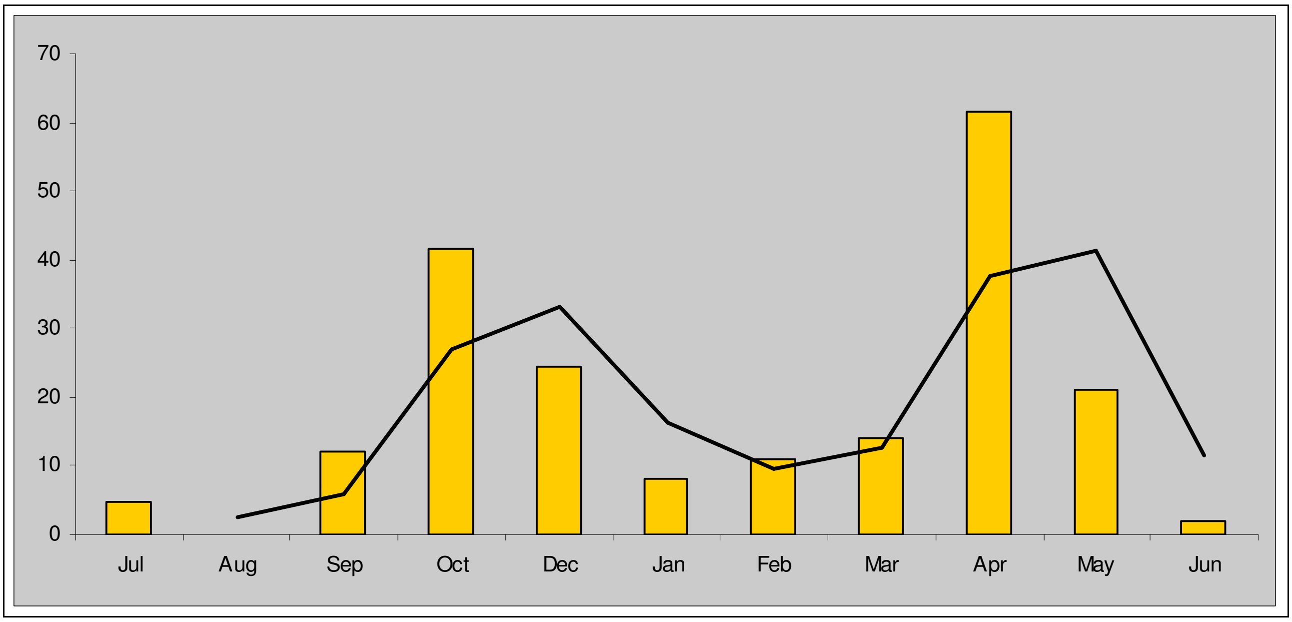
Alphasida grossa sicula

This is the species with the third value of CSD, with 10,58% of the entire sample of Coleoptera Tenebrionidae; it was present in all stations. The maximum value of CSD is expressed in the station **AC** (67,79%) and the minimum in the station **Tk** (3,86%) (graph. 5.2.7).



Graph. 5.2.7 - Trend of capture frequency (CSD) for *Alphasida grossa sicula* within the single station.

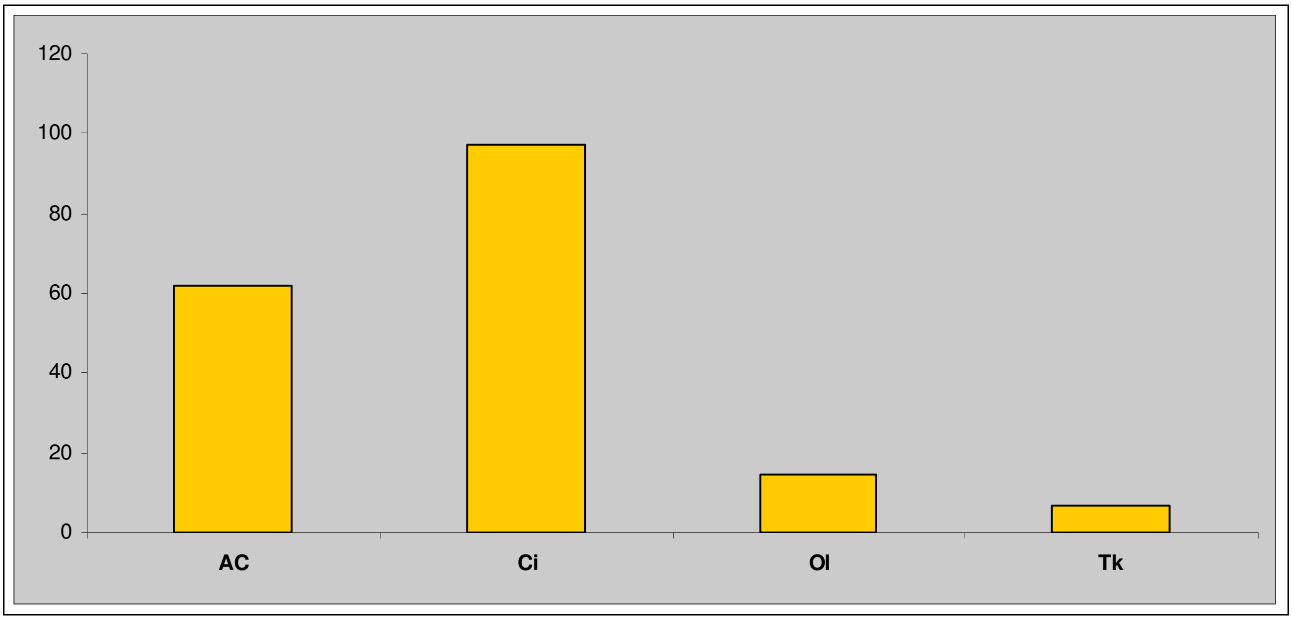
The frequency trend of its capture in the sampling period (graph. 5.2.8) shows that the species is present almost throughout the year, with higher values in spring, with April which has the maximum value of CSD as 30,61%, and autumn; significantly lower CSD values are recorded in winter and summer. Is to emphasize that this is the only species that has been sampled in December.



Graph. 5.2.8 - Trends in capture frequencies (CSD) of *Alphasida grossa sicula* in individual sampling periods.

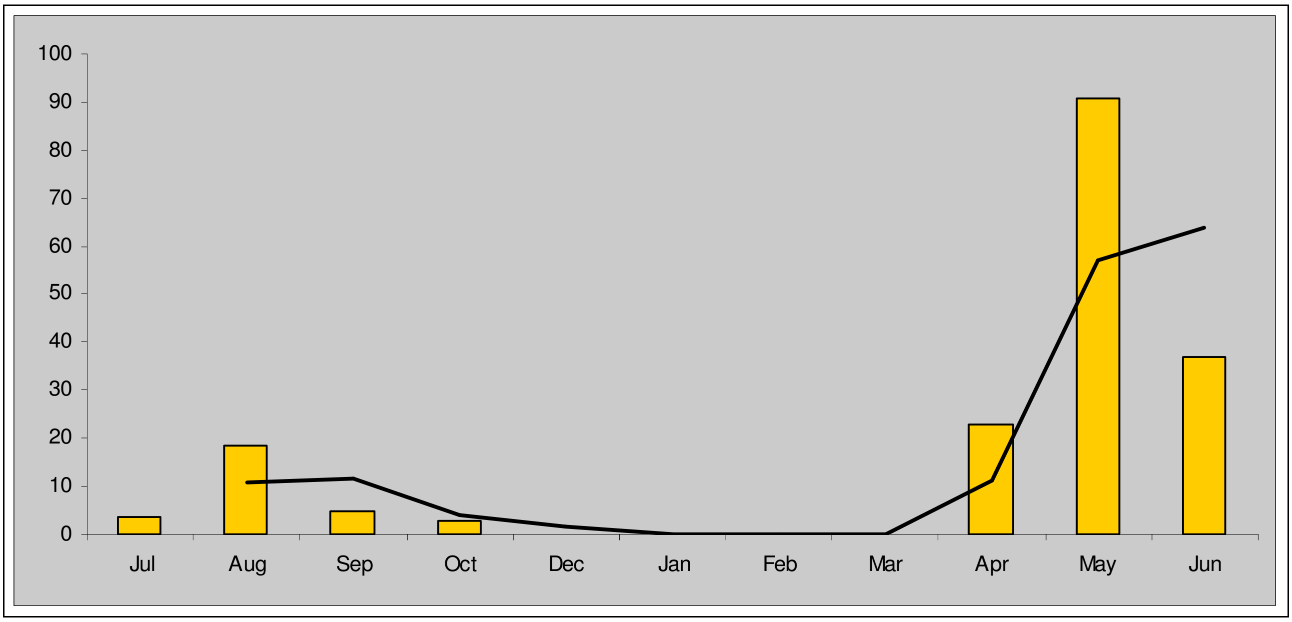
Stenosis sardoa sardoa

It has the fourth value of CSD, which represents 9.49% of the entire sample of Coleoptera Tenebrionidae, and as the previous species was found in all stations. The station with the highest CSD is **Ci** (53,88%), while the minimum is recorded in **Tk** (3,67%) (graph. 5.2.9).



Graph. 5.2.9 - Trend of capture frequency (CSD) for *Stenosis sardoa sardoa* within the single station.

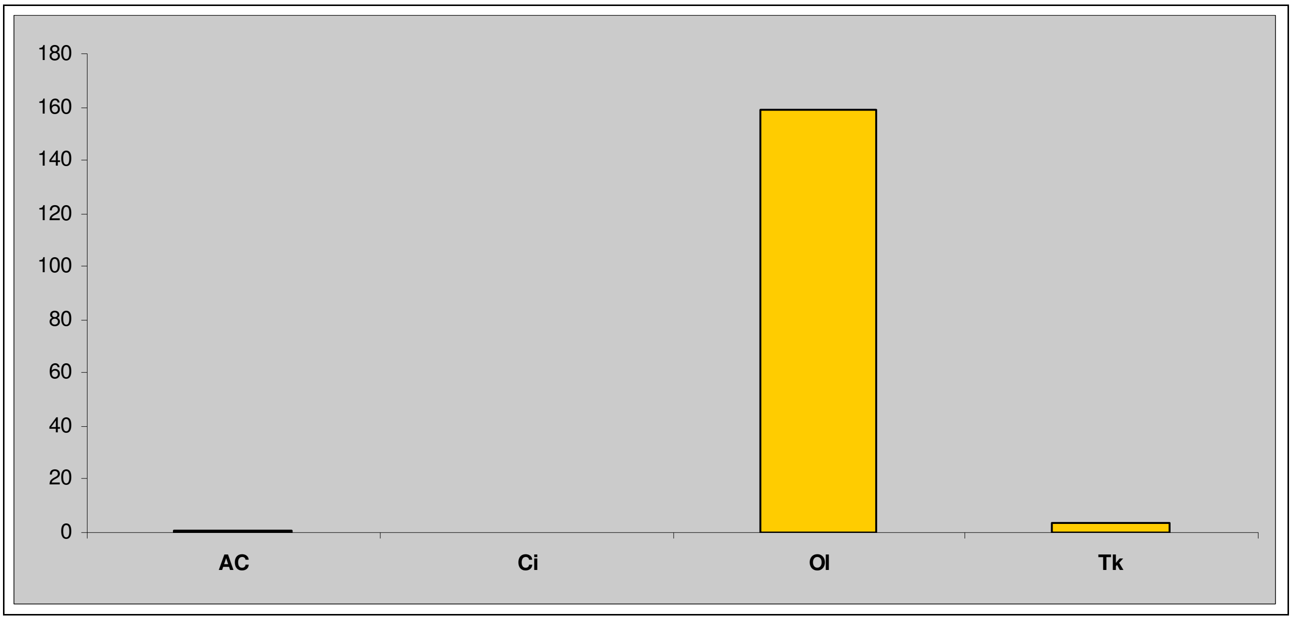
The trapping frequencies in the sampling period are concentrated (83,52%) between April and June, with a sharp peak in May (graph. 5.2.10). The species is absent in the months between December and March, recording lower CSD values for the other months.



Graph. 5.2.10 - Trends in capture frequencies (CSD) of *Stenosis sardoa sardoa* in individual sampling periods.

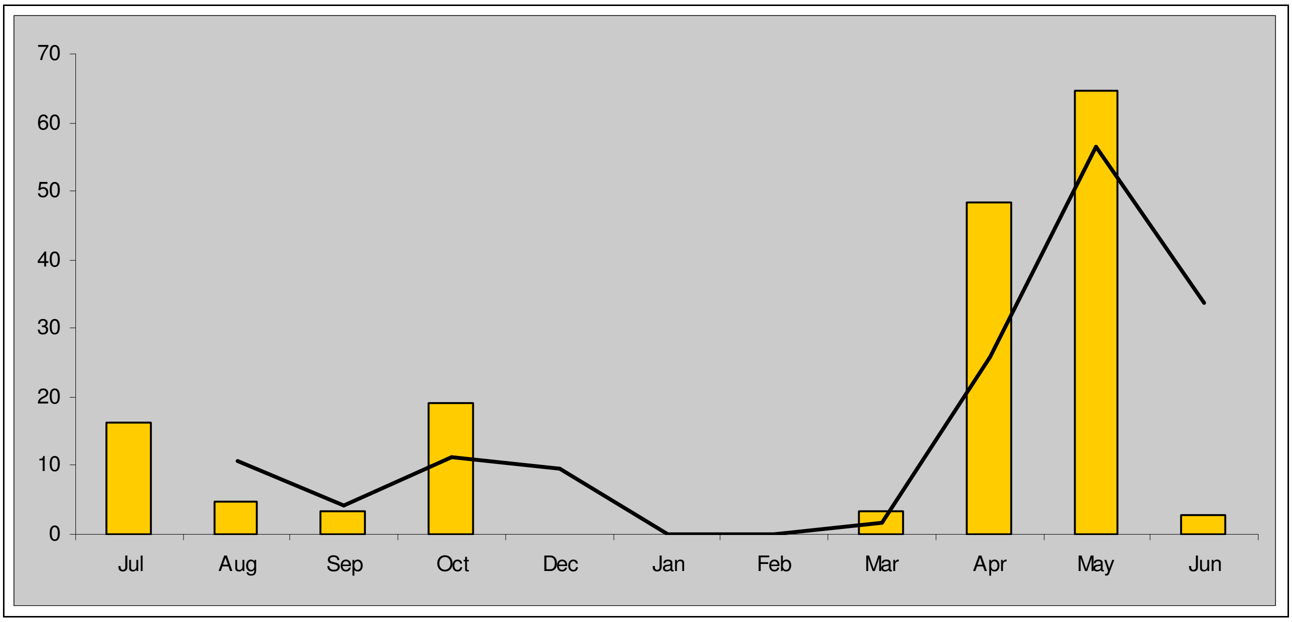
Pimelia rugulosa sublaevigata

It has the fifth value of CSD, which accounts for 8,58% of the entire sample of Coleoptera Tenebrionidae. The species was only sampled at stations **AC**, **Ol** and **Tk** (graph. 5.2.11), with a sharp peak in CDS values (97,50%) in the station **Ol**.



Graph. 5.2.11 - Trend of capture frequency (CSD) for *Pimelia rugulosa sublaevigata* within the single station.

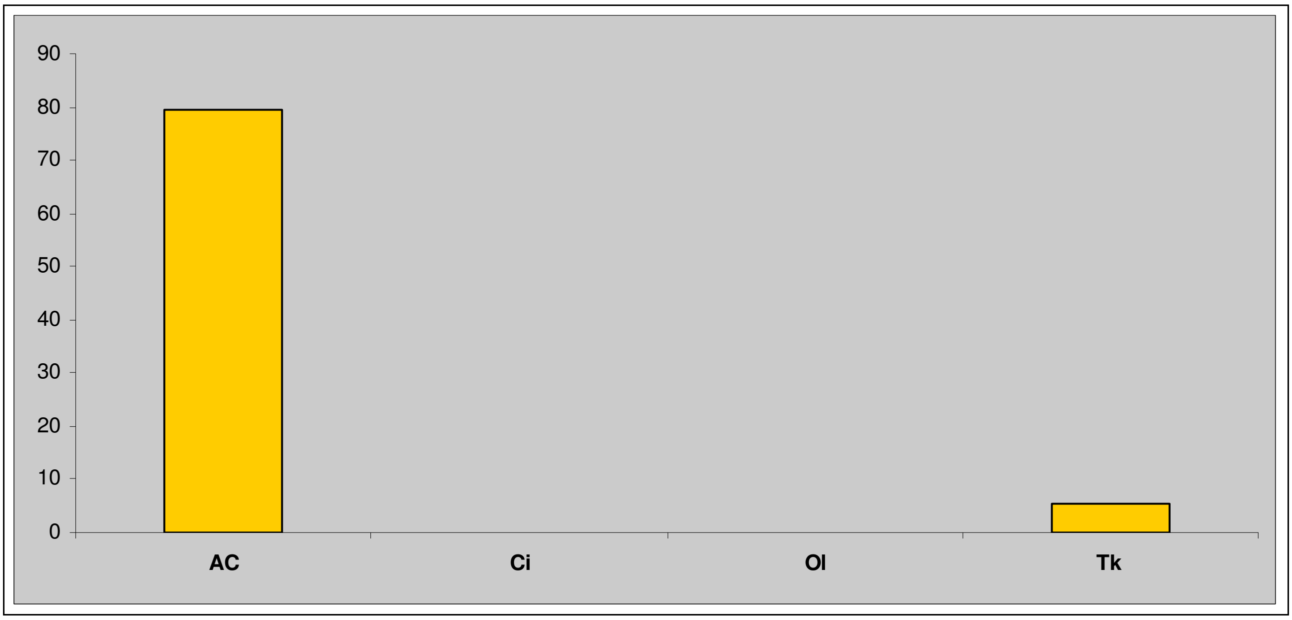
The frequency performance of its capture in the sample period (graph. 5.2.12) shows that more than 69% of them are concentrated between April and May, and that are significantly lower in other months, with null values between December and February.



Graph. 5.2.12 - Trends in capture frequencies (CSD) of *Pimelia rugulosa sublaevigata* in individual sampling periods.

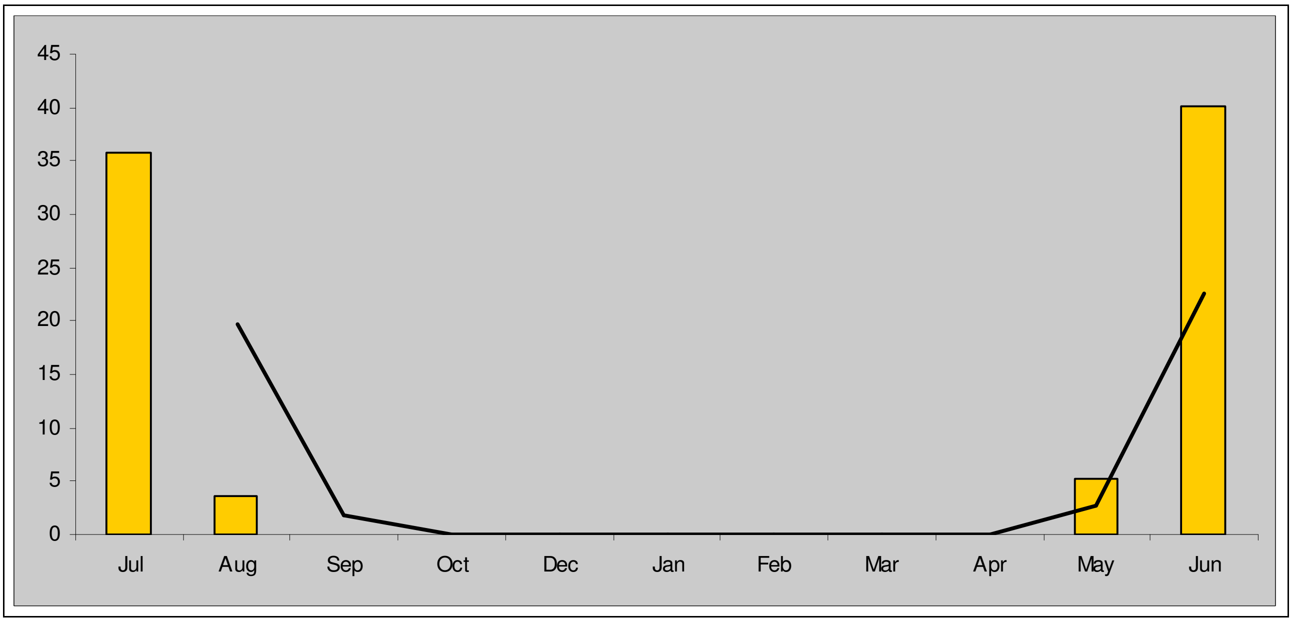
Stenosis melitana

It presents the sixth CSD value, which represents approximately 4,46% of the entire sample of Coleoptera Tenebrionidae. The species was sampled at stations **AC** and **Tk** (graph. 5.2.13), presenting with a distinct peak values of CDS (93,78%) in the station **AC**.



Graph. 5.2.13 - Trend of capture frequency (CSD) for *Stenosis melitana* within the single station.

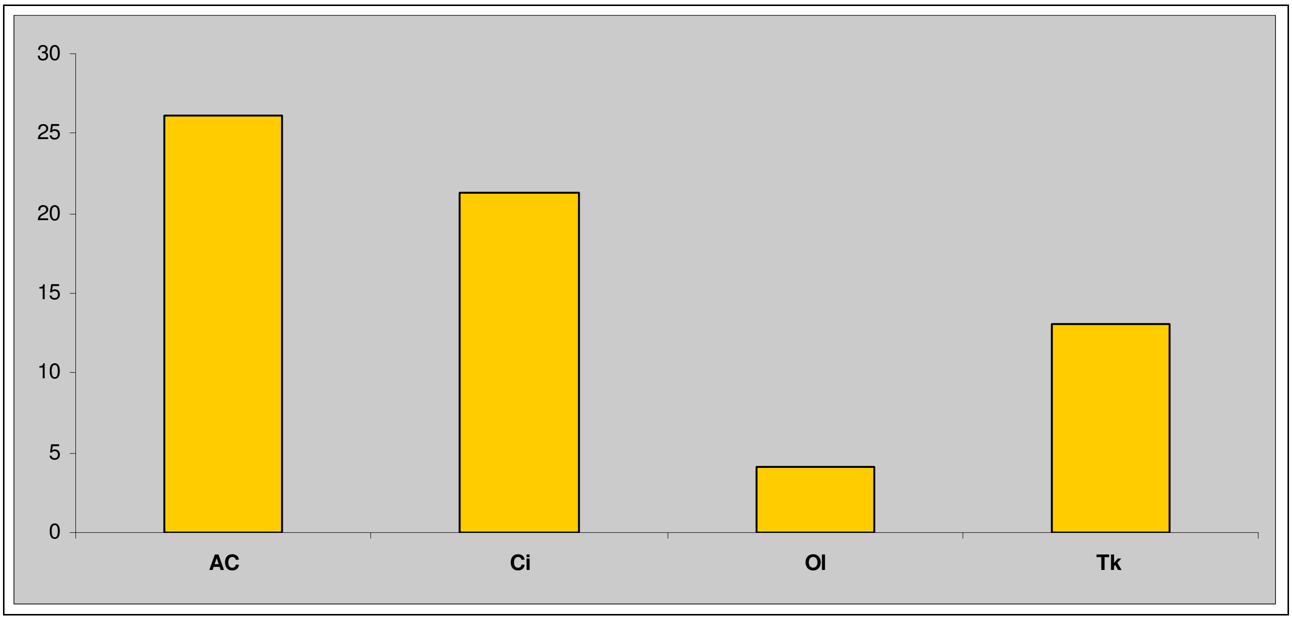
The frequency trend of its capture in the sample period (graph 5.2.14), shows two peaks in July and June (89,51%), and null values between September and April.



Graph. 5.2.14 - Trends in capture frequencies (CSD) of *Stenosis melitana* in individual sampling periods.

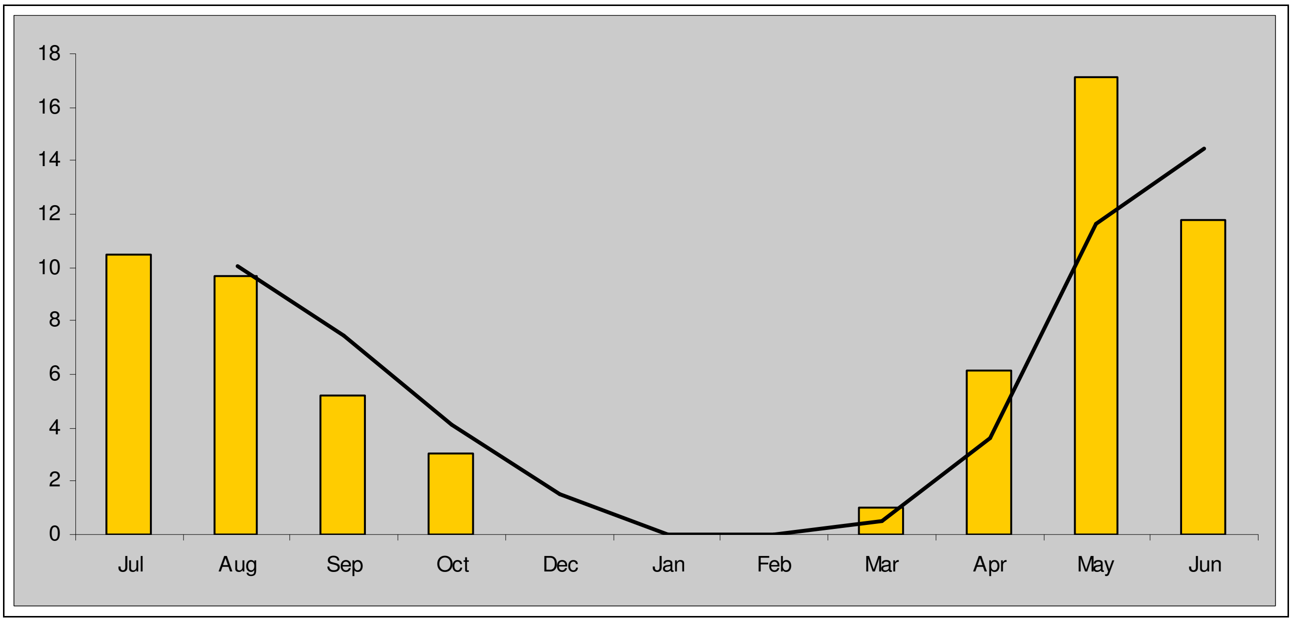
Akis spinosa spinosa

It presents the seventh CSD value, which represents approximately 3,40% of the entire sample of Coleoptera Tenebrionidae. The species has been sampled at all stations (graph. 5.2.15), with the highest value of CSD at station **AC** (40,42%) and the lowest one at station **Ol** (6,40%).



Graph. 5.2.15 - Trend of capture frequency (CSD) for *Akis spinosa spinosa* within the single station.

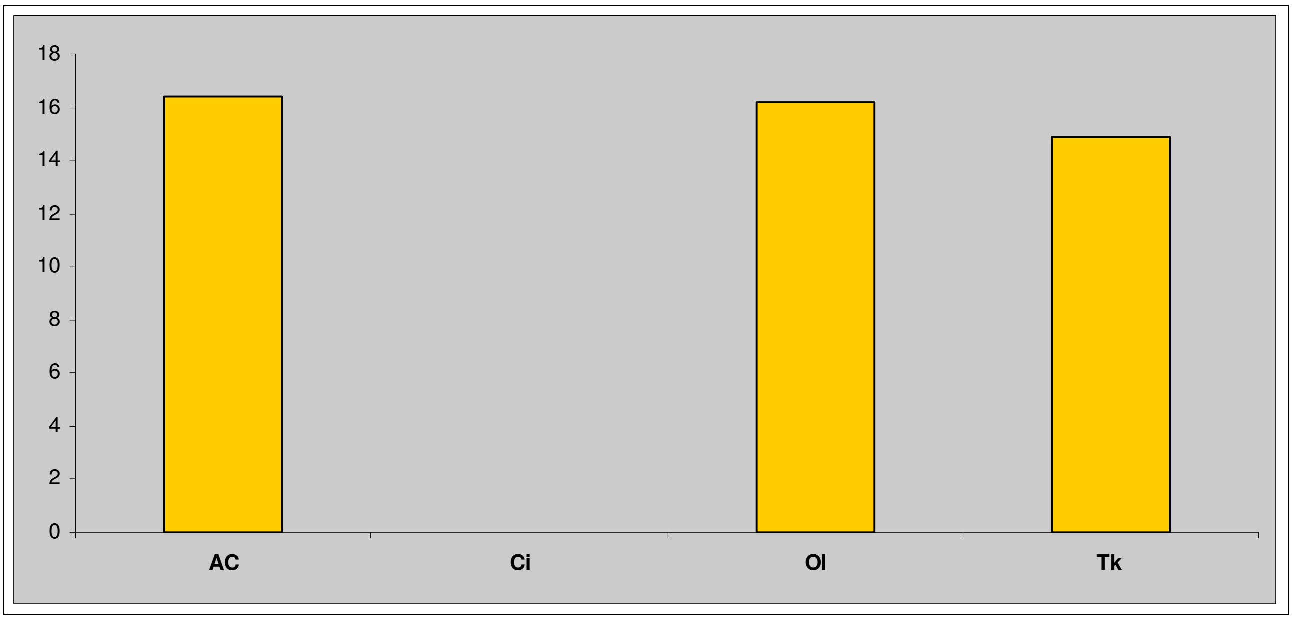
The frequency trend of its capture in the sample period (graph 5.2.16), shows how these are distributed in descending between July and October and increasingly between March and June, with maximum values in May-June (44,85%); the species is absent in the months between December and February.



Graph. 5.2.16 - Trends in capture frequencies (CSD) of *Akis spinosa spinosa* in individual sampling periods.

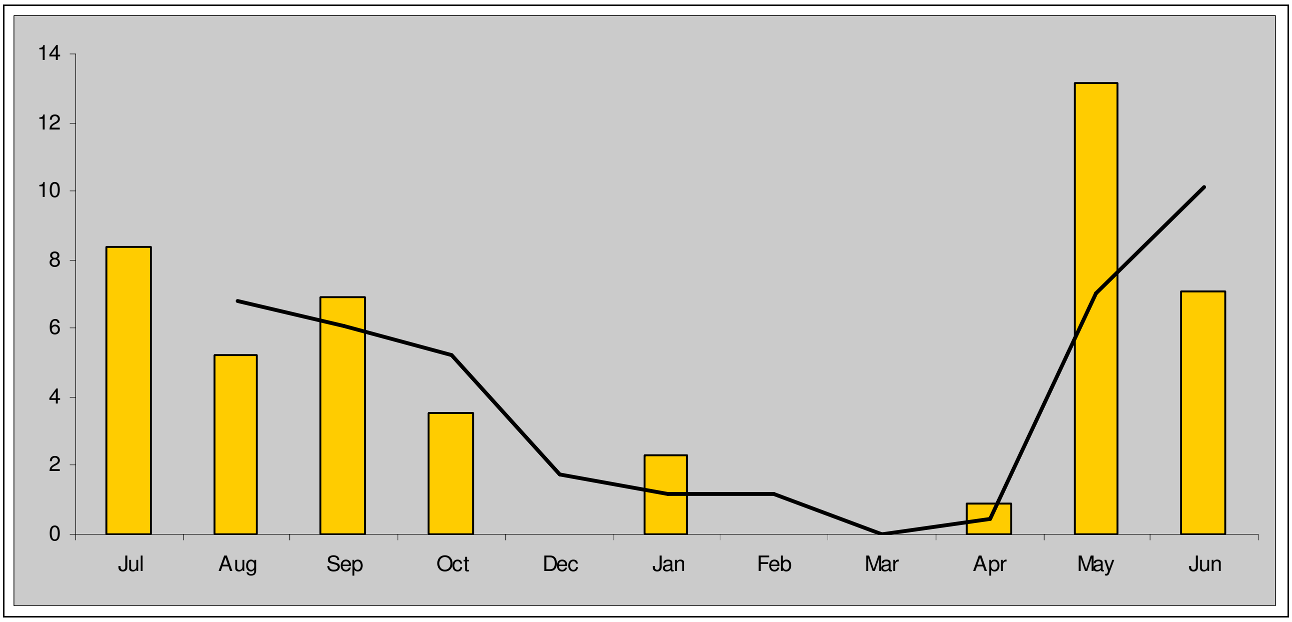
Scaurus striatus

It presents the eighth value of CSD, which represents 2,50% of the entire sample of Coleoptera Tenebrionidae. The species was sampled only in stations **AC**, **Ol** and **Tk** showing similar values of CSD (around 31-33%) in the three stations (graph. 5.2.17).



Graph. 5.2.17 - Trend of capture frequency (CSD) for *Scaurus striatus* within the single station.

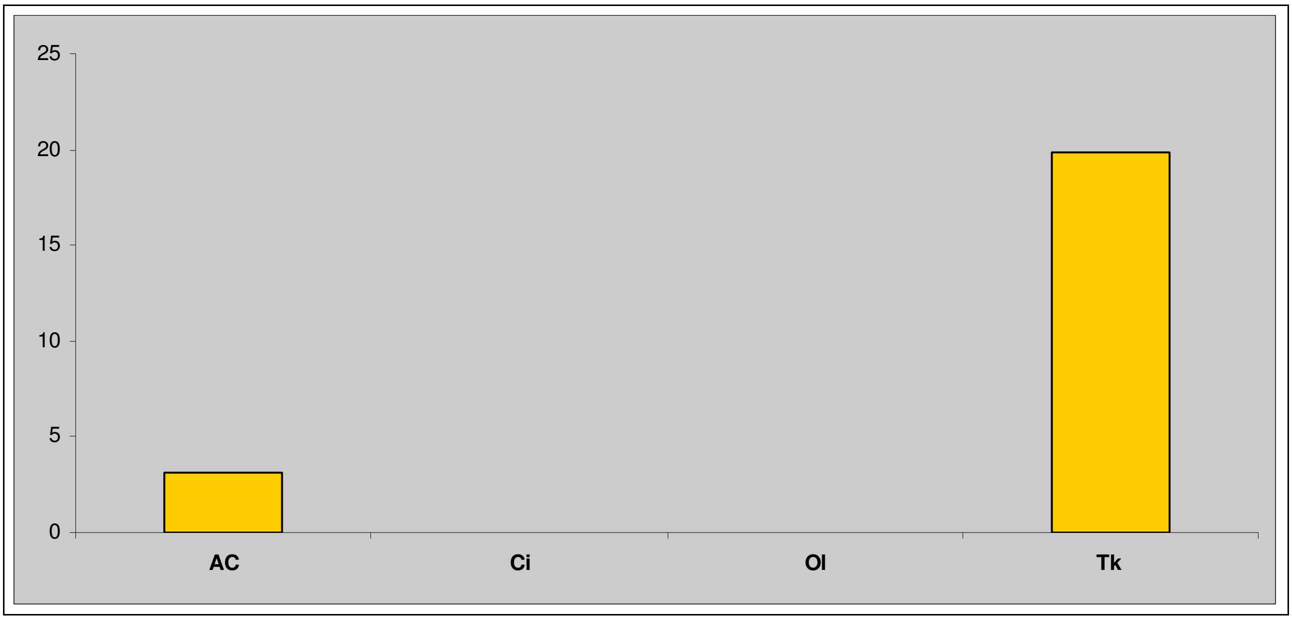
The performance of the capture frequencies over the sample period (graph 5.2.18) shows a peak in May (27,73%) and mean values between June and October. In the months between December and April, the CSD values are low or null.



Graph. 5.2.18 - Trends in capture frequencies (CSD) of *Scaurus striatus* in individual sampling periods.

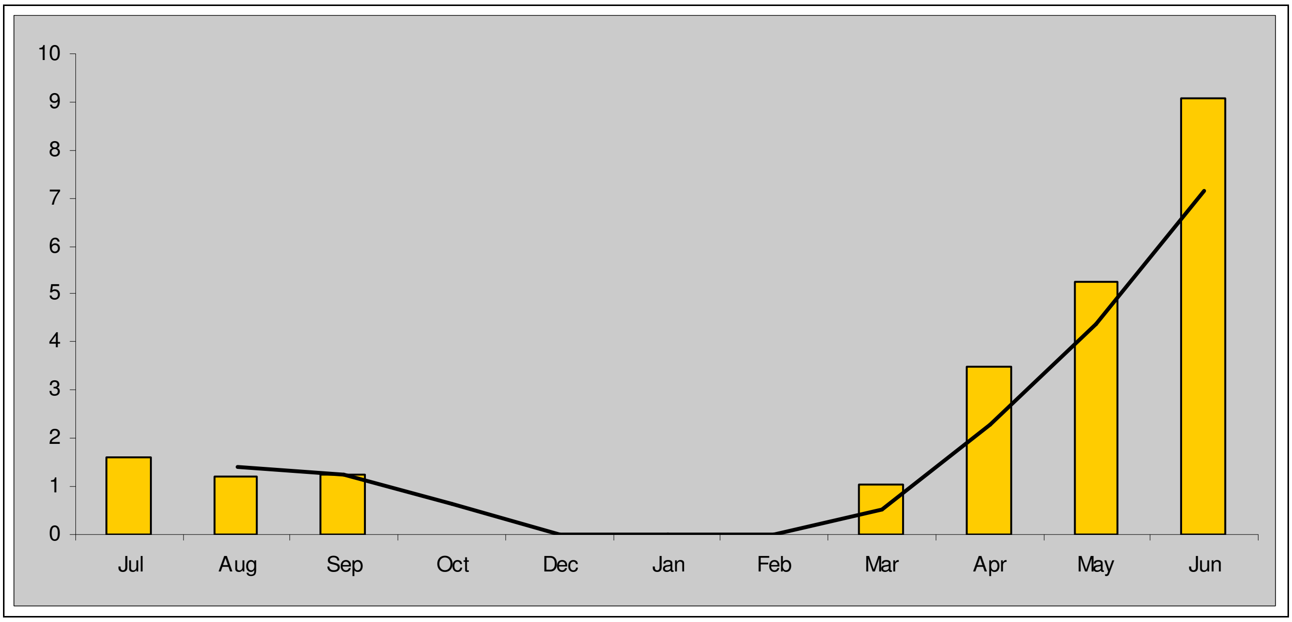
Dendarus lugens

It shows the ninth CSD value, which represents 1,21% of the entire sample of Coleoptera Tenebrionidae. The species was only sampled at stations **AC** and **Tk**, showing in the second one a sharp peak of CSD (86,41%) (graph. 5.2.19).



Graph. 5.2.19 - Trend of capture frequency (CSD) for *Dendarus lugens* within the single station.

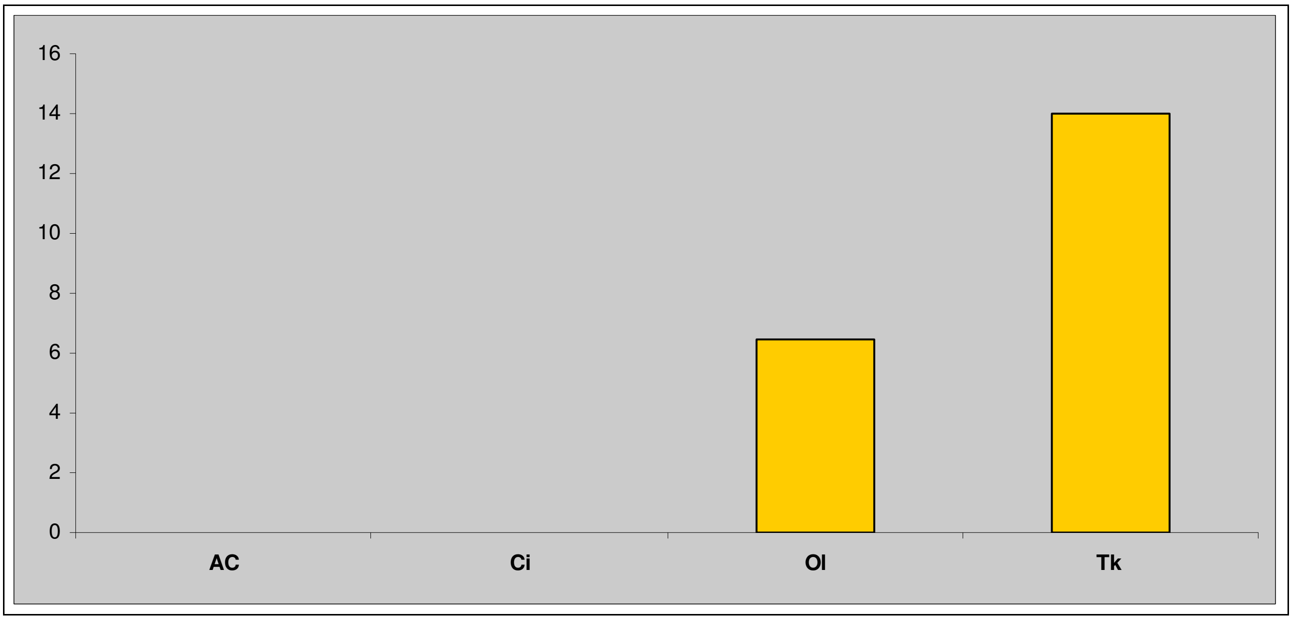
The performance of the capture frequencies over the sample period (graph 5.2.20) shows two periods of activity: the greatest of March and June, peaking in the last one (39,48%), and the lowest between July and September, with significantly lower values of CSD. In the months between October and February the species shows null values of CSD.



Graph. 5.2.20 - Trends in capture frequencies (CSD) of *Dendarus lugens* in individual sampling periods.

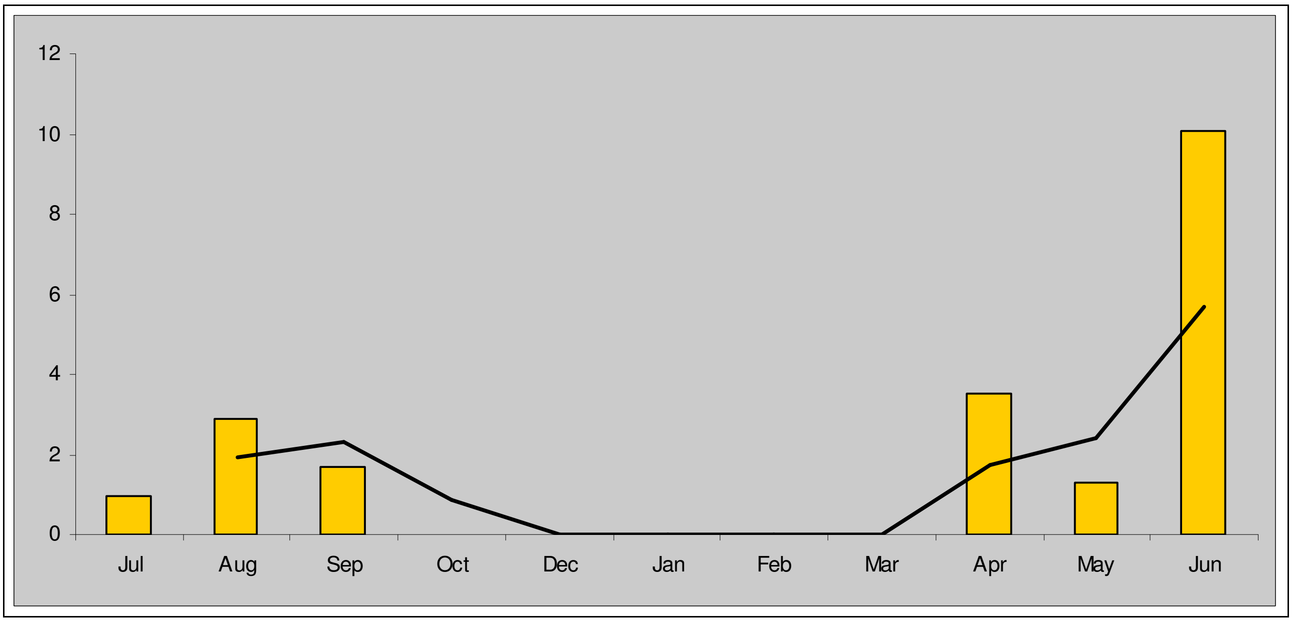
Scaurus tristis

It show the tenth value of CSD, which represents 1,08% of the entire sample of Coleoptera Tenebrionidae. The species was sampled at stations **Ol** and **Tk**, with the highest value of CSD in **Tk** (68,48%) (graph 5.2.21).



Graph. 5.2.21 - Trend of capture frequency (CSD) for *Scaurus tristis* within the single station.

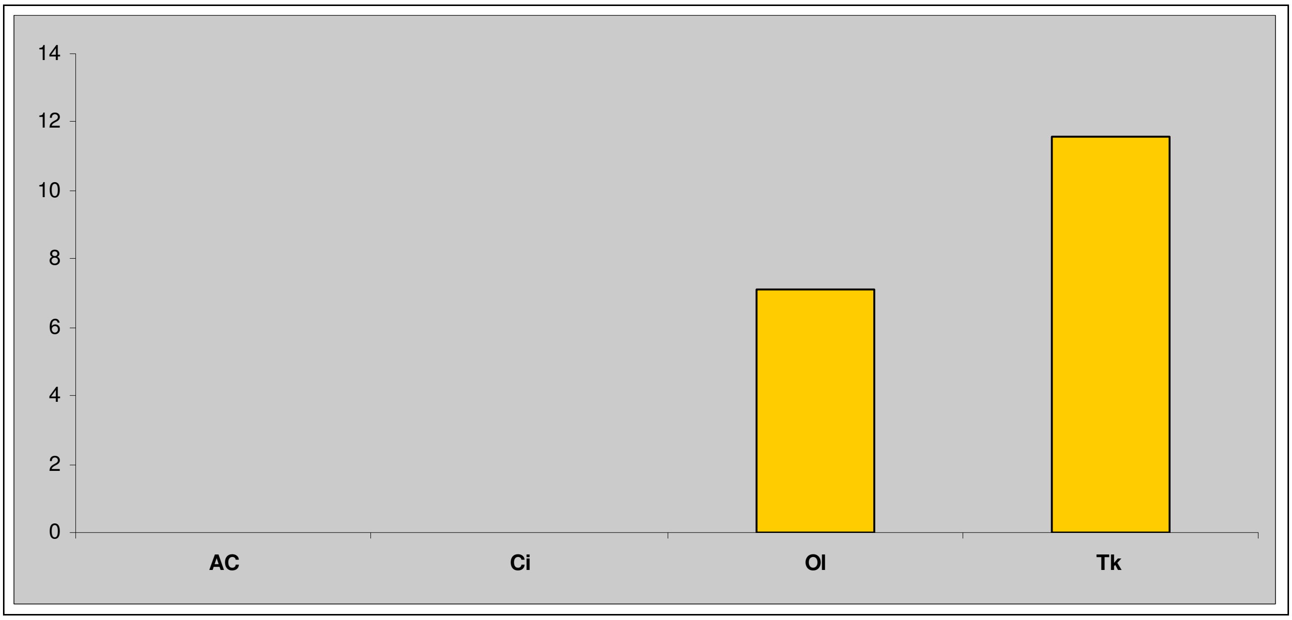
The trend of the capture frequencies over the sample period (graph 5.2.22) shows, as the previous species, two periods of activity: the greatest between April and June, peaking in June (49,17%) and the lowest between July and September, with significantly lower values of CSD. In the months between October and March the species shows null CSD values.



Graph. 5.2.22 - Trends in capture frequencies (CSD) of *Scaurus tristis* in individual sampling periods.

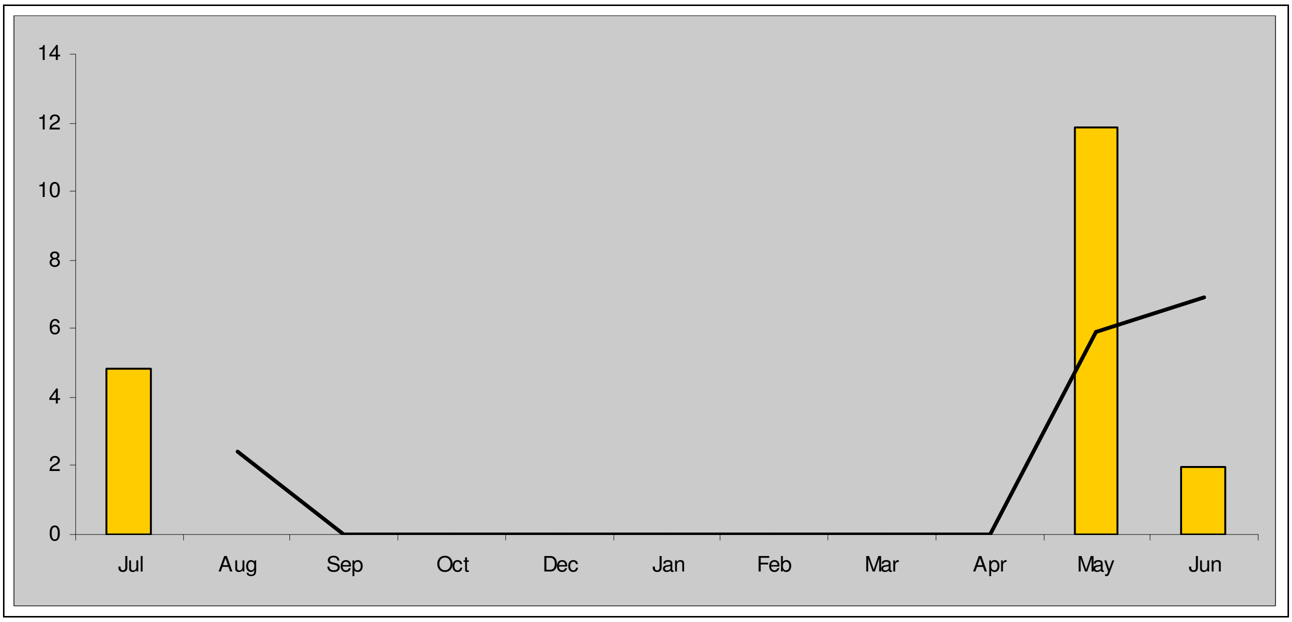
Erodius siculus siculus

It shows the eleventh value of CSD, which represents 0,98% of the entire sample of Coleoptera Tenebrionidae. The species was sampled at stations **Ol** and **Tk**, with the highest value of CSD in **Tk** (61,84%) (graph 5.2.23).



Graph. 5.2.23 - Trend of capture frequency (CSD) for *Erodius siculus siculus* within the single station.

The trend of the capture frequencies over the sample period (graph 5.2.24) shows that the species is present only in July, May and June, with the peak of CSD in May (63,56%).



Graph. 5.2.24 - Trends in capture frequencies (CSD) of *Erodius siculus siculus* in individual sampling periods.

5.3 COLEOPTERA STAPHYLINIDAE

From the discussion of this family was excluded Aleocharinae subfamily, large and certainly very important, but still too little known both taxonomic and ecological point of view, to be used for biocenotic studies in the Mediterranean.

Excluding Aleocharinae, in total were surveyed **46** species and subspecies of Coleoptera Staphylinidae that are reported in table 5.3.1.

For the nomenclature, reference is made to the checklist of the Italian fauna (CICERONI et alii 1995) updated to January 2011 according to the Checklist of Staphylinidae of Fauna Europaea Project (SMETANA 2011) (www.faunauer.org).

Regarding *Ocypus (Ocypus) ophthalmicus* (Scopoli 1763), given the complex taxonomic problems still unresolved, the specimens sampled were not allocated to any of the two subspecies currently recognized as valid.

For chorological categories it was referred to VIGNA TAGLIANTI et alii 1992, PILON (2004) and ZANETTI (2004). The distribution in Italy is taken from the checklist of the Italian fauna (CICERONI et alii 1995) updated according to the project CKmap (PILON 2004, ZANETTI 2004). regarding *Heterothops minutus* Wollaston 1860 it was referred to ZANETTI (2012, in press) that records it for the whole mainland Italy, Sardinia and Sicily.

	Species	**Chorology**	**Italy**
	Anotylus complanatus (Erichson 1839)	SubCOSM	N S Si Sa
	Anotylus inustus (Gravenhorst 1806)	CEM	N S Si Sa
	Anotylus nitidulus (Gravenhorst 1806)	SubCOSM	N S Si Sa
	Anotylus sculpturatus (Gravenhorst 1806)	TEM	N S Si Sa
	Anotylus speculifrons (Kraatz 1857)	TEM	N S Si Sa
	Anotylus tetracarinatus (Block 1799)	OLA	N S Si Sa
	Astenus (Astenopleuritus) melanurus (Kuster 1853)	SubCOSM	N? S Si Sa
	Astenus (Astenus) lyonessius (Joy 1908)	EUM	N S Si Sa
	Domene (Domene) stilicina (Erichson 1840)	MED	S Si Sa
	Euryporus aeneiventris (P. Lucas 1846)	WME	S Si
	Eusphalerum (Eusphalerum) luteicorne (Erichson 1840)	WME	Si
	Gabrius nigritulus (Gravenhorst 1802)	COSM	N S Si Sa
	Gyrohypnus (Gyrohypnus) fracticornis (O. Müller 1776)	SubCOSMi	N S Si Sa
	Habrocerus capillaricornis (Gravenhorst 1806)	SubCOSM	N S Si Sa
	Heterothops minutus Wollaston 1860	EUM	N S Si Sa
	Lordithon exoletus (Erichson 1839)	EUM	N S Si Sa
	Luzea nugritula (Erichson 1840)	EUM	N S Si Sa
	Megalinus glabratus (Gravenhorst 1806)	TEM	N S Si Sa
	Micropeplus porcatus Paykull 1789	EUM	N S Sa **new for Si**
	Micropeplus staphylinoides Marsham 1802	EUM	N S Si Sa
	Mycetoporus baudueri Mulsant & Rey 1875	EUM	N, S, Si, Sa?
	Ocypus (Ocypus) olens olens (O. Mueller 1764)	EUM NEAi	N S Si Sa
	Ocypus (Ocypus) ophthalmicus (Scopoli 1763)	PAL	N S Si Sa
	Ocypus (Pseudocypus) fortunatarum Wollaston 1871	WME	S Si Sa
	Ocypus (Pseudocypus) sericeicollis (Ménétriés 1832)	SEU	N S Si
	Omalium cinnamomeum Kraatz 1857	EME	N S Si
	Omalium rugatum Mulsant & Rey 1880	EUM	N S Si Sa
	Paraphloeostiba gayndahensis (MacLeay 1873)	Introdotta	N S Si Sa
	Philonthus (Philonthus) concinnus (Gravenhorst 1802)	CEM NEAi	N S Si Sa
	Platystethus (Craetopycrus) nitens (C. R. Sahlberg 1832)	PAL	N S Si Sa
	Proteinus atomarius Erichson 1840	OLA	N S Si Sa

	Quedius (Quedius) levicollis (Brullé 1832)	TEM	N S Si Sa
	Quedius (Raphirus) humeralis Stephens 1832	EUR	N S Si Sa
	Quedius (Raphirus) semiobscurus semiobscurus (Marsham 1802)	TEM	N S Si Sa
	Rugilus (Rugilus) orbiculatus (Paykull 1789)	OLA (AUS)	N S Si Sa
	Sepedophilus marshami (Stephens 1832)	EUM NEAi	N S Si
	Sepedophilus nirgipennis (Stephens 1832)	EUM	N S Si Sa
	Stenus cfr. *elegans* Rosenhauer 1856	WME	N S Si Sa
	Sunius (Sunius) algiricus (Coiffait 1969)	NAF	S (Calabria) Si
	Tachinus flavolimbatus Pandellé 1869	WME	S Si
	Tachyporus nitidulus (Fabricius 1781)	COSM	N S Si Sa
	Tachyporus pusillus Gravenhorst 1806	PAL	N S Si Sa
E	*Tasgius (Rayachelia) globulifer evitendus* (Tottenham 1945)	EUR	Si
E	*Tasgius (Tasgius) pedator siculus* (Aubé 1842)	SEU	Si
	Xantholinus (Calolinus) rufipennis Erichson 1839	EME	N S Si
	Xantholinus (Typholinus) graecus graecus Kraatz 1858	EME	S Si

Tab. 5.3.1 – List of species and subspecies of Staphylinidae surveyed. In the first column with letter **E** are indicated the endemic sicilian taxa. For each taxon is also reported the chorological category and distribution in Italy following the symbology used in the checklist of the Italian fauna. For further explanations and clarifications please refer to the text.

Two taxa, *Tasgius (Rayachelia) globulifer evitendus* (Tottenham 1945) and *Tasgius (Tasgius) pedator siculus* (Aubé 1842) are sicilian endemism.

***Tasgius* (*Rayachelia*) *globulifer evitendus* (Tottenham 1945)**
The subspecies is endemic of Sicily, while the nominal subspecies is reported for most of Europe territories, Turkey and Syria. In Sicily it is relatively common in open areas (meadows, pastures) from sea level to mountain.

***Tasgius* (*Tasgius*) *pedator siculus* (Aubé 1842)**
The subspecies is endemic of Sicily, while the nominal subspecies is reported for much of central and southern Europe, for Algeria, Turkey and Iran. In Sicily it is common in open xeric and sub-xeric environments and also in anthropized environments.

A species, *Micropeplus porcatus* Paykull 1789, resulted as new for sicilian fauna.

***Micropeplus porcatus* Paykull 1789**
Species widely distributed in Europe (Austria, Belgium, Bosnia-Herzegovina, Czech Republic, Denmark, Estonia, Finland, France, Great Britain, Germany, Greece, Hungary, Ireland, Italy, Latvia, Norway, Russia, Poland, Slovakia, Sweden and Switzerland) and North Africa (Algeria, Morocco and Tunisia) and reported also for Turkey and Far East Russia. Reported throughout mainland Italy and Sardinia.

Some other species deserve a brief comment in relation to its distribution and/or relative rarity.

***Euryporus aeneiventris* (P. Lucas 1846)**
Species known for Corsica, Southern Italy and Sicily, Spain and North Africa (Algeria, Egypt, Morocco and Tunisia). In Sicily it is relatively rare, having a tendency to forest habitats; more common in the mountain plain, its presence is sporadic in the plains.

***Eusphalerum* (*Eusphalerum*) *luteicorne* (Erichson 1840)**
Species known for Sicily, Algeria and Tunisia. In Sicily it is relatively rare species, associated to sclerophyllous forests of medium and low altitude and to the mediterranean maquis where he lives preferentially on flowers of *Euphorbia*.

***Sunius* (*Sunius*) *algiricus* (Coiffait 1969)**
Species known for Calabria, Sicily and Algeria. In Sicily the species is relatively common in southern regions where it lives in open areas and coastal wetlands.

***Tachinus flavolimbatus* Pandellé 1869**
Species known for western Europe and North Africa. In Italy its distribution is limited to the southern regions and Sicily, where is rare species with a tendency to forest habitats.

***Xantholinus* (*Calolinus*) *rufipennis* Erichson 1839**
Species with an eastern Mediterranean distribution, reported for the entire continental Italy and Sicily, where it is relatively rare in open environments.

***Xantholinus* (*Typholinus*) *graecus graecus* Kraatz 1858**
Species with an eastern Mediterranean distribution, reported for the central and southern Italy and Sicily, where it is relatively rare in open environments.

The species and subspecies of sampled Staphylinidae (with exception of Aleocharinae) and the number of specimens collected in the 5 stations are shown in table 5.3.2.

SPECIES	*AC*	*Ci*	*Ol*	*Tk*	*Vy*	**Tot_Nb_specimens**
Ocypus (Ocypus) olens olens	154	327	51	74	1	**607**
	15,01	*31,87*	*4,97*	*7,21*	*0,10*	*59,16*
Sepedophilus nigripennis	65	12	46	1		**124**
	6,34	*1,17*	*4,48*	*0,10*		*12,09*
Anotylus speculifrons	33	10	4			**47**
	3,22	*0,97*	*0,39*			*4,58*
Anotylus inustus	2		28	9	4	**43**
	0,19		*2,73*	*0,88*	*0,39*	*4,19*
Paraphloeostiba gayndahensis	1	22		6		**29**
	0,10	*2,14*		*0,58*		*2,83*
Xantholinus (Typholinus) graecus graecus	10		9	1		**20**
	0,97		*0,88*	*0,10*		*1,95*
Megalinus glabratus	11					**11**
	1,07					*1,07*
Xantholinus (Calolinus) rufipennis	10		1			**11**
	0,97		*0,10*			*1,07*
Heterothops minutus	6	1	2	1		**10**
	0,58	*0,10*	*0,19*	*0,10*		*0,97*
Tachyporus nitidulus	7			3		**10**
	0,68			*0,29*		*0,97*
Tachyporus pusillus	4		5	1		**10**
	0,39		*0,49*	*0,10*		*0,97*
Tasgius (Tasgius) pedator siculus		8	1	1		**10**
		0,78	*0,10*	*0,10*		*0,97*
Anotylus complanatus	5	1				**6**
	0,49	*0,10*				*0,58*
Micropeplus staphylinoides	2		3	1		**6**
	0,19		*0,29*	*0,10*		*0,58*
Mycetoporus baudueri	3		3			**6**
	0,29		*0,29*			*0,58*

Philonthus (Philonthus) concinnus		1	5			**6**
		0,10	*0,49*			*0,58*
Rugilus (Rugilus) orbiculatus		5	1			**6**
		0,49	*0,10*			*0,58*
Sepedophilus marshami	3		2	1		**6**
	0,29		*0,19*	*0,10*		*0,58*
Stenus cfr. elegans		6				**6**
		0,58				*0,58*
Astenus (Astenopleuritus) melanurus			3		2	**5**
			0,29		*0,19*	*0,49*
Ocypus (Pseudocypus) sericeicollis			5			**5**
			0,49			*0,49*
Ocypus (Ocypus) ophthalmicus		1	1	2		**4**
		0,10	*0,10*	*0,19*		*0,39*
Proteinus atomarius		1		3		**4**
		0,10		*0,29*		*0,39*
Astenus (Astenus) lyonessius	1		2			**3**
	0,10		*0,19*			*0,29*
Omalium rugatum	3					**3**
	0,29					*0,29*
Anotylus sculpturatus	2					**2**
	0,19					*0,19*
Domene (Domene) stilicina		1	1			**2**
		0,10	*0,10*			*0,19*
Euryporus aeneiventris		2				**2**
		0,19				*0,19*
Platystethus (Craetopycrus) nitens		2				**2**
		0,19				*0,19*
Quedius (Quedius) levicollis		2				**2**
		0,19				*0,19*
Sunius (Sunius) algiricus		2				**2**
		0,19				*0,19*
Tachinus flavolimbatus		2				**2**
		0,19				*0,19*
Anotylus nitidulus		1				**1**
		0,10				*0,10*
Anotylus tetracarinatus	1					**1**
	0,10					*0,10*
Eusphalerum (Eusphalerum) luteicorne	1					**1**
	0,10					*0,10*
Gabrius nigritulus		1				**1**
		0,10				*0,10*
Gyrohypnus (Gyrohypnus) fracticornis		1				**1**
		0,10				*0,10*
Habrocerus capillaricornis		1				**1**
		0,10				*0,10*
Lordithon exoletus		1				**1**
		0,10				*0,10*
Luzea nigritula	1					**1**
	0,10					*0,10*

Micropeplus porcatus		1				**1**
		0,10				*0,10*
Ocypus (Pseudocypus) fortunatarum			1			**1**
			0,10			*0,10*
Omalium cinnamomeum				1		**1**
				0,10		*0,10*
Quedius (Raphirus) humeralis	1					**1**
	0,10					*0,10*
Quedius (Raphirus) semiobscurus semiobscurus			1			**1**
			0,10			*0,10*
Tasgius (Rayachelia) globulifer evitendus		1				**1**
		0,10				*0,10*
Tot_Nb_specimens	326	413	175	105	7	**1.026**
	31,77	*40,25*	*17,1*	*10,2*	*0,68*	*100,00*
Tot_Nb_species	22	25	21	14	3	**46**

Tab. 5.3.2 - Trends in catches of Coleoptera Staphylinidae at each station expressed as total number (top row) and percentage (bottom row) of specimens sampled. The percentages refer to the total of the entire sample of Staphylinidae.

During the sample period in the 5 stations investigated within the Riserva Naturale Orientata "Pineta di Vittoria" were surveyed a total of **1.026** specimens of Staphylinidae (with exception of Aleocharinae), which, as mentioned, are representative of **46** species.

The most abundant species resulted: *Ocypus* (*Ocypus*) *olens olens* (**607** specimens) which alone accounts for about 59% of the total catch of Staphylinidae, *Sepedophilus nigripennis* (**124** specimens), *Anotylus speculifrons* (**47** specimens), *Anotylus inustus* (**43** specimens), *Paraphloeostiba gayndahensis* (**29** specimens), *Xantholinus* (*Typholinus*) *graecus graecus* (**20** specimens), *Megalinus glabratus* (**11** specimens), *Xantholinus* (*Calolinus*) *rufipennis* (**11** specimens), *Heterothops minutus* (**10** specimens), *Tachyporus nitidulus* (**10** specimens), *Tachyporus pusillus* (**10** specimens), *Tasgius* (*Tasgius*) *pedator siculus* (**10** specimens), representing the **10%** of the total sampled specimens of Coleoptera and about the **91%** of the total sampled Staphylinidae.

In fig. 5.3.1 are shown the percentages of specimens surveyed for the more abundantly sampled species of Staphylinidae compared to the total sample of the Family.

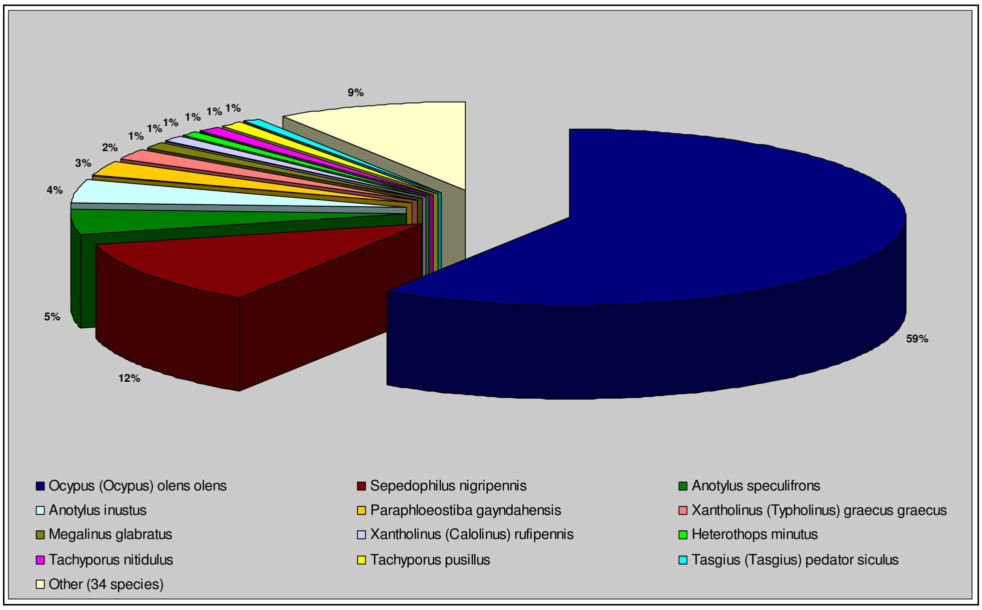


Fig. 5.3.1 - Overall trend (number of individual and percentage of total) of catches for more abundant species of Staphylinidae.

La tabella 5.3.3 shows the values of CSD for species counted within the individual stations, with the exclusion of station **Vy**, which has been eliminated from consideration for the reasons set out above.

SPECIES	AC	Ci	Ol	Tk	Tot_CSD
Ocypus (Ocypus) olens olens	139,10	341,82	47,03	64,61	592,55
Sepedophilus nigripennis	69,34	13,82	44,14	1,47	128,77
Anotylus speculifrons	30,78	11,66	3,04		45,48
Paraphloeostiba gayndahensis	1,08	29,03		9,98	40,09
Anotylus inustus	1,58		24,69	7,10	33,37
Xantholinus (Typholinus) graecus graecus	9,42		9,17	0,79	19,38
Tachyporus nitidulus	8,19			3,05	11,24
Tachyporus pusillus	4,10		5,43	1,47	10,99
Megalinus glabratus	10,63				10,63
Heterothops minutus	6,71	1,08	1,75	0,70	10,25
Tasgius (Tasgius) pedator siculus		7,30	0,79	1,47	9,56
Xantholinus (Calolinus) rufipennis	8,08		1,47		9,55
Stenus cfr. elegans		7,53			7,53
Rugilus (Rugilus) orbiculatus		5,39	1,47		6,86
Anotylus complanatus	5,08	1,47			6,55
Philonthus (Philonthus) concinnus		0,79	4,90		5,69
Mycetoporus baudueri	2,83		2,83		5,67
Micropeplus staphylinoides	1,77		2,83	0,98	5,58
Sepedophilus marshami	2,94		1,77	0,79	5,50
Ocypus (Pseudocypus) sericeicollis			5,49		5,49
Proteinus atomarius		1,29		2,37	3,66
Astenus (Astenopleuritus) melanurus			3,45		3,45
Ocypus (Ocypus) ophthalmicus		0,99	0,79	1,58	3,35
Astenus (Astenus) lyonessius	0,87		2,26		3,13
Euryporus aeneiventris		2,94			2,94
Omalium rugatum	2,94				2,94
Domene (Domene) stilicina		1,47	1,29		2,76
Anotylus sculpturatus	2,17				2,17
Platystethus (Craetopycrus) nitens		2,16			2,16
Sunius (Sunius) algiricus		2,16			2,16
Tachinus flavolimbatus		1,96			1,96
Quedius (Quedius) levicollis		1,75			1,75
Luzea nigritula	1,47				1,47
Ocypus (Pseudocypus) fortunatarum			1,47		1,47
Omalium cinnamomeum				1,40	1,40
Quedius (Raphirus) humeralis	1,29				1,29
Anotylus nitidulus		1,08			1,08
Gabrius nigritulus		1,08			1,08
Gyrohypnus (Gyrohypnus) fracticornis		1,08			1,08
Tasgius (Rayachelia) globulifer evitendus		0,99			0,99
Anotylus tetracarinatus	0,98				0,98
Eusphalerum (Eusphalerum) luteicorne	0,98				0,98
Habrocerus capillaricornis		0,98			0,98
Micropeplus porcatus		0,98			0,98
Quedius (Raphirus) semiobscurus semiobscurus			0,98		0,98
Lordithon exoletus		0,87			0,87
Tot_CSD	**312,33**	**441,65**	**167,04**	**97,75**	**1.018,77**
Nb_species	***22***	***25***	***21***	***14***	***46***

Tab. 5.3.3 - Trends in catches of Coleoptera Staphylinidae at each station expressed as CSD.

The analysis of the table and fig. 5.3.2 shows how the station **Ci** present a very sharp peak for frequencies of capture (equivalent to 43,35% of total), while the station **AC** shows a value of 30,66% of the total, and the stations **Ol** and **Tk** show lower values with respectively 16,40% and 9,59% of the total.

Examining the table 5.3.3 we observe that only 3 species, *Ocypus* (*Ocypus*) *olens olens, Sepedophilus nigripennis* and *Heterothops minutus* were observed in all stations; 9 species are present in three stations: *Anotylus speculifrons, Paraphloeostiba gayndahensis*, *Anotylus inustus*, *Xantholinus* (*Typholinus*) *graecus graecus*, *Tachyporus pusillus*, *Tasgius* (*Tasgius*) *pedator siculus*, *Micropeplus staphylinoides*, *Sepedophilus marshami* and *Ocypus* (*Ocypus*) *ophthalmicus*. The other species are present in only one or two stations.

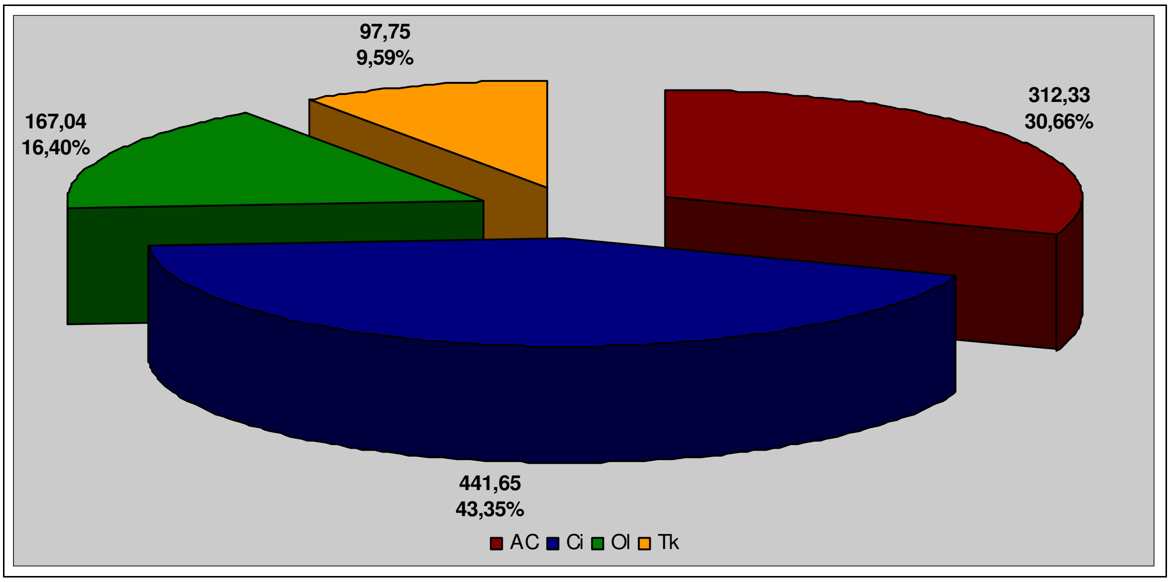
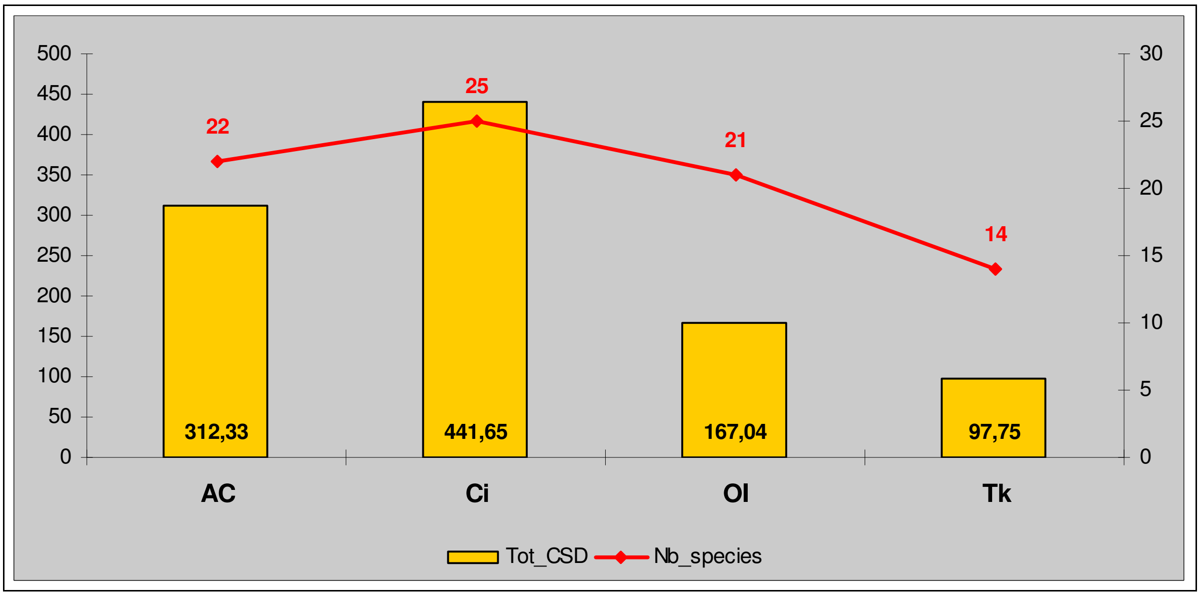


Fig. 5.3.2 – Frequency of capture of Coleoptera Staphylinidae in the stations and their percentage of the total value of CSD.

Considering the general trend of the capture frequency of Coleoptera Staphylinidae within the stations and the number of species sampled (graph. 5.3.1) is observed that the greatest number of species (**25**) has been surveyed in the **Ci** station and the minimum (**14**) in **Tk** station, passing through the stations **AC** (**22**) and **Ol** (**21**).

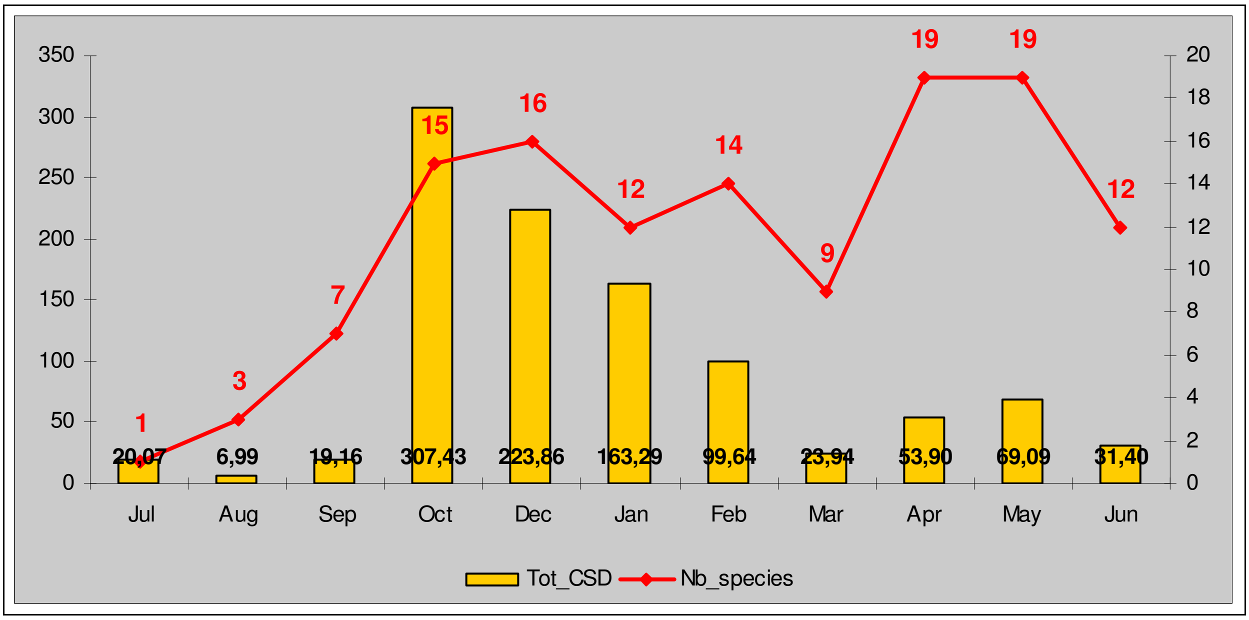


Graph. 5.3.1 - Overall trend of catches of Coleoptera Staphylinidae (Tot_CSD) and number of species (Nb_species) sampled at each station.

SPECIES	Jul	Aug	Sep	Oct	Dec	Jan	Feb	Mar	Ape	May	Jun	Tot_CSD
Ocypus (Ocypus) olens olens			4,67	234,07	145,04	121,89	60,31	3,02	5,88	13,23	4,45	592,55
Sepedophilus nigripennis			7,77	7,89	37,24	21,99	20,98	1,16	6,86	20,58	4,31	128,77
Anotylus speculifrons			1,27	10,25	9,80		0,87	4,17	14,70	4,41		45,48
Paraphloeostiba gayndahensis	20,07	4,84	0,79		0,98			4,49	0,98	1,47	6,47	40,09
Anotylus inustus				22,87	0,98	3,88	3,50	1,16	0,98			33,37
Xantholinus (Typholinus) graecus graecus				7,10	4,90	2,59	0,87		0,98	2,94		19,38
Tachyporus nitidulus				1,58				2,31	2,94	4,41		11,24
Tachyporus pusillus								4,62	4,90	1,47		10,99
Megalinus glabratus				3,94	2,94	1,29			0,98	1,47		10,63
Heterothops minutus			0,70			3,88	2,62		1,96		1,08	10,25
Tasgius (Tasgius) pedator siculus		1,08	3,17	2,76						1,47	1,08	9,56
Xantholinus (Calolinus) rufipennis				7,10					0,98	1,47		9,55
Stenus cfr. elegans							1,75	1,86	0,98	2,94		7,53
Rugilus (Rugilus) orbiculatus										1,47	5,39	6,86
Anotylus complanatus					2,94			1,16	0,98	1,47		6,55
Philonthus (Philonthus) concinnus			0,79		4,90							5,69
Mycetoporus baudueri					3,92		1,75					5,67
Micropeplus staphylinoides				0,79			0,87		3,92			5,58
Sepedophilus marshami				1,58	2,94				0,98			5,50
Ocypus (Pseudocypus) sericeicollis					0,98	1,29	1,75			1,47		5,49
Proteinus atomarius				2,37		1,29						3,66
Astenus (Astenopleuritus) melanurus						1,29					2,16	3,45
Ocypus (Ocypus) ophthalmicus				3,35								3,35
Astenus (Astenus) lyonessius				0,79			0,87			1,47		3,13
Euryporus aeneiventris										2,94		2,94
Omalium rugatum					2,94							2,94
Domene (Domene) stilicina						1,29				1,47		2,76
Anotylus sculpturatus						1,29	0,87					2,17
Platystethus (Craetopycrus) nitens											2,16	2,16
Sunius (Sunius) algiricus		1,08									1,08	2,16
Tachinus flavolimbatus									1,96			1,96
Quedius (Quedius) levicollis							1,75					1,75
Luzea nigritula										1,47		1,47
Ocypus (Pseudocypus) fortunatarum										1,47		1,47
Omalium cinnamomeum					1,40							1,40
Quedius (Raphirus) humeralis						1,29						1,29
Anotylus nitidulus											1,08	1,08
Gabrius nigritulus											1,08	1,08
Gyrohypnus (Gyrohypnus) fracticornis											1,08	1,08
Tasgius (Rayachelia) globulifer evitendus				0,99								0,99
Anotylus tetracarinatus					0,98							0,98
Eusphalerum (Eusphalerum) luteicorne									0,98			0,98
Habrocerus capillaricornis									0,98			0,98
Micropeplus porcatus									0,98			0,98
Quedius (Raphirus) semiobscurus semiobscurus					0,98							0,98
Lordithon exoletus							0,87					0,87
Tot_CSD	**20,07**	**6,99**	**19,16**	**307,43**	**223,86**	**163,29**	**99,64**	**23,94**	**53,90**	**69,09**	**31,40**	**1.018,77**
Nb_species	**1**	**3**	**7**	**15**	**16**	**12**	**14**	**9**	**19**	**19**	**12**	**46**

Tab. 5.3.4 - Trends in capture rates of species of Coleoptera Staphylinidae spread over the individual sampling periods.

Looking at the trend of frequency of capture of species distributed in the single sampling periods (tab. 5.3.4 e graph. 5.3.2), we observe that the 68,18% of catches is concentrated in the months of October and January, while for the months of August was recorded the minimum value for CDS.
Regarding the number of species, the highest (**19** of **46**) is recorded in April and May. In the months of July and August the number of species is much lower, even with the month of July that features a **single** species. In the remaining months these values amounted between **7** and **16**.

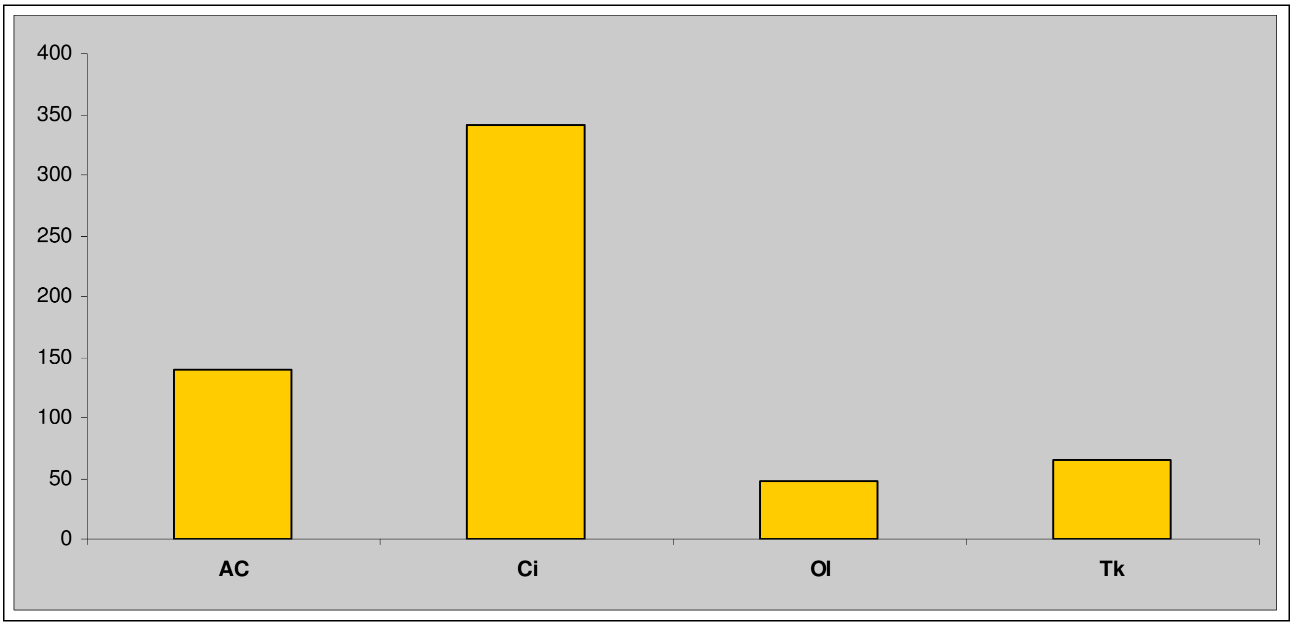


Graph. 5.3.2 - Trends in capture frequencies (CSD) of Coleoptera Staphylinidae in individual sampling periods and number of species sampled.

The Spearman rank correlation analysis for these series (number of catches per month and number of species per month) returns a value of r_s = 0,72 con $p < 0.05$, which suggests a positive relationship between the trend of the two sequences .
Below are considered the most abundant sampled species of Staphylinidae in relation to their distribution in the stations and their frequency of capture during the sampling year.

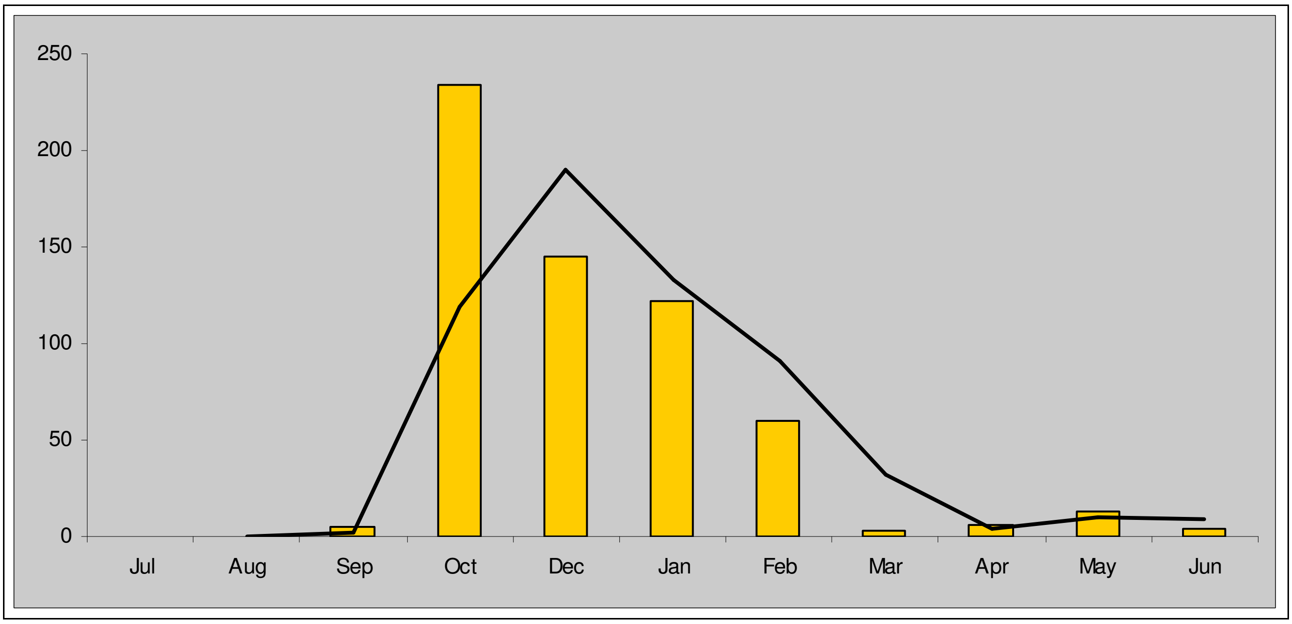
Ocypus (Ocypus) olens olens

This is the species with the highest value of CSD, which represents just over 58% of the entire sample of Coleoptera Staphylinidae. Were surveyed specimens of this species in all stations with 57,7% of the captures concentrated in the station **Ci** (graph. 5.3.3).



Graph. 5.3.3 - Trend of capture frequency (CSD) for *Ocypus* (*Ocypus*) *olens olens* within the single station.

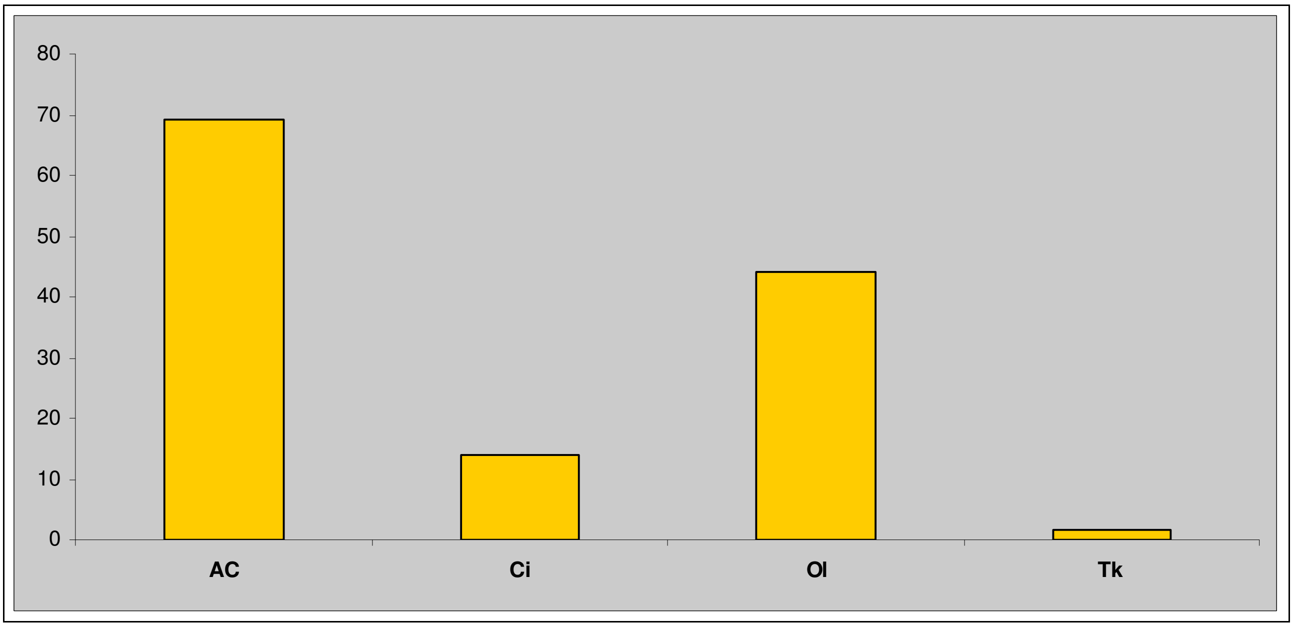
The frequency trend of its capture in the sampling period (graph. 5.3.4) shows that more than 94,7% of them are concentrated in the late autumn and winter months with a peak in October (23%) and that are significantly lower in other months, with minimum (March, April, May, June and September) or null (July and August) values.



Graph. 5.3.4 - Trends in capture frequencies (CSD) of *Ocypus* (*Ocypus*) *olens olens* in individual sampling periods.

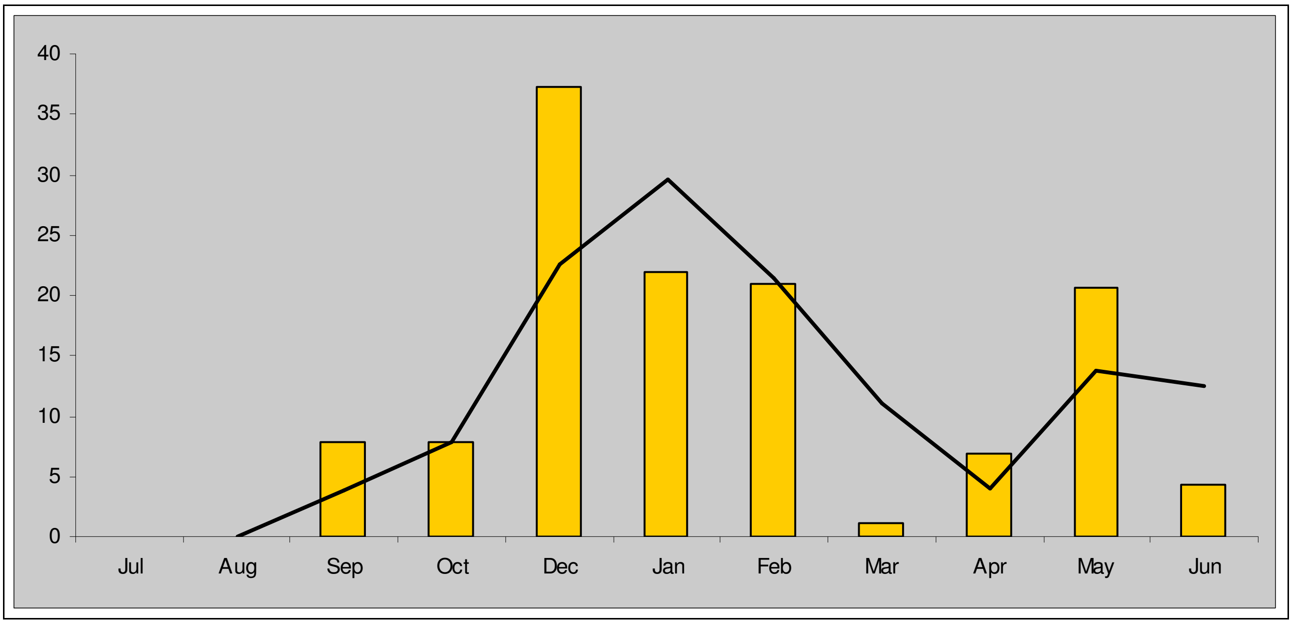
Sepedophilus nigripennis

This is the species with the second value of CSD, which represents 12,6% of the entire sample of Coleoptera Staphylinidae. Were captured specimens of this species in all the stations, with 53,8% of the catches recorded in the **AC** station and 34,3%, in **Ol** station, while the minimum is found in the station **Tk** (1,14%) (graph. 5.3.5).



Graph. 5.3.5 - Trend of capture frequency (CSD) for *Sepedophilus nigripennis* within the single station.

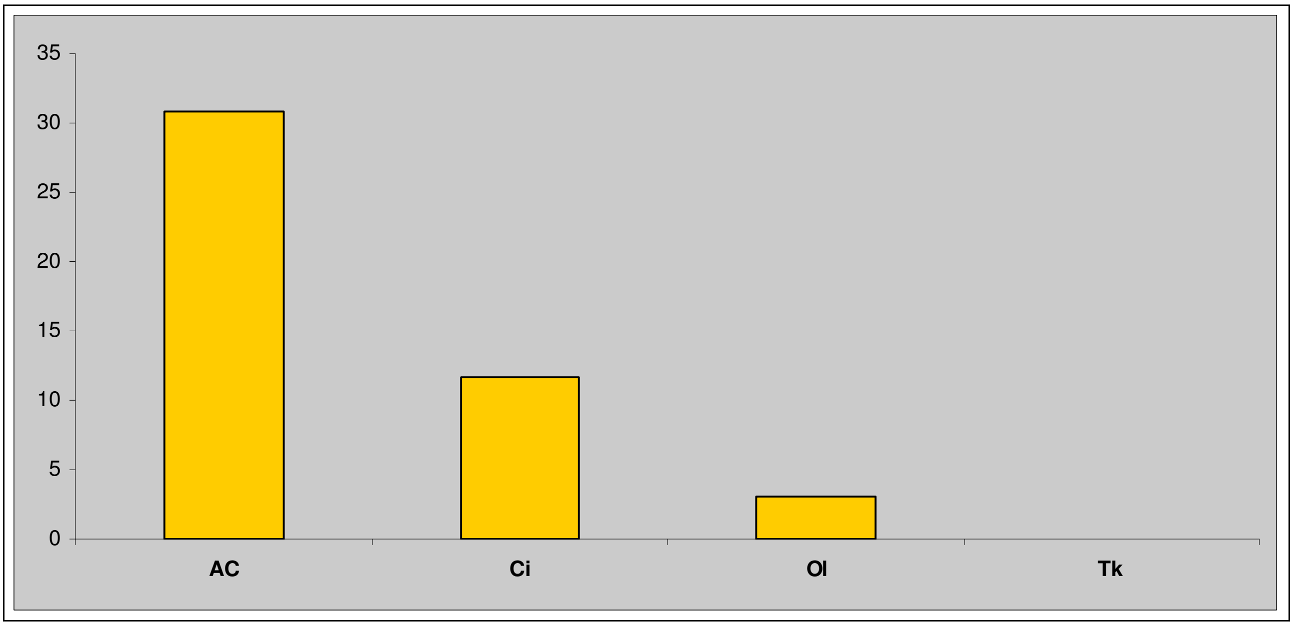
The frequency performance of its capture in the sampling period (graph. 5.3.6) shows high values in winter (December-February), including 62,3% of the total CSD. The species was not sampled during the months of July and August, and it has low values of CSD in March, June, September and October, while in May the values are significant and similar to those recorded in January and February.



Graph. 5.3.6 - Trends in capture frequencies (CSD) of *Sepedophilus nigripennis* in individual sampling periods.

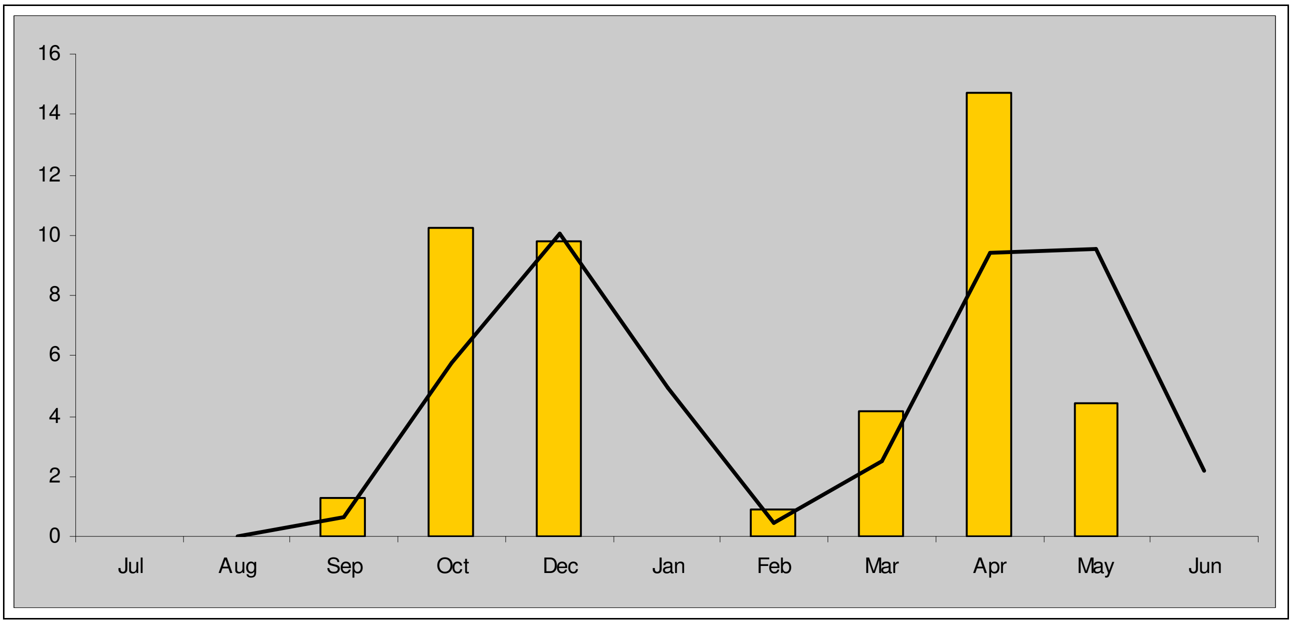
Anotylus speculifrons

This is the species with the third value of CSD, with 12,6% of the entire sample of Coleoptera Staphylinidae. It resulted present in all the stations except for **Tk** one. The maximum CSD value is recorded in station **AC** (67,7%), and the minimum in **Ol** station (6,68%) (graph. 5.3.7).



Graph. 5.3.7 - Trend of capture frequency (CSD) for *Anotylus speculifrons* within the single station.

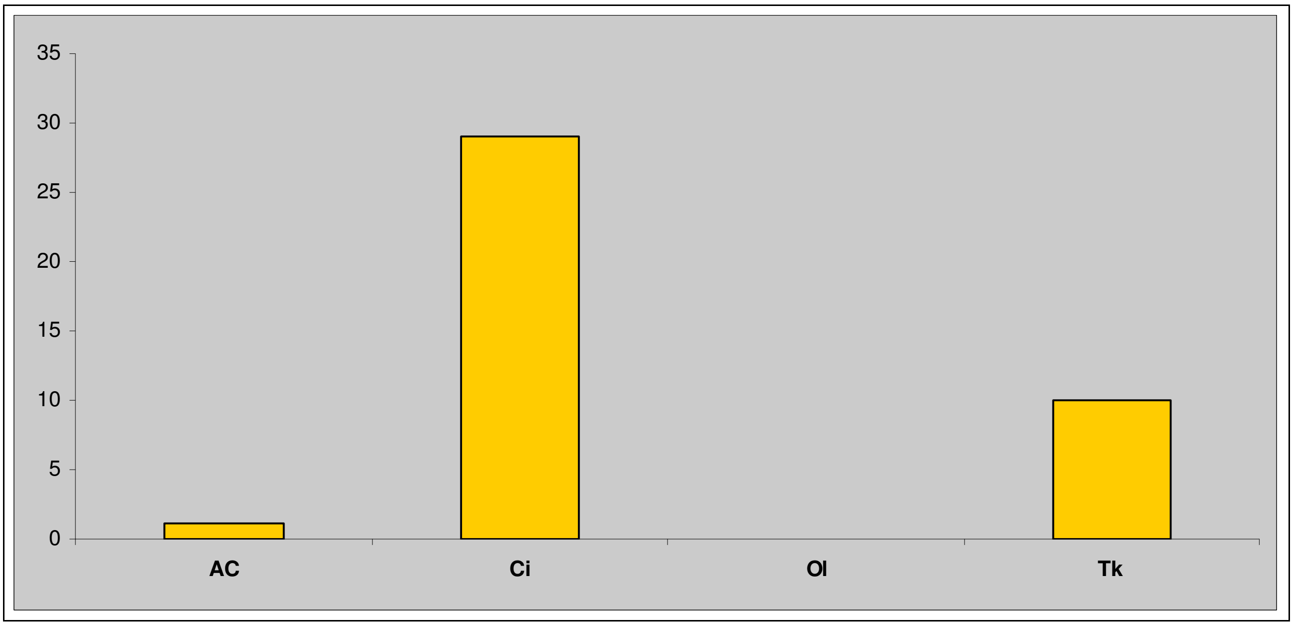
The trend of the capture frequencies over the sample period (graph. 5.3.8) shows two periods in which they concentrate. In the first period between October and December is recorded 44% of the total value of CSD, while the second period is between March and May recorded 51,2% of the total capture frequencies with a maximum in April. The species is absent in the period between June and August and in January.



Graph. 5.3.8 - Trends in capture frequencies (CSD) of *Anotylus speculifrons* in individual sampling periods.

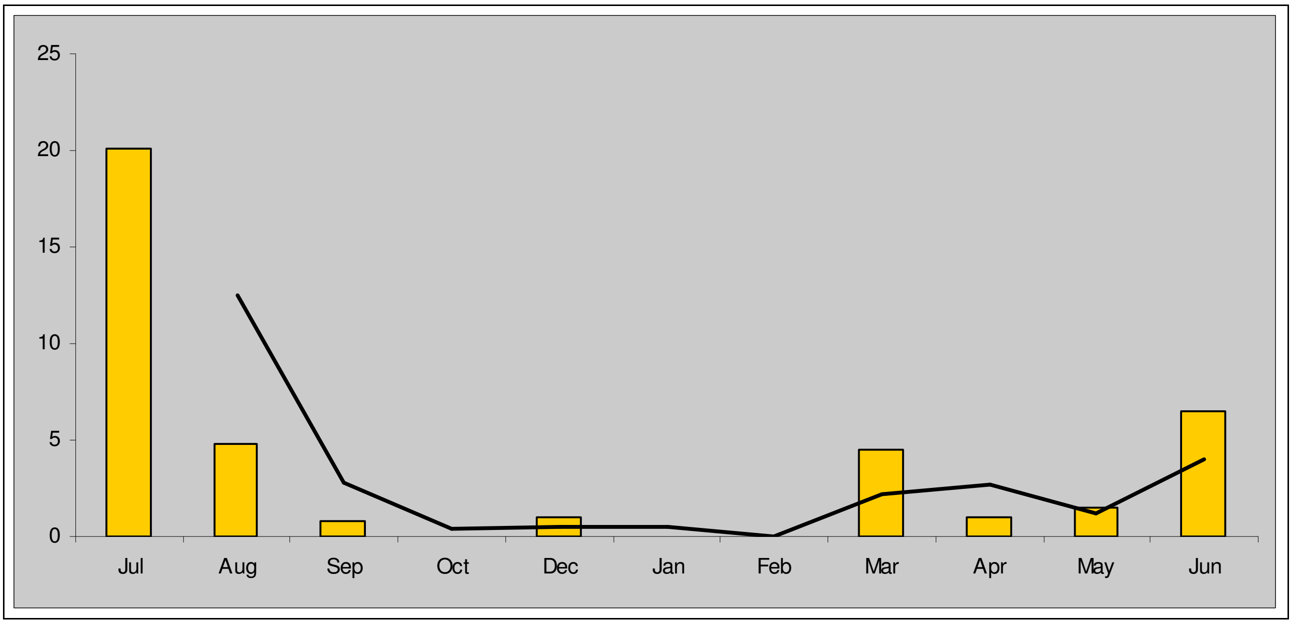
Paraphloeostiba gayndahensis

It present the fourth value of CSD, with 3,9% of the entire sample of Coleoptera Staphylinidae. It resulted present in all the stations except for **Ol** one. The maximum CSD value is recorded in station **Ci** (72,41%), and the minimum in station **AC** (2,69%) (graph. 5.3.9).



Graph. 5.3.9 - Trend of capture frequency (CSD) for *Paraphloeostiba gayndahensis* within the single station.

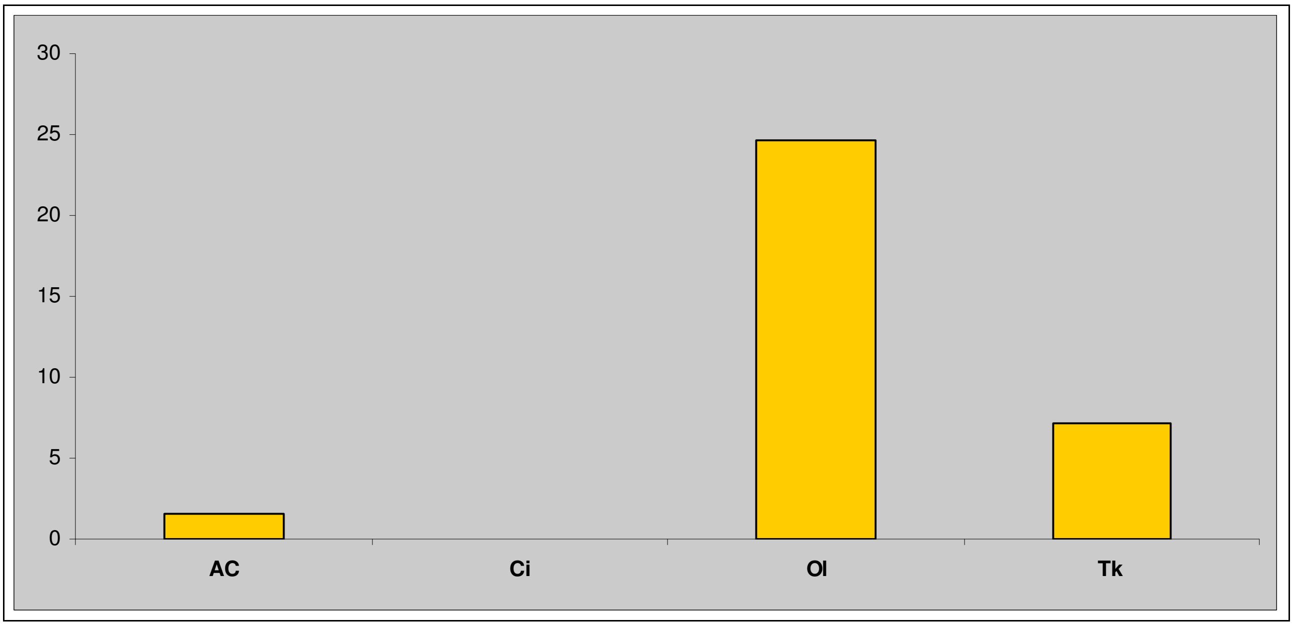
The trapping frequencies are concentrated in the sampling period between June and August (78,3%), with a sharp peak in July (graph. 5.3.10). The species is absent in the months of January, February and October, while it records low values of CSD in the remaining months except March. It is to emphasize that this is the only species that has been sampled in August.



Graph. 5.3.10 - Trends in capture frequencies (CSD) of *Paraphloeostiba gayndahensis* in individual sampling periods.

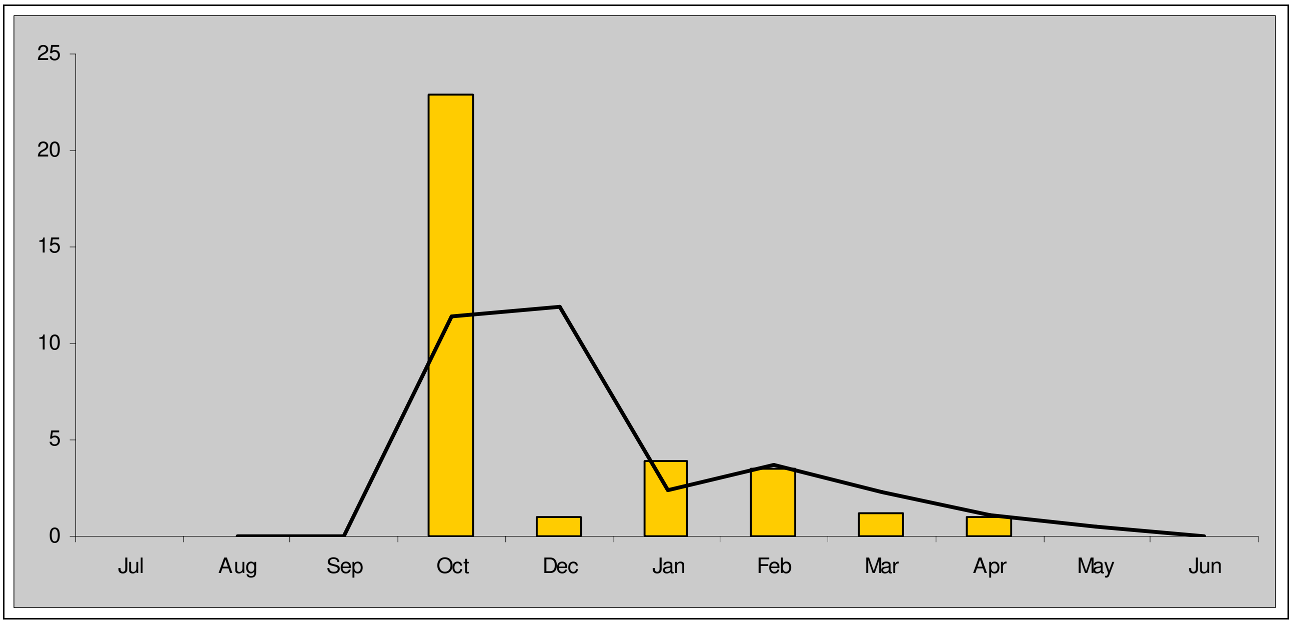
Anotylus inustus

It has the fifth value of CSD, which represents 3,27% of the entire sample of Coleoptera Staphylinidae. The species has been sampled at all stations except for **Ci** (graph. 5.3.11), with a net peak value of CDS (74%) in **Ol** station and a minimum (4,7%) in the **AC** station.



Graph. 5.3.11 - Trend of capture frequency (CSD) for *Anotylus inustus* within the single station.

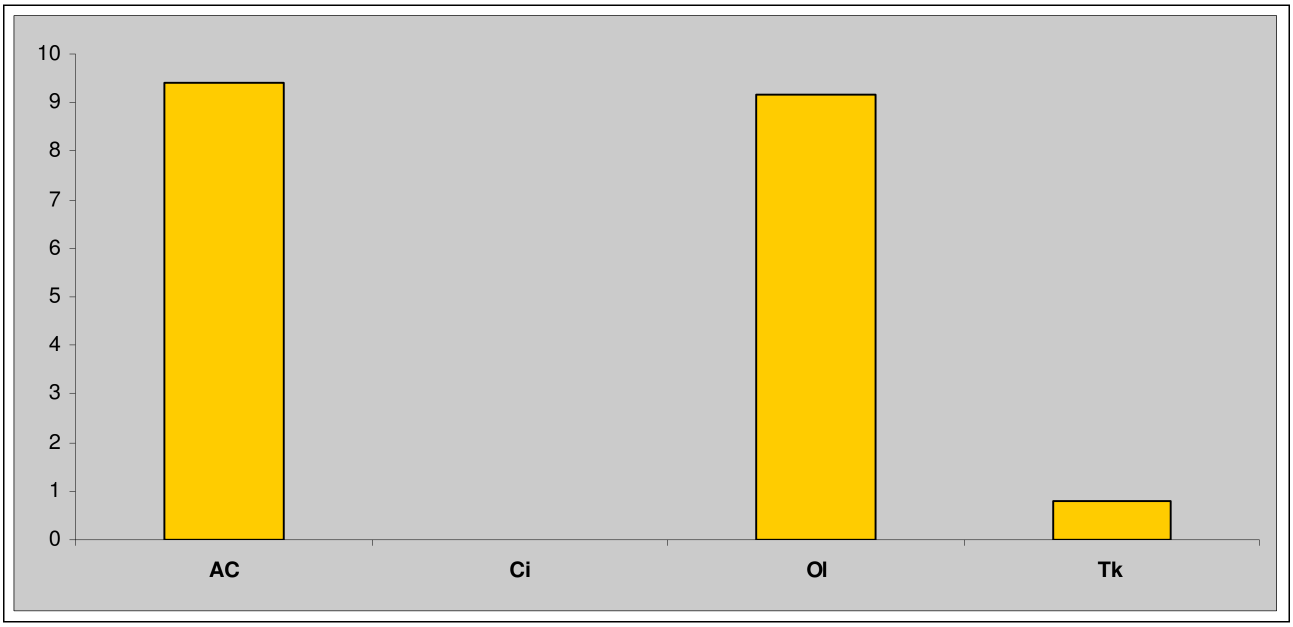
The frequency trend of its capture in the sample period (graph. 5.3.12) shows that more than 68% of them are concentrated in October and that are significantly lower in other months, with null values between May and September.



Graph. 5.3.12 - Trends in capture frequencies (CSD) of *Anotylus inustus* in individual sampling periods.

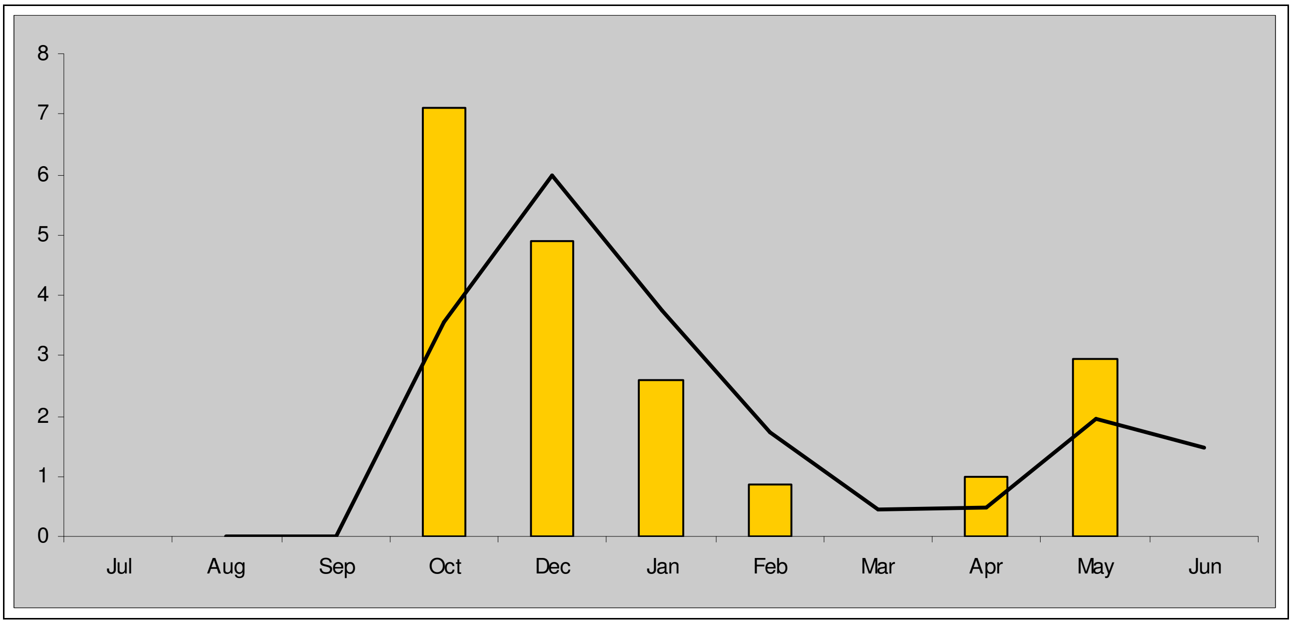
Xantholinus (*Typholinus*) *graecus graecus*

It presents the sixth CSD value, which represents approximately 1,9% of the entire sample of Coleoptera Staphylinidae. The species was sampled at all stations except for **Ci** (graph. 5.3.13), with significant values of CDS in stations **AC** and **Ol**, while the station **Tk** records a clear minimum (4% of total CSD).



Graph. 5.3.13 - Trend of capture frequency (CSD) for *Xantholinus* (*Typholinus*) *graecus graecus* within the single station.

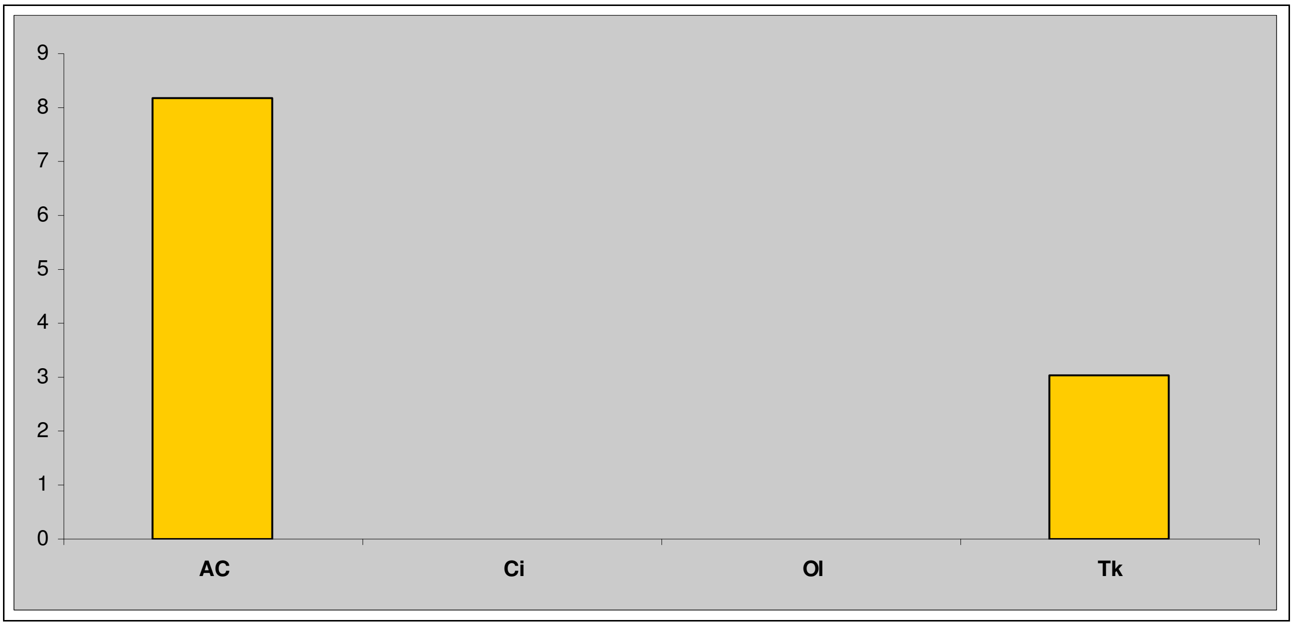
The trend of the CSD values over the sample period (graph. 5.3.14), shows a concentration of capture frequencies between October and January, peaking in October, and with null values in March and between June and September.



Graph. 5.3.14 - Trends in capture frequencies (CSD) of *Xantholinus* (*Typholinus*) *graecus graecus* in individual sampling periods.

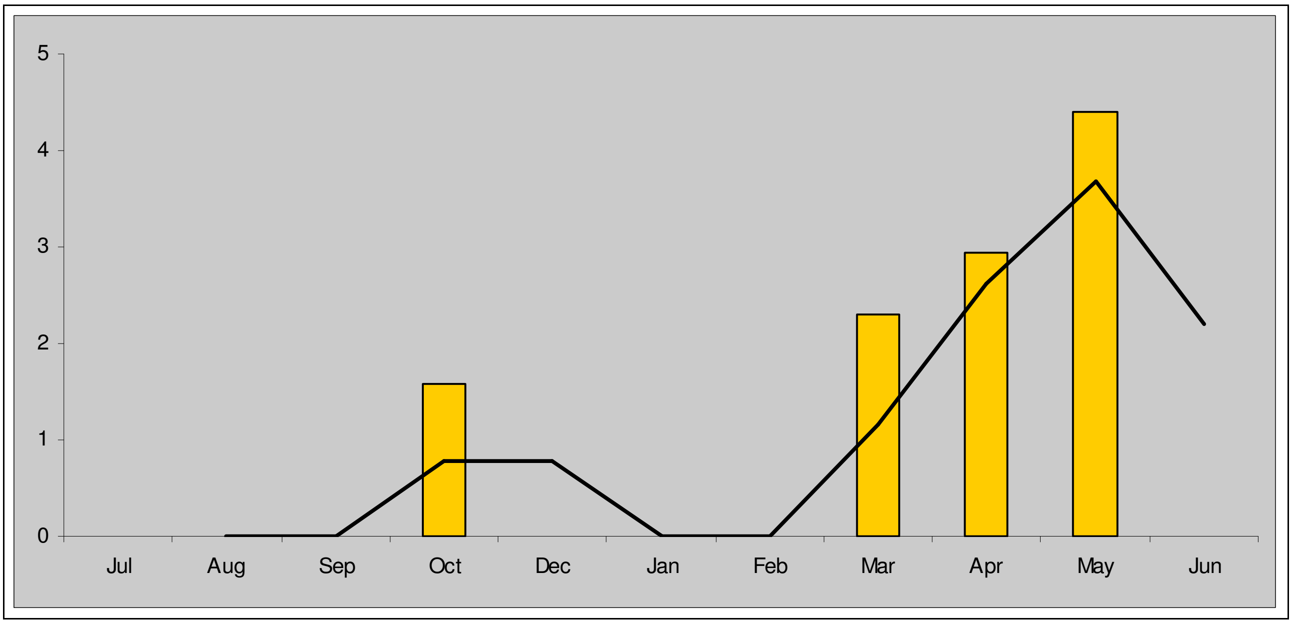
Tachyporus nitidulus

It presents the seventh CSD value, representing 1,1% of the entire sample of Coleoptera Staphylinidae. The species was sampled just in stations **AC** (72,8%) and **Tk** (27,2%) (graph. 5.3.15).



Graph. 5.3.15 - Trend of capture frequency (CSD) for *Tachyporus nitidulus* within the single station.

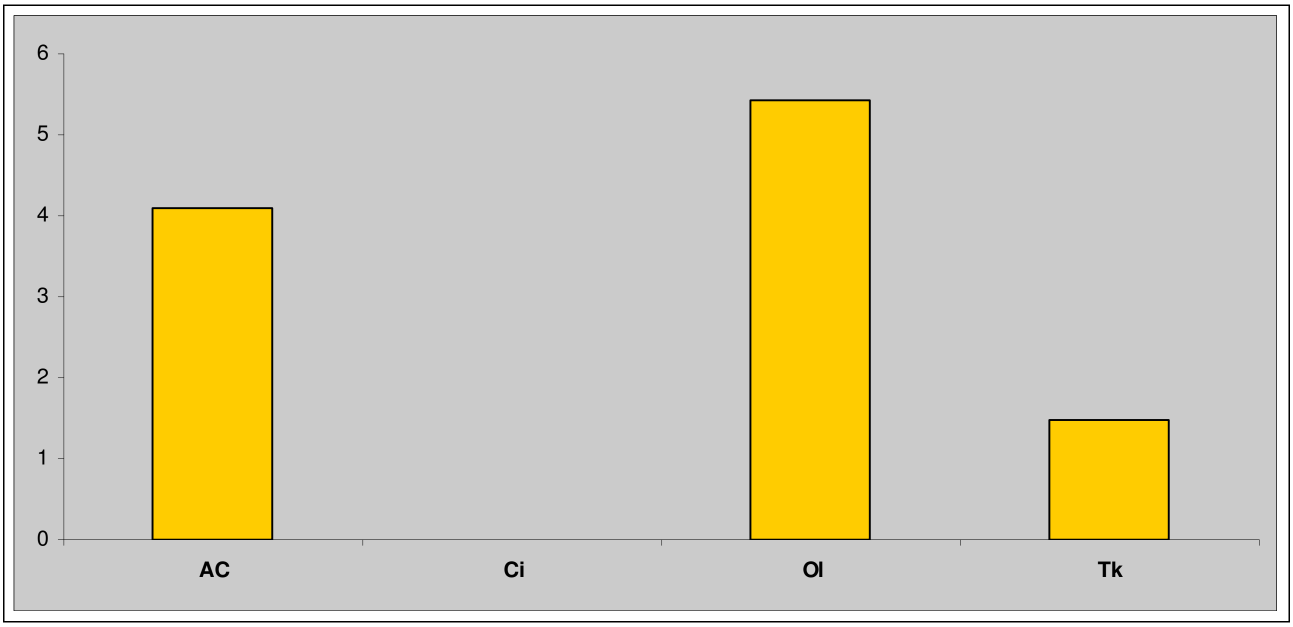
The frequency trend of its capture in the sample period (graph. 3.5.16), shows how these are distributed in increasing between March and May; the species is absent in all other months except October.



Graph. 5.3.16 - Trends in capture frequencies (CSD) of *Tachyporus nitidulus* in individual sampling periods.

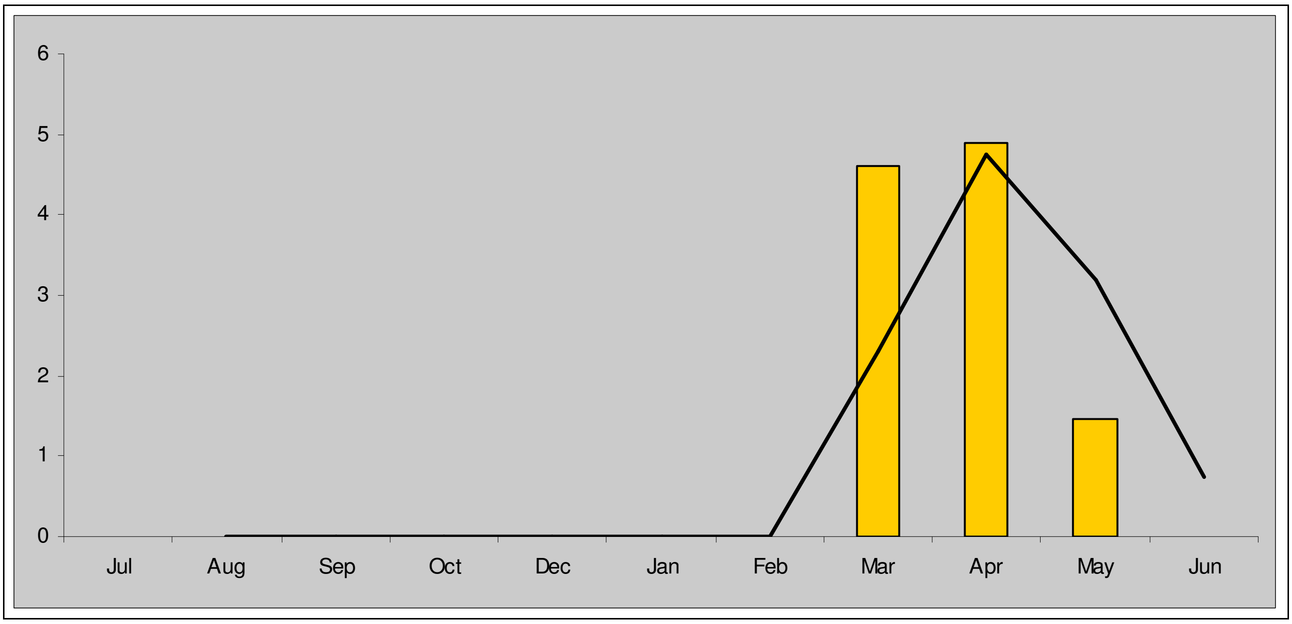
Tachyporus pusillus

It presents the eighth CSD value, representing 1,07% of the entire sample of Coleoptera Staphylinidae. The species resulted sampled in stations **AC**, **Ol** and **Tk** (graph. 5.3.17).



Graph. 5.3.17 - Trend of capture frequency (CSD) for *Tachyporus pusillus* within the single station.

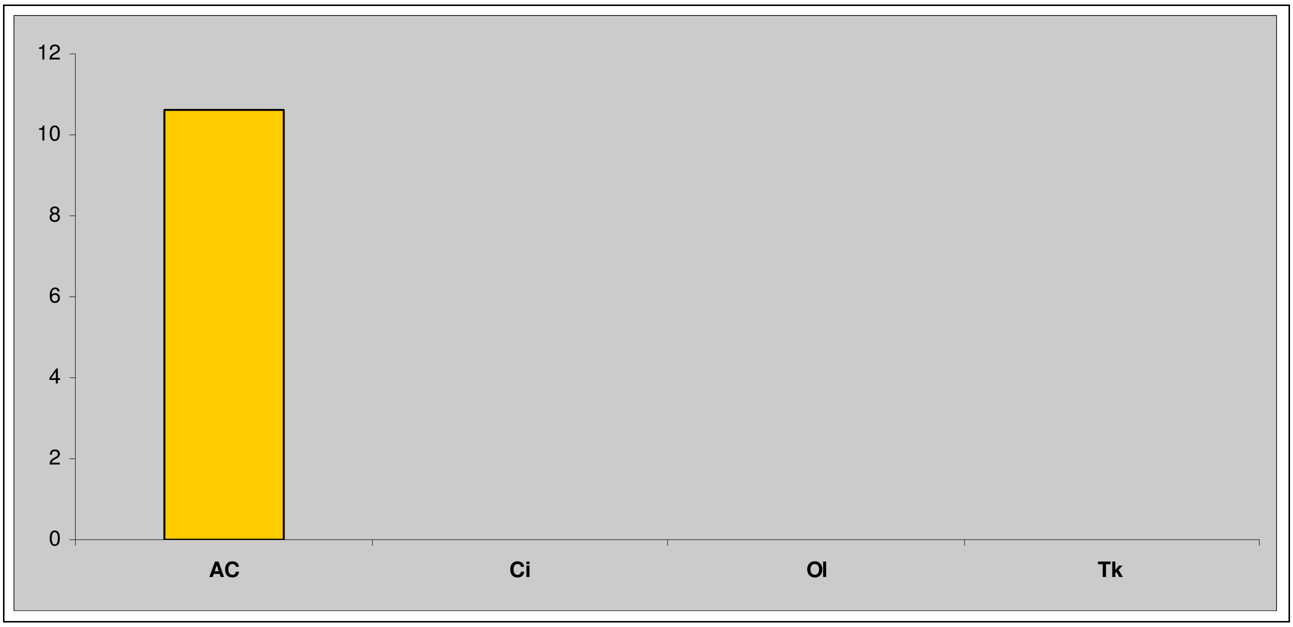
The trend of the capture frequencies over the sample period (graph. 5.3.18) shows that all catches have occurred during the period between March and May.



Graph. 5.3.18 - Trends in capture frequencies (CSD) of *Tachyporus pusillus* in individual sampling periods.

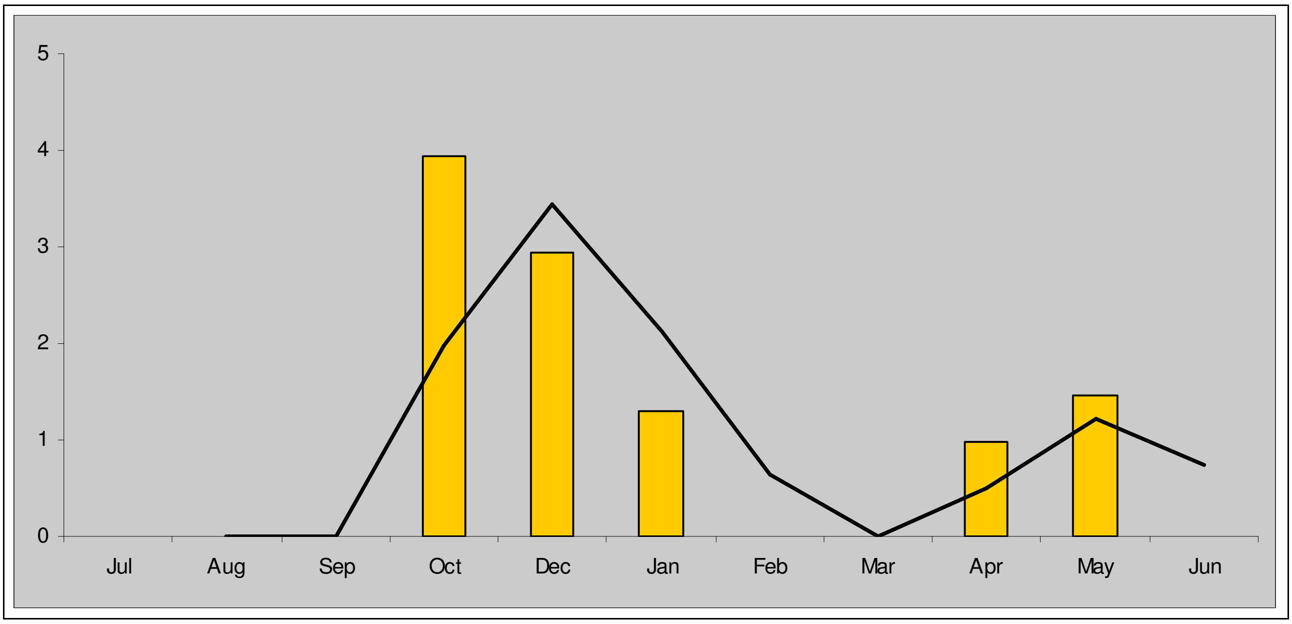
Megalinus glabratus

It shows the ninth CSD value, representing 1,04% of the entire sample of Coleoptera Staphylinidae. The species resulted sampled just in station **AC** (graph. 5.3.19).



Graph. 5.3.19 - Trend of capture frequency (CSD) for *Megalinus glabratus* within the single station.

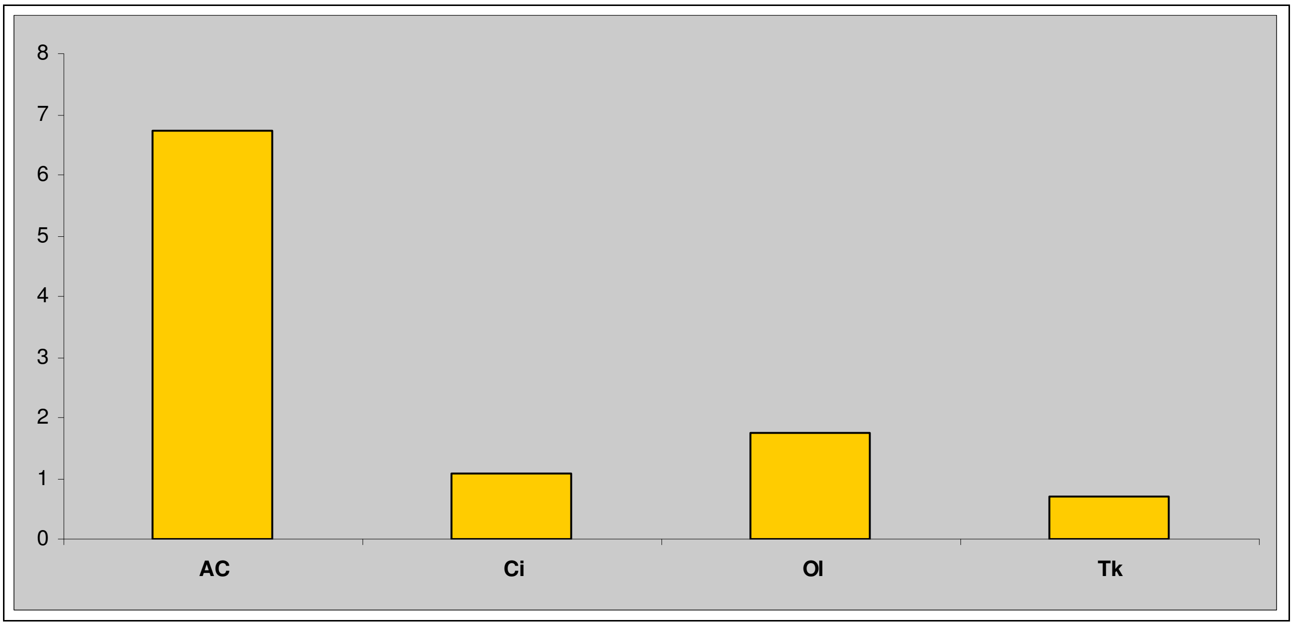
The trend of the capture frequencies over the sample period (graph. 5.3.20) shows two periods of activity: the greatest between October and January and the lowest between April and May; in the remaining months of the species resulted absent.



Graph. 5.3.20 - Trends in capture frequencies (CSD) of *Megalinus glabratus* in individual sampling periods.

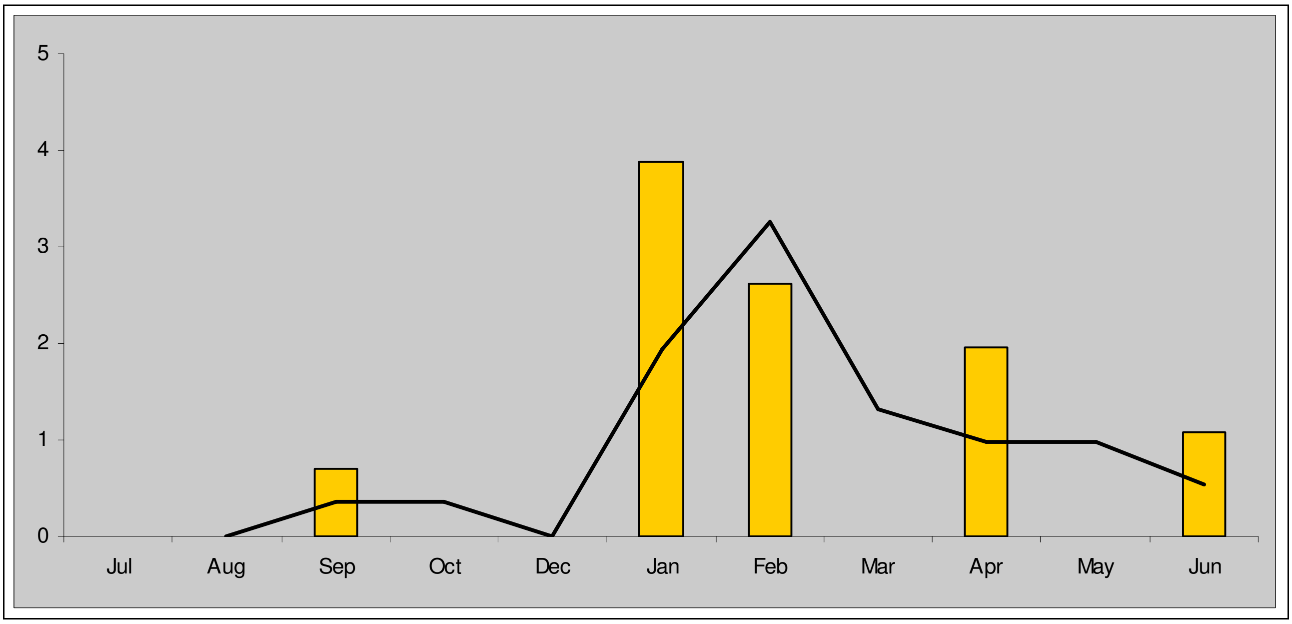
Heterothops minutus

It shows the tenth CSD value, representing 1% of the entire sample of Coleoptera Staphylinidae. The species was sampled in all stations, with the maximum CSD value in **AC** station (graph. 5.3.21).



Graph. 5.3.21 - Trend of capture frequency (CSD) for *Heterothops minutus* within the single station.

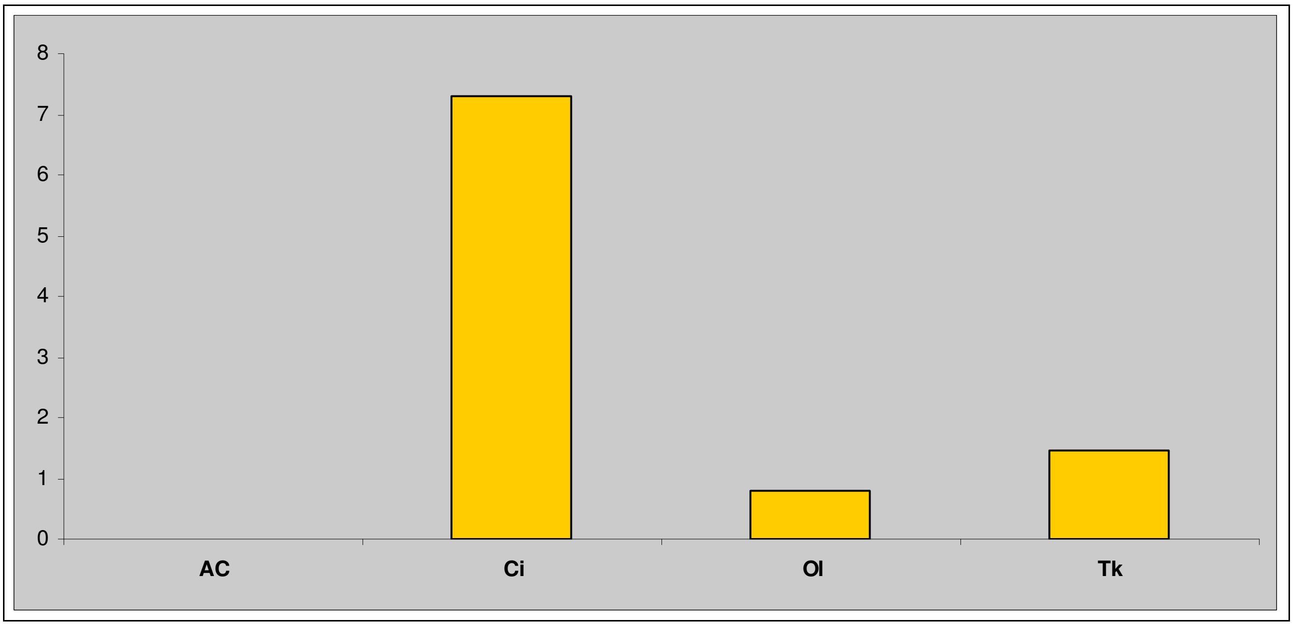
The trend of the capture frequencies over the sample period (graph. 5.3.22) is quite irregular with the greatest number of catches in the period January - February.



Graph. 5.3.22 - Trends in capture frequencies (CSD) of *Heterothops minutus* in individual sampling periods.

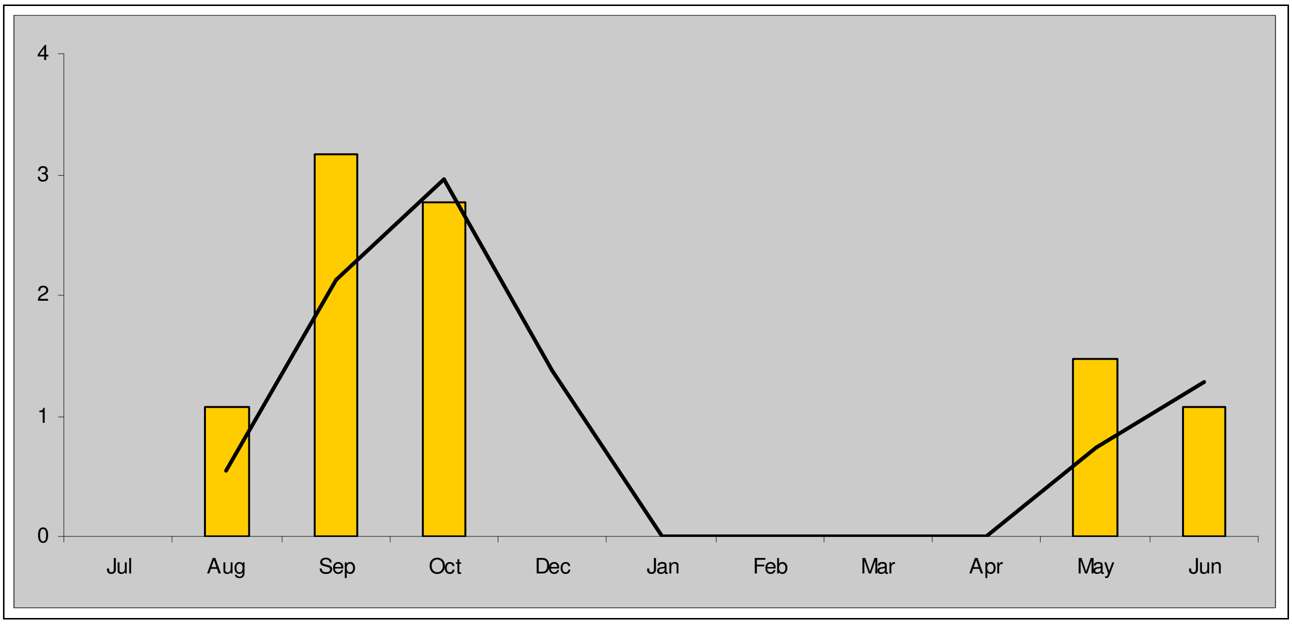
Tasgius (*Tasgius*) *pedator siculus*

It shows the eleventh CSD value, representing 0,93% of the entire sample of Coleoptera Staphylinidae. The species was sampled in **Ol, Tk** and **Ci** with by this last one the highest CSD value (graph. 5.3.23).



Graph. 5.3.23 - Trend of capture frequency (CSD) for *Tasgius* (*Tasgius*) *pedator siculus* within the single station.

The trend of the capture frequencies over the sample period (graph. 5.3.24) shows that the species is present only in two periods: between August and October and between May and June.



Graph. 5.3.24 - Trends in capture frequencies (CSD) of *Tasgius* (*Tasgius*) *pedator siculus* in individual sampling periods.

6 ANALYSIS PER STATION FOR SPECIES OF CARABIDAE, TENEBRIONIDAE, STAPHILINIDAE

6.1 COLEOPTERA CARABIDAE

Station AC (Arable-land with Carob trees)

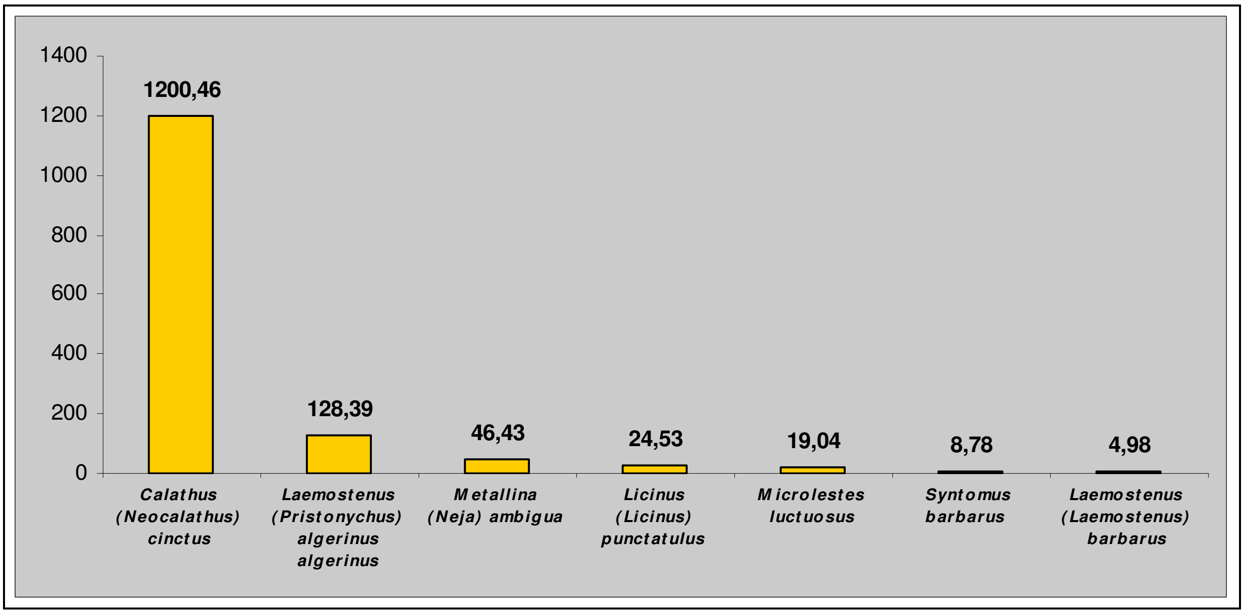
In **AC** station was sampled a total of **24** species of Carabidae with a value of CSD **1.466,81**.
Calathus (*Neocalathus*) *cinctus* (CSD: 1.200,46) and *Laemostenus* (*Pristonychus*) *algerinus algerinus* (CSD: 128,39) strongly characterize this station regarding the frequency of capture; other species with relatively higher values of CSD are (see also graph. 6.1.1):

Metallina (*Neja*) *ambigua*: CSD 46,43
Licinus (*Licinus*) *punctatulus*: CSD 24,53
Microlestes luctuosus: CSD 19,04
Syntomus barbarus: CSD 8,78

These six species represent the 97,63% of the total CSD for the station, with *Calathus* (*Neocalathus*) *cinctus* that alone accounts for about the 82%.
The trend in the capture frequency for the species of Carabidae in the five **AC** station traps is shown in table 6.1.1.

SPECIE	AC-1	AC-2	AC-3	AC-4	AC-5	Tot_CSD
Calathus (Neocalathus) cinctus	231,65	194,26	309,09	119,35	346,10	1200,46
Laemostenus (Pristonychus) algerinus algerinus	40,63	11,04	17,44	41,45	17,82	128,39
Metallina (Neja) ambigua		21,95	3,42		21,06	46,43
Licinus (Licinus) punctatulus	8,40	3,24	4,11	4,81	3,97	24,53
Microlestes luctuosus		8,78	8,30		1,95	19,04
Syntomus barbarus	1,15	3,73	2,93		0,98	8,78
Laemostenus (Laemostenus) barbarus		2,72			2,26	4,98
Microlestes fissuralis			3,90			3,90
Harpalus (Harpalus) distinguendus distinguendus		1,46	0,87	1,15		3,48
Notiophilus geminatus					3,24	3,24
Calathus (Neocalathus) mollis	0,98			0,98	0,98	2,93
Platyderus (Platyderus) lombardii		0,98		1,66		2,63
Amara (Celia) montana	0,79		0,79	0,98		2,55
Trechus (Trechus) quadristriatus				1,46	0,98	2,44
Carabus (Eurycarabus) faminii sabellai	1,29	0,98				2,26
Carabus (Macrothorax) morbillosus alternans			0,87	0,79		1,66
Ophonus (Ophonus) ardosiacus					1,58	1,58
Calathus (Calathus) fuscipes graecus	0,79				0,79	1,57
Paradromius (Manodromius) linearis			1,46			1,46
Asaphidion rossii			0,98			0,98
Calathus (Bedelinus) circumseptus				0,98		0,98
Syntomus fuscomaculatus					0,98	0,98
Broscus politus					0,79	0,79
Pseudomasoreus canigoulensis		0,79				0,79
Tot_CSD	285,67	249,92	354,16	173,60	403,47	**1466,81**
Num_Specie	8	11	12	10	14	**24**

Tab. 6.1.1 - Trend in the capture frequency (CSD) for the species of Carabidae in traps of station **AC**.



Graph. 6.1.1 - Frequency of capture (CSD) of the more abundantly sampled species of Carabidae in the station **AC**.

Among sampled species just 3, *Calathus* (*Neocalathus*) *cinctus*, *Laemostenus* (*Pristonychus*) *algerinus algerinus* and *Licinus* (*Licinus*) *punctatulus,* are present in all the traps although sometimes with different values of CSD; *Metallina* (*Neja*) *ambigua* and *Microlestes luctuosus* are absent in traps **AC-1** and **AC-4**, while *Syntomus barbarus* is absent in trap **AC-4**.
In the table below (tab. 6.1.2) are indicated the first 7 species rank / abundance in the individual traps. *Calathus* (*Neocalathus*) *cinctus* ranks first in all traps; *Laemostenus* (*Pristonychus*) *algerinus algerinus* ranks second in traps **AC-1**, **AC-3** and **AC-4,** and third in traps **AC-2** and **AC-5**; *Metallina* (*Neja*) *ambigua* (absent in traps **AC-1** and **AC-4**) ranks second in traps **AC-2** and **AC-5,** and sixt in trap **AC-3**.

AC-1
Calathus (Neocalathus) cinctus
Laemostenus (Pristonychus) algerinus algerinus
Licinus (Licinus) punctatulus
Carabus (Eurycarabus) faminii sabellai
Syntomus barbarus
Calathus (Neocalathus) mollis
Amara (Celia) montana

AC-2
Calathus (Neocalathus) cinctus
Metallina (Neja) ambigua
Laemostenus (Pristonychus) algerinus algerinus
Microlestes luctuosus
Syntomus barbarus
Licinus (Licinus) punctatulus
Laemostenus (Laemostenus) barbarus

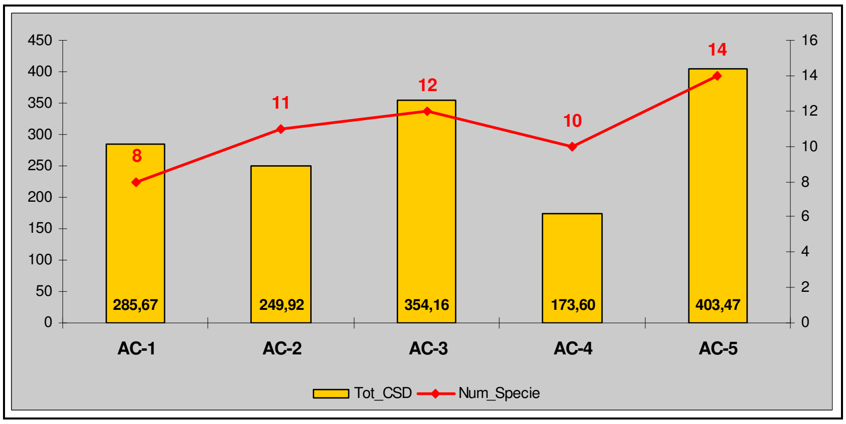
AC-3
Calathus (Neocalathus) cinctus
Laemostenus (Pristonychus) algerinus algerinus
Microlestes luctuosus
Licinus (Licinus) punctatulus
Microlestes fissuralis
Metallina (Neja) ambigua
Syntomus barbarus

AC-4
Calathus (Neocalathus) cinctus
Laemostenus (Pristonychus) algerinus algerinus
Licinus (Licinus) punctatulus
Platyderus (Platyderus) lombardii
Trechus (Trechus) quadristriatus
Harpalus (Harpalus) distinguendus distinguendus
Amara (Celia) montana

AC-5
Calathus (Neocalathus) cinctus
Metallina (Neja) ambigua
Laemostenus (Pristonychus) algerinus algerinus
Licinus (Licinus) punctatulus
Notiophilus geminatus
Laemostenus (Laemostenus) barbarus
Microlestes luctuosus

Tab. 6.1.2 – Rank / abundance of the first 7 species of Carabidae in the traps of the station **AC**.

The graph. 6.1.2 represents Carabidae capture frequencies and number of species sampled at each trap for station **AC**.
The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 109,45 con p = 0,000000), present the highest value in the trap **AC-5** and the lowest value in the trap **AC-4**.
No trap has collected all the **24** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 1,82 con p = 0,77) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**14**) was recorded in the trap **AC-5** and the minimum (**8**) in the trap **AC-1**.



Graph. 6.1.2 - Frequency of capture (CSD) and number of species of Carabidae in the traps of station **AC**.

Station Ol (Olive-grove)

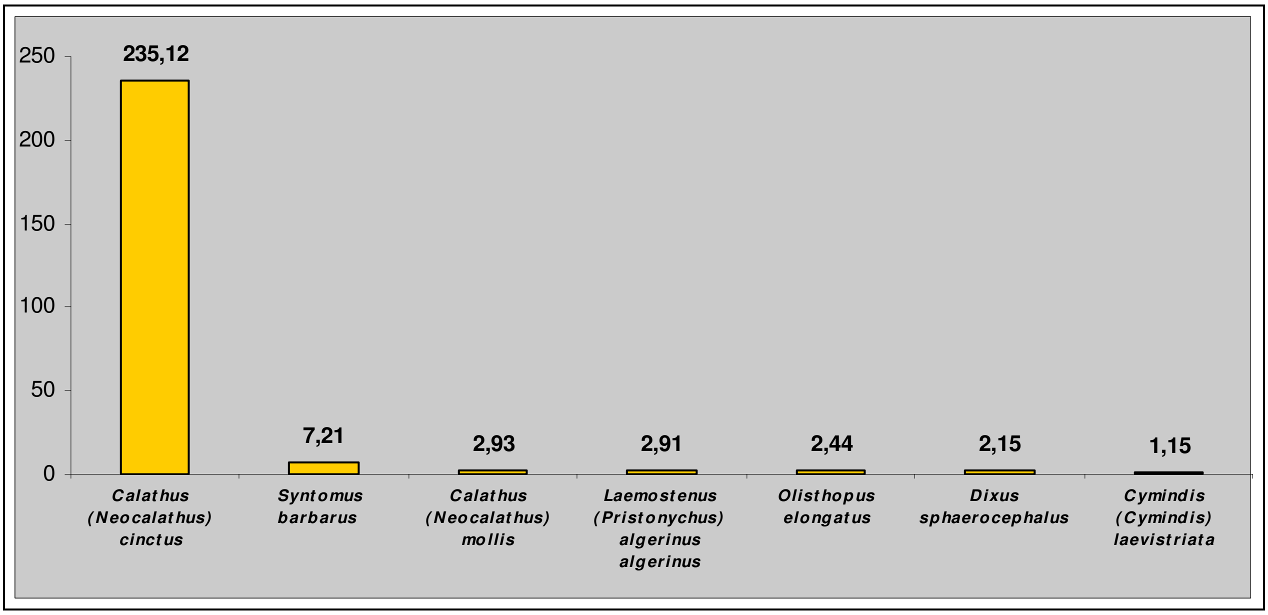
In **Ol** station was sampled a total of **9** species of Carabidae with a CSD value of **255,77**.
Calathus (*Neocalathus*) *cinctus* (CSD: 235,12) strongly characterizes this station regarding the frequency of capture (91,93%); other species show much lower values of CSD (see also graph. 6.1.3) as follows:

Syntomus barbarus: CSD 7,21
Calathus (*Neocalathus*) *mollis*: CSD 2,93
Laemostenus (*Pristonychus*) *algerinus algerinus*: CSD 2,91
Olisthopus elongatus: CSD 2,44
Dixus sphaerocephalus: CSD 2,15

The trend in the frequency of capture of the species of Carabidae in the **Ol** station 5 traps is shown in table 6.1.3.

SPECIE	Ol-1	Ol-2	Ol-3	Ol-4	Ol-5	Tot_CSD
Calathus (Neocalathus) cinctus	61,74	66,24	12,55	65,03	29,56	235,12
Syntomus barbarus	1,46		1,46	1,95	2,33	7,21
Calathus (Neocalathus) mollis		1,95		0,98		2,93
Laemostenus (Pristonychus) algerinus algerinus	1,15			0,79	0,98	2,91
Olisthopus elongatus	0,98		1,46			2,44
Dixus sphaerocephalus		2,15				2,15
Cymindis (Cymindis) laevistriata	1,15					1,15
Microlestes fissuralis	1,07					1,07
Microlestes luctuosus					0,79	0,79
Tot_CSD	67,55	70,34	15,47	68,74	33,66	**255,77**
Num_specie	6	3	3	4	4	**9**

Tab. 6.1.3 - Trend in the capture frequency (CSD) for the species of Carabidae in traps of station **Ol**.



Graph. 6.1.3 - Frequency of capture (CSD) of the more abundantly sampled species of Carabidae in the station **Ol.**

Among sampled species just one, *Calathus* (*Neocalathus*) *cinctus,* is present in all traps; *Syntomus barbarus* is absent in trap **Ol-2;** *Laemostenus* (*Pristonychus*) *algerinus algerinus* is absent in traps **Ol-2** and **Ol-3**, while the other species are present in only one or two traps.

In the following table (tab. 6.1.4) are indicated the rank / abundance of species in the individual traps. *Calathus* (*Neocalathus*) *cinctus* ranks first in all traps, while *Syntomus barbarus* (absent in trap **Ol-2**) ranks second in traps **Ol-1**, **Ol-4** and **Ol-5**, and third in trap **Ol-3**.

Ol-1
Calathus (Neocalathus) cinctus
Syntomus barbarus
Cymindis (Cymindis) laevistriata
Laemostenus (Pristonychus) algerinus algerinus
Microlestes fissuralis
Olisthopus elongatus

Ol-2
Calathus (Neocalathus) cinctus
Dixus sphaerocephalus
Calathus (Neocalathus) mollis

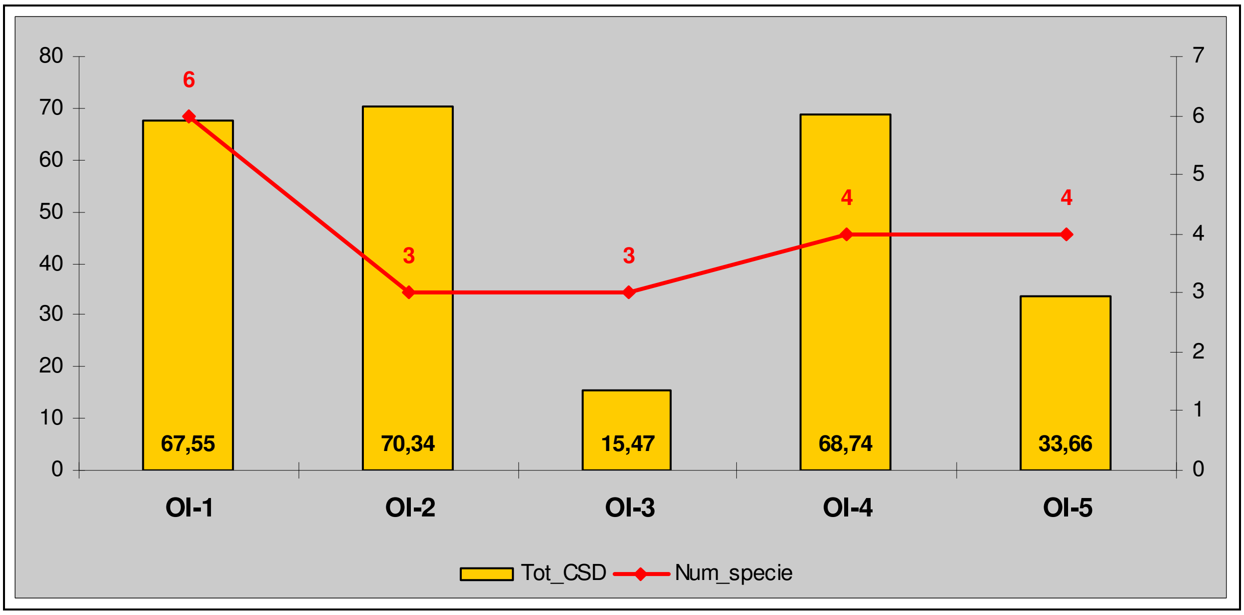
Ol-3
Calathus (Neocalathus) cinctus
Olisthopus elongatus
Syntomus barbarus

Ol-4
Calathus (Neocalathus) cinctus
Syntomus barbarus
Calathus (Neocalathus) mollis
Laemostenus (Pristonychus) algerinus algerinus

Ol-5
Calathus (Neocalathus) cinctus
Syntomus barbarus
Laemostenus (Pristonychus) algerinus algerinus
Microlestes luctuosus

Tab. 6.1.4 – Rank / abundance of the species of Carabidae in the traps of the station **Ol**.

The graph. 6.1.4 represents Carabidae capture frequencies and number of species sampled at each trap for station **Ol**.
The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 49,37 con p = 0,000000), present the highest value in the trap **Ol-2** and the lowest value in the trap **Ol-3**.
No trap has collected all the **9** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 1,50 con p = 0,83) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**6**) was recorded in the trap **Ol-1** and the minimum (**3**) in the traps **Ol-2** and **Ol-3**.



Graph. 6.1.4 - Frequency of capture (CSD) and number of species of Carabidae in the traps of station **Ol**.

Station Ci (Citrus-grove)

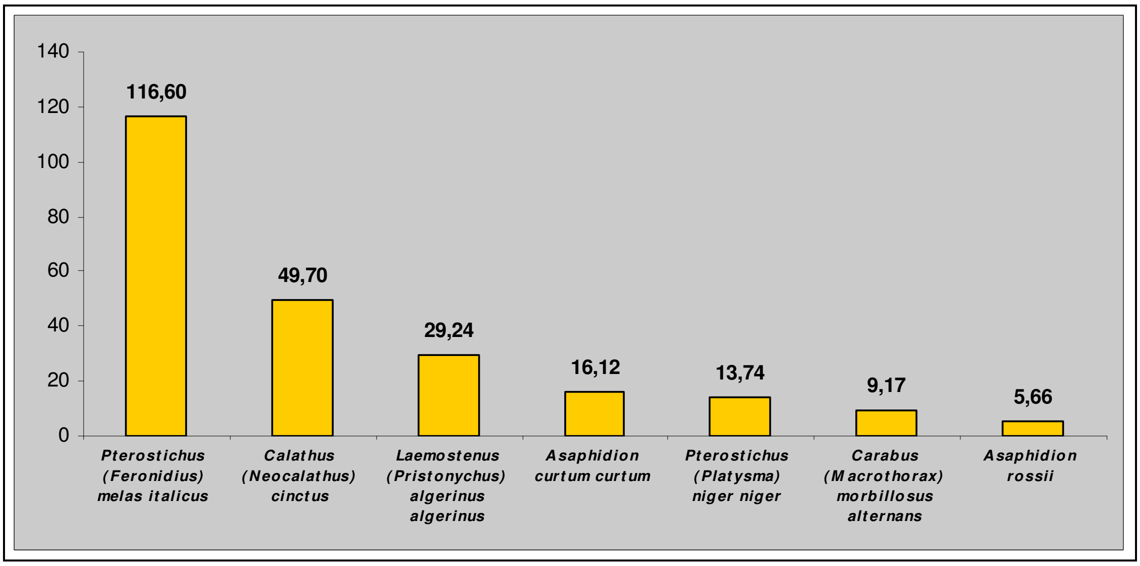
In **AC** station was sampled a total of **18** species of Carabidae with a value of CSD **262,50**. *Pterostichus* (*Feronidius*) *melas italicus* (CSD: 116,60) and *Calathus* (*Neocalathus*) *cinctus* (CSD: 49,70) strongly characterize this station regarding the frequency of capture (63,35%); other species show much lower values of CSD (see also graph. 6.1.5) as follows:

Laemostenus (*Pristonychus*) *algerinus algerinus*: CSD 29,24
Asaphidion curtum curtum: CSD 16,12
Pterostichus (*Platysma*) *niger niger*: CSD 13,74
Carabus (*Macrothorax*) *morbillosus alternans*: CSD 9,17
Asaphidion rossii: CSD 5,66

The trend in the frequency of capture of the species of Carabidae in the **Ci** station 5 traps is shown in table 6.1.5.

SPECIE	Ci-1	Ci-2	Ci-3	Ci-4	Ci-5	Tot_CSD
Pterostichus (Feronidius) melas italicus	21,55	5,38	7,63	40,09	41,96	116,60
Calathus (Neocalathus) cinctus	41,00		0,87	7,83		49,70
Laemostenus (Pristonychus) algerinus algerinus	10,90	2,93	1,95	4,46	9,00	29,24
Asaphidion curtum curtum			2,33	4,72	9,06	16,12
Pterostichus (Platysma) niger niger				1,96	11,77	13,74
Carabus (Macrothorax) morbillosus alternans	1,85	0,87	0,98	1,95	3,51	9,17
Asaphidion rossii	0,98			4,69		5,66
Ocys harpaloides		0,98		1,29	1,96	4,22
Platyderus (Platyderus) lombardii	2,58		0,87			3,45
Pseudoophonus (Pseudoophonus) rufipes		0,79			2,37	3,16
Trechus (Trechus) rufulus	0,98				1,46	2,44
Platytarus faminii faminii		1,58			0,79	2,37
Licinus (Licinus) punctatulus	0,98				0,98	1,96
Calathus (Bedelinus) circumseptus	0,98					0,98
Paranchus albipes		0,98				0,98
Philorhizus melanocephalus		0,98				0,98
Poecilus (Poecilus) cupreus cupreus				0,98		0,98
Chlaenius (Claeinus) velutinus auricollis		0,79				0,79
Tot_CSD	81,78	15,26	14,63	67,96	82,86	**262,50**
Num_specie	9	9	6	9	10	**18**

Tab. 6.1.5 - Trend in the capture frequency (CSD) for the species of Carabidae in traps of station **Ci**.



Graph. 6.1.5 - Frequency of capture (CSD) of the more abundantly sampled species of Carabidae in the station **Ci.**

Among sampled specie just 3, *Pterostichus* (*Feronidius*) *melas italicus, Laemostenus* (*Pristonychus*) *algerinus algerinus* and *Carabus* (*Macrothorax*) *morbillosus alternans,* are present in all traps; among that present only in three traps, *Calathus* (*Neocalathus*) *cinctus* is present in traps **Ci-1, Ci-3** and **Ci-4;** *Asaphidion curtum curtum* is present in traps **Ci-3**, **Ci-4** and **Ci-5**; *Ocys harpaloides* is present in traps **Ci-2**, **Ci-4** and **Ci-5**; the other species are present in only one or two traps.

In the table below (tab. 6.1.6) are indicated the first 7 (6 for trap **Ci-3**) species rank / abundance in the individual traps. *Pterostichus* (*Feronidius*) *melas italicus* ranks first in traps **Ci-2, Ci-3, Ci-4** and **Ci-5**, and second in trap **Ci-1**; *Calathus* (*Neocalathus*) *cinctus* (absent in traps **Ci-2** and **Ci-5**) ranks first in traps **Ci-1** and **Ci-4**, and fifth in trap **Ci-3**; *Laemostenus* (*Pristonychus*) *algerinus algerinus* ranks second in trap **Ci-2**, third in traps **Ci-1** and **Ci-3**, fourth in trap **Ci-5**, and fifth in trap **Ci-4**; *Carabus* (*Macrothorax*) *morbillosus alternans* thought present in all traps get a fourth position (**Ci-3**), two fifth position (**Ci-1** and **Ci-5**) and two seventh position (**Ci-2** and **Ci-4**).

Ci-1
Calathus (Neocalathus) cinctus
Pterostichus (Feronidius) melas italicus
Laemostenus (Pristonychus) algerinus algerinus
Platyderus (Platyderus) lombardii
Carabus (Macrothorax) morbillosus alternans
Asaphidion rossii
Calathus (Bedelinus) circumseptus

Ci-2
Pterostichus (Feronidius) melas italicus
Laemostenus (Pristonychus) algerinus algerinus
Platytarus faminii faminii
Ocys harpaloides
Paranchus albipes
Philorhizus melanocephalus
Carabus (Macrothorax) morbillosus alternans

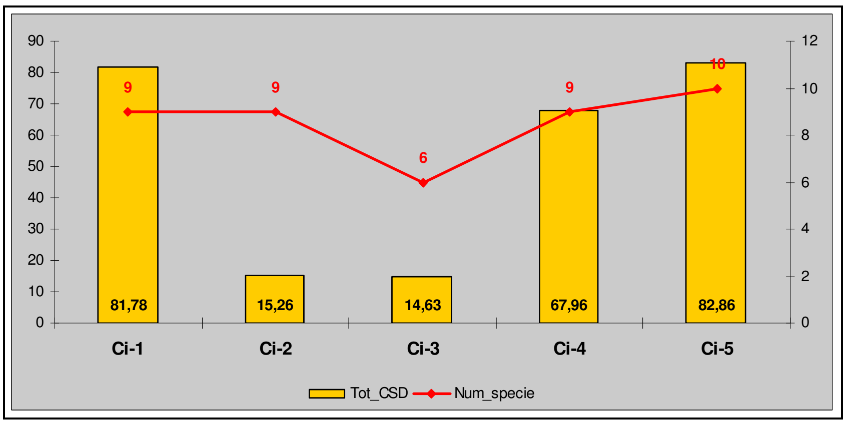
Ci-3
Pterostichus (Feronidius) melas italicus
Asaphidion curtum curtum
Laemostenus (Pristonychus) algerinus algerinus
Carabus (Macrothorax) morbillosus alternans
Calathus (Neocalathus) cinctus
Platyderus (Platyderus) lombardii

Ci-4
Pterostichus (Feronidius) melas italicus
Calathus (Neocalathus) cinctus
Asaphidion curtum curtum
Asaphidion rossii
Laemostenus (Pristonychus) algerinus algerinus
Pterostichus (Platysma) niger niger
Carabus (Macrothorax) morbillosus alternans

Ci-5
Pterostichus (Feronidius) melas italicus
Pterostichus (Platysma) niger niger
Asaphidion curtum curtum
Laemostenus (Pristonychus) algerinus algerinus
Carabus (Macrothorax) morbillosus alternans
Pseudoophonus (Pseudoophonus) rufipes
Ocys harpaloides

Tab. 6.1.6 – Rank / abundance of the first 7 (or 6) species of Carabidae in the traps of the station **Ci**.

The graph. 6.1.6 represents Carabidae capture frequencies and number of species sampled at each trap for station **Ci**.
The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 92,17 con p = 0,000000), present the highest value in the trap **Ci-5** and the lowest value in the trap **Ci-3**.
No trap has collected all the **18** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 1,07 con p = 0,90) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**10**) was recorded in the trap **Ci-5** and the minimum (**6**) in the trap **Ci-3**.



Graph. 6.1.6 - Frequency of capture (CSD) and number of species of Carabidae in the traps of station **Ci**.

Station Tk (*P. halepensis* - *Q. calliprinos* Thicket)

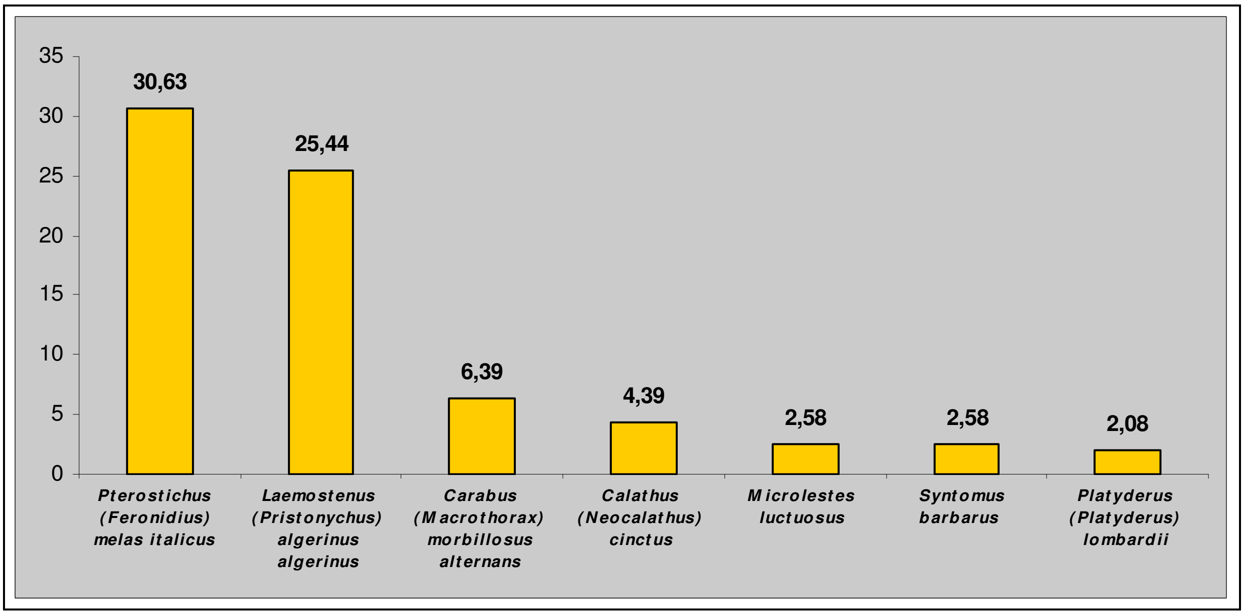
In **Tk** station was sampled a total of **8** species of Carabidae with a value of CSD **75,49**.
Pterostichus (*Feronidius*) *melas italicus* (CSD: 30,63) and *Laemostenus* (*Pristonychus*) *algerinus algerinus* (CSD: 25,44) strongly characterize this station regarding the frequency of capture (74,27%); other species show much lower values of CSD (see also graph. 6.1.7) as follows:

Carabus (*Macrothorax*) *morbillosus alternans*: CSD 6,39
Calathus (*Neocalathus*) *cinctus*: CSD 4,39

The trend in the frequency of capture of the species of Carabidae in the **Tk** station 5 traps is shown in table 6.1.7.

SPECIE	Tk-1	Tk-2	Tk-3	Tk-4	Tk-5	Tot_CSD
Pterostichus (Feronidius) melas italicus			30,63			30,63
Laemostenus (Pristonychus) algerinus algerinus	4,25	4,45	8,28	4,54	3,93	25,44
Carabus (Macrothorax) morbillosus alternans	4,23		0,70	1,46		6,39
Calathus (Neocalathus) cinctus					4,39	4,39
Microlestes luctuosus	1,46				1,12	2,58
Syntomus barbarus					2,58	2,58
Platyderus (Platyderus) lombardii	2,08					2,08
Laemostenus (Laemostenus) barbarus				1,39		1,39
Tot_CSD	12,02	4,45	39,61	7,39	12,02	**75,49**
Num_specie	4	1	3	3	4	**8**

Tab. 6.1.7 - Trend in the capture frequency (CSD) for the species of Carabidae in traps of station **Tk**.



Graph. 6.1.7 - Frequency of capture (CSD) of the more abundantly sampled species of Carabidae in the station **Tk.**

Among sampled species just one, *Laemostenus* (*Pristonychus*) *algerinus algerinus*, is present in alla traps (besides is the unique species present at trap **Tk-2**); even *Pterostichus* (*Feronidius*) *melas italicus* showing the highest CSD value among species resulted present just in trap **Tk-3**; *Carabus* (*Macrothorax*) *morbillosus alternans* is present in traps **Tk-1**, **Tk-3** and **Tk-4**. The other species are present in only one or two traps.
In the following table (tab. 6.1.8) are indicated the rank / abundance of species in the individual traps.

Pterostichus (*Feronidius*) *melas italicus*, as said, is present just in trap **Tk-3** where ranks first; *Laemostenus* (*Pristonychus*) *algerinus algerinus* ranks first in traps **Tk-1**, **Tk-2** and **Tk-4**, and second in traps **Tk-3** and **Tk-5**; *Calathus* (*Neocalathus*) *cinctus* ranks first in trap **Tk-5**, the only trap where is present; *Carabus* (*Macrothorax*) *morbillosus alternans* ranks second in traps **Tk-1** and **Tk-4**, and third in trap **Tk-3**.

Tk-1
Laemostenus (Pristonychus) algerinus algerinus
Carabus (Macrothorax) morbillosus alternans
Platyderus (Platyderus) lombardii
Microlestes luctuosus

Tk-2
Laemostenus (Pristonychus) algerinus algerinus

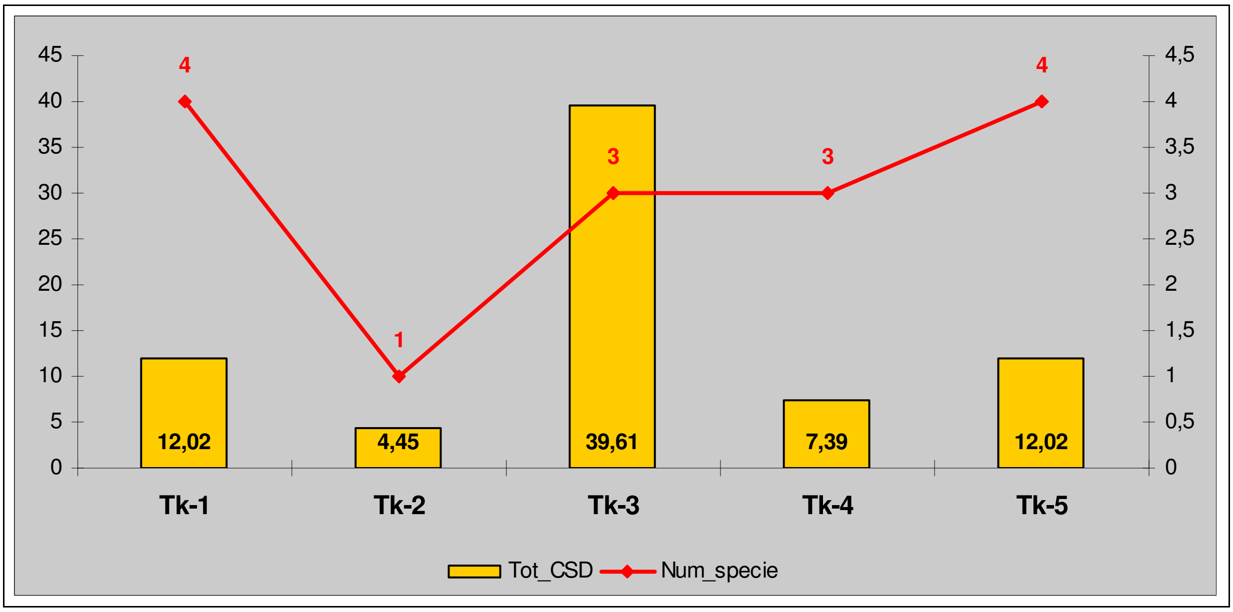
Tk-3
Pterostichus (Feronidius) melas italicus
Laemostenus (Pristonychus) algerinus algerinus
Carabus (Macrothorax) morbillosus alternans

Tk-4
Laemostenus (Pristonychus) algerinus algerinus
Carabus (Macrothorax) morbillosus alternans
Laemostenus (Laemostenus) barbarus

Tk-5
Calathus (Neocalathus) cinctus
Laemostenus (Pristonychus) algerinus algerinus
Syntomus barbarus
Microlestes luctuosus

Tab. 6.1.8 – Rank / abundance of Carabidae species in the traps of the station **Tk**.

The graph. 6.1.8 represents Carabidae capture frequencies and number of species sampled at each trap for station **Tk**.
The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 52,50 con p = 0,000000), present the highest value in the trap **Tk-3** and the lowest value in the trap **Tk-2**.
No trap has collected all the **8** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 2,00 con p = 0,74) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**4**) was recorded in the traps **Tk-1** and **Tk-5** and the minimum (**1**) in the trap **Tk-2**.



Graph. 6.1.8 - Frequency of capture (CSD) and number of species of Carabidae in the traps of station **Tk**.

6.2 COLEOPTERA TENEBRIONIDAE

Station AC (Arable-land with Carob trees)

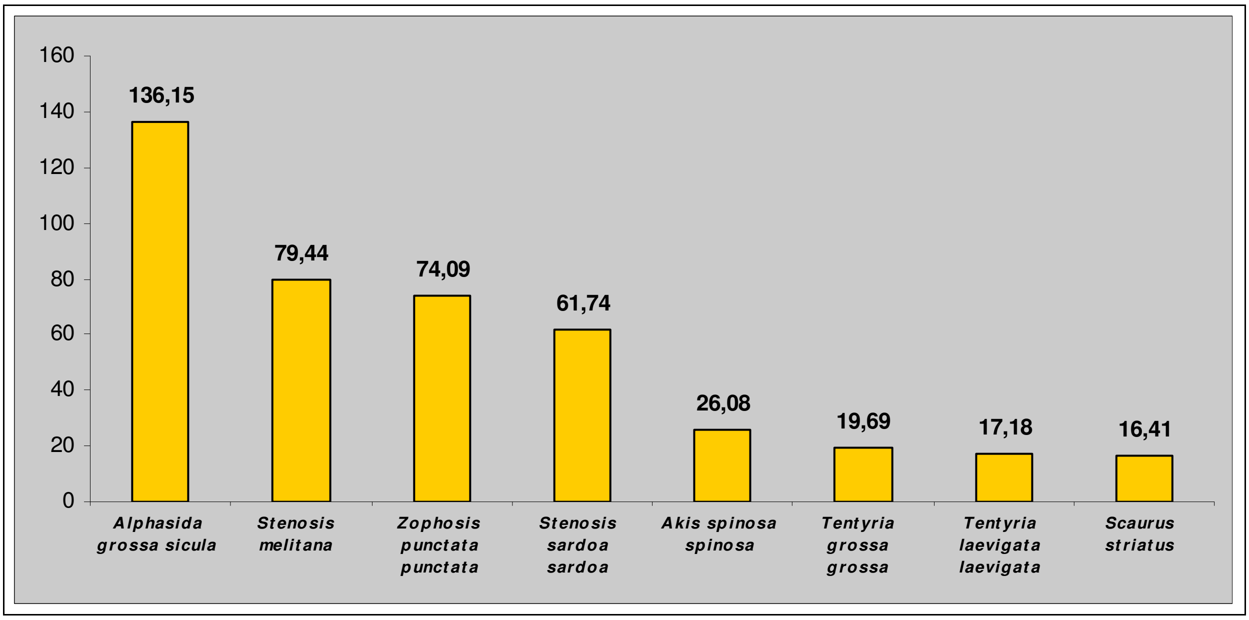
In **AC** station was sampled a total of **19** species of Tenebrionidae with a value of CSD **469,69**. *Alphasida grossa sicula* (CSD: 136,15) characterizes this station regarding the frequency of capture (28,99%); other species with relatively higher values of CSD are (see also graph. 6.2.1):

Stenosis melitana: CSD 79,44
Zophosis punctata punctata: CSD 74,09
Stenosis sardoa sardoa: CSD 61,74
Akis spinosa spinosa: CSD 36,08
Tentyria grossa grossa: CSD 19,69
Tentyria laevigata laevigata: CSD 17,18
Scaurus striatus: CSD 16,41

These 8 species rappresent 93,84% of the CSD total value for the station.
The trend in the capture frequency for the species of Tenebrionidae in the five **AC** station traps is shown in table 6.2.1.

SPECIES	AC-1	AC-2	AC-3	AC-4	AC-5	Tot_CSD
Alphasida grossa sicula	28,24	41,70	21,79	20,76	23,66	136,15
Stenosis melitana	11,05	22,96	37,16	6,22	2,06	79,44
Zophosis punctata punctata		1,32	5,15		67,62	74,09
Stenosis sardoa sardoa	12,73	4,22	18,88		25,91	61,74
Akis spinosa spinosa	6,83	11,24	1,03	3,02	3,95	26,08
Tentyria grossa grossa	1,32	1,32	10,54	0,88	5,64	19,69
Tentyria laevigata laevigata	0,88		13,67		2,63	17,18
Scaurus striatus	1,84	3,41	4,65		6,51	16,41
Opatroides punctulatus punctulatus	1,16		3,46		3,81	8,42
Scaurus atratus		2,63	2,63		1,99	7,26
Cnemeplatia atropos atropos		1,73			3,95	5,69
Dichillus pertusus		1,03	3,62			4,65
Dendarus lugens		3,12				3,12
Allophylax picipes		1,32	0,88	0,88		3,07
Probaticus tomentosus				1,99	0,97	2,96
Catomus consentaneus					1,16	1,16
Catomus rotundicollis					1,16	1,16
Crypticus gibbulus			0,71			0,71
Pimelia rugulosa sublaevigata					0,71	0,71
Tot_CSD	64,06	96,00	124,16	33,75	151,72	**469,69**
Num_Specie	8	12	13	6	15	**19**

Tab. 6.2.1 - Trend in the capture frequency (CSD) for the species of Tenebrionidae in traps of **AC** station.



Graf. 6.2.1 - Frequency of capture (CSD) of the more abundantly sampled species of Tenebrionidae in the station **AC**.

Among the species sampled only 4 (*Alphasida grossa sicula*, *Stenosis melitana*, *Akis spinosa spinosa* e *Tentyria grossa grossa*) are present in all the traps, although sometimes with different values of CSD. *Zophosis punctata punctata* is absent in the traps **AC-1** e **AC-4**, *Stenosis sardoa sardoa* and *Scaurus striatus* are absent in the traps **AC-4**, while *Tentyria laevigata laevigata* is absent in the traps **AC-2** e **AC-4**.

In the table below (tab. 6.2.2) are indicated the first 6 species rank / abundance in the individual traps. *Alphasida grossa sicula* ranks first in the traps **AC-1, AC-2** and **AC-4**, second in the trap **AC-3** and third in the trap **AC-5**; *Stenosis melitana* ranks first in the trap **AC-3**, second in the traps **AC-2** and **AC-4**, third in the trap **AC-1**, while is not among the top six species in trap **AC-5**; *Zophosis punctata punctata* (absent in the traps **AC-1** and **AC- 4**) is first in the trap **AC-5**, sixth in the trap **AC-3** and not in the top six species in the trap **AC-2**.

AC-1
Alphasida grossa sicula
Stenosis sardoa sardoa
Stenosis melitana
Akis spinosa spinosa
Scaurus striatus
Tentyria grossa grossa

AC-2
Alphasida grossa sicula
Stenosis melitana
Akis spinosa spinosa
Stenosis sardoa sardoa
Scaurus striatus
Dendarus lugens

AC-3
Stenosis melitana
Alphasida grossa sicula
Stenosis sardoa sardoa
Tentyria laevigata laevigata
Tentyria grossa grossa
Zophosis punctata punctata

AC-4
Alphasida grossa sicula
Stenosis melitana
Akis spinosa spinosa
Probaticus tomentosus
Allophylax picipes
Tentyria grossa grossa

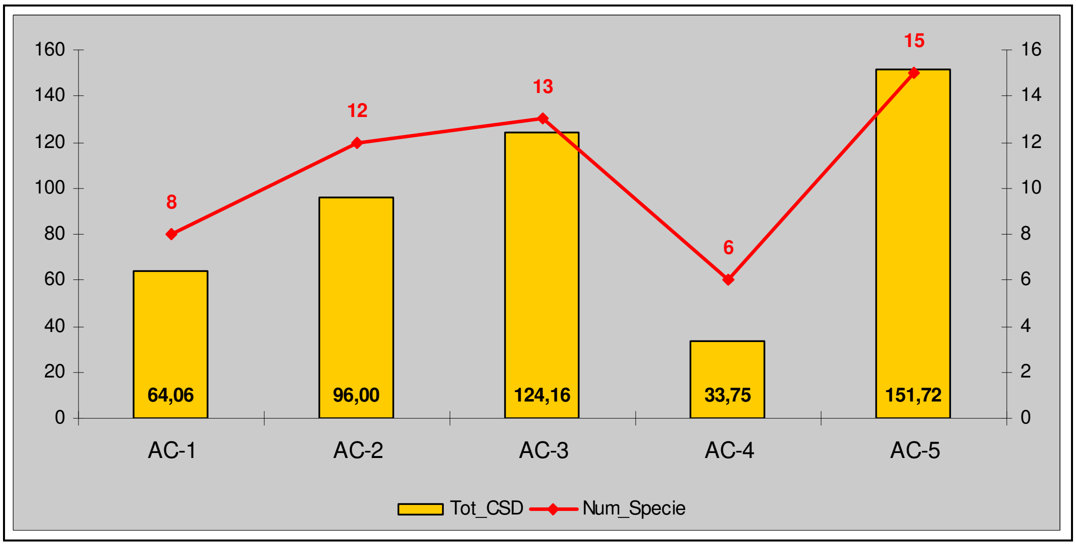
AC-5
Zophosis punctata punctata
Stenosis sardoa sardoa
Alphasida grossa sicula
Scaurus striatus
Tentyria grossa grossa
Akis spinosa spinosa

Tab. 6.2.2 – Rank / abundance of the first 6 species of Tenebrionidae in the traps of the station **AC**.

The graph. 6.2.2 represents Tenebrionidae capture frequencies and number of species sampled at each trap for station **AC**.

The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 93,38 con p = 0,000000), present the highest value in the trap **AC-5** and the lowest value in the trap **AC-4**.

No trap has collected all the **19** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 5,07 con p = 0,28) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**15**) was recorded in the trap **AC-5** and the minimum (**6**) in the trap **AC-4**.



Graf. 6.2.2 - Frequency of capture (CSD) and number of species of Tenebrionidae in the traps of station **AC**.

Station Ol (Olive-grove)

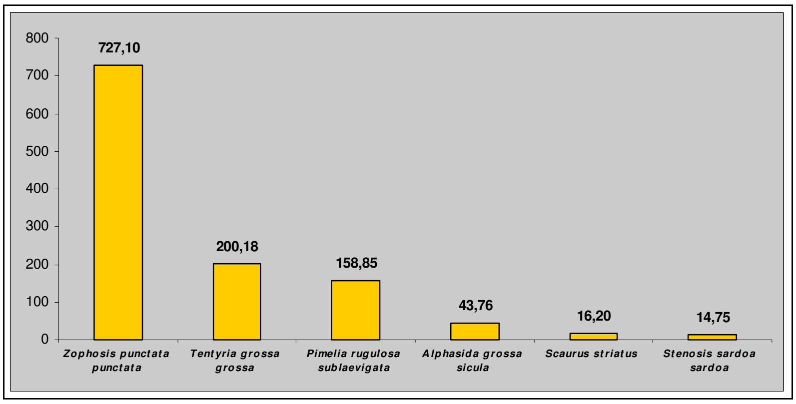
In **Ol** station was sampled a total of **14** species of Tenebrionidae with a CSD value of **1.186,87**. *Zophosis punctata punctata* (CSD: 727,10) strongly characterizes this station regarding the frequency of capture (61,26%); other species show much lower values of CSD (see also graph. 6.2.3) as follows:

Tentyria grossa grossa: CSD 200,18
Pimelia rugulosa sublaevigata: CSD 158,85
Alphasida grossa sicula: CSD 43,76
Scaurus striatus: CSD 16,20
Stenosis sardoa sardoa: CSD 14,75

These six species represent 97.80% of total CSD for the station.
The trend in the frequency of capture of the species of Tenebrionidae in the **Ol** station 5 traps is shown in table 6.2.3.

SPECIES	Ol-1	Ol-2	Ol-3	Ol-4	Ol-5	Tot_CSD
Zophosis punctata punctata	17,30	138,35	79,33	44,79	447,33	727,10
Tentyria grossa grossa	9,57	48,77	59,91	38,38	43,54	200,18
Pimelia rugulosa sublaevigata	41,28	45,47	12,12	22,16	37,83	158,85
Alphasida grossa sicula	23,09	9,50	6,76	2,83	1,59	43,76
Scaurus striatus	2,85	3,95		1,67	7,73	16,20
Stenosis sardoa sardoa	5,27	4,92	2,28	1,32	0,97	14,75
Erodius siculus siculus		1,93	0,97	4,22		7,11
Scaurus tristis		1,93		3,95	0,57	6,45
Akis spinosa spinosa		1,67	1,32	1,14		4,13
Allophylax picipes	0,71		2,28			2,99
Probaticus tomentosus	1,93					1,93
Opatroides punctulatus punctulatus					1,32	1,32
Pedinus helopioides			1,14			1,14
Dichillus socius					0,97	0,97
Tot_CSD	102,00	256,50	166,11	120,44	541,82	1186,87
Num_Species	8	9	9	9	9	14

Tab. 6.2.3 - Trend in the capture frequency for the species of Tenebrionidae in traps of **Ol** station.



Graf. 6.2.3 - Frequency of capture (CSD) of the more abundantly sampled species of Tenebrionidae in the station **Ol.**

Among sampled species just 5 (*Zophosis punctata punctata, Tentyria grossa grossa, Pimelia rugulosa sublaevigata, Alphasida grossa sicula, Stenosis sardoa sardoa*) are present in all traps; *Scaurus striatus* is absent in trap **Ol-3**, *Erodius siculus siculus* and *Akis spinosa spinosa* are absent on traps **Ol-1** and **Ol-5**; *Scaurus tristis* is absent in traps **Ol-1** and **Ol-3**, while the other species are present in only one or two traps.

In the following table (tab. 6.2.4) are indicated the first 6 species in the rank / abundance in the individual traps. *Zophosis punctata punctata* ranks first in traps **Ol-2**, **Ol-3**, **Ol-4** and **Ol-5,** and third in trap **Ol-1**; *Pimelia rugulosa sublaevigata* ranks first in trap **Ol-1,** and third in the remaining four traps; *Tentyria grossa grossa* ranks second in traps **Ol-2**, **Ol-3, Ol-4** and **Ol-5,** and fourth in trap **Ol-1**.

Ol-1
Pimelia rugulosa sublaevigata
Alphasida grossa sicula
Zophosis punctata punctata
Tentyria grossa grossa
Stenosis sardoa sardoa
Scaurus striatus

Ol-2
Zophosis punctata punctata
Tentyria grossa grossa
Pimelia rugulosa sublaevigata
Alphasida grossa sicula
Stenosis sardoa sardoa
Scaurus striatus

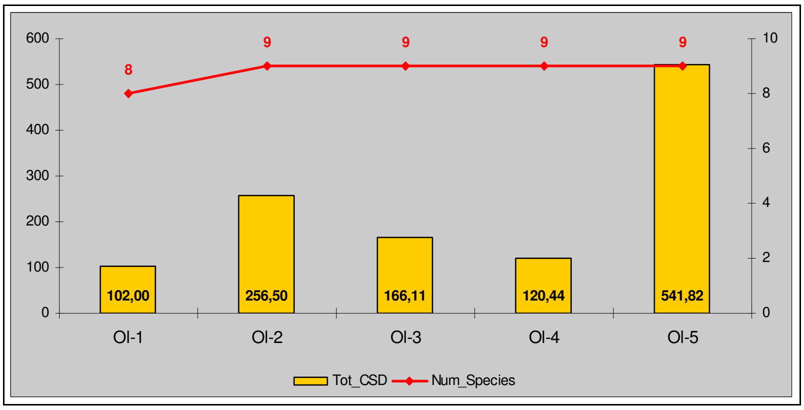
Ol-3
Zophosis punctata punctata
Tentyria grossa grossa
Pimelia rugulosa sublaevigata
Alphasida grossa sicula
Allophylax picipes
Stenosis sardoa sardoa

Ol-4
Zophosis punctata punctata
Tentyria grossa grossa
Pimelia rugulosa sublaevigata
Erodius siculus siculus
Scaurus tristis
Alphasida grossa sicula

Ol-5
Zophosis punctata punctata
Tentyria grossa grossa
Pimelia rugulosa sublaevigata
Scaurus striatus
Alphasida grossa sicula
Opatroides punctulatus punctulatus

Tab. 6.2.4 – Rank / abundance of the first 6 species of Tenebrionidae in the traps of the station **Ol**.

The graph. 6.2.4 represents Tenebrionidae capture frequencies and number of species sampled at each trap for station **Ol**.
The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 548,22 con p = 0,000000), present the highest value in the trap **Ol-5** and the lowest value in the trap **Ol-1**.
No trap has collected all the **14** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 0,09 con p = 0,99) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**9**) was recorded in the traps **Ol-2**, **Ol-3, Ol-4** e **Ol-5** and the minimum (**8**) in the trap **Ol-1**.



Graf. 6.2.4 - Frequency of capture (CSD) and number of species of Tenebrionidae in the traps of station **Ol**.

Station Ci (Citrus-grove)

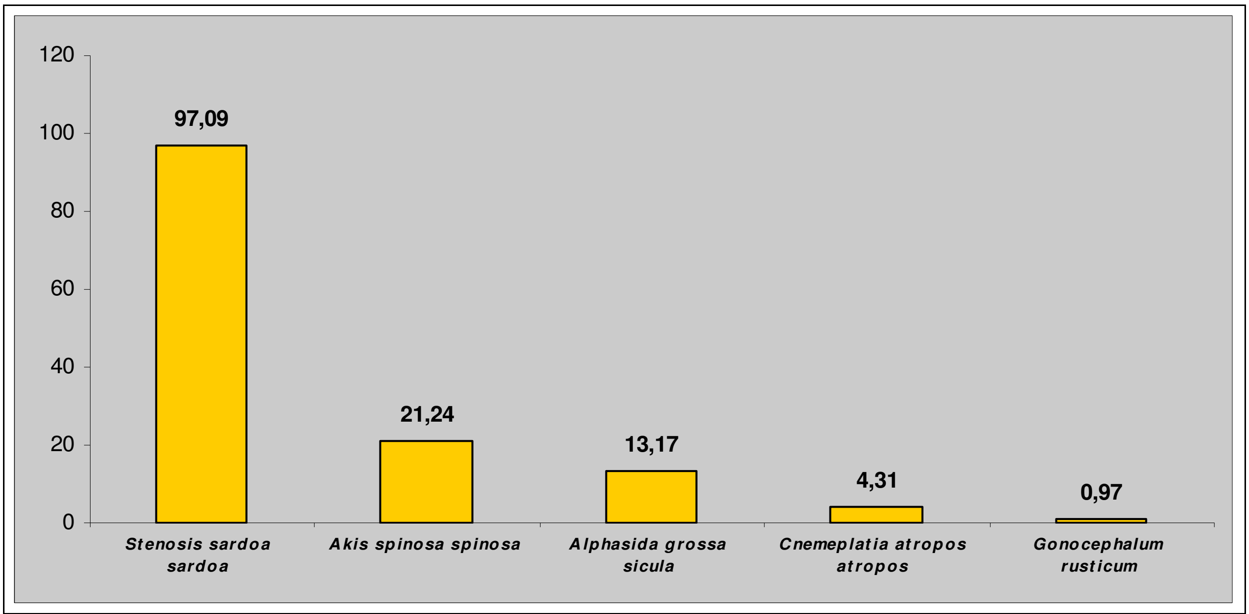
In **Ci** station was sampled a total of **5** species of Tenebrionidae with a CSD value of **136,78**. *Stenosis sardoa sardoa* (CSD: 97,09) strongly characterizes this station regarding the frequency of capture (70,98%); other species show much lower values of CSD (see also graph. 6.2.5) as follows:

Akis spinosa spinosa: CSD 21,24
Alphasida grossa sicula: CSD 13,17

These three species represent 96,14% of total CSD for the station.
The trend in the frequency of capture of the species of Tenebrionidae in the **Ci** station 5 traps is shown in table 6.2.5.

SPECIES	Ci-1	Ci-2	Ci-3	Ci-4	Ci-5	Tot_CSD
Stenosis sardoa sardoa	6,53	26,09	24,50	26,98	13,00	97,09
Akis spinosa spinosa	21,24					21,24
Alphasida grossa sicula	11,33	0,97		0,88		13,17
Cnemeplatia atropos atropos		3,60			0,71	4,31
Gonocephalum rusticum		0,97				0,97
Tot_CSD	39,10	31,62	24,50	27,85	13,71	136,78
Num_Species	3	4	1	2	2	5

Tab. 6.2.5 - Trend in the capture frequency (CSD) for the species of Tenebrionidae in traps of **Ci** station.



Graf. 6.2.5 - Frequency of capture (CSD) of the more abundantly sampled species of Tenebrionidae in the station **Ci**.

Among the sampled species just 1 (*Stenosis sardoa sardoa*) is present in all the traps; *Alphasida grossa sicula* is present in 3 traps (**Ci-1**, **Ci-2** and **Ci-4**); the other species are present in only one or two traps.
In the following table (tab. 6.2.6) are indicated the species in the rank / abundance in the individual traps. *Stenosis sardoa sardoa* ranks first in traps **Ci-2**, **Ci-3** (where it is the unique species)**, Ci-4** and **Ci-5**, and third in trap **Ci-1**; *Akis spinosa spinosa* ranks first in trap **Ci-1**, the only trap where that species is present.

Ci-1
Akis spinosa spinosa
Alphasida grossa sicula
Stenosis sardoa sardoa

Ci-2
Stenosis sardoa sardoa
Cnemeplatia atropos atropos
Alphasida grossa sicula
Gonocephalum rusticum

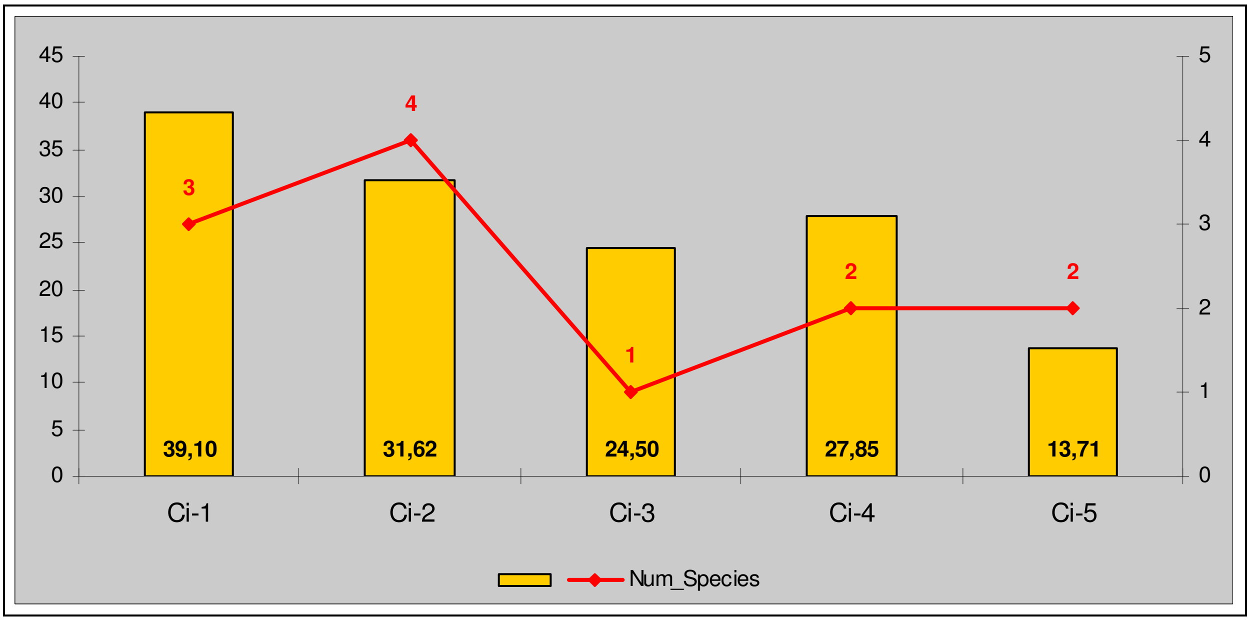
Ci-3
Stenosis sardoa sardoa

Ci-4
Stenosis sardoa sardoa
Alphasida grossa sicula

Ci-5
Stenosis sardoa sardoa
Cnemeplatia atropos atropos

Tab. 6.2.6 – Rank / abundance of the first species of Tenebrionidae in the traps of the station **Ci**.

The graph. 6.2.6 represents Tenebrionidae capture frequencies and number of species sampled at each trap for station **Ci**.
The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 12,82 con p = 0,01), present the highest value in the trap **Ci-1** and the lowest value in the trap **Ci-5**. No trap has collected all the **5** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 2,17 con p = 0,70) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**4**) was recorded in the trap **Ci-2** and the minimum (**1**) in the trap **Ci-3**.



Graf. 6.2.6 - Frequency of capture (CSD) and number of species of Tenebrionidae in the traps of station **Ci**.

Station Tk (*P. halepensis- Q. calliprinos* Thicket)

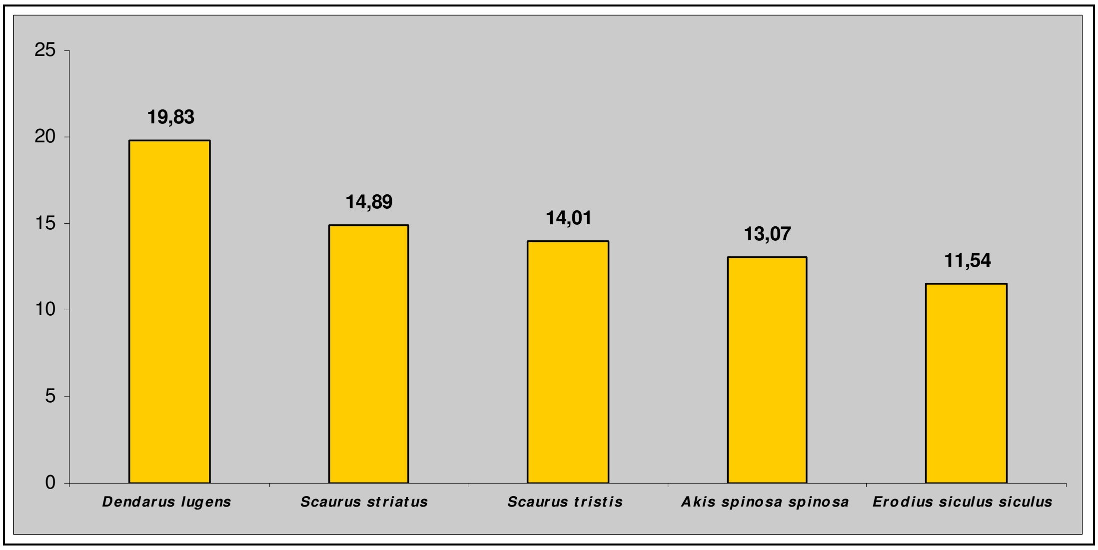
At station **Tk** where sampled a total of **11** species of Tenebrionidae with a CSD value of **105,54**. Among the species with the highest values of CSD there are not really that characterize the station; that more abundant is *Dendarus lugens* (CSD: 19,83) followed by:

Scaurus striatus: CSD 14,89
Scaurus tristis: CSD 14,01
Akis spinosa spinosa: CSD 13,07
Erodius siculus siculus: CSD 11,54

These five species represent 69,49% of total CSD for the station; other species show much lower values of CSD (cfr. anche graf. 6.2.7).
The trend in the frequency of capture of the species of Tenebrionidae in the **Tk** station 5 traps is shown in table 6.2.7.

SPECIES	Tk-1	Tk-2	Tk-3	Tk-4	Tk-5	Tot_CSD
Dendarus lugens	3,62	9,06	7,15			19,83
Scaurus striatus				12,28	2,62	14,89
Scaurus tristis				11,38	2,63	14,01
Akis spinosa spinosa	1,32	1,26	1,01	1,32	8,17	13,07
Erodius siculus siculus				2,63	8,91	11,54
Alphasida grossa sicula		3,51	1,32	2,22	0,71	7,75
Tentyria grossa grossa				1,32	5,99	7,30
Stenosis sardoa sardoa	3,62		2,12		0,88	6,62
Stenosis melitana	1,32			3,95		5,27
Pimelia rugulosa sublaevigata			1,01	2,35		3,36
Nalassus aemulus aemulus		1,87				1,87
Tot_CSD	9,88	15,70	12,60	37,45	29,90	105,54
Num_Species	4	4	5	8	7	11

Tab. 6.2.7 - Trend in the capture frequency (CSD) for the species of Tenebrionidae in traps of **Tk** station.



Graf. 6.2.7 - Frequency of capture (CSD) of the more abundantly sampled species of Tenebrionidae in the station **Tk.**

Among the sampled species just one (*Akis spinosa spinosa*) is present in all the traps; *Alphasida grossa sicula* is present in traps **Tk-2**, **Tk-3**, **Tk-4** and **Tk-5**; *Dendarus lugens* is present in traps **Tk-1**, **Tk-2** and **Tk-3**; *Stenosis sardoa sardoa* is present in traps **Tk-1**, **Tk-3** and **Tk-5**. The other species are present in only one or two traps, including *Scaurus striatus* and *Scaurus tristis* showing respectively the second and the third largest value of CSD for the station.

In the following table (tab. 6.2.8) are indicated the first 4 species in the rank / abundance in the individual traps. *Dendarus lugens* (absent in traps **Tk-4** and **Tk-5**) ranks first in the remaining traps (**Tk-1**, **Tk-2** e **Tk-3**); *Scaurus striatus*, present as mentioned in only two traps, ranks first in trap **Tk-4** but not among the first four species in the trap **Tk-5**; *Erodius siculus siculus* ranks first in the trap **Tk-5** and fourth in trap **Tk-4**.

Tk-1
Dendarus lugens
Stenosis sardoa sardoa
Akis spinosa spinosa
Stenosis melitana

Tk-2
Dendarus lugens
Alphasida grossa sicula
Nalassus aemulus aemulus
Akis spinosa spinosa

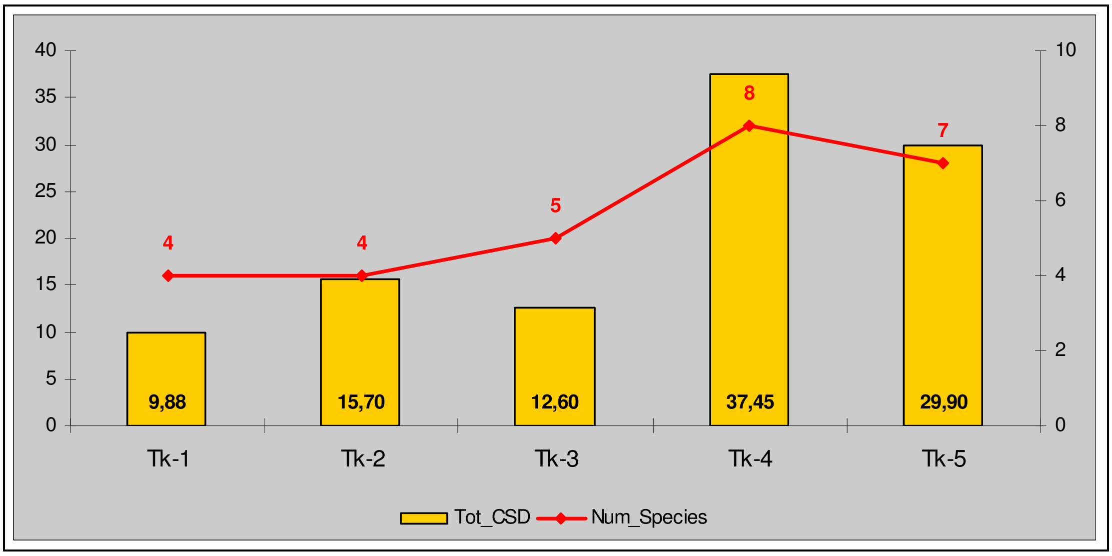
Tk-3
Dendarus lugens
Stenosis sardoa sardoa
Alphasida grossa sicula
Akis spinosa spinosa

Tk-4
Scaurus striatus
Scaurus tristis
Stenosis melitana
Erodius siculus siculus

Tk-5
Erodius siculus siculus
Akis spinosa spinosa
Tentyria grossa grossa
Scaurus tristis

Tab. 6.2.8 – Rank / abundance of the first species of Tenebrionidae in the traps of the station **Tk**.

The graph. 6.2.8 represents Tenebrionidae capture frequencies and number of species sampled at each trap for station **Tk**.
The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 27,10 con p = 0,000019), present the highest value in the trap **Tk-4** and the lowest value in the trap **Tk-1**.
No trap has collected all the **11** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 2,36 con p = 0,67) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**8**) was recorded in the trap **Tk-4** and the minimum (**4**) in the traps **Tk-1** and **Tk-2**.



Graf. 6.2.8 - Frequency of capture (CSD) and number of species of Tenebrionidae in the traps of station **Tk**.

6.3 COLEOPTERA STAPHYLINIDAE

Station AC (Arable-land with Carob trees)

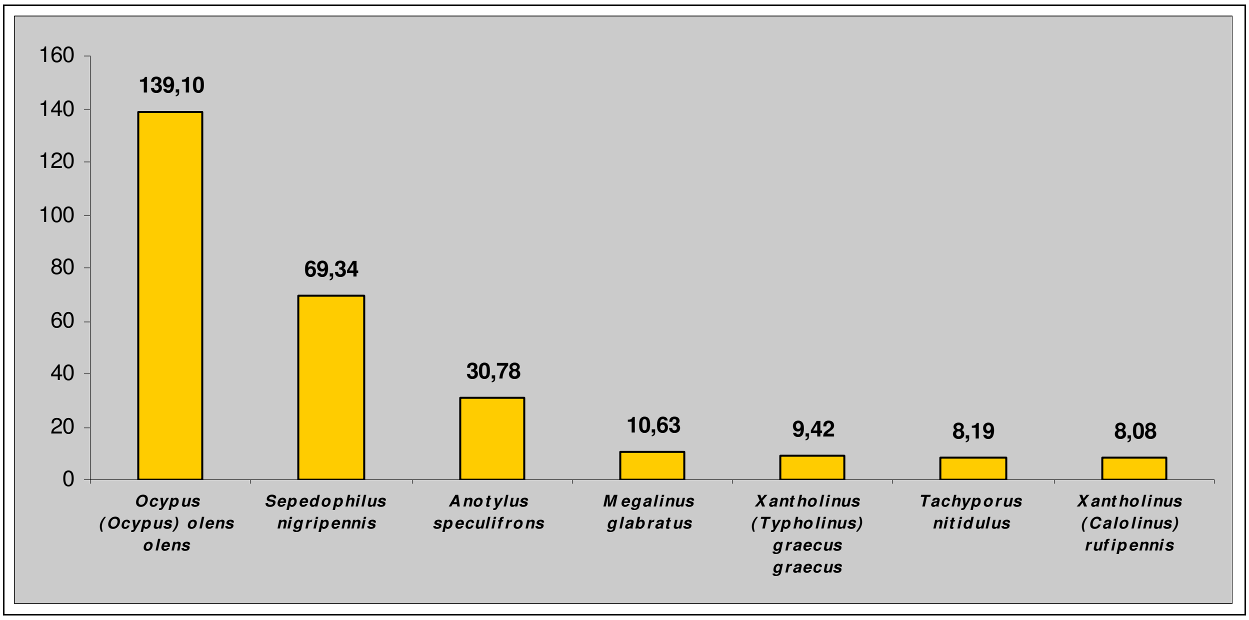
In **AC** station was sampled a total of **22** species of Staphylinidae with a value of CSD **312,33**.
Ocypus (*Ocypus*) *olens olens* (CSD: 139,10) characterizes this station regarding the frequency of capture (44,54%); other species show much lower values of CSD (see also graph. 6.3.1) as follows:

Sepedophilus nigripennis: CSD 69,34
Anotylus speculifrons: CSD 30,78
Megalinus glabratus: CSD 10,63
Xantholinus (*Typholinus*) *graecus graecus*: CSD 9,42
Tachyporus nitidulus: CSD 8,19
Xantholinus (*Calolinus*) *rufipennis*: CSD 8,08

These seven species represent the 88,22% of the total CSD for the station.
The trend in the capture frequency for the species of Staphylinidae in the five **AC** station traps is shown in table 6.3.1.

SPECIES	AC-1	AC-2	AC-3	AC-4	AC-5	Tot_CSD
Ocypus (Ocypus) olens olens	34,67	13,89	25,65	47,22	17,67	139,10
Sepedophilus nigripennis	3,73	8,60	5,92	16,34	34,75	69,34
Anotylus speculifrons	10,42	2,83	3,24	6,64	7,65	30,78
Megalinus glabratus	2,26	2,27	0,79	4,52	0,79	10,63
Xantholinus (Typholinus) graecus graecus		0,79	0,98	3,92	3,73	9,42
Tachyporus nitidulus	0,98		2,31		4,90	8,19
Xantholinus (Calolinus) rufipennis	3,94			1,77	2,37	8,08
Heterothops minutus		2,83		3,88		6,71
Anotylus complanatus				1,16	3,92	5,08
Tachyporus pusillus			2,94		1,16	4,10
Omalium rugatum					2,94	2,94
Sepedophilus marshami	0,98	0,98			0,98	2,94
Mycetoporus baudueri	0,87	1,96				2,83
Anotylus sculpturatus			0,87		1,29	2,17
Micropeplus staphylinoides					1,77	1,77
Anotylus inustus	0,79				0,79	1,58
Luzea nigritula					1,47	1,47
Quedius (Raphirus) humeralis			1,29			1,29
Paraphloeostiba gayndahensis		1,08				1,08
Anotylus tetracarinatus		0,98				0,98
Eusphalerum (Eusphalerum) luteicorne				0,98		0,98
Astenus (Astenus) lyonessius	0,87					0,87
Tot_CSD	59,52	36,22	44,00	86,42	86,17	**312,33**
Num_Species	10	10	9	9	15	**22**

Tab. 6.3.1 - Trend in the capture frequency (CSD) for the species of Staphylinidae in traps of station AC.



Graph. 6.3.1 - Frequency of capture (CSD) of the more abundantly sampled species of Staphylinidae in the station **AC.**

Among sampled species only 4, *Ocypus* (*Ocypus*) *olens olens*, *Sepedophilus nigripennis*, *Anotylus speculifrons* e *Megalinus glabratus,* are present in all traps, although sometimes with different values of CSD. *Xantholinus* (*Typholinus*) *graecus graecus* is absent in trap **AC-1**; *Tachyporus nitidulus*, *Xantholinus* (*Calolinus*) *rufipennis* and *Sepedophilus marshami* were sapled only in three traps, while the other species are present in only one or two traps.
In the table below (tab. 6.3.2) are indicated the first 7 species rank / abundance in the individual traps. *Ocypus* (*Ocypus*) *olens olens* ranks first in all traps with exception of **AC-5** where it ranks second; *Sepedophilus nigripennis* ranks first in trap **AC-5**, second in trap **AC-2**, **AC3** and **AC-4**, fourth in trap **AC-1**; *Anotylus speculifrons* ranks third in all traps with excemption of **AC-1** where it ranks second; *Megalinus glabratus* ranks fifth in traps **AC-1** and **AC-2**, fourth in trap **AC-4**, and and not in the top seven species in traps **AC-3** and **AC-5**.

AC-1
Ocypus (Ocypus) olens olens
Anotylus speculifrons
Xantholinus (Calolinus) rufipennis
Sepedophilus nigripennis
Megalinus glabratus
Sepedophilus marshami
Tachyporus nitidulus

AC-2
Ocypus (Ocypus) olens olens
Sepedophilus nigripennis
Anotylus speculifrons
Heterothops minutus
Megalinus glabratus
Mycetoporus baudueri
Paraphloeostiba gayndahensis

AC-3
Ocypus (Ocypus) olens olens
Sepedophilus nigripennis
Anotylus speculifrons
Tachyporus pusillus
Tachyporus nitidulus
Quedius (Raphirus) humeralis
Xantholinus (Typholinus) graecus graecus

AC-4
Ocypus (Ocypus) olens olens
Sepedophilus nigripennis
Anotylus speculifrons
Megalinus glabratus
Xantholinus (Typholinus) graecus graecus
Heterothops minutus
Xantholinus (Calolinus) rufipennis

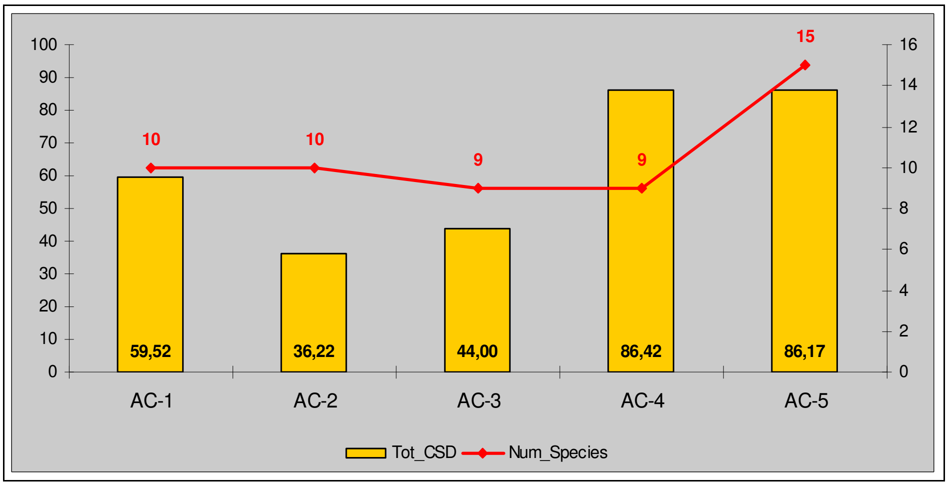
AC-5
Sepedophilus nigripennis
Ocypus (Ocypus) olens olens
Anotylus speculifrons
Tachyporus nitidulus
Anotylus complanatus
Xantholinus (Typholinus) graecus graecus
Omalium rugatum

Tab. 6.3.2 – Rank / abundance of the first 7 species of Staphylinidae in the traps of the station **AC**.

The graph. 6.3.2 represents Staphylinidae capture frequencies and number of species sampled at each trap for station **AC**.

The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 34,81 con p = 0,000001), present the highest value in the trap **AC-5** and the lowest value in the trap **AC-2**.

No trap has collected all the **22** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 2,38 con p = 0,67) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**15**) was recorded in the trap **AC-5** and the minimum (**9**) in the traps **AC-3** e **AC-4**.



Graph. 6.3.2 - Frequency of capture (CSD) and number of species of Staphylinidae in the traps of station **AC**.

Station Ol (Olive-grove)

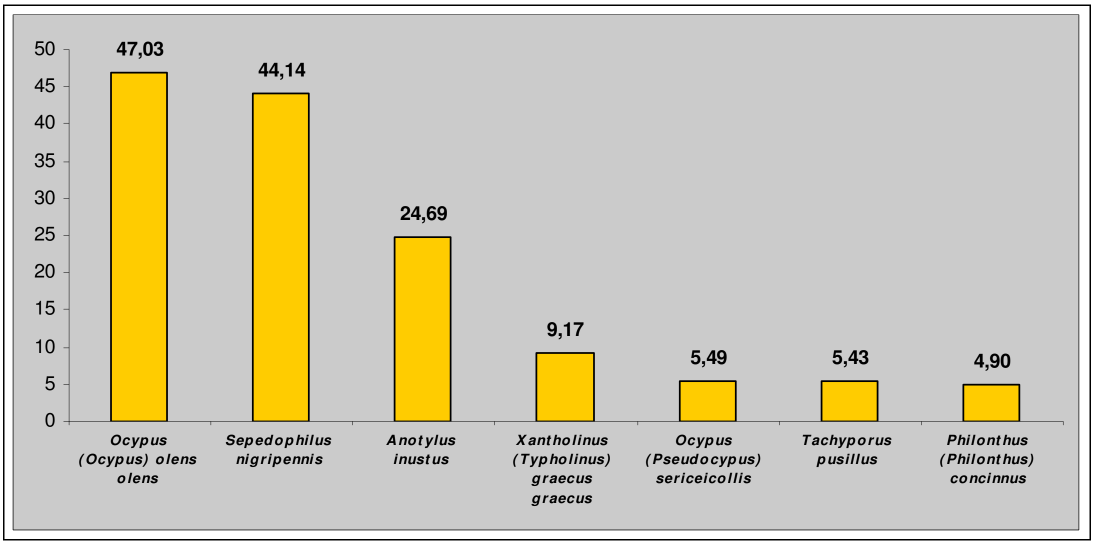
In **Ol** station was sampled a total of **21** species of Staphylinidae with a value of CSD **167,04**.
Ocypus (*Ocypus*) *olens olens* (CSD: 47,03) and *Sepedophilus nigripennis* (CSD: 44,14) strongly characterize this station regarding the frequency of capture(54,58%); other species show much lower values of CSD (see also graph. 6.3.3) as follows:

Anotylus inustus: CSD 24,69
Xantholinus (*Typholinus*) *graecus graecus*: CSD 9,17
Ocypus (*Pseudocypus*) *sericeicollis*: CSD 5,49
Tachyporus pusillus: CSD 5,43
Philonthus (*Philonthus*) *concinnus*: CSD 4,90

These seven species represent the 84,32% of the total CSD for the station.
The trend in the capture frequency for the species of Staphylinidae in the five **AC** station traps is shown in table 6.3.3.

SPECIES	Ol-1	Ol-2	Ol-3	Ol-4	Ol-5	Tot_CSD
Ocypus (Ocypus) olens olens	27,06	0,79	1,77	0,98	16,43	47,03
Sepedophilus nigripennis	21,37	6,69	8,70	4,50	2,88	44,14
Anotylus inustus	1,29	14,70	2,03	0,79	5,88	24,69
Xantholinus (Typholinus) graecus graecus	1,29	1,96	5,13	0,79		9,17
Ocypus (Pseudocypus) sericeicollis			0,87		4,62	5,49
Tachyporus pusillus		1,16			4,27	5,43
Philonthus (Philonthus) concinnus					4,90	4,90
Astenus (Astenopleuritus) melanurus			1,08		2,37	3,45
Anotylus speculifrons		0,63		0,79	1,61	3,04
Micropeplus staphylinoides	0,98		1,85			2,83
Mycetoporus baudueri			1,96	0,87		2,83
Astenus (Astenus) lyonessius		1,47	0,79			2,26
Sepedophilus marshami		1,77				1,77
Heterothops minutus	1,75					1,75
Ocypus (Pseudocypus) fortunatarum		1,47				1,47
Rugilus (Rugilus) orbiculatus	1,47					1,47
Xantholinus (Calolinus) rufipennis	1,47					1,47
Domene (Domene) stilicina	1,29					1,29
Quedius (Raphirus) semiobscurus semiobscurus					0,98	0,98
Ocypus (Ocypus) ophthalmicus					0,79	0,79
Tasgius (Tasgius) pedator siculus					0,79	0,79
Tot_CSD	57,98	30,64	24,18	8,72	45,52	**167,04**
Num_Species	9	9	9	6	11	**21**

Tab. 6.3.3 - Trend in the capture frequency (CSD) for the species of Staphylinidae in traps of station **Ol**.



Graph. 6.3.3 - Frequency of capture (CSD) of the more abundantly sampled species of Staphylinidae in the station **Ol**.

Among sampled species only 3 (*Ocypus* (*Ocypus*) *olens olens*, *Sepedophilus nigripennis* and *Anotylus inustus*) are present in alla traps, although sometimes with different values of CSD. *Xantholinus* (*Typholinus*) *graecus graecus* is absent just in trap **Ol-5;** *Anotylus speculifrons* is absent in traps **Ol-1** e **Ol-3**, while the other species are present in only one or two traps.

In the table below (tab. 6.3.4) are indicated the first species rank / abundance in the individual traps. *Ocypus* (*Ocypus*) *olens olens* ranks first in traps **Ol-1** and **Ol-5**, second in trap **Ol-4**, sixth in trap **Ol-3**, and not in the top species in trap **Ol-2**; *Sepedophilus nigripennis* ranks first in traps **Ol-3** and **Ol-4**, second in traps **Ol-1** and **Ol-2**, and sixth in traps il sesto nella trappola **Ol-5**. *Anotylus inustus* ranks first in trap **Ol-2**, second in trap **Ol-5**, third in trap **Ol-3**, and not in the top species in traps **Ol-1** and **Ol-4**.

Ol-1
Ocypus (Ocypus) olens olens
Sepedophilus nigripennis
Heterothops minutus
Rugilus (Rugilus) orbiculatus
Xantholinus (Calolinus) rufipennis

Ol-2
Anotylus inustus
Sepedophilus nigripennis
Xantholinus (Typholinus) graecus graecus
Sepedophilus marshami
Astenus (Astenus) lyonessius
Ocypus (Pseudocypus) fortunatarum

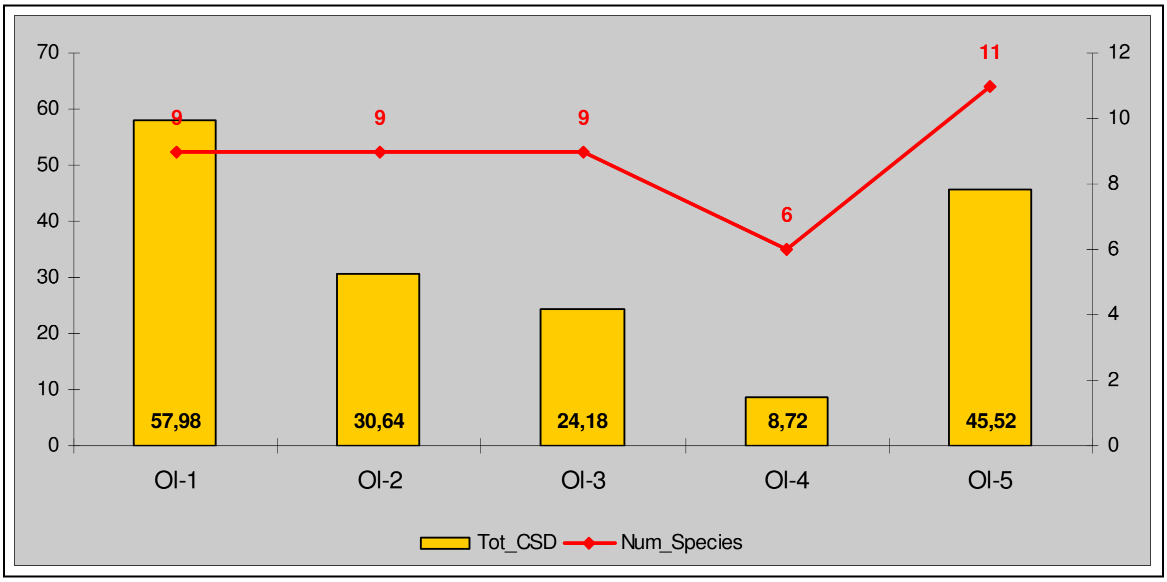
Ol-3
Sepedophilus nigripennis
Xantholinus (Typholinus) graecus graecus
Anotylus inustus
Mycetoporus baudueri
Micropeplus staphylinoides
Ocypus (Ocypus) olens olens

Ol-4
Sepedophilus nigripennis
Ocypus (Ocypus) olens olens
Mycetoporus baudueri

Ol-5
Ocypus (Ocypus) olens olens
Anotylus inustus
Philonthus (Philonthus) concinnus
Ocypus (Pseudocypus) sericeicollis
Tachyporus pusillus
Sepedophilus nigripennis

Tab. 6.3.4 – Rank / abundance of the first species of Staphylinidae in the traps of the station **Ol**.

The graph. 6.3.4 represents Staphylinidae capture frequencies and number of species sampled at each trap for station **Ol**.
The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 43,49 con p = 0,000000), present the highest value in the trap **Ol-1** and the lowest value in the trap **Ol-4**.
No trap has collected all the **21** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 1,45 con p = 0,83) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**11**) was recorded in the trap **Ol-5** and the minimum (**6**) in the trap **Ol-4**.



Graph. 6.3.4 - Frequency of capture (CSD) and number of species of Staphylinidae in the traps of station **Ol**.

Station Ci (Citrus-grove)

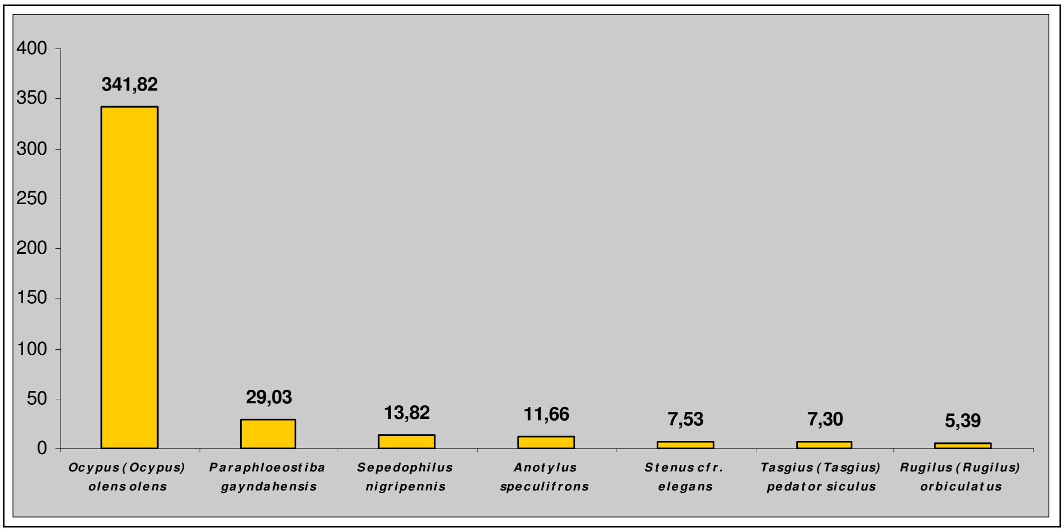
In **Ci** station was sampled a total of **25** species of Staphylinidae with a value of CSD **441,65**.
Ocypus (Ocypus) olens olens (CSD: 341,82) strongly characterizes this station regarding the frequency of capture (77,40%); other species show much lower values of CSD (see also graph. 6.3.5) as follows:

Paraphloeostiba gayndahensis: CSD 29,03
Sepedophilus nigripennis: CSD 13,82
Anotylus speculifrons: CSD 11,66
Stenus cfr. elegans: CSD 7,53
Tasgius (Tasgius) pedator siculus: CSD 7,30
Rugilus (Rugilus) orbiculatus: CSD 5,39

These seven species represent the 94,32% of the total CSD for the station.
The trend in the capture frequency for the species of Staphylinidae in the five **Ci** station traps is shown in table 6.3.5.

SPECIES	Ci-1	Ci-2	Ci-3	Ci-4	Ci-5	Tot_CSD
Ocypus (Ocypus) olens olens	38,12	41,56	69,86	93,28	98,99	341,82
Paraphloeostiba gayndahensis	14,12	2,16		7,15	5,60	29,03
Sepedophilus nigripennis	2,75	1,08	1,47	4,50	4,02	13,82
Anotylus speculifrons	1,96	0,98	0,98	6,27	1,47	11,66
Stenus cfr. elegans	2,74			2,45	2,34	7,53
Tasgius (Tasgius) pedator siculus		1,78	1,08	2,66	1,78	7,30
Rugilus (Rugilus) orbiculatus		2,16		3,23		5,39
Euryporus aeneiventris				2,94		2,94
Platystethus (Craetopycrus) nitens		1,08	1,08			2,16
Sunius (Sunius) algiricus		1,08			1,08	2,16
Tachinus flavolimbatus			0,98		0,98	1,96
Quedius (Quedius) levicollis				0,87	0,87	1,75
Anotylus complanatus					1,47	1,47
Domene (Domene) stilicina			1,47			1,47
Proteinus atomarius			1,29			1,29
Anotylus nitidulus		1,08				1,08
Gabrius nigritulus		1,08				1,08
Gyrohypnus (Gyrohypnus) fracticornis				1,08		1,08
Heterothops minutus				1,08		1,08
Ocypus (Ocypus) ophthalmicus	0,99					0,99
Tasgius (Rayachelia) globulifer evitendus					0,99	0,99
Habrocerus capillaricornis					0,98	0,98
Micropeplus porcatus					0,98	0,98
Lordithon exoletus				0,87		0,87
Philonthus (Philonthus) concinnus					0,79	0,79
Tot_CSD	60,68	54,02	78,21	126,39	122,34	**441,65**
Num_Species	6	10	8	12	14	**25**

Tab. 6.3.5 - Trend in the capture frequency (CSD) for the species of Staphylinidae in traps of station **Ci**.



Graph. 6.3.5 - Frequency of capture (CSD) of the more abundantly sampled species of Staphylinidae in the station **Ci.**

Among sampled species only 3, *Ocypus* (*Ocypus*) *olens olens*, *Sepedophilus nigripennis* e *Anotylus speculifrons*) are present in all traps, although sometimes with different values of CSD. *Paraphloeostiba gayndahensis* is absent just in trap **Ci-3**; *Tasgius* (*Tasgius*) *pedator siculus* is absent in trap **Ci-1**; *Stenus* cfr. *elegans* is absent in traps **Ol-1** and **Ol-3**, while the other species are present in only one or two traps.

In the table below (tab. 6.3.6) are indicated the first species rank / abundance in the individual traps. *Ocypus* (*Ocypus*) *olens olens* ranks first in all traps; *Paraphloeostiba gayndahensis* ranks second in all traps with exception of trap **Ci-3** where it is absent; *Sepedophilus nigripennis* ranks third in traps **Ci-1**, **Ci-3** and **Ci-5**, fourth in trap **Ci-4** and eighth in trap **Ci-2**; *Anotylus speculifrons* ranks third in trap **Ci-4**, fifth in trap **Ci-1,** seventh in trap **Ci-5** and not in the top species in traps **Ci-2** e **Ci-3**.

Ci-1
Ocypus (Ocypus) olens olens
Paraphloeostiba gayndahensis
Sepedophilus nigripennis
Stenus cfr. elegans
Anotylus speculifrons
Ocypus (Ocypus) ophthalmicus

Ci -2
Ocypus (Ocypus) olens olens
Paraphloeostiba gayndahensis
Rugilus (Rugilus) orbiculatus
Tasgius (Tasgius) pedator siculus
Anotylus nitidulus
Gabrius nigritulus
Platystethus (Craetopycrus) nitens
Sepedophilus nigripennis
Sunius (Sunius) algiricus

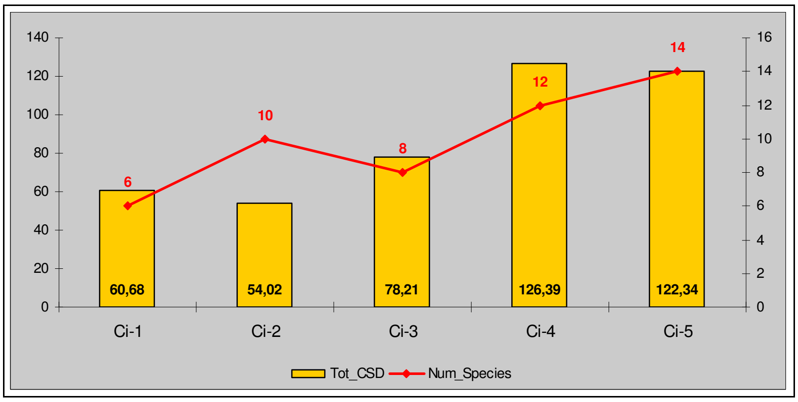
Ci -3
Ocypus (Ocypus) olens olens
Domene (Domene) stilicina
Sepedophilus nigripennis
Proteinus atomarius
Platystethus (Craetopycrus) nitens
Tasgius (Tasgius) pedator siculus

Ci -4
Ocypus (Ocypus) olens olens
Paraphloeostiba gayndahensis
Anotylus speculifrons
Sepedophilus nigripennis
Rugilus (Rugilus) orbiculatus
Euryporus aeneiventris
Tasgius (Tasgius) pedator siculus

Ci -5
Ocypus (Ocypus) olens olens
Paraphloeostiba gayndahensis
Sepedophilus nigripennis
Stenus cfr. elegans
Tasgius (Tasgius) pedator siculus
Anotylus complanatus
Anotylus speculifrons

Tab. 6.3.6 – Rank / abundance of the first species of Staphylinidae in the traps of the station **Ci**.

The graph. 6.3.6 represents Staphylinidae capture frequencies and number of species sampled at each trap for station **Ci**.
The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 52,63 con p = 0,000000), present the highest value in the trap **Ci-4** and the lowest value in the trap **Ci-2**.
No trap has collected all the **25** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 4,00 con p = 0,41) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**14**) was recorded in the trap **Ci-5** and the minimum (**6**) in the trap **Ci-1**.



Graph. 6.3.6 - Frequency of capture (CSD) and number of species of Staphylinidae in the traps of station **Ci**.

Station Tk (*P. halepensis- Q. calliprinos* Thicket)

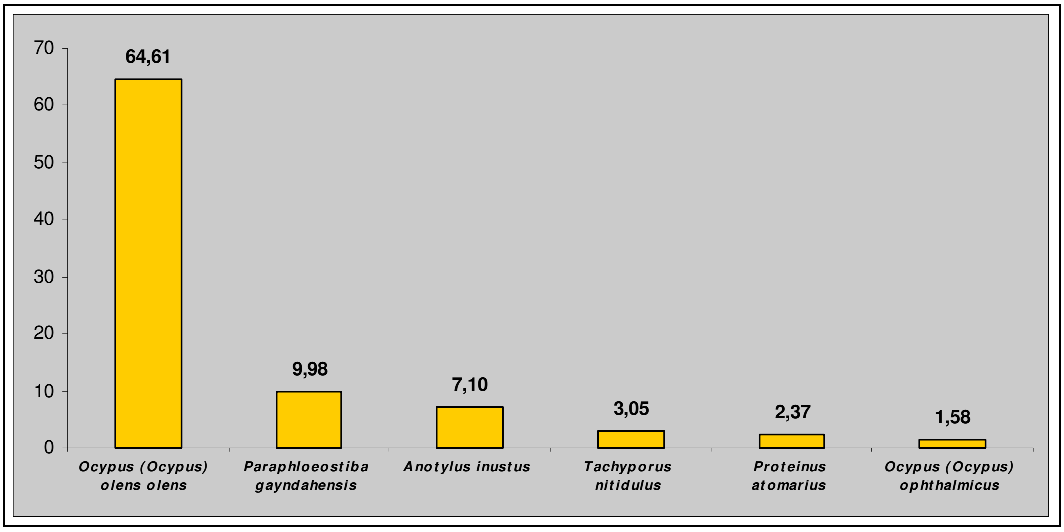
In **Tk** station was sampled a total of **14** species of Staphylinidae with a value of CSD **97,75**.
Ocypus (Ocypus) olens olens (CSD: 64,61) strongly characterizes this station regarding the frequency of capture (66,10%); other species show much lower values of CSD (see also graph. 6.3.7) as follows:

Paraphloeostiba gayndahensis: CSD 9,98
Anotylus inustus: CSD 7,10
Tachyporus nitidulus: CSD 3,05
Proteinus atomarius: CSD 2,37
Ocypus (*Ocypus*) *ophthalmicus*: CSD 1,58

Theset six species represent the 90,72% of the total CSD for the station specie.
The trend in the capture frequency for the species of Staphylinidae in the five **Tk** station traps is shown in table 6.3.7.

SPECIES	Tk-1	Tk-2	Tk-3	Tk-4	Tk-5	Tot_CSD
Ocypus (Ocypus) olens olens	7,35	7,21	50,05			64,61
Paraphloeostiba gayndahensis	6,93				3,05	9,98
Anotylus inustus			7,10			7,10
Tachyporus nitidulus	1,58			1,47		3,05
Proteinus atomarius	0,79		1,58			2,37
Ocypus (Ocypus) ophthalmicus		0,79	0,79			1,58
Sepedophilus nigripennis				1,47		1,47
Tachyporus pusillus	1,47					1,47
Tasgius (Tasgius) pedator siculus			1,47			1,47
Omalium cinnamomeum					1,40	1,40
Micropeplus staphylinoides		0,98				0,98
Sepedophilus marshami			0,79			0,79
Xantholinus (Typholinus) graecus graecus			0,79			0,79
Heterothops minutus		0,70				0,70
Tot_CSD	18,11	9,68	62,56	2,94	4,45	**97,75**
Num_Species	5	4	7	2	2	**14**

Tab. 6.3.7 - Trend in the capture frequency (CSD) for the species of Staphylinidae in traps of station **Tk**.



Graph. 6.3.7 - Frequency of capture (CSD) of the more abundantly sampled species of Staphylinidae in the station

None of the sampled species is present in all traps. *Ocypus* (*Ocypus*) *olens olens* is present in three traps (**Tk-1, Tk-2** and **Tk-3**), while the other species are present in only one or two traps.

In the table below (tab. 6.3.8) are indicated the first (or unique for traps **Tk-4** and **Tk-5**) species rank / abundance in the individual traps. *Ocypus* (*Ocypus*) *olens olens* ranks first in traps **Tk-1**, **Tk-2** and **Tk-3** and, as mentioned, in absent in the other traps.

Tk-1
Ocypus (Ocypus) olens olens
Paraphloeostiba gayndahensis
Tachyporus nitidulus

Tk-2
Ocypus (Ocypus) olens olens
Micropeplus staphylinoides
Ocypus (Ocypus) ophthalmicus

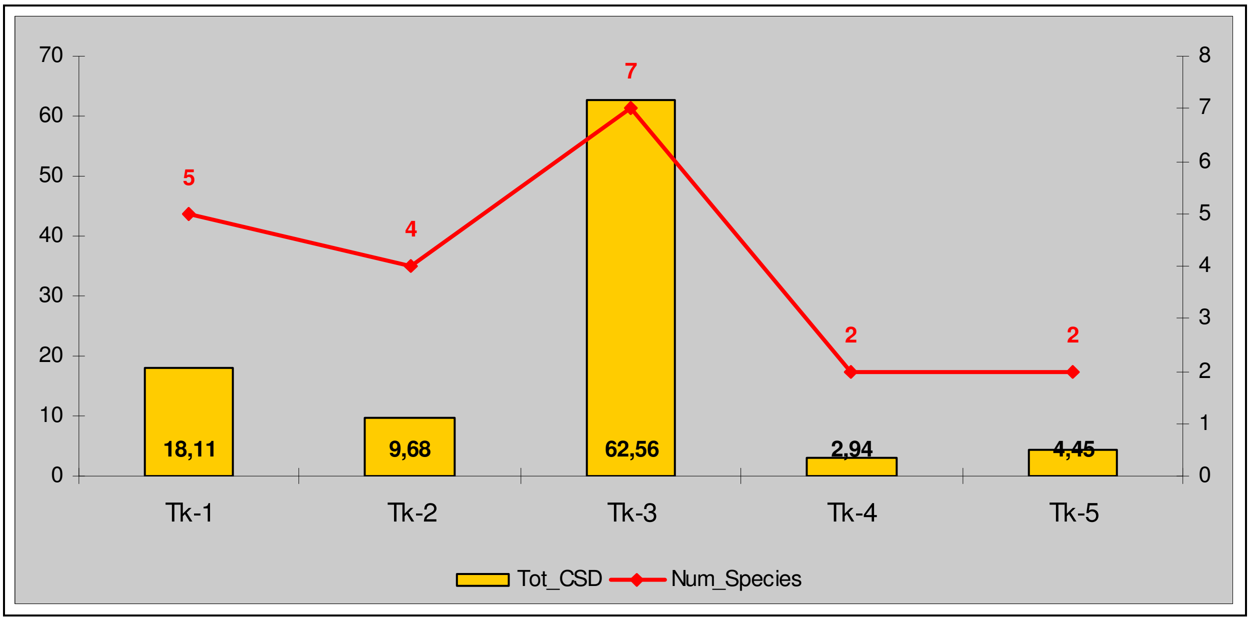
Tk-3
Ocypus (Ocypus) olens olens
Anotylus inustus
Proteinus atomarius
Tasgius (Tasgius) pedator siculus

Tk-4
Sepedophilus nigripennis
Tachyporus nitidulus

Tk-5
Paraphloeostiba gayndahensis
Omalium cinnamomeum

Tab. 6.3.8 – Rank / abundance of the first species of Staphylinidae in the traps of the station **Tk**.

The graph. 6.3.8 represents Staphylinidae capture frequencies and number of species sampled at each trap for station **Tk**.
The CSD values found in the individual traps, which do not show statistically similar values (χ^2_4 = 125,50 con p = 0,000000), present the highest value in the trap **Tk-3** and the lowest value in the trap **Tk-4**.
No trap has collected all the **14** species sampled in the station. With regard to the number of species sampled traps are similar (χ^2_4 = 4,50 con p = 0,34) and this suggests that the number of species is not influenced by the frequency of capture. The greatest number of species (**7**) was recorded in the trap **Tk-3** and the minimum (**2**) in the traps **Tk-4** e **Tk-5**.



Graph. 6.3.8 - Frequency of capture (CSD) and number of species of Staphylinidae in the traps of station **Tk**.

7 BIODIVERSITY, EVENNESS AND SIMILARITY INDICES

To synthetically assess the level of biodiversity for the individual stations, the frequency distribution of taxa within them, and the similarity between stations were developed a set of indicators, as detailed in paragraph 3.4.
In particular, to evaluate the richness of families and species has been used Margalef's index (**d**); for the estimation of biodiversity were calculated Simpson's (**D**) and Shannon's (**H'**) indices; were also calculated the Pielou's evenness index (**J**) and Simpson's Dominance index (**λ**). Finally, the similarity between the stations was evaluated using the quality index of Sørensen (**QS**).
Analyses were performed on both the total of Families of Coleoptera surveyed in the entire sample, and on species of Coleoptera Carabidae, Tenebrionidae and Staphylinidae (excluding Aleocharinae).

7.1 BIODIVERSITY AND EVENNESS INDICES

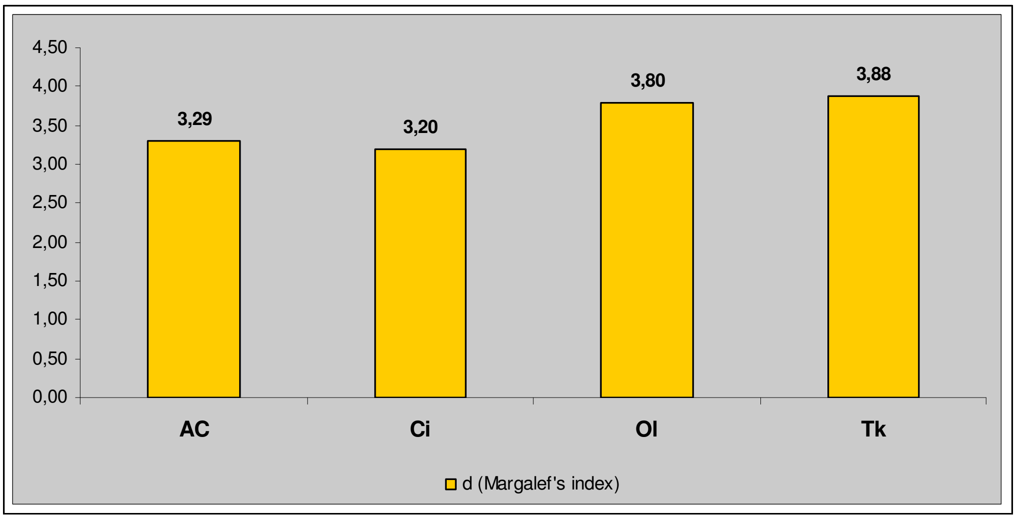
COLEOPTERA FAMILIES

Table 7.1.1 synthesizes assessed values for single stations relatively to indices of Margalef (**d**), Simpson (**D**), Shannon (**H'**), Pielou (**J**), Simpson's Dominance (**λ**).

STATION	*d*	*D*	*H'*	*J*	*λ*
AC	3,29	0,79	0,85	0,58	0,21
Ci	3,20	0,81	0,90	0,64	0,19
Ol	3,80	0,83	0,95	0,63	0,17
Tk	3,88	0,83	0,93	0,64	0,17

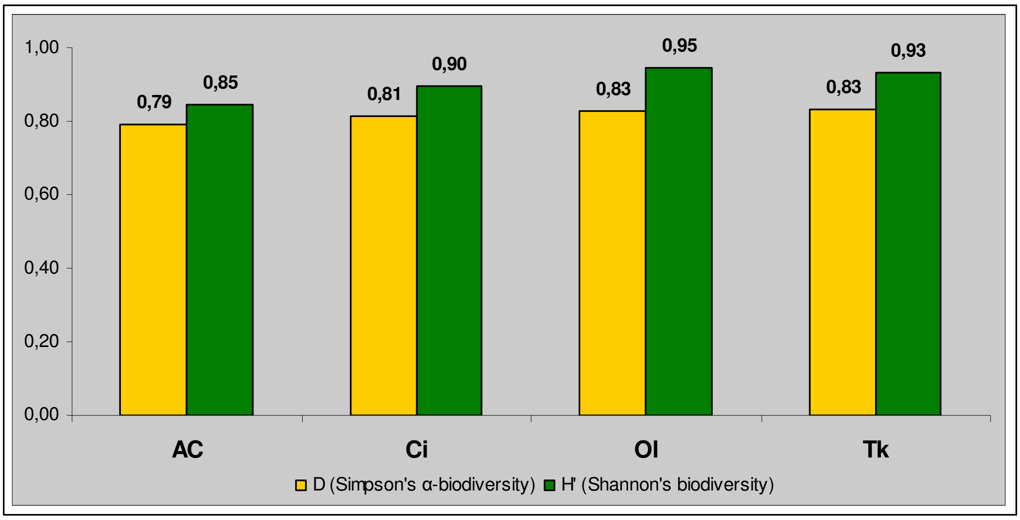
Tab 7.1.1 – Summary indices table of biodiversity and evenness for Families of Coleoptera.Margalef (**d**), Simpson (**D**), Shannon (**H'**), Pielou (**J**), Simpson's Dominance (**λ**).

Looking at the index of Margalef (graph. 7.1.1) is observed as the stations present similar values, all included in the range considered of mean diversity, with a minimum in the **Ci** station and a maximum in **Tk**.



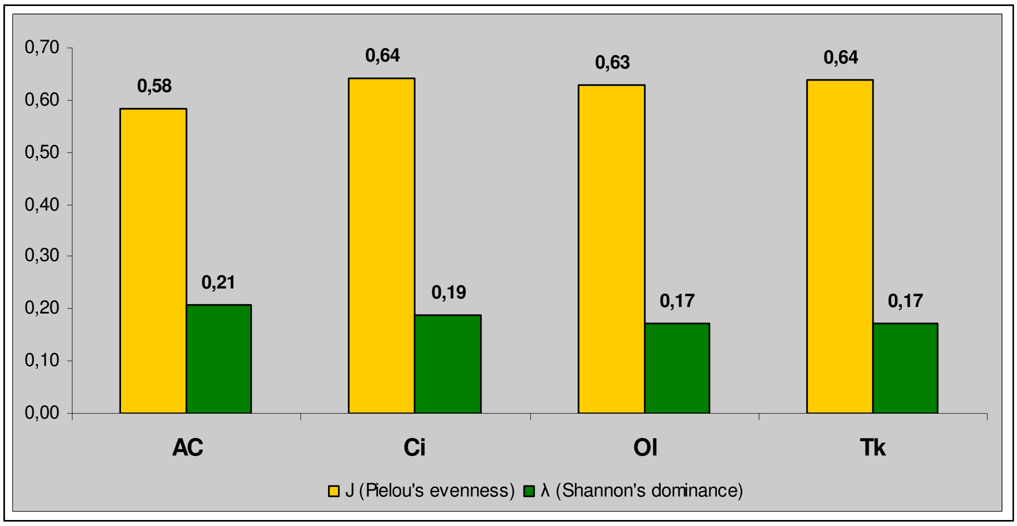
Graph. 7.1.1 - Margalef index value of the stations investigated in relation to the Families of Coleoptera.

All surveyed stations present on average high values of index of Simpson and Shannon with the maximum both for D index and H' index (graph. 7.1.2) in stations **Tk** and **Ol**, and the minimum value for both indices in station **AC**. None of the stations reaches the minimum value of 1 for the index of Shannon.



Graph. 7.1.2 – Values of Simpson's index (D) and Shannon's index (H') in the stations investigated in relation to Families of Coleoptera.

Regarding the indices of evenness and dominance (graph. 7.1.3) is observed as the station AC presents values lowest for the dominance and highest for the evenness, while the other three stations show almost identical values for each of both indexes.



Graph. 7.1.3 - Values of Pielou's index (J) and Dominance index (λ) in the stations investigated in relation to Families of Coleoptera.

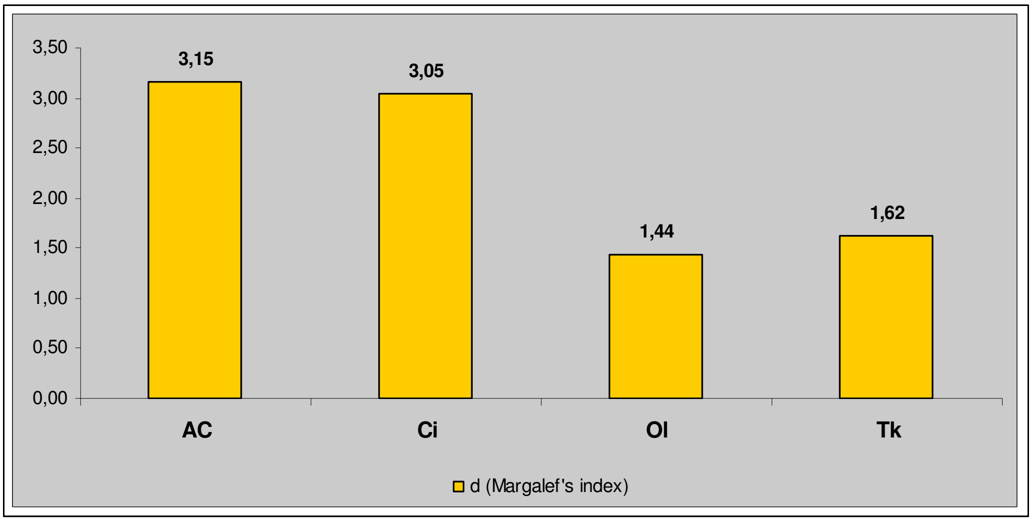
SPECIES OF CARABIDAE

Table 7.1.2 synthesizes assessed values for single stations relatively to indices of Margalef (**d**), Simpson (**D**), Shannon (**H'**), Pielou (**J**), Simpson's Dominance (λ).

STATION	*d*	*D*	*H'*	*J*	*λ*
AC	3,15	0,32	0,35	0,26	0,68
Ci	3,05	0,75	0,80	0,64	0,25
Ol	1,44	0,15	0,19	0,20	0,85
Tk	1,62	0,72	0,66	0,73	0,29

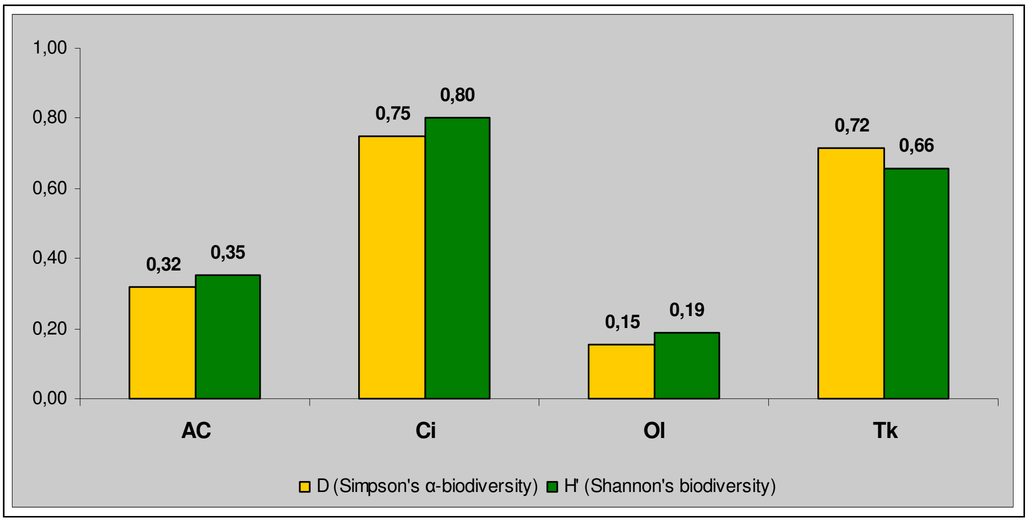
Tab. 7.1.2 – Summary indices table of biodiversity and evenness for Families of Coleoptera.Margalef (**d**), Simpson (**D**), Shannon (**H'**), Pielou (**J**), Simpson's Dominance (λ).

Analyzing the Margalef index (graph. 7.1.4) it is evident that the stations **AC** and **Ci** show values about double those found in the stations **Tk** and **Ol**. With regard to the species of Carabidae, only **AC** and **Ci** are within the range considered of mean diversity, while **Ol** and **Tk** fall within the range considered of low diversity.



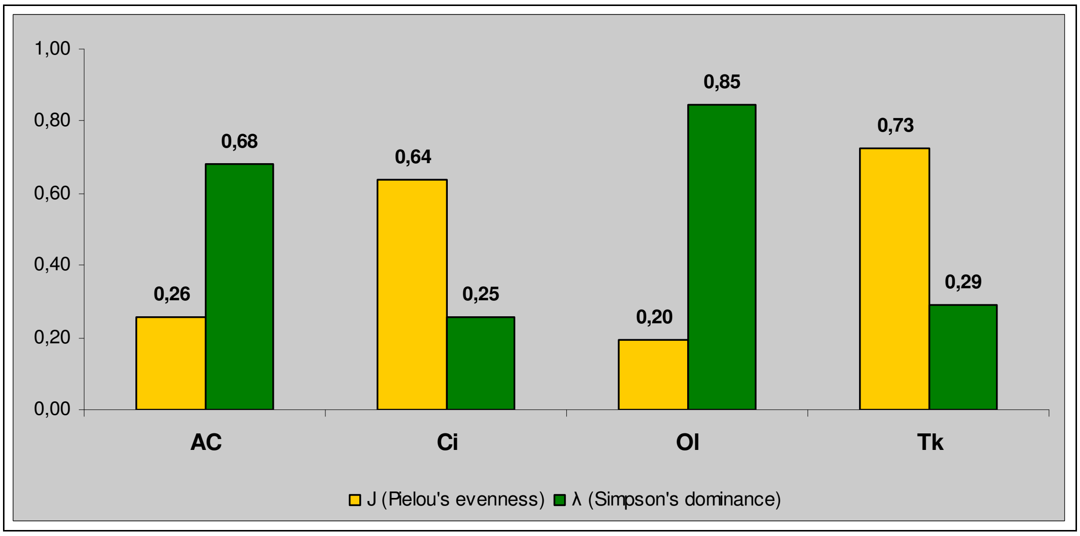
Graph. 7.1.4 - Margalef's index value of the stations investigated in relation to species of Carabidae.

Looking at the indices D and H' (graph. 7.1.5), we see that the highest values are recorded in the stations **Ci** and **Tk**, and a clear minimum of both indices value is shown by **Ol** station. Again none of the stations reaches the minimum value of 1 for index of Shannon.



Graph. 7.1.5 - Values of Simpson's index (D) and Shannon's index (H') in the stations investigated in relation to species of Carabidae.

Finally, the comparison between the evenness and dominance indices (graph. 7.1.6) shows that the stations **Ol** and **AC** show very low Pielou's index values, which are connected to high values of D, while the stations and **Tk** and **Ci** record evenness values more than 3 times higher than the previous two stations.



Graph. 7.1.6 - Values of Pielou's index (J) and Dominance index (λ) in the stations investigated in relation to species of Carabidae.

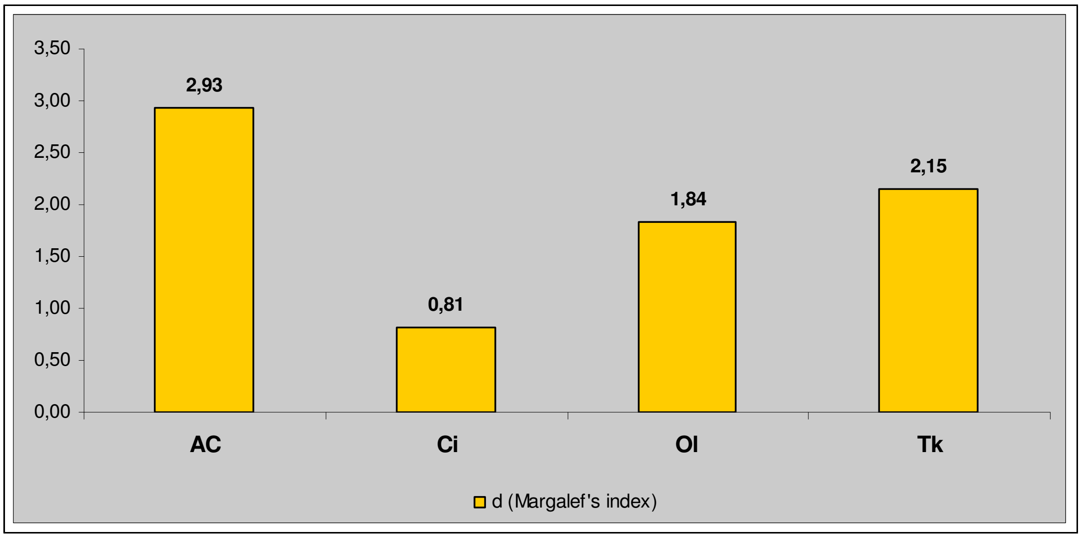
Species of Tenebrionidae

Table 7.1.3 synthesizes assessed values for single stations relatively to indices of Margalef (**d**), Simpson (**D**), Shannon (**H'**), Pielou (**J**), Simpson's Dominance (**λ**).

STATION	*d*	*D*	*H'*	*J*	*λ*
AC	2,93	0,84	0,93	0,72	0,16
Ci	0,81	0,47	0,39	0,56	0,54
Ol	1,84	0,58	0,53	0,47	0,42
Tk	2,15	0,89	0,97	0,93	0,12

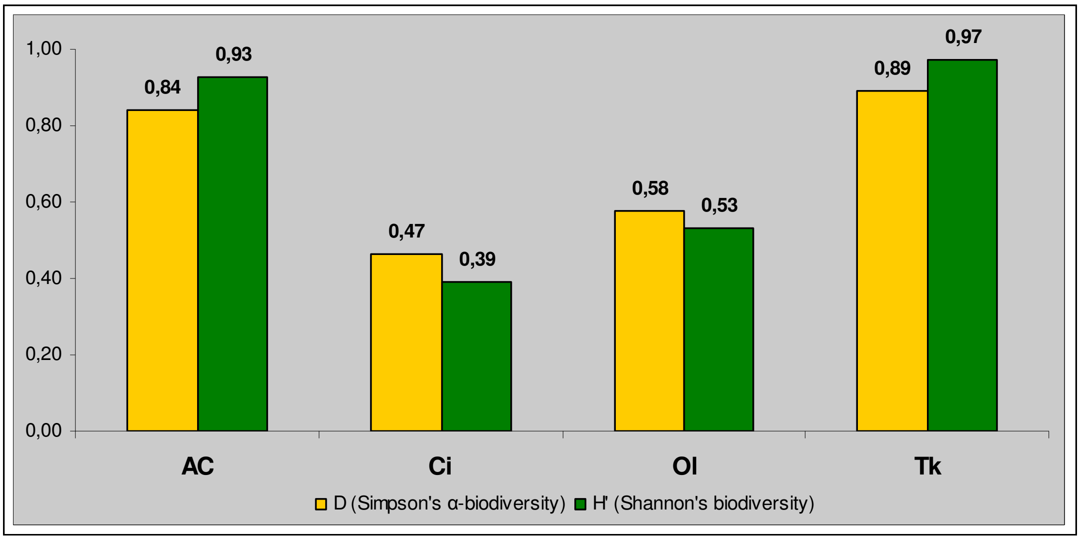
Tab 7.1.3 – Summary indices table of biodiversity and evenness for Families of Coleoptera.Margalef (**d**), Simpson (**D**), Shannon (**H'**), Pielou (**J**), Simpson's Dominance (**λ**).

Analyzing the Margalef's index (graph. 7.1.7), we see that the **AC** and **Tk** stations show higher values than the stations **Ol** and **Ci,** falling within the range considered of mean diversity, while the values of **Ol** and **Ci** in the fall range considered of low diversity.



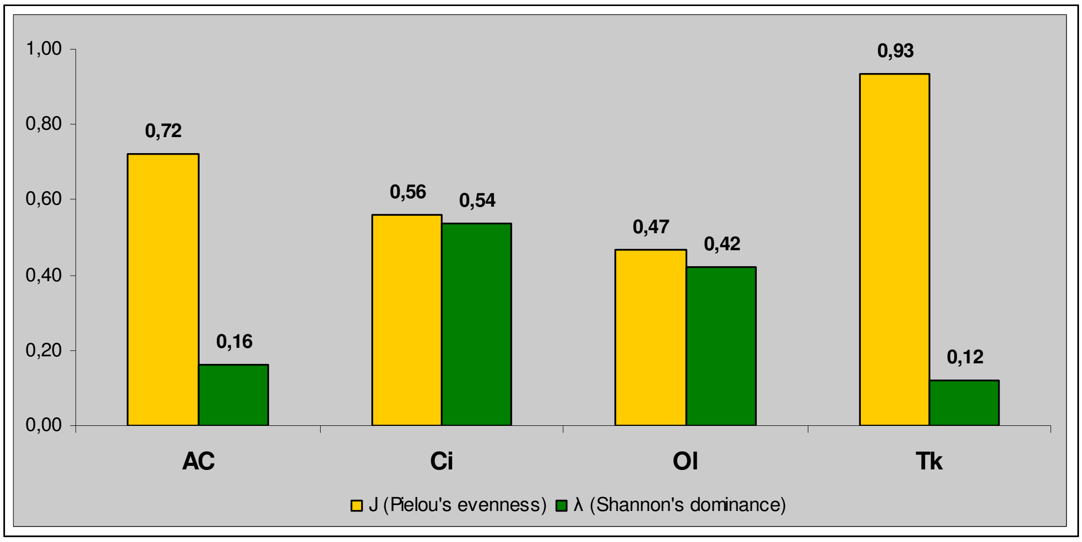
Graph. 7.1.7 – Margalef's index value of the stations investigated in relation to species of Tenebrionidae.

Taking into consideration the indices D and H' (graph. 7.1.8) is observed as the stations **Tk** (which has the maximum value for both indices) and **AC** show values considerably higher than **Ol** and **Ci** (this last register the minimum). Again none of the stations reaches the minimum value of 1 index of Shannon.



Graf. 7.1.8 - Values of Simpson's index (D) and Shannon's index (H') in the stations investigated in relation to species of Tenebrionidae.

Finally, examination of the evenness and dominance indices (graph. 7.1.9) shows that the station **Tk** present a marked peak of index **J** followed by station **AC**, while the minimum for Pielou's index is found in station **Ol**. The trend of index dominance is specular to the evenness one.



Graph. 7.1.9 - Values of Pielou's index (J) and Dominance index (λ) in the stations investigated in relation to species of Tenebrionidae.

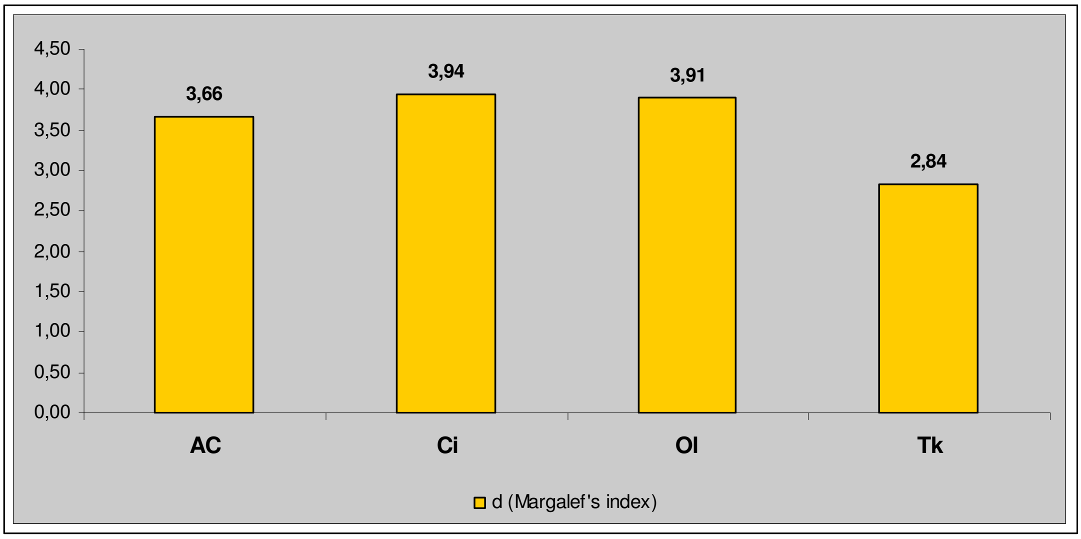
SPECIES OF STAPHYLINIDAE

Table 7.1.4 synthesizes assessed values for single stations relatively to indices of Margalef (**d**), Simpson (**D**), Shannon (**H'**), Pielou (**J**), Simpson's Dominance (**λ**).

STATION	*d*	*D*	*H'*	*J*	*λ*
AC	3,66	0,74	0,82	0,61	0,26
Ci	3,94	0,39	0,48	0,34	0,61
Ol	3,91	0,83	0,94	0,71	0,18
Tk	2,84	0,55	0,60	0,52	0,46

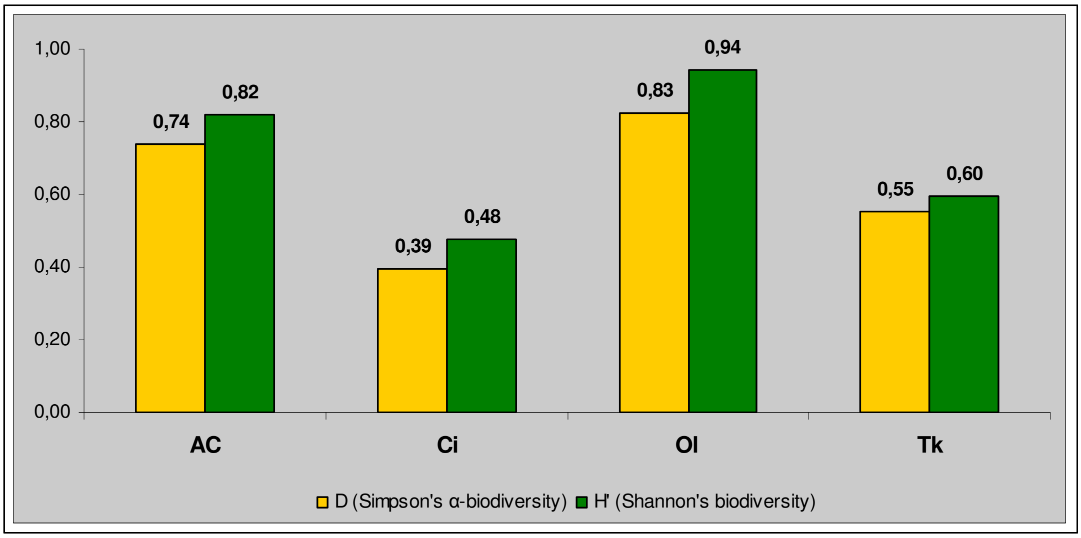
Tab 7.1.4 – Summary indices table of biodiversity and evenness for Families of Coleoptera.Margalef (**d**), Simpson (**D**), Shannon (**H'**), Pielou (**J**), Simpson's Dominance (**λ**).

Analyzing the Margalef's index (graph. 7.1.10), we see that all stations are within the range considered of mean diversity, with the highest value in **Ci** station and the lowest in **Tk** station.



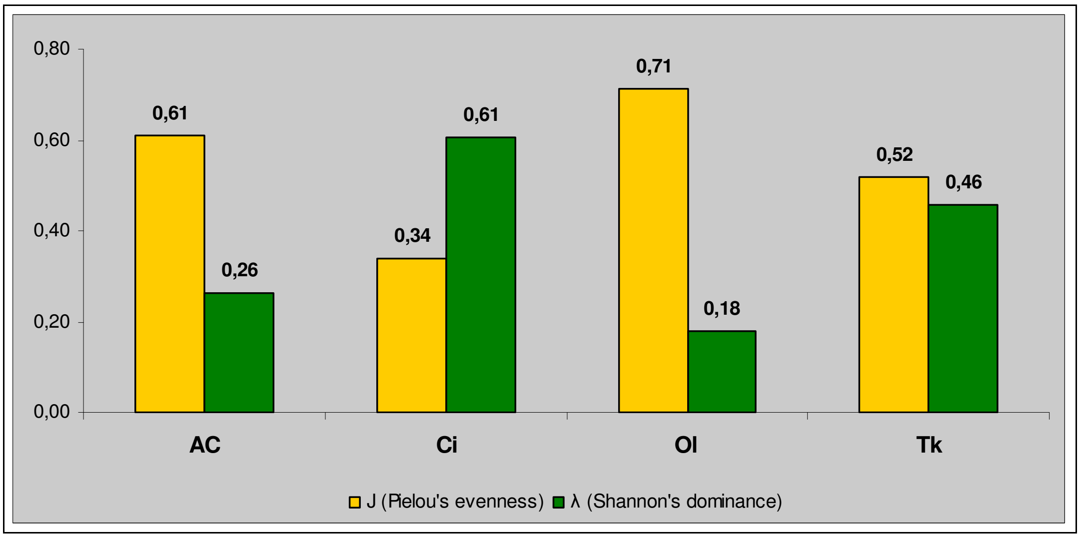
Graph. 7.1.10 - Margalef's index value of the stations investigated in relation to species of Staphylinidae.

If one observes the indices D and H' (graph. 7.1.11) stations **Ol**, recording the maximum values, and **AC** show appreciably higher values than **Tk** and **Ci**, with that last recording the minimum. Again none of the stations reaches the minimum value of 1 for index of Shannon.



Graph. 7.1.11 - Values of Simpson's index (D) and Shannon's index (H') in the stations investigated in relation to species of Staphylinidae.

Finally, examination of the evenness and dominance indices (graph. 7.1.12) shows that the station **Ol** present a marked peak of index **J** followed by station AC, while the minimum for Pielou's index is found in station **Ci**. The trend of index dominance is specular to the evenness one.



Graph. 7.1.12 - Values of Pielou's index (J) and Dominance index (λ) in the stations investigated in relation to species of Staphylinidae.

7.2 COMPARISON AMONG THE INDICES OF BIODIVERSITY AND EVENNESS

The tables below provide a summary for the values of the Margalef's index (d) (tab. 7.2.1), Simpson's index (D) (tab. 7.2.2), Shannon's index (H') (tab. 7.2.3), Pielou's index (J) (tab. 7.2.4) and Dominance index (λ) (tab. 7.2.5) recorded in each station by the taxa examined.
The Margalef's index (tab. 7.2.1) shows a peak value in the station **Tk** considering the Families of Coleoptera, in the station **AC** for Coleoptera Carabidae and Tenebrionidae, in the station **Ci** for Coleoptera Staphylinidae, while the minimum values are recorded in the station **Ci** for the Families of Coleoptera and Coleoptera Tenebrionidae, in the station **Ol** for Coleoptera Carabidae and in the station **Tk** with regard to the Coleoptera Staohylinidae.

	STATIONS			
INDEX	**AC**	**Ci**	**Ol**	**Tk**
Margalef Coleoptera Families	**3** (3,29)	**4** (3,20)	**2** (3,80)	**1** (3,88)
Margalef Carabidae species	**1** (3,15)	**2** (3,05)	**4** (1,44)	**3** (1,62)
Margalef Tenebrionidae species	**1** (2,93)	**4** (0,81)	**3** (1,84)	**2** (2,15)
Margalef Staphylinidae species	**3** (3,66)	**1** (3,94)	**2** (3,91)	**4** (2,84)

Tab. 7.2.1 - Summary of Margalef's index (d) values in the individual stations. In **bold** is indicated the rank of the index value for the taxon examined; is highlighted in green the rank 1, in light blue the rank 4.

The Simpson's (tab. 7.2.2) and Shannon's (tab. 7.2.3) indices show trends that largely overlap each other and only partially coherent with the values recorded for the Margalef's index in the stations. The highest values for the two indices are observed in **Ol** station for the Families of Coleoptera and for the Coleoptera Staohylinidae, in station **Tk** for Tenebrionidae, and in station **Ci** and for Carabidae, while the minimum values are recorded in the station **AC** in relation to the families of Coleoptera,in the station **Ci** for Tenebrionidae and Staphylinidae and station **Ol** for Carabidae.

	STATIONS			
INDEX	**AC**	**Ci**	**Ol**	**Tk**
D Coleoptera Families	**4** (0,79)	**3** (0,81)	**1** (0,83)	**1** (0,83)
D Carabidae species	**3** (0,32)	**1** (0,75)	**4** (0,15)	**2** (0,66)
D Tenebrionidae species	**2** (0,84)	**4** (0,47)	**3** (0,58)	**1** (0,89)
D Staphylinidae species	**2** (0,74)	**4** (0,39)	**1** (0,83)	**3** (0,55)

Tab. 7.2.2 - Summary of Simpson's index (D) values in the individual stations. In **bold** is indicated the rank of the index value for the taxon examined; is highlighted in green the rank 1, in light blue the rank 4.

Carabidae, Tenebrionidae and Staphylinidae seem to confirm the hypothesis that individual taxonomic groups give different answers regarding the definition of the indices of biodiversity, even in the same Order. Biodiversity appears to be a function of both the intrinsic structure of the stations, and the groups of animals taken into account, which can provide frameworks significantly, although not substantially, different.

INDEX	STATIONS AC	Ci	Ol	Tk
H' Coleoptera Families	**4** (0,85)	**3** (0,90)	**1** (0,95)	**2** (0,93)
H' Carabidae species	**3** (0,35)	**1** (0,80)	**4** (0,19)	**2** (0,66)
H' Tenebrionidae species	**2** (0,93)	**4** (0,39)	**3** (0,53)	**1** (0,97)
H' Staphylinidae species	**2** (0,82)	**4** (0,48)	**1** (0,94)	**3** (0,60)

Tab. 7.2.3 - Summary of Shannon's index (H') in the individual stations. In **bold** is indicated the rank of the index value for the taxon examined; is highlighted in green the rank 1, in light blue the rank 4.

We observe a partial coherence between the Simpson's and Shannon's indices and that of evenness (J) (tab. 7.2.4); at high values of the first two is not always an high value of the second. The evenness index shows in any case generally high values **(> 0,50)**, with the exception of the station **AC** and **Ol** for Coleoptera Carabidae, the station **Ci** Coleoptera for Staphylinidae and station for **Ol** Tenebrionidae.

INDEX	STATIONS AC	Ci	Ol	Tk
J Coleoptera Families	**4** (0,58)	**1** (0,64)	**3** (0,63)	**1** (0,64)
J Carabidae species	**3** (0,26)	**2** (0,64)	**4** (0,20)	**1** (0,73)
J Tenebrionidae species	**2** (0,72)	**3** (0,56)	**4** (0,47)	**1** (0,93)
J Staphylinidae species	**2** (0,61)	**4** (0,34)	**1** (0,71)	**3** (0,52)

Tab. 7.2.4 - Summary of Pielou's index (J) values in the individual stations. In **bold** is indicated the rank of the index value for the taxon examined; is highlighted in green the rank 1, in light blue the rank 4.

Finally, there is a correspondence between the indices of evenness and dominance (tab. 7.2.5): at high values of the first correspond low values of the second.
The index of dominance has generally low values (**≤ 0,50**), except at station AC for Carabidae, at **Ci** station for Tenebrionidae and Staphylinidae, and **Ol** station for Carabidae.

INDEX	STATIONS AC	Ci	Ol	Tk
λ Coleoptera Families	**1** (0,21)	**2** (0,19)	**4** (0,17)	**4** (0,17)
λ Carabidae species	**2** (0,68)	**4** (0,25)	**1** (0,85)	**3** (0,29)
λ Tenebrionidae species	**3** (0,16)	**1** (0,54)	**2** (0,42)	**4** (0,12)
λ Staphylinidae species	**3** (0,26)	**1** (0,61)	**4** (0,18)	**2** (0,46)

Tab. 7.2.5 - Summary of Dominance index (λ) values in the individual stations. In **bold** is indicated the rank of the index value for the taxon examined; is highlighted in green the rank 1, in light blue the rank 4.

7.3 SIMILARITY INDEX OF SØRENSEN

FAMILIES OF COLEOPTERA

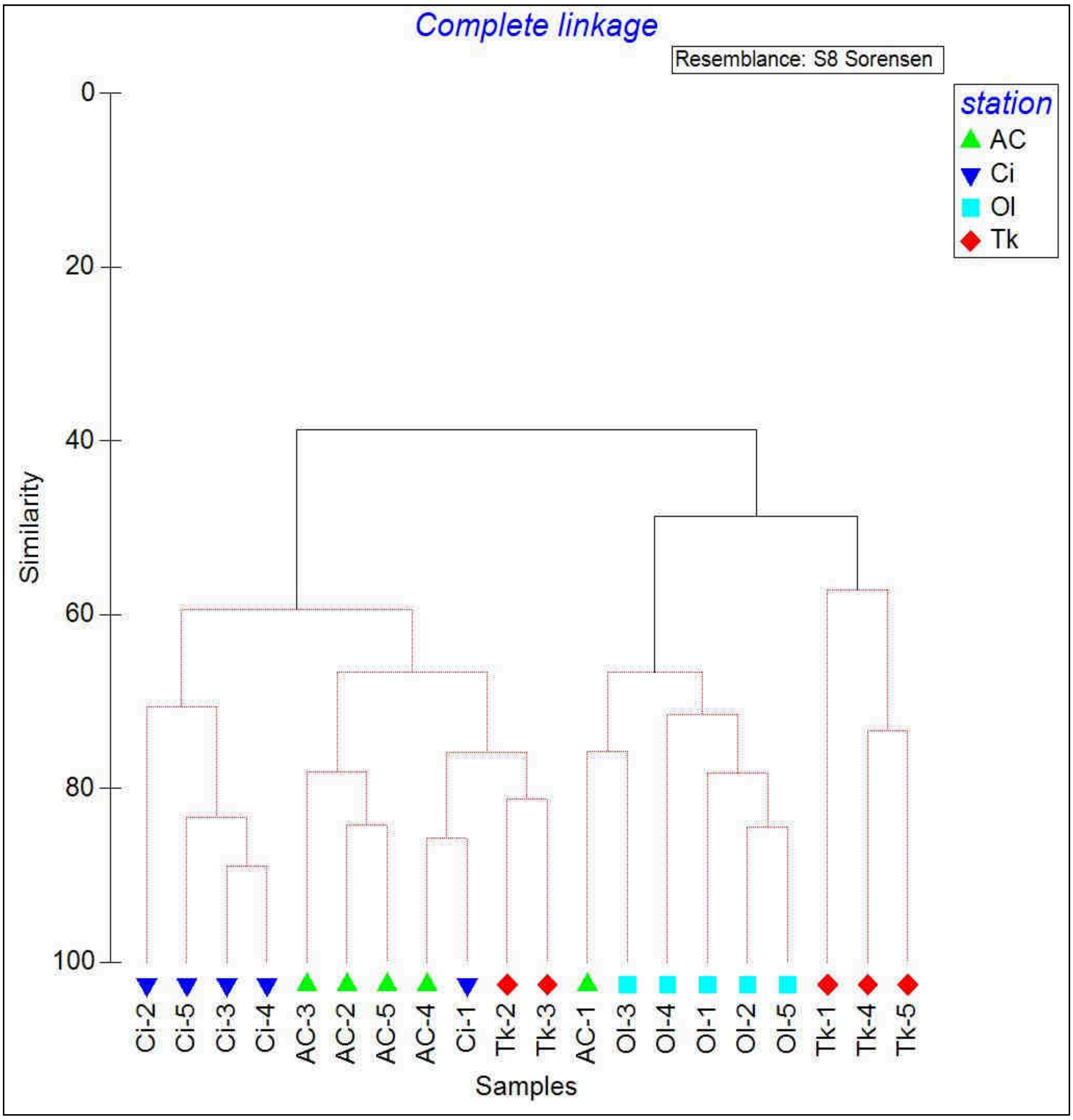
The examination of the Sørensen's index of similarity in relation to all the Families of Coleoptera (tab. 7.3.1), shows a medium-high similarity (values above 50% similarity) between almost all stations: the mean value is 67,73 (SD 9,32). Only four comparisons between stations recorded values lower than 50% of similarity.

	AC-1	AC-2	AC-3	AC-4	AC-5	Ci-1	Ci-2	Ci-3	Ci-4	Ci-5	Ol-1	Ol-2	Ol-3	Ol-4	Ol-5	Tk-1	Tk-2	Tk-3	Tk-4	Tk-5
AC-1																				
AC-2	82,35																			
AC-3	75,68	82,93																		
AC-4	68,97	78,79	72,22																	
AC-5	70,59	84,21	78,05	78,79																
Ci-1	82,76	84,85	77,78	85,71	72,73															
Ci-2	58,06	68,57	63,16	73,33	68,57	73,33														
Ci-3	60,61	59,46	75,00	75,00	70,27	68,75	70,59													
Ci-4	60,61	64,86	70,00	81,25	75,68	75,00	82,35	88,89												
Ci-5	60,61	70,27	65,00	81,25	75,68	75,00	70,59	83,33	88,89											
Ol-1	70,27	73,17	77,27	72,22	68,29	72,22	63,16	65,00	70,00	65,00										
Ol-2	66,67	69,77	69,57	57,89	65,12	63,16	60,00	47,62	52,38	47,62	78,26									
Ol-3	75,68	68,29	68,18	55,56	63,41	66,67	57,89	55,00	55,00	50,00	72,73	82,61								
Ol-4	66,67	64,86	70,00	62,50	64,86	75,00	64,71	61,11	66,67	61,11	75,00	71,43	75,00							
Ol-5	72,22	70,00	79,07	62,86	70,00	68,57	59,46	61,54	61,54	56,41	83,72	84,44	74,42	82,05						
Tk-1	71,43	62,50	57,14	66,67	56,25	74,07	55,17	58,06	58,06	58,06	68,57	54,05	62,86	58,06	52,94					
Tk-2	73,33	70,59	70,27	75,86	70,59	82,76	64,52	78,79	78,79	78,79	64,86	51,28	64,86	72,73	61,11	64,29				
Tk-3	62,50	66,67	66,67	83,87	72,22	77,42	66,67	74,29	80,00	80,00	66,67	53,66	56,41	68,57	57,89	60,00	81,25			
Tk-4	60,00	58,82	70,27	62,07	58,82	62,07	38,71	66,67	54,55	54,55	64,86	56,41	48,65	54,55	66,67	57,14	60,00	62,50		
Tk-5	73,33	70,59	70,27	68,97	70,59	68,97	45,16	60,61	54,55	54,55	70,27	66,67	70,27	60,61	72,22	71,43	60,00	56,25	73,33	

Tab. 7.3.1 - Sørensen index values (QS) between the traps of the stations investigated in relation to Families of Coleoptera. In green are marked the values equal to or greater than 50, in light blue those under 50.

The dendrogram of similarity between the traps based on the index of Sørensen relative to Families of Coleoptera (graph. 7.3.1) reveals three clusters that show statistically significant differences according to the SIMPROF tests:

1. **all** the traps of station **Ci**, traps **AC-2**, **AC-3**, **AC-4** and **AC-5**, traps **Tk-2** and **Tk-3**;
2. **all** the traps of station **Ol** and trap **AC-1**;
3. traps **Tk-1**, **Tk-4** e **Tk-5**.



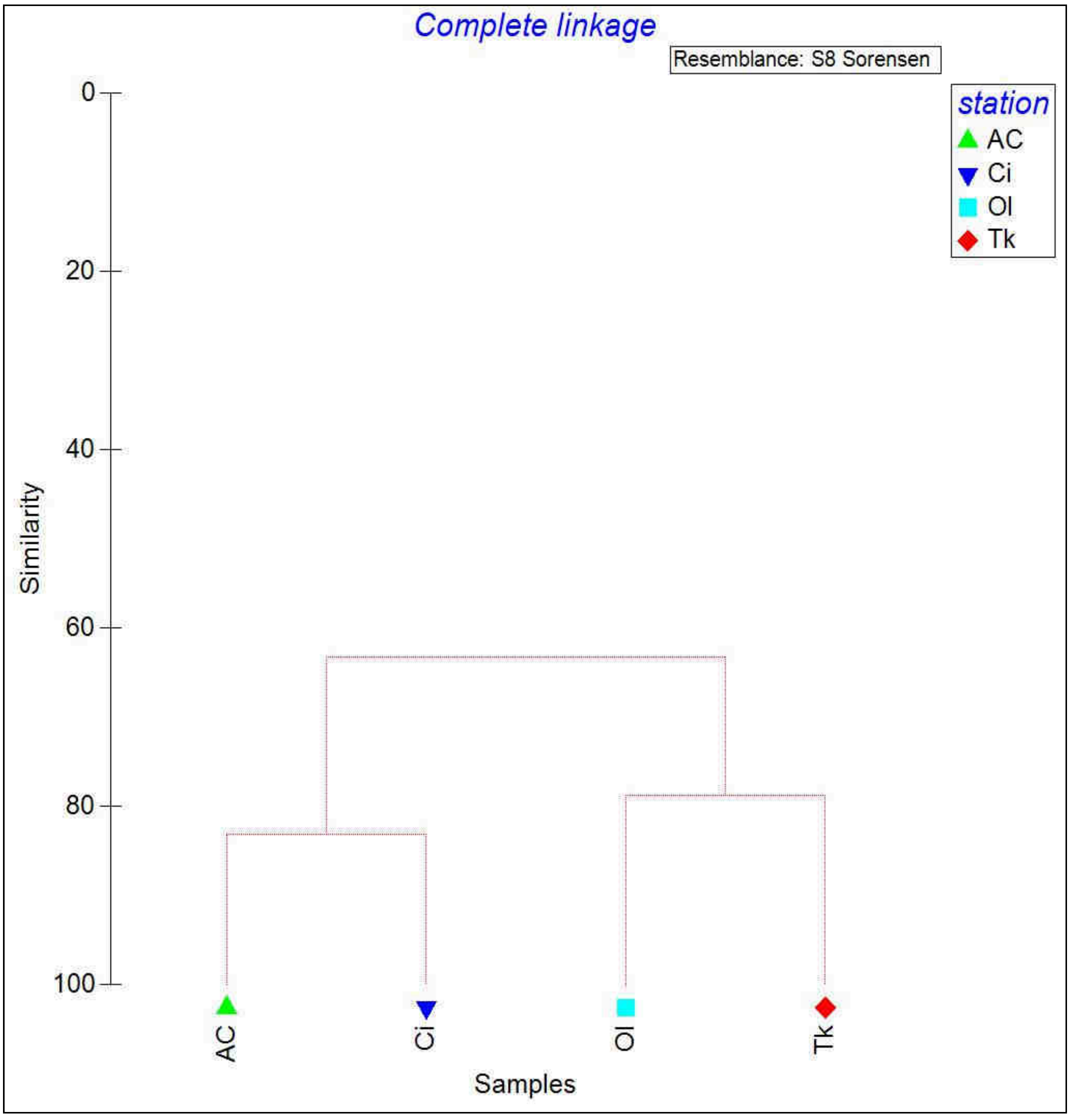
Graph. 7.3.1 – Dendrogram of similarity, based on the index of Sørensen (QS), among traps of surveyed stations relative to the Families of Coleoptera.

The examination of the index relative to all the Families of Coleoptera (tab. 7.3.2) shows a high similarity between all stations with values always higher than 50. The maximum value of similarity (83,02) is observed for the pair **AC/Ci**, while the pair **Ci/Ol** shows the minimum value (63,16).

	AC	**Ci**	**Ol**	**Tk**
AC				
Ci	83,02			
Ol	76,67	63,16		
Tk	73,68	70,37	78,69	

Tab. 7.3.2 – Sørensen's index values (QS) between the investigated stations in relation to Families of Coleoptera. In red is highlighted the maximum value of the index, in yellow the minimum.

The examination of the similarity dendrogram among the stations based on the index of Sørensen in relation to the Families of Coleoptera (graph. 7.3.2) shows the two groups **AC/Ci** and **Ol/Tk**, which are not statistically significant according to the SIMPROF test.



Graph. 7.3.2 – Dendrogram of similarity, based on the index of Sørensen (QS), between the surveyed stations on the Families of Coleoptera.

SPECIES OF CARABIDAE

The examination of the Sørensen's index of similarity in relation to species of Carabidae (tab. 7.3.3), shows a medium-low (values under 50% similarity) or null similarity in 75,79% of the comparisons between the stations. The mean value is 33,49 (DS 18,13). Only for 24,21% of comparisons between stations recorded values equal or higher than 50% of similarity.

	AC-1	AC-2	AC-3	AC-4	AC-5	Ci-1	Ci-2	Ci-3	Ci-4	Ci-5	Ol-1	Ol-2	Ol-3	Ol-4	Ol-5	Tk-1	Tk-2	Tk-3	Tk-4	Tk-5
AC-1																				
AC-2	52,63																			
AC-3	50,00	60,87																		
AC-4	55,56	47,62	54,55																	
AC-5	54,55	56,00	46,15	41,67																
Ci-1	35,29	40,00	47,62	63,16	26,09															
Ci-2	11,76	10,00	19,05	21,05	8,70	33,33														
Ci-3	28,57	35,29	33,33	50,00	20,00	66,67	40,00													
Ci-4	23,53	20,00	38,10	31,58	17,39	55,56	44,44	66,67												
Ci-5	22,22	19,05	27,27	30,00	16,67	52,63	63,16	50,00	63,16											
Ol-1	42,86	35,29	44,44	25,00	30,00	26,67	13,33	33,33	26,67	12,50										
Ol-2	36,36	14,29	13,33	30,77	23,53	16,67	0,00	22,22	16,67	0,00	22,22									
Ol-3	36,36	28,57	26,67	15,38	23,53	16,67	0,00	22,22	16,67	0,00	66,67	33,33								
Ol-4	66,67	40,00	37,50	42,86	44,44	30,77	15,38	40,00	30,77	14,29	60,00	57,14	57,14							
Ol-5	50,00	53,33	50,00	28,57	44,44	30,77	15,38	40,00	30,77	14,29	60,00	28,57	57,14	75,00						
Tk-1	16,67	40,00	37,50	42,86	22,22	46,15	30,77	60,00	30,77	28,57	20,00	0,00	0,00	25,00	50,00					
Tk-2	22,22	16,67	15,38	18,18	13,33	20,00	20,00	28,57	20,00	18,18	28,57	0,00	0,00	40,00	40,00	40,00				
Tk-3	18,18	14,29	26,67	30,77	11,76	50,00	50,00	66,67	50,00	46,15	22,22	0,00	0,00	28,57	28,57	57,14	50,00			
Tk-4	18,18	28,57	26,67	30,77	23,53	33,33	33,33	44,44	33,33	30,77	22,22	0,00	0,00	28,57	28,57	57,14	50,00	66,67		
Tk-5	50,00	53,33	50,00	28,57	44,44	30,77	15,38	40,00	30,77	14,29	60,00	28,57	57,14	75,00	100	50,00	40,00	28,57	28,57	

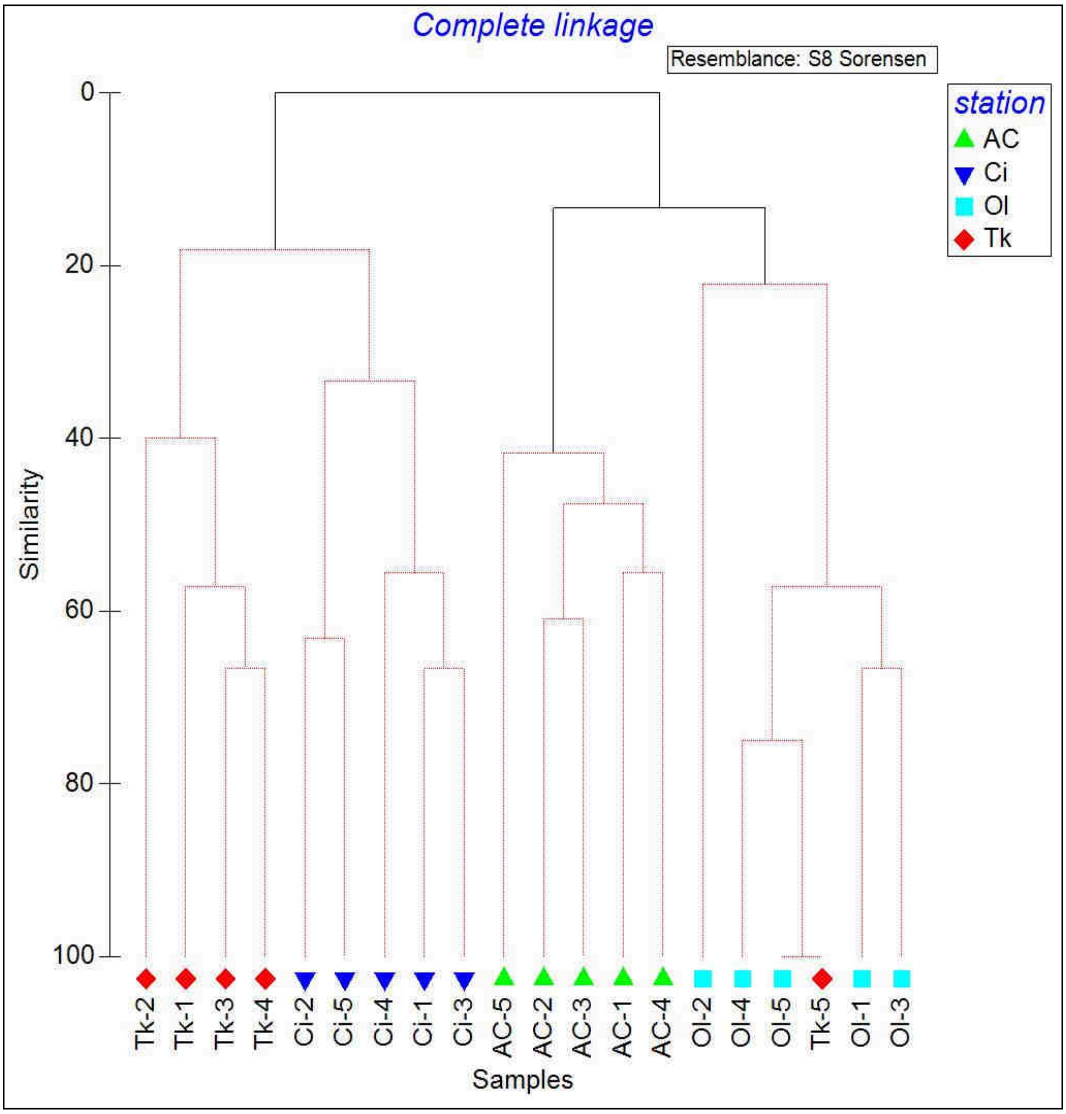
Tab. 7.3.3 - Sørensen index values (QS) between the traps of the stations investigated in relation to species of Carabidae. In green are marked the values equal to or greater than 50, in light blue those under 50.

The dendrogram of similarity between the traps based on the index of Sørensen relative to species of Carabidae (graph. 7.3.3) reveals three clusters that show statistically significant differences according to the SIMPROF tests:

1. **all** the traps of station **Ci**, and traps **Tk-1**, **Tk-2**, **Tk-3** and **Tk-4**;

2. **all** the traps of **AC**;

3. **all** the traps of **Ol** and trap **Tk-5**.



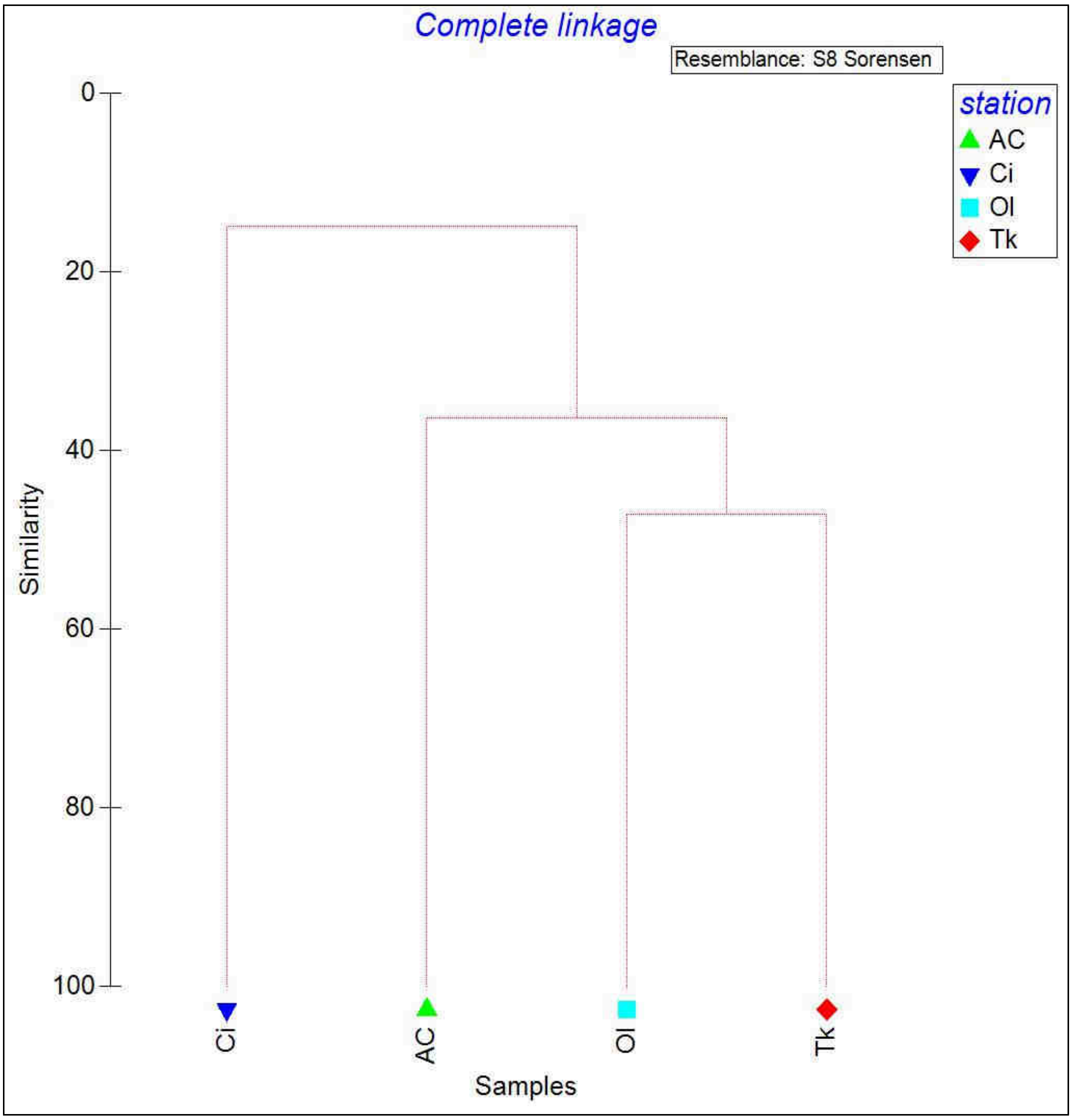
Graph. 7.3.3 – Dendrogram of similarity, based on the index of Sørensen (QS), among traps of surveyed stations relative to species of Carabidae.

The examination of the index relative to species of Carabidae (tab. 7.3.4) shows a low similarity between all stations with values always lower than 50. The maximum value of similarity (47,06) is observed for the pair **Ol/Tk**, while the pair **Ci/Ol** shows the minimum value (14,81).

	AC	**Ci**	**Ol**	**Tk**
AC				
Ci	33,33			
Ol	36,36	14,81		
Tk	43,75	38,46	47,06	

Tab. 7.3.4 - Sørensen's index values (QS) between the investigated stations in relation to species of Carabidae. In red is highlighted the maximum value of the index, in yellow the minimum.

The examination of the similarity dendrogram among the stations based on the index of Sørensen in relation to the species of Carabidae (graph. 7.3.4) shows three groups: **Ol/Tk**, **AC** and **Ci**, which are not statistically significant according to the SIMPROF test.



Graph. 7.3.4 – Dendrogram of similarity, based on the index of Sørensen (QS), between the surveyed stations on the species of Carabidae.

SPECIES OF TENEBRIONIDAE

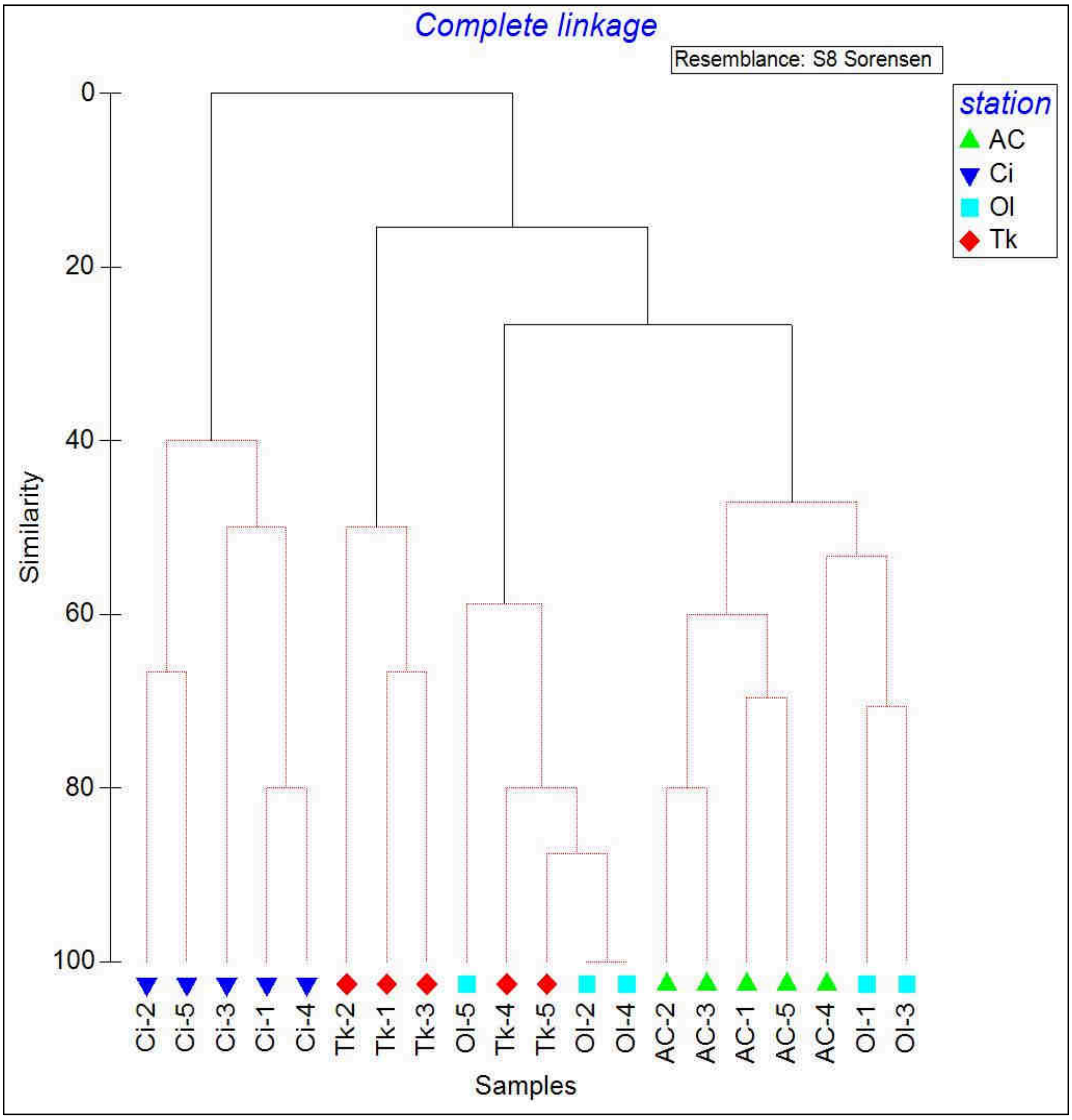
The examination of the Sørensen's index of similarity in relation to species of Tenebrionidae (tab. 7.3.5), shows a medium-low or low (values under 50% similarity) or null similarity in 56,32% of the comparisons between the stations. The mean value is 43,68 (DS 19,76). Only for 43,68% of comparisons between stations recorded values equal or higher than 50% of similarity.

	AC-1	AC-2	AC-3	AC-4	AC-5	Ci-1	Ci-2	Ci-3	Ci-4	Ci-5	Ol-1	Ol-2	Ol-3	Ol-4	Ol-5	Tk-1	Tk-2	Tk-3	Tk-4	Tk-5
AC-1																				
AC-2	60,00																			
AC-3	76,19	80,00																		
AC-4	57,14	55,56	52,63																	
AC-5	69,57	66,67	71,43	47,62																
Ci-1	54,55	40,00	37,50	44,44	33,33															
Ci-2	33,33	37,50	23,53	20,00	31,58	57,14														
Ci-3	22,22	15,38	14,29	0,00	12,50	50,00	40,00													
Ci-4	40,00	28,57	26,67	25,00	23,53	80,00	66,67	66,67												
Ci-5	20,00	28,57	13,33	0,00	23,53	40,00	66,67	66,67	50,00											
Ol-1	50,00	60,00	57,14	57,14	60,87	36,36	33,33	22,22	40,00	20,00										
Ol-2	58,82	57,14	54,55	40,00	58,33	50,00	30,77	20,00	36,36	18,18	70,59									
Ol-3	47,06	57,14	54,55	53,33	50,00	50,00	30,77	20,00	36,36	18,18	70,59	77,78								
Ol-4	58,82	57,14	54,55	40,00	58,33	50,00	30,77	20,00	36,36	18,18	70,59	100	77,78							
Ol-5	58,82	47,62	54,55	26,67	58,33	33,33	30,77	20,00	36,36	18,18	70,59	77,78	55,56	77,78						
Tk-1	50,00	50,00	35,29	40,00	31,58	57,14	25,00	40,00	33,33	33,33	16,67	30,77	30,77	30,77	15,38					
Tk-2	33,33	37,50	23,53	40,00	21,05	57,14	25,00	0,00	33,33	0,00	16,67	30,77	30,77	30,77	15,38	50,00				
Tk-3	46,15	47,06	33,33	36,36	40,00	75,00	44,44	33,33	57,14	28,57	46,15	57,14	57,14	57,14	42,86	66,67	66,67			
Tk-4	62,50	50,00	47,62	57,14	52,17	36,36	16,67	0,00	20,00	0,00	50,00	82,35	58,82	82,35	58,82	33,33	33,33	46,15		
Tk-5	66,67	52,63	50,00	46,15	45,45	60,00	36,36	25,00	44,44	22,22	53,33	87,50	62,50	87,50	62,50	36,36	36,36	50,00	80,00	

Tab. 7.3.5 - Sørensen index values (QS) between the traps of the stations investigated in relation to species of Tenebrionidae. In green are marked the values equal to or greater than 50, in light blue those under 50.

The dendrogram of similarity between the traps based on the index of Sørensen relative to species of Tenebrionidae (graph. 7.3.5) reveals four clusters that show statistically significant differences according to the SIMPROF tests:

1. **all** the traps of station **Ci**;
2. traps **Tk-1**, **Tk-2** and **Tk-3**;
3. traps **Tk-4**, **Tk-5** and traps **Ol-2, Ol-4** and **Ol-5**;
4. **all** the traps of station **AC** and traps **Ol-1** and **Ol-3**.



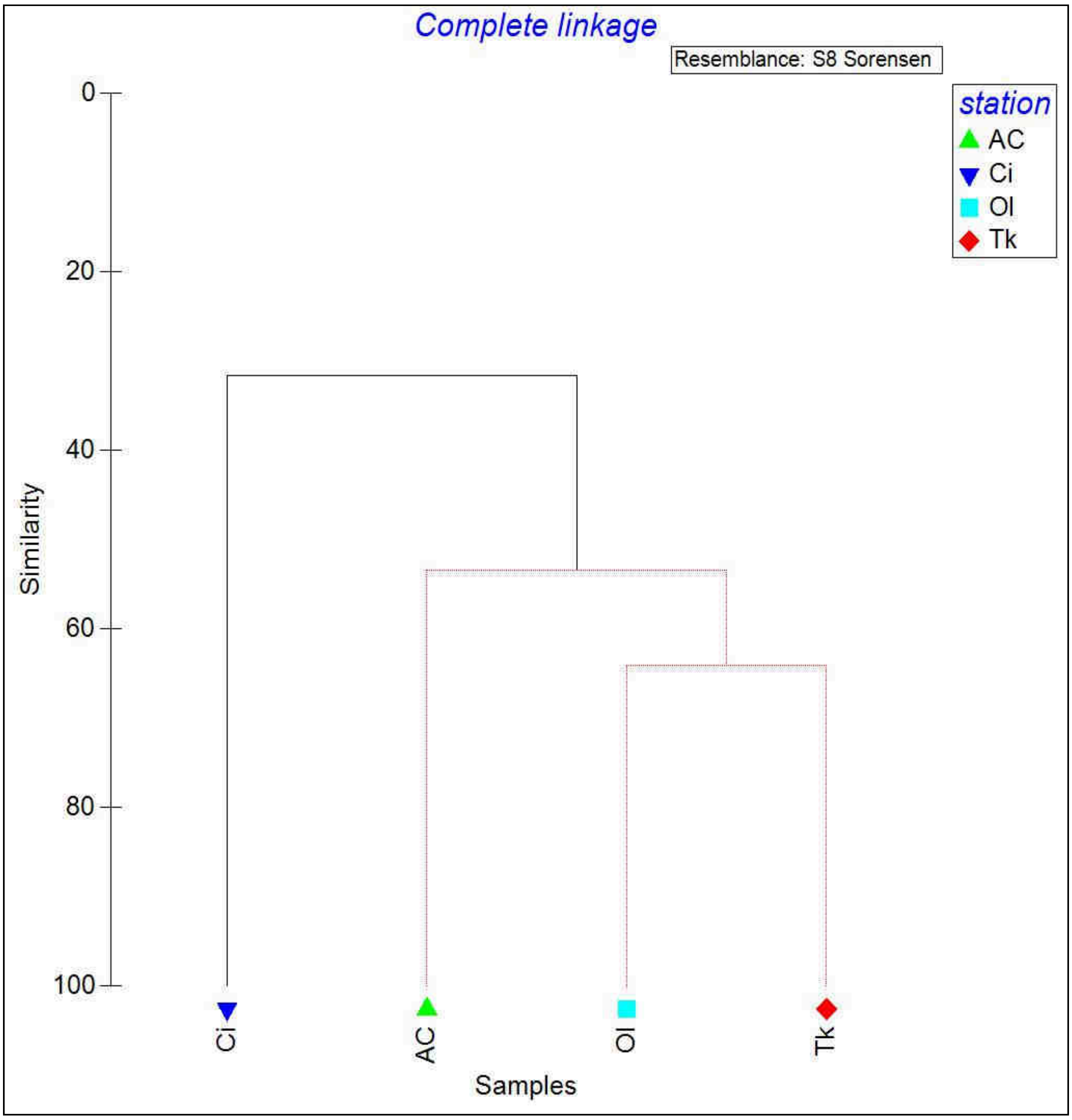
Graph. 7.3.5 – Dendrogram of similarity, based on the index of Sørensen (QS), among traps of surveyed stations relative to species of Tenebrionidae.

The examination of the index relative to species of Tenebrionidae (tab. 7.3.6) shows on average a not high similarity between all stations. The maximum value of similarity (64,00) is observed for the pair **Ol/Tk**, while the pair **Ci/Ol** shows the minimum value (31,58).

	AC	**Ci**	**Ol**	**Tk**
AC				
Ci	33,33			
Ol	60,61	31,58		
Tk	53,33	37,50	64,00	

Tab. 7.3.6 - Sørensen's index values (QS) between the investigated stations in relation to species of Tenebrionidae. In red is highlighted the maximum value of the index, in yellow the minimum.

The examination of the similarity dendrogram among the stations based on the index of Sørensen in relation to the species of Tenebrionidae (graph. 7.3.6) shows three groups: **Ol/Tk**, **AC** and **Ci**, which are not statistically significant according to the SIMPROF test.



Graph. 7.3.6 – Dendrogram of similarity, based on the index of Sørensen (QS), between the surveyed stations on the species of Tenebrionidae.

SPECIES OF STAPHYLINIDAE

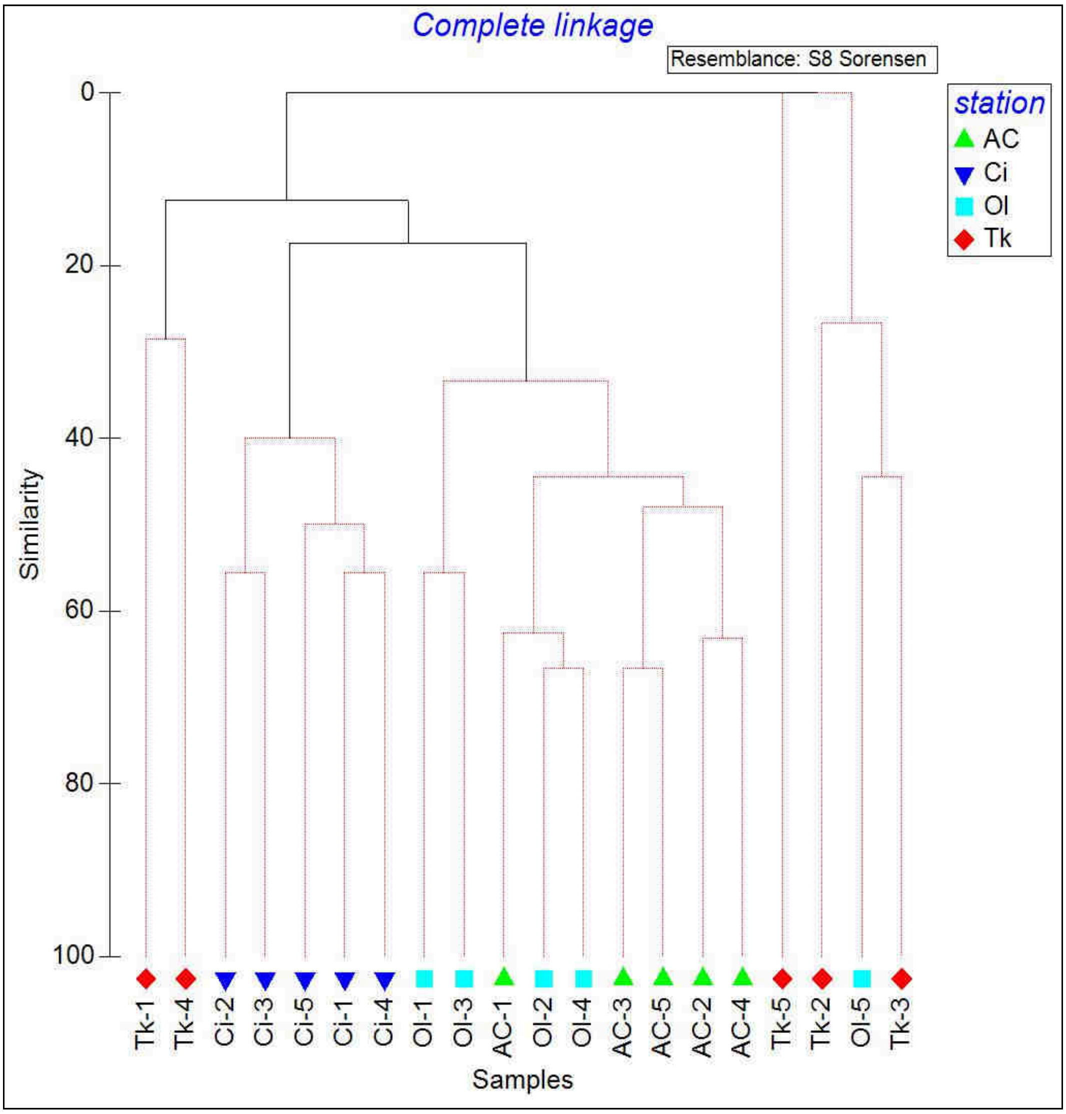
The examination of the Sørensen's index of similarity in relation to species of Staphylinidae (tab. 7.3.7), shows a medium-low (values under 50% similarity) or null similarity in 80,53% of the comparisons between the stations. The mean value is 32,49 (DS 16,35). Only for 19,47% of comparisons between stations recorded values equal or higher than 50% of similarity.

	AC-1	AC-2	AC-3	AC-4	AC-5	Ci-1	Ci-2	Ci-3	Ci-4	Ci-5	Ol-1	Ol-2	Ol-3	Ol-4	Ol-5	Tk-1	Tk-2	Tk-3	Tk-4	Tk-5
AC-1																				
AC-2	60,00																			
AC-3	52,63	52,63																		
AC-4	52,63	63,16	55,56																	
AC-5	64,00	48,00	66,67	58,33																
Ci-1	37,50	50,00	40,00	40,00	28,57															
Ci-2	30,00	40,00	31,58	31,58	24,00	50,00														
Ci-3	33,33	33,33	35,29	35,29	26,09	42,86	55,56													
Ci-4	27,27	45,45	28,57	38,10	22,22	55,56	54,55	40,00												
Ci-5	25,00	33,33	26,09	34,78	27,59	50,00	50,00	45,45	53,85											
Ol-1	42,11	42,11	33,33	55,56	50,00	26,67	31,58	35,29	38,10	17,39										
Ol-2	63,16	52,63	55,56	44,44	58,33	40,00	31,58	35,29	28,57	26,09	44,44									
Ol-3	52,63	42,11	33,33	33,33	41,67	26,67	21,05	23,53	19,05	17,39	55,56	55,56								
Ol-4	62,50	62,50	53,33	53,33	47,62	50,00	37,50	42,86	33,33	30,00	53,33	66,67	66,67							
Ol-5	38,10	28,57	40,00	30,00	38,46	47,06	38,10	42,11	34,78	40,00	30,00	50,00	50,00	47,06						
Tk-1	26,67	26,67	42,86	14,29	30,00	36,36	26,67	30,77	23,53	21,05	14,29	28,57	14,29	18,18	25,00					
Tk-2	14,29	28,57	15,38	30,77	21,05	40,00	14,29	16,67	25,00	11,11	46,15	15,38	30,77	20,00	26,67	22,22				
Tk-3	35,29	35,29	25,00	25,00	36,36	30,77	23,53	40,00	21,05	19,05	37,50	50,00	37,50	46,15	44,44	33,33	36,36			
Tk-4	33,33	16,67	36,36	18,18	23,53	25,00	16,67	20,00	14,29	12,50	18,18	18,18	18,18	25,00	15,38	28,57	0,00	0,00		
Tk-5	0,00	16,67	0,00	0,00	0,00	25,00	16,67	0,00	14,29	12,50	0,00	0,00	0,00	0,00	0,00	28,57	0,00	0,00	0,00	

Tab. 7.3.7 - Sørensen index values (QS) between the traps of the stations investigated in relation to species of Staphylinidae. In green are marked the values equal to or greater than 50, in light blue those under 50.

The dendrogram of similarity between the traps based on the index of Sørensen relative to species of Staphylinidae (graph. 7.3.7) reveals four clusters that show statistically significant differences according to the SIMPROF tests:

1. traps **Tk1** and **Tk4**;
2. **all** the traps of station **Ci**;
3. **all** the traps of station **AC** and traps **Ol-1**, **Ol-2**, **Ol-3** and **Ol-4**;
4. traps **Tk-2**, **Tk-3**, **Tk-5** and **Ol-5**.



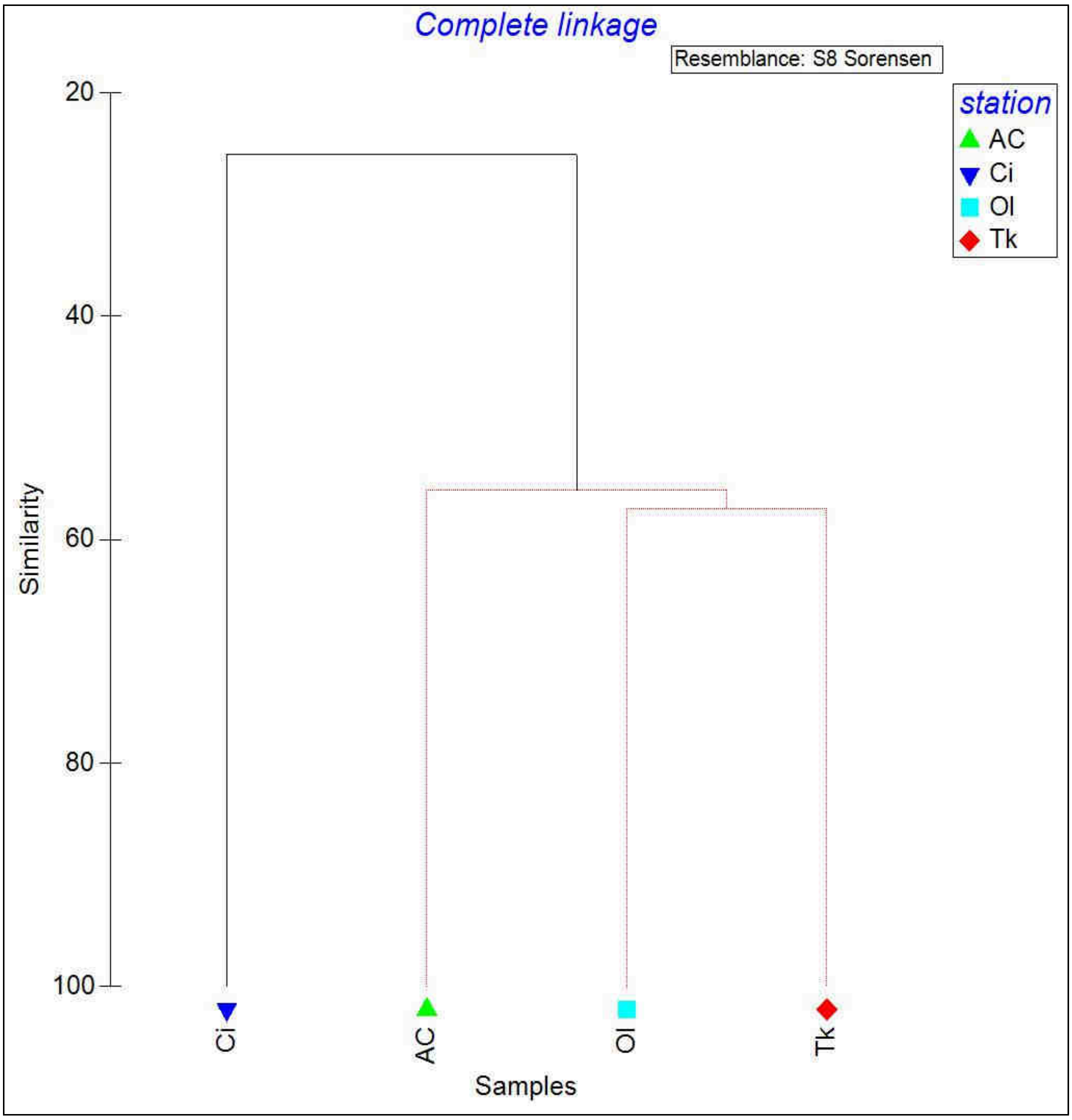
Graph. 7.3.7 – Dendrogram of similarity, based on the index of Sørensen (QS), among traps of surveyed stations relative to species of Staphylinidae.

The examination of the index relative to species of Staphylinidae (tab. 7.3.8) shows a low similarity between all stations. The maximum value of similarity (57,14) is observed for the pair **Ol/Tk**, while the pair **AC/Ci** shows the minimum value (25,23).

	AC	**Ci**	**Ol**	**Tk**
AC				
Ci	25,53			
Ol	55,81	39,13		
Tk	55,56	35,90	57,14	

Tab. 7.3.8 - Sørensen's index values (QS) between the investigated stations in relation to species of Staphylinidae. In red is highlighted the maximum value of the index, in yellow the minimum.

The examination of the similarity dendrogram among the stations based on the index of Sørensen in relation to the species of Staphylinidae (graph. 7.3.8) shows that station **Ci** is statistically different from the others, while the groups **AC** and **Ol/Tk** are not statistically significant according to the SIMPROF test.



Graph. 7.3.8 – Dendrogram of similarity, based on the index of Sørensen (QS), between the surveyed stations on the species of Staphylinidae.

8 OVERALL ANALYSIS OF INDIVIDUAL STATIONS

Below are summarized the main characteristics of the individual stations emerged from the analysis carried out in previous chapters.

Station AC (Arable-land with Carob trees)

Total Number of sampled traps: **52**

Unit of effort	
July	**5**
August	**4**
September	**2**
October	**5**
December	**5**
January	**5**
February	**5**
March	**5**
April	**5**
May	**5**
June	**4,7**

FAMILIES OF COLEOPTERA

Total Number of Coleoptera specimens	**3.724**
Percentage of total	**36,16%**

CSD Value	**3.624,86**

Total Number of Families	**28**
Percentage of total	**66,67%**

Margalef's index Value: 3,29

Simpson's index Value: 0,79

Shannon's index Value: 0,85

Pielou's index Value: 0,58

Dominance index Value: 0,21

FIRST 6 FAMILIES OD COLEOPTERA IN ORDER OF CSD VALUE

Family	CSD	%
Carabidae	1.332,48	**36,76**
Nitidulidae	693,89	**19,14**
Tenebrionidae	473,47	**13,06**
Staphylinidae	425,69	**11,74**
Curculionidae	167,00	**4,61**
Anthicidae	131,68	**3,63**

FAMILIES OF COLEOPTERA EXCLUSIVE OF THE STATION

Family	CSD	%
Kateretidae	5,88	**0,06**

SPECIES OF CARABIDAE

Number of species: **24**
Percentage on total of sampled Carabidae species: **63,16%**

Margalef's index Value: 3,15
Simpson's index Value: 0,32
Shannon's index Value: 0,35
Pielou's index Value: 0,26
Dominance index Value: 0,68

FIRTS 10 SPECIES IN ORDER OF CSD VALUE

Species	**CSD**	**% tot stat/Carabidae**	**% tot stat/general**
Calathus (Neocalathus) cinctus	1200,46	81,84	33,12
Laemostenus (Pristonychus) algerinus algerinus	128,39	8,75	3,54
Metallina (Neja) ambigua	46,43	3,17	1,28
Licinus (Licinus) punctatulus	24,53	1,67	0,68
Microlestes luctuosus	19,04	1,30	0,53
Syntomus barbarus	8,78	0,60	0,24
Laemostenus (Laemostenus) barbarus	4,98	0,34	0,14
Microlestes fissuralis	3,90	0,27	0,11
Harpalus (Harpalus) distinguendus distinguendus	3,48	0,24	0,10
Notiophilus geminatus	3,24	0,22	0,09

SPECIES EXCLUSIVE OF THE STATION

Species	**CSD**	**%**
Metallina (Neja) ambigua	46,43	3,17
Harpalus (Harpalus) distinguendus distinguendus	3,48	0,24
Notiophilus geminatus	3,24	0,22
Amara (Celia) montana	2,55	0,17
Trechus (Trechus) quadristriatus	2,44	0,17
Carabus (Eurycarabus) faminii sabellai	2,26	0,15
Ophonus (Ophonus) ardosiacus	1,58	0,11
Calathus fuscipes graecus	1,57	0,11
Paradromius (Manodromius) linearis	1,46	0,10
Syntomus fuscomaculatus	0,98	0,07
Broscus politus	0,79	0,05
Pseudomasoreus canigoulensis	0,79	0,05

SPECIES OF TENEBRIONIDAE

Number of species: 19
Percentage on total of sampled Tenebrionidae species: 76,00

Margalef's index Value: 2,93
Simpson's index Value: 0,84
Shannon's index Value: 0,93
Pielou's index Value: 0,72
Dominance index Value: 0,16

FIRTS 10 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Tenebrionidae	% tot stat/general
Alphasida grossa sicula	136,15	28,99	3,76
Stenosis melitana	79,44	16,91	2,19
Zophosis punctata punctata	74,09	15,77	2,04
Stenosis sardoa sardoa	61,74	13,14	1,70
Akis spinosa spinosa	26,08	5,55	0,72
Tentyria grossa grossa	19,69	4,19	0,54
Tentyria laevigata laevigata	17,18	3,66	0,47
Scaurus striatus	16,41	3,49	0,45
Opatroides punctulatus punctulatus	8,42	1,79	0,23
Scaurus atratus	7,26	1,55	0,20

SPECIES EXCLUSIVE OF THE STATION

Species	CSD	%
Tentyria laevigata laevigata	17,18	3,66
Scaurus atratus	7,26	1,55
Dichillus pertusus	4,65	0,99
Catomus consentaneus	1,16	0,25
Catomus rotundicollis	1,16	0,25
Crypticus gibbulus	0,71	0,15

SPECIES OF STAPHYLINIDAE

Number of species: 22
Percentage on total of sampled Staphylinidae species: 47,83

Margalef's index Value: 3,66
Simpson's index Value: 0,74
Shannon's index Value: 0,82
Pielou's index Value: 0,61
Dominance index Value: 0,26

FIRTS 10 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Staphylinidae	% tot stat/general
Ocypus (Ocypus) olens olens	139,10	44,54	3,84
Sepedophilus nigripennis	69,34	22,20	1,91
Anotylus speculifrons	30,78	9,85	0,85
Megalinus glabratus	10,63	3,40	0,29
Xantholinus (Typholinus) graecus graecus	9,42	3,02	0,26
Tachyporus nitidulus	8,19	2,62	0,23
Xantholinus (Calolinus) rufipennis	8,08	2,59	0,22
Heterothops minutus	6,71	2,15	0,19
Anotylus complanatus	5,08	1,63	0,14
Tachyporus pusillus	4,10	1,31	0,11

SPECIES EXCLUSIVE OF THE STATION

Species	CSD	%
Megalinus glabratus	10,63	3,40
Omalium rugatum	2,94	0,94
Anotylus sculpturatus	2,17	0,69
Luzea nigritula	1,47	0,47
Quedius (Raphirus) humeralis	1,29	0,41
Anotylus tetracarinatus	0,98	0,31
Eusphalerum (Eusphalerum) luteicorne	0,98	0,31

CONSIDERATIONS

FAMILIES OF COLEOPTERS

The station has sampled the **36,16%** of the specimens of this Order, and **28** families on 42 registered. Among these are in order the most abundant **Carabidae, Nitidulidae, Tenebrionidae** and **Staphylinidae** which include about **81%** of the whole sample of Coleoptera for the station.

It presents the lowest value for indices of Simpson, Shannon and Pielou and the penultimate value for index of Margalef.

1 single **Family**, **Kateretidae**, was **exclusive** of the station, but with both absolute and percentage values little significant.

CARABIDAE

The station has sampled **24** species on 38 registered. Among these ***Calathus* (*Neocalathus*) *cinctus*** is the most abundant with more than **81%** of capture frequencies, followed by ***Laemostenus* (*Pristonychus*) *algerinus algerinus*** (8,75%), while no other species exceeds the value of 4% or 2% of the total capture frequencies for Carabidae in the station.

It presents the penultimate value for indices of Simpson, Shannon and Pielou and the higher value for index of Margalef.

12 species resulted **exclusive** of the station, but with both absolute and percentage values little significant with exception of ***Metallina* (*Neja*) *ambigua*** (3,17% of the total capture frequencies for Carabidae in the station).

TENEBRIONIDAE

The station has sampled **19** species on 25 registered. Among these the most abundant are in order ***Alphasida grossa sicula***, ***Stenosis melitana***, ***Zophosis punctata puntata*** and ***Stenosis sardoa sardoa,*** representing **75%** of the total capture frequencies for Tenebrionidae in the station. ***Akis spinosa spinosa*** and ***Tentyria grossa grossa*** exceed the threshold of 4% of the total CSD value for Tenebrionidae in the station, while ***Tentyria laevigata levigata*** and ***Scaurus striatus*** exceed that of 2%.

It presents the second value for indices of Simpson, Shannon and Pielou and the higher value for index of Margalef.

6 species resulted **exclusive** of the station, but with both absolute and percentage values little significant with exception of ***Tentyria laevigata levigata*** and ***Scaurus atratus*** with respectively 3,66% and l'1,55% of the total capture frequencies for Tenebrionidae in the station.

STAPHYLINIDAE

The station has sampled **22** species on 46 registered. Among these ***Ocypus* (*Ocypus*) *olens olens*** and ***Sepedophilus nigripennis*** are dominant, representing about **64,7%** of the entire sample of Staphylinidae in the station. Also ***Anotylus speculifrons*** is relatively abundant with more than 9,8% of the total frequency for capture of Staphylinidae in the station. No other species exceeds 4% of the total value of CSD for Staphylinidae of the station, while five species, ***Megalinus glabratus***, ***Xantholinus* (*Typholinus*) *graecus graecus***, ***Tachyporus nitidulus***, ***Xantholinus* (*Calolinus*) *rufipennis*** e ***Heterothops minutus*** exceed the threshold of 2 %.

It present the second value for indices of Simpson, Shannon and Pielou and the penultimate value for index of Margalef.

7 species resulted **exclusive** of the station, but with both absolute and percentage values little significant with exception of ***Megalinus glabratus*** with 3,4% of the total frequency for capture of Staphylinidae in the station.

Station Ol (Olive-grove)

Total Number of sampled traps: **55**

Unit of effort	
July	**5**
August	**5**
September	**5**
October	**5**
December	**5**
January	**5**
February	**5**
March	**5**
April	**5**
May	**5**
June	**5**

FAMILIES OF COLEOPTERA

Total Number of Coleoptera specimens	**3.581**
Percentage of total	**34,77%**

CSD Value	**3.524,10**

Total Number of Families	**32**
Percentage of total	**76,19%**

Margalef's index Value: 3,80

Simpson's index Value: 0,83

Shannon's index Value: 0,95

Pielou's index Value: 0,63

Dominance index Value: 0,17

FIRST 6 FAMILIES OD COLEOPTERA IN ORDER OF CSD VALUE

Family	CSD	%
Tenebrionidae	1.202,73	**34,13**
Nititulidae	525,47	**14,91**
Staphylinidae	421,01	**11,95**
Melolonthidae	246,16	**6,99**
Carabidae	232,10	**6,59**
Melyridae	226,76	**6,43**

FAMILIES OF COLEOPTERA EXCLUSIVE OF THE STATION

Family	CSD	%
Melolonthidae	246,16	6,99
Cebrionidae	1,33	0,01
Cucujdae	1,33	0,01
Drilidae	0,89	0,01

SPECIES OF CARABIDAE

Number of species: 9
Percentage on total of sampled Carabidae species: 23,68

Margalef's index Value: 1,44
Simpson's index Value: 0,15
Shannon's index Value: 0,19
Pielou's index Value: 0,20
Dominance index Value: 0,85

FIRTS 6 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Carabidae	% tot stat/general
Calathus (Neocalathus) cinctus	235,12	91,93	6,67
Syntomus barbarus	7,21	2,82	0,20
Calathus (Neocalathus) mollis	2,93	1,15	0,08
Laemostenus (Pristonychus) algerinus algerinus	2,91	1,14	0,08
Olisthopus elongatus	2,44	0,95	0,07
Dixus sphaerocephalus	2,15	0,84	0,06

SPECIES EXCLUSIVE OF THE STATION

Species	CSD	%
Olisthopus elongatus	2,44	0,95
Ditomus sphaerocephalus	2,15	0,84
Cymindis (Cymindis) laevistriata	1,15	0,45

SPECIES OF TENEBRIONIDAE

Number of species: 14
Percentage on total of sampled Tenebrionidae species: 56,00

Margalef's index Value: 1,84
Simpson's index Value: 0,58
Shannon's index Value: 0,53
Pielou's index Value: 0,47
Dominance index Value: 0,42

FIRTS 10 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Tenebrionidae	% tot stat/general
Zophosis punctata punctata	727,10	61,26	20,63
Tentyria grossa grossa	200,18	16,87	5,68
Pimelia rugulosa sublaevigata	158,85	13,38	4,51
Alphasida grossa sicula	43,76	3,69	1,24
Scaurus striatus	16,20	1,36	0,46
Stenosis sardoa sardoa	14,75	1,24	0,42
Erodius siculus siculus	7,11	0,60	0,20
Scaurus tristis	6,45	0,54	0,18
Akis spinosa spinosa	4,13	0,35	0,12
Allophylax picipes	2,99	0,25	0,08

SPECIES EXCLUSIVE OF THE STATION

Species	CSD	%
Pedinus helopioides	1,14	0,10
Dichillus socius	0,97	0,08

SPECIES OF STAPHYLINIDAE

Number of species: 21
Percentage on total of sampled Staphylinidae species: 45,65

Margalef's index Value: 3,91
Simpson's index Value: 0,83
Shannon's index Value: 0,94
Pielou's index Value: 0,71
Dominance index Value: 0,18

FIRTS 11 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Staphylinidae	% tot stat/general
Ocypus (Ocypus) olens olens	47,03	28,15	1,33
Sepedophilus nigripennis	44,14	26,42	1,25
Anotylus inustus	24,69	14,78	0,70
Xantholinus (Typholinus) graecus graecus	9,17	5,49	0,26
Ocypus (Pseudocypus) sericeicollis	5,49	3,29	0,16
Tachyporus pusillus	5,43	3,25	0,15
Philonthus (Philonthus) concinnus	4,90	2,93	0,14
Astenus (Astenopleuritus) melanurus	3,45	2,07	0,10
Anotylus speculifrons	3,04	1,82	0,09
Micropeplus staphylinoides	2,83	1,69	0,08
Mycetoporus baudueri	2,83	1,69	0,08

SPECIES EXCLUSIVE OF THE STATION

Species	CSD	%
Ocypus (Pseudocypus) sericeicollis	5,49	3,29
Astenus (Astenopleuritus) melanurus	3,45	2,07
Ocypus (Pseudocypus) fortunatarum	1,47	0,88
Quedius (Raphirus) semiobscurus semiobscurus	0,98	0,59

CONSIDERATIONS

FAMILY OF COLEOPTERA

The station has sampled **34,8%** of specimens of this Order, and **32** families on 42 registered. Among these are in order the most abundant **Tenebrionidae**, **Nitidulidae**, **Staphylinidae, Melolonthidae**, **Carabidae** and **Melyridae** representing about **81%** of the sample of Coleoptera for the station.
It presents the highest value for indices of Simpson and Shannon, and the second value for indices of Margalef and Pielou.
4 Families resulted **exclusive** of the station, but with both absolute and percentage values little significant with exception of **Melolonthidae** (6,99% of the total capture frequency of beetles in the station).

CARABIDAE

The station has sampled **9** species on 38 registered. Among these ***Calathus* (*Neocalathus*) *cinctus*** is dominant with more than **91%** of capture frequency for Carabidae in the station, followed by ***Syntomus barbarus*** (2,82%), while no other species exceeds 2% of the total frequency of capture for Carabidae in the station.
It presents the lowest value for indices of Margalef, Simpson, Shannon and Pielou.
3 species resulted **exclusive** of the station, but with both absolute and percentage values little significant.

TENEBRIONIDAE

The station has sampled **14** species on 25 registered. Among these are in order the most abundant ***Zophosis punctata puntata Tentyria grossa grossa*** e ***Pimelia rugulosa sublaevigata*** which includes **91,5%** of the entire sample of Tenebrionidae in the station. Among the other species, only ***Alphasida grossa sicula*** exceeds the threshold of 2% of the total CSD value for Tenebrionidae in the station.
It presents the penultimate value for indices of Margalef, Simpson and Shannon and the lowest value for index of Pielou.
2 species were **exclusive** to the station, but with both absolute and percentage values little significant.

STAPHYLINIDAE

The station has sampled **21** species on 46 registered. Among these ***Ocypus* (*Ocypus*) *olens olens***, ***Sepedophilus nigripennis*** and ***Anotylus inustus*** are dominant, comprising about **69,3%** of the entire sample of Staphylinidae in the station. Even ***Xantholinus* (*Typholinus*) *graecus graecus*** is relatively abundant with more than 5,4% of the total frequency of capture of Staphylinidae in the station. No other species exceeds 4% of the total value of CSD for Staphylinidae in the station, while four species, ***Ocypus* (*Pseudocypus*) *sericeicollis*, *Tachyporus pusillus***, ***Philonthus* (*Philonthus*) *concinnus*** e ***Astenus* (*Astenopleuritus*) *melanurus***, exceed the threshold of 2% .
It presents the highest value for indices of Simpson, Shannon and Pielou, and the second for index of Margalef.
4 species were **exclusive** of the station, with both absolute and percentage values little significant with exception for ***Ocypus* (*Pseudocypus*) *sericeicollis*** e ***Astenus* (*Astenopleuritus*) *melanurus*** respectively with 3,29% and 2,07% of total capture frequencies for Staphylinidae in the station.

Station Ci (Citrus-grove)

Total Number of sampled traps: **53**

Unit of effort	
July	**3,5**
August	**5**
September	**4**
October	**4**
December	**5**
January	**5**
February	**5**
March	**3,1**
April	**5**
May	**5**
June	**5**

FAMILIES OF COLEOPTERA

Total Number of Coleoptera specimens	**1.801**
Percentage of total	**17,49%**

CSD Value	**1.797,95**

Total Number of Families	**25**
Percentage of total	**59,52%**

Margalef's index Value: 3,20

Simpson's index Value: 0,81

Shannon's index Value: 0,90

Pielou's index Value: 0,64

Dominance index Value: 0,19

FIRST 6 FAMILIES OD COLEOPTERA IN ORDER OF CSD VALUE

Family	CSD	%
Staphylinidae	574,21	**31,94**
Ptinidae	422,52	**23,49**
Carabidae	239,18	**13,30**
Tenebrionidae	137,91	**7,67**
Nitidulidae	88,91	**4,95**
Curculionidae	65,57	**3,65**

FAMILIES OF COLEOPTERA EXCLUSIVE OF THE STATION

Family	CSD	%
Cybocephalidae	1,77	**0,02**
Phalacridae	0,72	**0,01**

SPECIES OF CARABIDAE

Number of species: 18
Percentage on total of sampled Carabidae species: 47,37

Margalef's index Value: 3,05
Simpson's index Value: 0,75
Shannon's index Value: 0,80
Pielou's index Value: ,0,64
Dominance index Value: 0,25

FIRTS 10 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Carabidae	% tot stat/general
Pterostichus (Feronidius) melas italicus	116,60	44,42	6,49
Calathus (Neocalathus) cinctus	49,70	18,93	2,76
Laemostenus (Pristonychus) algerinus algerinus	29,24	11,14	1,63
Asaphidion curtum curtum	16,12	6,14	0,90
Pterostichus (Platysma) niger niger	13,74	5,23	0,76
Carabus (Macrothorax) morbillosus alternans	9,17	3,49	0,51
Asaphidion rossii	5,66	2,16	0,31
Ocys harpaloides	4,22	1,61	0,23
Platyderus (Platyderus) lombardii	3,45	1,31	0,19
Pseudoophonus (Pseudoophonus) rufipes	3,16	1,20	0,18

SPECIES EXCLUSIVE OF THE STATION

Species	CSD	%
Ocys harpaloides	4,22	1,61
Pseudoophonus (Pseudoophonus) rufipes	3,16	1,20
Trechus (Trechus) rufulus	2,44	0,93
Platytarus faminii faminii	2,37	0,90
Paranchus albipes	0,98	0,37
Philorhizus melanocephalus	0,98	0,37
Poecilus (Poecilus) cupreus cupreus	0,98	0,37
Chlaenius (Claeinus) velutinus auricollis	0,79	0,30

SPECIES OF TENEBRIONIDAE

Number of species: 5
Percentage on total of sampled Tenebrionidae species: 25

Margalef's index Value: 0,81
Simpson's index Value: 0,47
Shannon's index Value: 0,39
Pielou's index Value: 0,56
Dominance index Value: 0,54

FIRTS 3 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Tenebrionidae	% tot stat/general
Stenosis sardoa sardoa	97,09	70,98	3,95
Akis spinosa spinosa	21,24	15,53	0,86
Alphasida grossa sicula	13,17	9,63	0,54

SPECIES EXCLUSIVE OF THE STATION

Species	CSD	%
Gonocephalum rusticum	0,97	0,71

SPECIES OF STAPHYLINIDAE

Number of species: 25
Percentage on total of sampled Staphylinidae species: 54,35

Margalef's index Value: 3,94
Simpson's index Value: 0,39
Shannon's index Value: 0,48
Pielou's index Value: 0,34
Dominance index Value: 0,61

FIRTS 10 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Staphylinidae	% tot stat/general
Ocypus (Ocypus) olens olens	341,82	77,40	4,30
Paraphloeostiba gayndahensis	29,03	6,57	0,37
Sepedophilus nigripennis	13,82	3,13	0,17
Anotylus speculifrons	11,66	2,64	0,15
Stenus cfr. elegans	7,53	1,70	0,09
Tasgius (Tasgius) pedator siculus	7,30	1,65	0,09
Rugilus (Rugilus) orbiculatus	5,39	1,22	0,07
Euryporus aeneiventris	2,94	0,67	0,04
Platystethus (Craetopycrus) nitens	2,16	0,49	0,03
Sunius (Sunius) algiricus	2,16	0,49	0,03

SPECIES EXCLUSIVE OF THE STATION

Species	CSD	%
Stenus cfr. elegans	7,53	1,70
Euryporus aeneiventris	2,94	0,67
Platystethus (Craetopycrus) nitens	2,16	0,49
Sunius (Sunius) algiricus	2,16	0,49
Tachinus flavolimbatus	1,96	0,44
Quedius (Quedius) levicollis	1,75	0,40
Anotylus nitidulus	1,08	0,24
Gabrius nigritulus	1,08	0,24
Gyrohypnus (Gyrohypnus) fracticornis	1,08	0,24
Tasgius (Rayachelia) globulifer evitendus	0,99	0,22
Habrocerus capillaricornis	0,98	0,22
Micropeplus porcatus	0,98	0,22
Lordithon exoletus	0,87	0,20

CONSIDERATIONS

FAMILIES OF COLEOPTERA

The station has sampled **17,49%** of the total specimens of this Order, with **25** families on 42 registered. Among these are in order the most abundant **Staphylinidae**, **Ptnidae**, **Carabidae**, **Tenebrionidae** and **Nitidulidae**, which include more than **81%** of the entire sample of Coleoptera for the station.

It has the lowest value for index of Margalef, the penultimate value for indices of Simpson and Shannon, and the highest value for index of Pielou (together with **Tk**).

2 Families were **exclusive** of the station, but with both absolute and percentage values little significant.

CARABIDAE

The station has sampled **18** species on 38 registered. Among these ***Pterostichus* (*Feronidius*) *melas italicus***, ***Calathus* (*Neocalathus*) *cinctus*** and ***Laemostenus* (*Pristonychus*) *algerinus algerinus*** are dominant, with about **74,5%** of the capture frequency of Carabidae in the station, followed by ***Asaphidion curtum curtum*** (6,14%) and ***Pterostichus* (*Platysma*) *niger niger*** (5,23%), while two other species, ***Carabus* (*Macrothorax*) *morbillosus alternans*** and ***Asaphidion rossii***, exceed the value of 2% of the total capture frequency of Carabidae in the station.

It presents the lowest value for indices of Simpson and Shannon and the second value for indices of Margalef and Pielou.

8 species were **exclusive** of the station, but with both absolute and percentage values little significant except for ***Ocys harpaloides*** and ***Pseudoophonus* (*Pseudoophonus*) *rufipes*** respectively with 1,61% and 1,20% of total capture frequency of Carabidae for the station

TENEBRIONIDAE

The station has sampled **5** species on 25 registered. Among these ***Stenosis sardoa sardoa*** is dominant with about **71%** of the capture frequency of Tenebrionidae in the station, followed by ***Akis spinosa spinosa*** (15,53%) and ***Alphasida grossa sicula*** (9,63%).

It presenta the lowest value for indices of Margalef, Simpson and Shannon and the penultimate value for index of Pielou.

1 species, *Gonocephalum rusticum*, resulted **exclusive** of the sation, but with both absolute and percentage values little significant.

STAPHYLINIDAE

The station has sampled **25** species on 46 registered. Among these ***Ocypus* (*Ocypus*) *olens olens*** is dominant, with **77,4%** of total frequency capture for Staphylinidae in the station. ***Paraphloeostiba gayndahensis*** is relatively abundant with more than 6,5% of the total frequency of capture of Staphylinidae in the station. No other species exceeds 4% of the total value of CSD for Staphylinidae in the station, while two species, ***Sepedophilus nigripennis*** and ***Anotylus speculifrons***, exceed the 2% threshold.

It has the lowest value for indices of Simpson, Shannon and Pielou and the highest value for index of Margalef.

13 species were **exclusive** of the station with both absolute and percentage values little significant except for ***Stenus*** cfr. ***elegans*** with 1,7% of the total frequency of capture for Stafilinidae in the station.

Station Tk (*P. halepensis* - *Q. calliprinos* Thicket)

Total Number of sampled traps: **54**

Unit of effort	
July	**3**
August	**4,3**
September	**4,5**
October	**5**
December	**3,5**
January	**3,1**
February	**2,6**
March	**2,2**
April	**5**
May	**5**
June	**4,8**

FAMILIES OF COLEOPTERA

Total Number of Coleoptera specimens	**1.192**
Percentage of total	**11,58%**

CSD Value	**1.350,92**

Total Number of Families	**29**
Percentage of total	**69,05%**

Margalef's index Value: 3,88

Simpson's index Value: 0,83

Shannon's index Value: 0,93

Pielou's index Value: 0,64

Dominance index Value: 0,17

FIRST 6 FAMILIES OD COLEOPTERA IN ORDER OF CSD VALUE

Family	CSD	%
Ptinidae	427,26	**31,63**
Silvanidae	257,68	**19,07**
Staphylinidae	166,19	**12,30**
Tenebrionidae	106,41	**7,88**
Nitidulidae	85,31	**6,31**
Cryptophagidae	81,02	**6,00**

FAMILIES OF COLEOPTERA EXCLUSIVE OF THE STATION

Family	CSD	%
Cerambycidae	1,33	**0,01**
Trogidae	1,27	**0,01**

SPECIES OF CARABIDAE

Number of species: 8
Percentage on total of sampled Carabidae species: 21,05

Margalef's index Value: 1,62
Simpson's index Value: 0,72
Shannon's index Value: 0,66
Pielou's index Value: 0,73
Dominance index Value: 0,29

FIRTS 6 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Carabidae	% tot stat/general
Pterostichus (Feronidius) melas italicus	30,63	40,57	2,27
Laemostenus (Pristonychus) algerinus algerinus	25,44	33,70	1,88
Carabus (Macrothorax) morbillosus alternans	6,39	8,46	0,47
Calathus (Neocalathus) cinctus	4,39	5,82	0,32
Microlestes luctuosus	2,58	3,42	0,19
Syntomus barbarus	2,58	3,42	0,19

SPECIES EXCLUSIVE OF THE STATION: 0

SPECIES OF TENEBRIONIDAE

Number of species: 11
Percentage on total of sampled Tenebrionidae species: 44,00

Margalef's index Value: 2,15
Simpson's index Value: 0,89
Shannon's index Value: 0,97
Pielou's index Value: 0,93
Dominance index Value: 0,12

FIRTS 10 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Tenebrionidae	% tot stat/general
Dendarus lugens	19,83	18,79	1,47
Scaurus striatus	14,89	14,11	1,10
Scaurus tristis	14,01	13,27	1,04
Akis spinosa spinosa	13,07	12,38	0,97
Erodius siculus siculus	11,54	10,93	0,85
Alphasida grossa sicula	7,75	7,34	0,57
Tentyria grossa grossa	7,30	6,92	0,54
Stenosis sardoa sardoa	6,62	6,27	0,49
Stenosis melitana	5,27	4,99	0,39
Pimelia rugulosa sublaevigata	3,36	3,18	0,25

SPECIES EXCLUSIVE OF THE STATION

Species	CSD	%
Nalassus aemulus aemulus	1,87	1,77

SPECIES OF STAPHYLINIDAE

Number of species: 14
Percentage on total of sampled Staphylinidae species: 30,43

Margalef's index Value: 2,84
Simpson's index Value: 0,55
Shannon's index Value: 0,60
Pielou's index Value: 0,52
Dominance index Value: 0,46

FIRTS 10 SPECIES IN ORDER OF CSD VALUE

Species	CSD	% tot stat/Staphylinidae	% tot stat/general
Ocypus (Ocypus) olens olens	64,61	66,10	4,78
Paraphloeostiba gayndahensis	9,98	10,21	0,74
Anotylus inustus	7,10	7,26	0,53
Tachyporus nitidulus	3,05	3,12	0,23
Proteinus atomarius	2,37	2,42	0,18
Ocypus (Ocypus) ophthalmicus	1,58	1,62	0,12
Sepedophilus nigripennis	1,47	1,50	0,11
Tachyporus pusillus	1,47	1,50	0,11
Tasgius (Tasgius) pedator siculus	1,47	1,50	0,11
Omalium cinnamomeum	1,40	1,43	0,10

SPECIES EXCLUSIVE OF THE STATION

Species	CSD	%
Omalium cinnamomeum	1,40	1,43

CONSIDERATIONS

FAMILIES OF COLEOPTERA

The station has sampled **11,58%** of the total sample of this Order, with **29** families on 42 registered. Among these are in order the most abundant **Ptnidae**, **Silvanidae**, **Staphylinidae**, **Tenebrionidae**, **Nitidulidae** and **Cryptophagidae**, which include about **83, 2%** of the entire sample of Coleoptera for the station.

It presents the highest value for indices of Margalef and Pielou and the second value for indices of Simpson and Shannon.

2 Families were exclusive of the station, but with both absolute and percentage values little insignificant.

CARABIDAE

The station has sampled **8** species on 38 registered. Among these ***Pterostichus* (*Feronidius*) *melas italicus*** and ***Laemostenus* (*Pristonychus*) *algerinus algerinus*** are dominant, with about **74,5%** of the total capture frequency of Carabidae in the station, followed by ***Carabus* (*Macrothorax*) *morbillosus alternans*** (8,46%) and ***Calathus* (*Neocalathus*) *cinctus*** (5,82%), while two other species, ***Microlestes luctuosus*** and ***Syntomus barbarus***, exceed the value of 2% of the total frequency of capture of Carabidae in the station.

It present the second value for indices of Simpson, Shannon and Pielou and the penultimate value for index of Margalef.

There are **no exclusive species** of the station.

TENEBRIONIDAE

The station has sampled **11** species on 26 registered. Among these ***Dendarus lugens***, ***Scaurus striatus***, ***Scaurus tristis***, ***Akis spinosa spinosa*** and ***Erodius siculus siculus*** show similar and high CDS values representing **69,5%** of the total capture frequency of Tenebrionidae in the station, followed by ***Alphasida grossa sicula*** (7,34%), ***Tentyria grossa grossa*** (6,92%), ***Stenosis sardoa sardoa*** (6,27%), ***Stenosis melitana*** (4,99%) and ***Pimelia rugulosa sublaevigata*** (3,18%).

It presents the highest value for indices of Simpson, Shannon and Pielou and the second value for index of Margalef.

1 species, ***Nalassus aemulus aemulus***, is **exclusive** of the station with the 1,77 of the total frequency of capture for Tenebrionidae in the station.

STAPHYLINIDAE

The station has sampled **14** species on 46 registered. Among these ***Ocypus* (*Ocypus*) *olens olens***, with **66,6%** of total capture frequency for Staphylinidae in the station, is dominant. ***Paraphloeostiba gayndahensis,*** with more than 9,9% of the total frequency of capture for Staphylinidae in the station, and ***Anotylus inustus*** with 7,1% are relatively abundant. No other species exceeds 4% of the total CSD value for Staphylinidae in the station, while two species, ***Tachyporus nitidulus*** and ***Proteinus atomarius***, exceed the threshold of 2%.

It presents the penultimate value for indices of Simpson, Shannon and Pielou and the lowest value for index of Margalef.

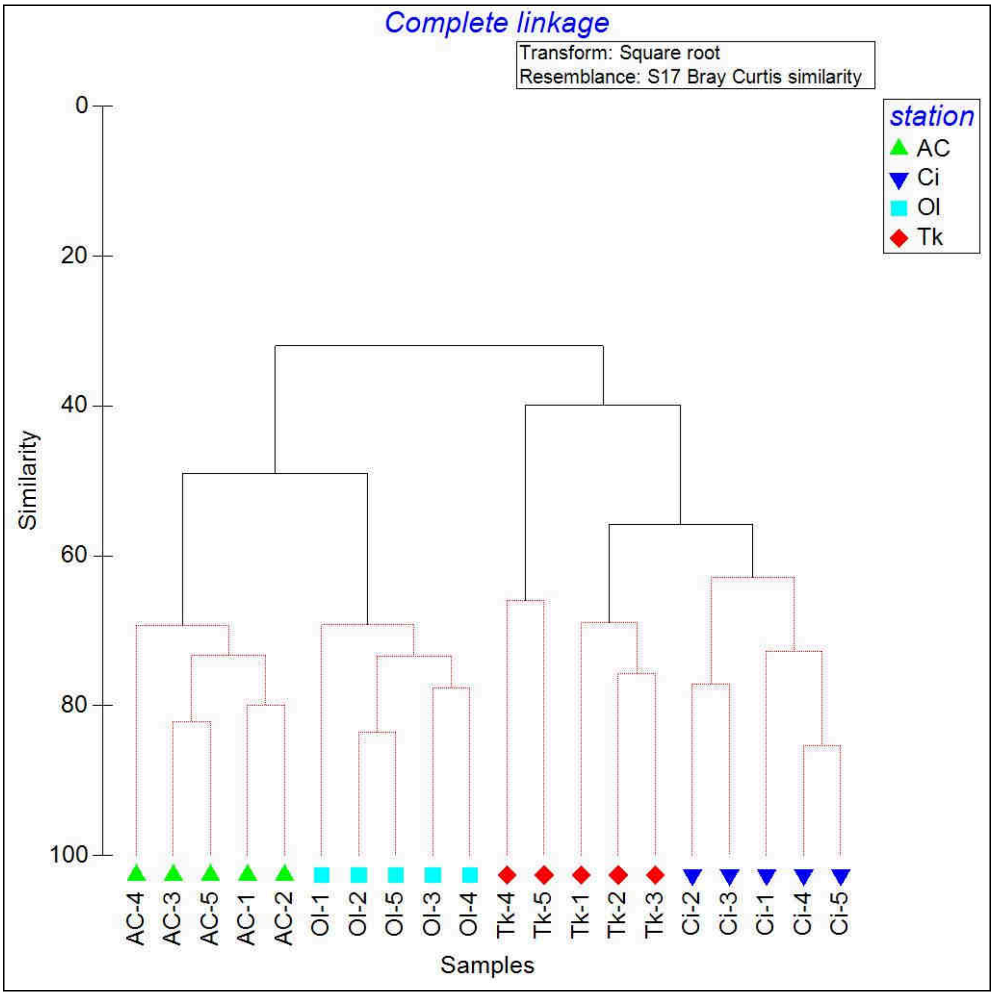
1 species is **exclusive** of the station: ***Omalium cinnamomeum*** with 1,43% of total capture frequencies of Stafilinidae in the station.

9 MULTIVARIATE ANALYSIS OF THE COMMUNITIES

9.1 NON METRIC MULTIDIMENSIONAL SCALING BASED ON THE BRAY-CURTIS MATRIX

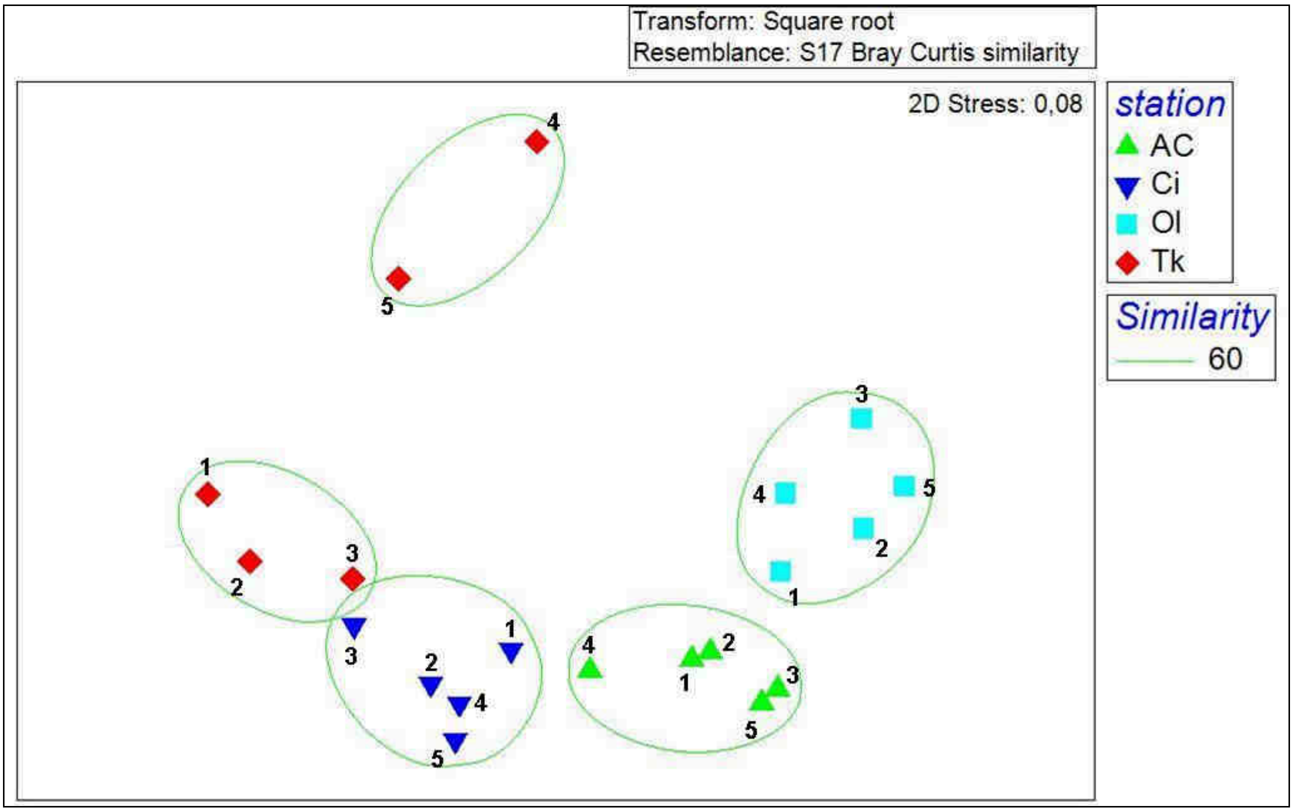
FAMILIES OF COLEOPTERA

Looking at the dendrogram of similarity among traps based on the index of Bray-Curtis in relation to the Families of Coleoptera (graph. 9.1.1) it is evident that some of the clusters identified result different with each other in a statistically significance (p <0.5 at least %) according to the SIMPROF test.
5 clusters are individuated, at a level of similarity around 60%, significantly different from each, grouping:
1. **all traps** of station **AC**;
2. **all traps** of station **Ol**;
3. **all traps** of station **Ci**;
4. traps **Tk-1**, **Tk-2**, **Tk-3**;
5. traps **Tk-4** and **Tk-5**.

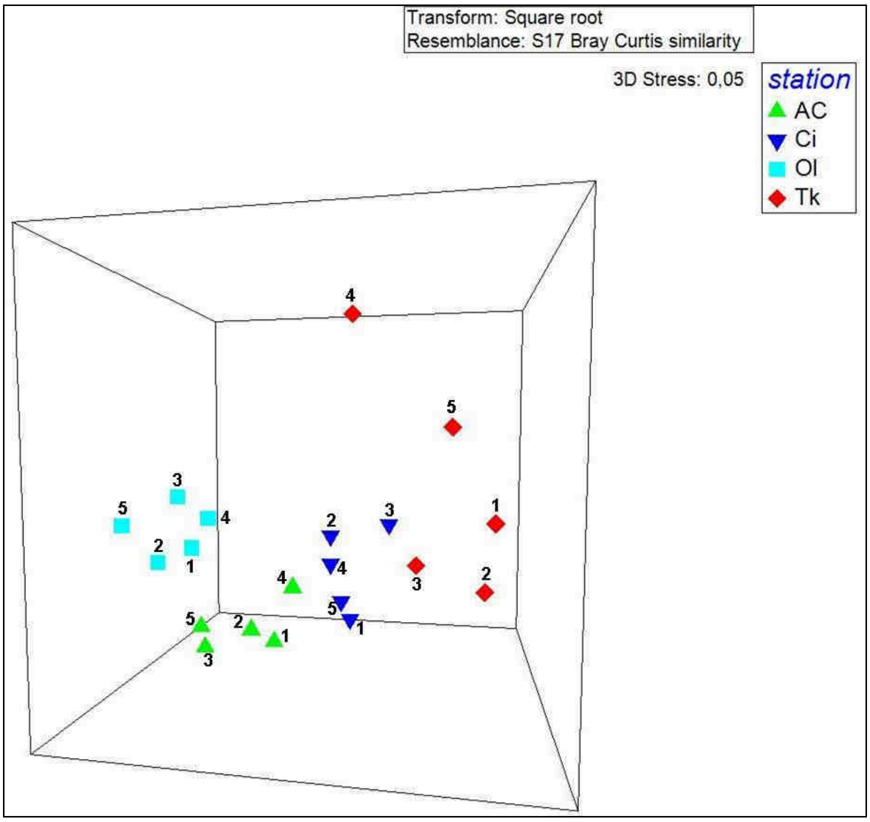


Graph. 9.1.1 - Dendrogram of values based on similarity index of Bray Curtis between the traps of stations investigated in relation to the Families of Coleoptera. The black lines show the clusters that are statistically significantly different (at least p <0,5%) according to the SIMPROF test.

The Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps, in relation to Families of Coleoptera, both in 2 D (graph. 9.1.2) and 3 D (graph. 9.1.3) vision, shows (at a level of similarity around 60%) a cluster for traps of stations **Ol**, **AC** and **Ci**, a cluster for traps **Tk-1**, **Tk-2** and **Tk-3** and a further cluster for traps **Tk-4** and **Tk-5**.

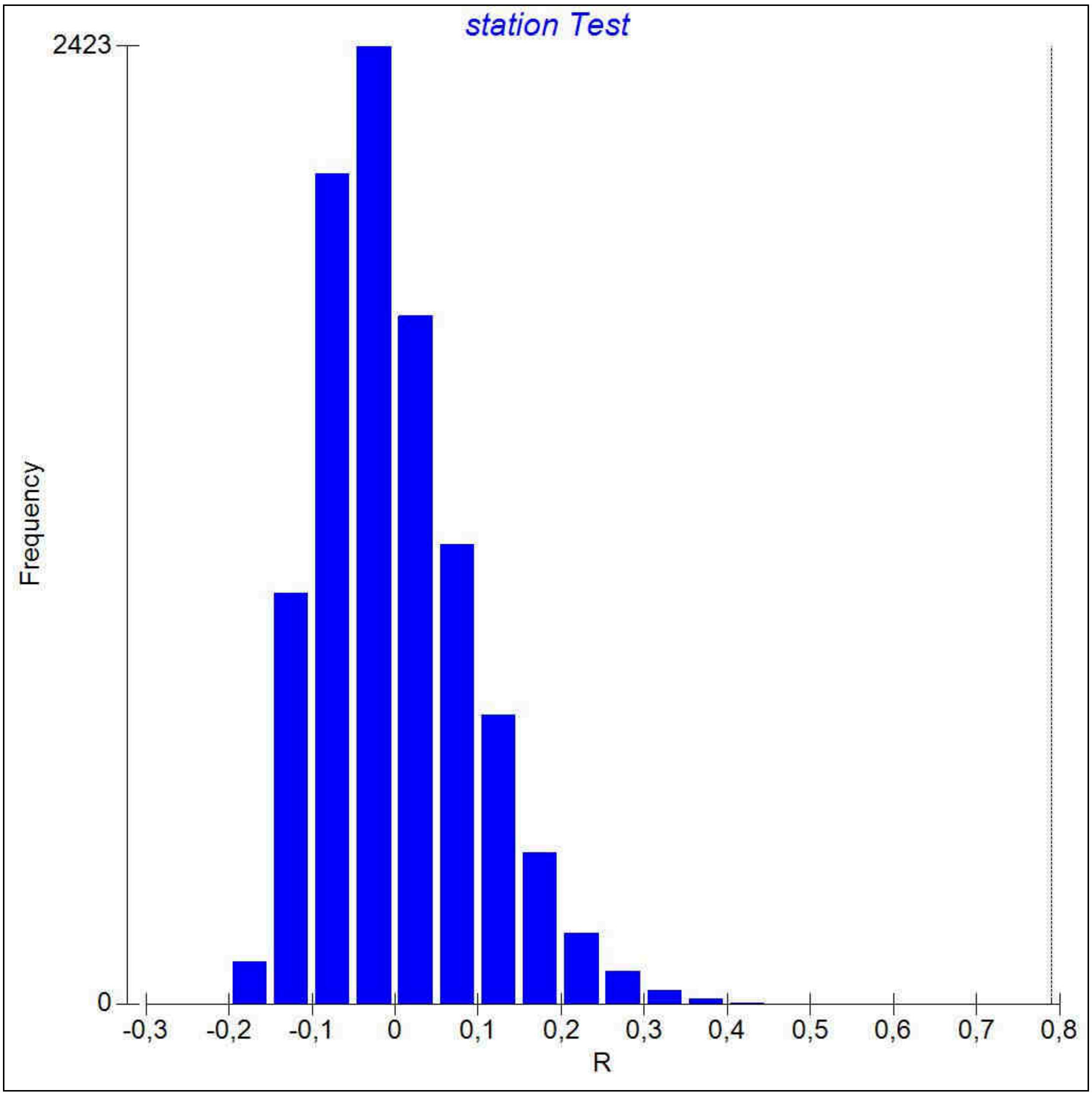


Graph. 9.1.2 - The Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps of investigated stations, in relation to Families of Coleoptera (2 D vision).



Graph. 9.1.3 - Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps of investigated stations, in relation to Families of Coleoptera (3 D vision).

The analysis shows that the traps of a station are, in most cases, more similar to each other than with the traps of other stations. The ANOSIM test (graph. 9.1.4) confirms this hypothesis with high statistical significance.



Graph. 9.1.4 – ANOSIM tests: distribution of expected frequencies of R (histogram) compared with the observed value of R (**0,79**) (continuous line) between the traps of the stations investigated in relation to Families of Coleoptera.

In tables 9.1.1-9.1.4 are shown the Families of Coleoptera that determine the similarity between the traps of each station. For each family is given the mean abundance in the traps (Av. Abund) and the mean similarity (Av. Sim) between them in relation to each single Family. In the third column is shown the value of the ratio between similarity and standard deviation (Sim/SD), which provides an indication of the uniformity of distribution of the taxon in the samples: higher values indicate greater uniformity, lower values indicate little homogeneous distributions of catches. In the last two columns are shown the percentage contribution of each family of Coleoptera in determining the overall average similarity between the traps (Contrib%) and the cumulative percentage of families in question (Cum%) up to the threshold of 90%.

From the analysis comes out that in general are 8 the Families, although with different weight in relation to individual stations, which contribute most to the determination of the similarity between the traps: **Carabidae**, **Cryptophagidae**, **Melolonthidae**, **Nitidulidae**, **Ptinidae**, **Silvanidae**, **Staphylinidae** and **Tenebrionidae**, with Staphylinidae, Tenebrionidae and Carabidae always occupy one of the first 4 places in the ranking, except for Carabidae in station **Tk** that occupy the 6th place.

Station AC

Average similarity: 76,00

Family	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Carabidae	16,17	18,04	10,62	23,73	23,73
Nitidulidae	11,72	13,58	11,42	17,86	41,6
Staphylinidae	9,16	10,57	6,99	13,9	55,5
Tenebrionidae	9,45	9,52	6,89	12,53	68,03
Curculionidae	5,4	4,79	2,32	6,3	74,33
Cryptophagidae	3,17	3,16	5,36	4,16	78,49
Ptinidae	3,57	3,08	2,09	4,06	82,55
Anthicidae	4,34	3,03	2,73	3,99	86,54
Chrysomelidae	2,02	1,86	6,11	2,45	88,99
Silvanidae	1,82	1,8	3,05	2,37	**91,36**

Tab. 9.1.1 – Average similarity between the traps and percentage contribution to the similarity of the Families of Coleoptera in the **AC** station; further explanations in the text.

Station Ci

Average similarity: 74,75

Family	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Staphylinidae	10,61	16,15	11,05	21,61	21,61
Ptinidae	8,74	11,7	11,76	15,65	37,26
Carabidae	6,51	8,28	2,82	11,07	48,33
Tenebrionidae	5,18	7,81	4,92	10,45	58,78
Nitidulidae	4,19	6,57	14,03	8,79	67,57
Cryptophagidae	3,04	4,5	4	6,03	73,59
Anthicidae	2,76	3,35	2,54	4,48	78,07
Curculionidae	3,19	3,32	2,06	4,44	82,51
Lathridiidae	2,14	3,04	2,32	4,07	86,58
Orthoperidae	2,66	2,31	1,14	3,09	89,68
Scydmaenidae	2,36	2,22	1,01	2,97	**92,65**

Tab. 9.1.2 – Average similarity between the traps and percentage contribution to the similarity of the Families of Coleoptera in the **Ci** station; further explanations in the text.

Station Ol

Average similarity: 75,32

Family	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Tenebrionidae	14,7	12,73	5,93	16,9	16,9
Nitidulidae	10,1	9,89	8,51	13,13	30,04
Staphylinidae	8,96	8,47	10,34	11,25	41,28
Melyridae	6,67	6,77	7,52	8,98	50,27
Carabidae	6,6	6,18	3,06	8,2	58,47
Melolonthidae	6,53	5,4	2,7	7,17	65,64
Anthicidae	6,13	4,87	2,92	6,47	72,11
Curculionidae	4,65	4,79	8,62	6,36	78,47
Chrysomelidae	4,59	4,43	9,22	5,88	84,35
Cryptophagidae	2,56	2,38	16,69	3,16	87,51
Ptinidae	1,84	1,68	2,84	2,23	89,74
Elateridae	2,24	1,68	1,9	2,22	**91,96**

Tab. 9.1.3 – Average similarity between the traps and percentage contribution to the similarity of the Families of Coleoptera in the **Ol** station; further explanations in the text.

Station Tk

Average similarity: 59,07

Family	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Ptinidae	8,17	10,22	1,89	17,29	17,29
Staphylinidae	5,46	8,49	4,06	14,38	31,67
Silvanidae	6,39	8,27	1,69	14	45,67
Tenebrionidae	4,47	7,7	3,39	13,03	58,7
Nitidulidae	3,95	6,66	11,94	11,28	69,98
Carabidae	3,44	5,39	3,6	9,12	79,1
Cryptophagidae	3,42	3,93	1,97	6,65	85,75
Chrysomelidae	1,77	2,4	1,08	4,06	89,81
Curculionidae	1,54	1,82	1,08	3,08	**92,89**

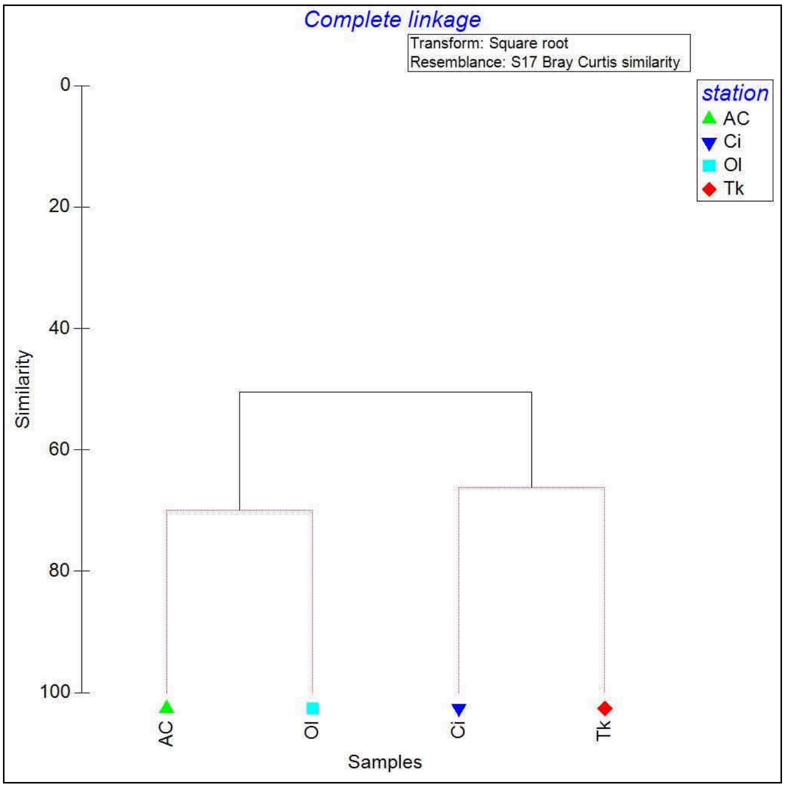
Tab. 9.1.4 – Average similarity between the traps and percentage contribution to the similarity of the Families of Coleoptera in the **Tk** station; further explanations in the text.

The statistical significance of differences between the stations was calculated using the Parwise test, based on comparison of observed and expected values of R between pairs of stations (tab. 9.1.5). The analysis shows that all stations highly significant differ from each other; these are grouped together according to the index of Bray-Curtis (graph. 9.1.5) into two clusters: the first with about 70% similarity includes the station **AC** and **Ol**, the second with about 65% similarity includes the station **Ci** and **Tk**.

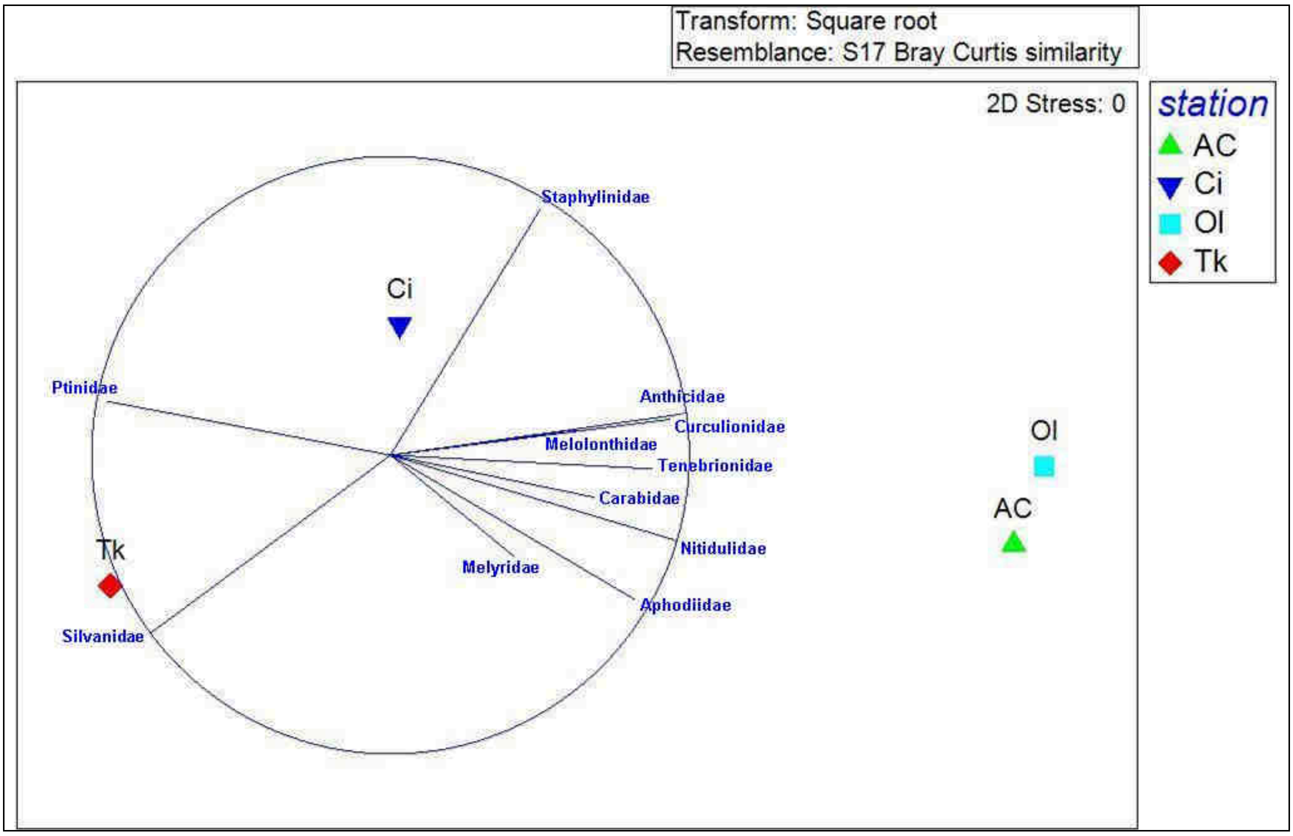
Groups	R Statistic	Significance Level %	Possible Permutations	Actual Permutations	Number >= Observed
AC/Ci	0,964	0,8	126	126	1
AC/Ol	0,928	0,8	126	126	1
AC/Tk	0,764	0,8	126	126	1
Ci/Ol	1	0,8	126	126	1
Ci/Tk	0,492	0,8	126	126	1
Ol/Tk	0,836	0,8	126	126	1

Tab. 9.1.5 - Pairwise tests based on the values of R observed for pair of stations in relation to Families of Coleoptera. The significance % refers to the number of values of R that fall within the range of expected frequencies compared to the total number of possible permutations.

The Nonmetric Multi Dimensional Scaling (NMDS) in 2 D vision (graph. 9.1.6), elaborated on the Bray Curtis similarity matrix between stations, in relation to Families of Coleoptera shows again more dissimilarity between stations **Tk** and **Ci** (despite being more close than the pair **AC** and **Ol**) and more affinity between the stations **AC** and **Ol**.
Family **Silvanidae** is centered on station **Tk** characterizing it and clearly differentiating that station rather from other stations. Family **Ptnidae** occupy an intermediate position between stations **Tk** and **Ci** characterizing them from stations **AC** and **Ol**. **Staphylinidae** take an intermediate position between station **Ci** and the pair **AC/Ol** differentiating these form station **Tk**. **Anthicidae**, **Nitidulidae** and **Curculionidae** are centered on the pair of station **AC/Ol** contributing to determine their similarities and to differentiate them from stations **Ci** and **Tk**. **Carabidae** and **Aphodidae** are centerd on sono station **AC**, while **Tenebrionidae** are centered on station **Ol**, together with **Melolonthidae**, exclusive of that station. **Melyridae** are in between the stations **Tk** and **Ol**, however resulting in much closer to that **Ol**.



Graph. 9.1.5 - Dendrogram of Bray Curtis similarity index values between the investigated stations of with regard to the Families of Coleoptera.



Graph. 9.1.6 - Correlation between Nonmetric Multi Dimensional Scaling (NMDS) developed on the Bray Curtis similarity matrix between the stations and the Families of Coleoptera; in the figure are indicated only those most abundantly sampled and that determine the differences or similarities among the four stations.

In tables 9.1.6-9.1.11 are shown the Families of Coleoptera that determine the dissimilarity between the traps of each station. For each family is given the mean abundance in the traps (Av. Abund) and the mean dissimilarity (Av. Diss) between them in relation to each single Family. In the fourth column is shown the value of the ratio between dissimilarity and standard deviation (Dis/SD), which provides an indication of the uniformity of distribution of the taxon in the samples: higher values indicate greater uniformity, lower values indicate little homogeneous distributions of catches. In the last two columns are shown the percentage contribution of each family of Coleoptera in determining the overall average dissimilarity between the traps (Contrib%) and the cumulative percentage of families in question (Cum%) up to the threshold of 90%.
In general, the mean overall value of dissimilarity between stations varies from 37,37% of the pair **AC/Ol** and 56,58% of the pair **Ol/Tk**. By examination of the tables is also clear that for each comparison between pairs of stations the first 6 Families in order of abundance give a dissimilarity between stations with a contribution that varies from about 49% to 58%.
Among the families that occur most frequently in the first six positions are: **Carabidae**, **Nitidulidae**, **Ptinidae**, **Tenebrionidae**, **Melolonthidae** and **Melyridae**.

Groups AC/Ci
Average dissimilarity = 39,82

Family	Group AC Av.Abund	Group Ci Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Carabidae	16,17	6,51	6,92	2,85	17,37	17,37
Nitidulidae	11,72	4,19	5,38	6,39	13,51	30,88
Ptinidae	3,57	8,74	3,63	1,65	9,11	39,99
Tenebrionidae	9,45	5,18	2,92	1,9	7,34	47,33
Aphodiidae	3,51	0	2,37	1	5,95	53,28
Curculionidae	5,4	3,19	2,07	1,52	5,2	58,48
Anthicidae	4,34	2,76	1,68	1,11	4,21	62,69
Scydmaenidae	0,19	2,36	1,61	1,54	4,05	66,74
Orthoperidae	1,19	2,66	1,39	1,28	3,48	70,23
Staphylinidae	9,16	10,61	1,36	1,38	3,42	73,65
Melyridae	1,42	0,23	0,94	1,06	2,35	76
Hysteridae	1,32	0	0,92	1,73	2,3	78,3
Lathridiidae	2,14	2,14	0,91	1,59	2,29	80,59
Silvanidae	1,82	1,38	0,81	1,35	2,02	82,61
Chrysomelidae	2,02	1,16	0,68	1,14	1,7	84,31
Kateretidae	0,93	0	0,64	1,62	1,61	85,92
Silphidae	0,2	0,95	0,62	1,46	1,57	87,49
Cryptophagidae	3,17	3,04	0,62	1,46	1,56	89,05
Leiodiidae	0,62	0,74	0,6	1,24	1,52	**90,56**

Tab. 9.1.6 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Ci** for Families of Coleoptera more abundantly sampled; additional explanations in the text.

Groups AC/Ol
Average dissimilarity = 37,37

Family	Group AC Av.Abund	Group Ol Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Carabidae	16,17	6,6	5,57	3,73	14,9	14,9
Melolonthidae	0	6,53	3,93	2,19	10,51	25,41
Tenebrionidae	9,45	14,7	3,41	1,11	9,12	34,53
Melyridae	1,42	6,67	3,14	2,7	8,39	42,92
Anthicidae	4,34	6,13	1,99	1,39	5,31	48,23
Aphodiidae	3,51	1,68	1,91	1,07	5,1	53,34
Chrysomelidae	2,02	4,59	1,54	2,01	4,13	57,47
Nitidulidae	11,72	10,1	1,3	1,44	3,48	60,94
Lathridiidae	2,14	0	1,22	1,64	3,26	64,2
Curculionidae	5,4	4,65	1,15	1,54	3,08	67,27
Ptinidae	3,57	1,84	1,12	1,3	3,01	70,28
Staphylinidae	9,16	8,96	1,12	1,5	2,99	73,27
Elateridae	0,83	2,24	0,93	1,36	2,49	75,76
Hysteridae	1,32	2,21	0,89	1,07	2,37	78,13
Silvanidae	1,82	0,51	0,8	1,58	2,15	80,28
Buprestidae	0,19	1,33	0,72	1,52	1,94	82,21
Coccinellidae	0,19	1,34	0,71	1,92	1,9	84,11
Cryptophagidae	3,17	2,56	0,6	1,42	1,61	85,73
Mordellidae	0	0,87	0,55	0,75	1,48	87,21
Leiodiidae	0,62	0,88	0,55	1,26	1,46	88,67
Kateretidae	0,93	0	0,53	1,63	1,42	**90,09**

Tab. 9.1.7 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Ol** for Families of Coleoptera more abundantly sampled; additional explanations in the text.

Groups AC/Tk
Average dissimilarity = 52,38

Family	Group AC Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Carabidae	16,17	3,44	9,83	5,48	18,77	18,77
Nitidulidae	11,72	3,95	6,07	4,19	11,59	30,36
Ptinidae	3,57	8,17	3,97	1,45	7,59	37,95
Tenebrionidae	9,45	4,47	3,67	2,22	7	44,95
Silvanidae	1,82	6,39	3,64	1,74	6,96	51,9
Curculionidae	5,4	1,54	2,98	1,87	5,69	57,6
Staphylinidae	9,16	5,46	2,96	1,58	5,65	63,24
Anthicidae	4,34	0,8	2,62	1,31	5	68,24
Aphodiidae	3,51	0,5	2,37	0,99	4,53	72,77
Melyridae	1,42	2,18	1,85	0,99	3,53	76,3
Cryptophagidae	3,17	3,42	1,55	1,49	2,95	79,25
Lathridiidae	2,14	0,68	1,32	1,36	2,51	81,76
Leiodiidae	0,62	1,3	0,95	1,2	1,82	83,58
Hysteridae	1,32	0,23	0,89	1,58	1,71	85,29
Orthoperidae	1,19	0,24	0,8	1,54	1,53	86,82
Chrysomelidae	2,02	1,77	0,77	1,33	1,47	88,29
Kateretidae	0,93	0	0,69	1,61	1,32	89,61
Elateridae	0,83	0,19	0,61	1,17	1,17	**90,78**

Tab. 9.1.8 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Tk** for Families of Coleoptera more abundantly sampled; additional explanations in the text.

Groups Ci/Ol
Average dissimilarity = 49,68

Family	Group Ci Av.Abund	Group Ol Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Tenebrionidae	5,18	14,7	6,32	1,98	12,72	12,72
Ptinidae	8,74	1,84	4,56	2,65	9,17	21,89
Melolonthidae	0	6,53	4,48	2,21	9,03	30,92
Melyridae	0,23	6,67	4,34	5,76	8,73	39,65
Nitidulidae	4,19	10,1	3,96	3,34	7,96	47,61
Anthicidae	2,76	6,13	2,37	1,55	4,78	52,39
Chrysomelidae	1,16	4,59	2,31	2,98	4,64	57,04
Staphylinidae	10,61	8,96	1,67	1,41	3,37	60,41
Carabidae	6,51	6,6	1,54	1,21	3,09	63,5
Scydmaenidae	2,36	0,39	1,48	1,47	2,97	66,47
Hysteridae	0	2,21	1,45	1,34	2,93	69,4
Lathridiidae	2,14	0	1,45	3,25	2,92	72,32
Orthoperidae	2,66	0,9	1,4	1,41	2,82	75,14
Curculionidae	3,19	4,65	1,37	1,53	2,76	77,89
Elateridae	0,61	2,24	1,19	1,58	2,4	80,29
Aphodiidae	0	1,68	1,08	0,75	2,18	82,47
Buprestidae	0	1,33	0,9	1,67	1,8	84,28
Silvanidae	1,38	0,51	0,78	1,04	1,58	85,85
Silphidae	0,95	0	0,65	1,76	1,31	87,16
Cryptophagidae	3,04	2,56	0,64	1,67	1,29	88,45
Mordellidae	0	0,87	0,64	0,75	1,28	89,73
Coccinellidae	0,83	1,34	0,59	1,61	1,18	**90,91**

Tab. 9.1.9 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ci** and **Ol** for Families of Coleoptera more abundantly sampled; additional explanations in the text.

Groups Ci/Tk

Average dissimilarity = 42,88

Family	Group Ci Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Staphylinidae	10,61	5,46	4,85	1,99	11,31	11,31
Silvanidae	1,38	6,39	4,65	1,77	10,84	22,14
Ptinidae	8,74	8,17	3,97	1,46	9,25	31,4
Carabidae	6,51	3,44	3,09	1,57	7,21	38,6
Orthoperidae	2,66	0,24	2,27	1,43	5,3	43,9
Melyridae	0,23	2,18	2,18	0,82	5,07	48,98
Scydmaenidae	2,36	0,17	2,13	1,51	4,96	53,94
Anthicidae	2,76	0,8	1,85	1,49	4,3	58,24
Cryptophagidae	3,04	3,42	1,8	1,59	4,21	62,45
Curculionidae	3,19	1,54	1,8	1,23	4,2	66,65
Lathridiidae	2,14	0,68	1,53	1,68	3,58	70,23
Tenebrionidae	5,18	4,47	1,22	1,5	2,85	73,08
Leiodiidae	0,74	1,3	1,06	1,43	2,47	75,55
Chrysomelidae	1,16	1,77	1,04	1,38	2,42	77,97
Nitidulidae	4,19	3,95	1	1,59	2,33	80,3
Silphidae	0,95	0	0,91	1,76	2,11	82,41
Coccinellidae	0,83	0	0,82	1,04	1,92	84,34
Colydiidae	0,8	0,19	0,71	1,15	1,66	85,99
Buprestidae	0	0,64	0,63	0,49	1,47	87,46
Elateridae	0,61	0,19	0,6	0,9	1,41	88,86
Aphodiidae	0	0,5	0,51	0,71	1,19	**90,05**

Tab. 9.1.10 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ci** and **Tk** for Families of Coleoptera more abundantly sampled; additional explanations in the text.

Groups Ol/Tk

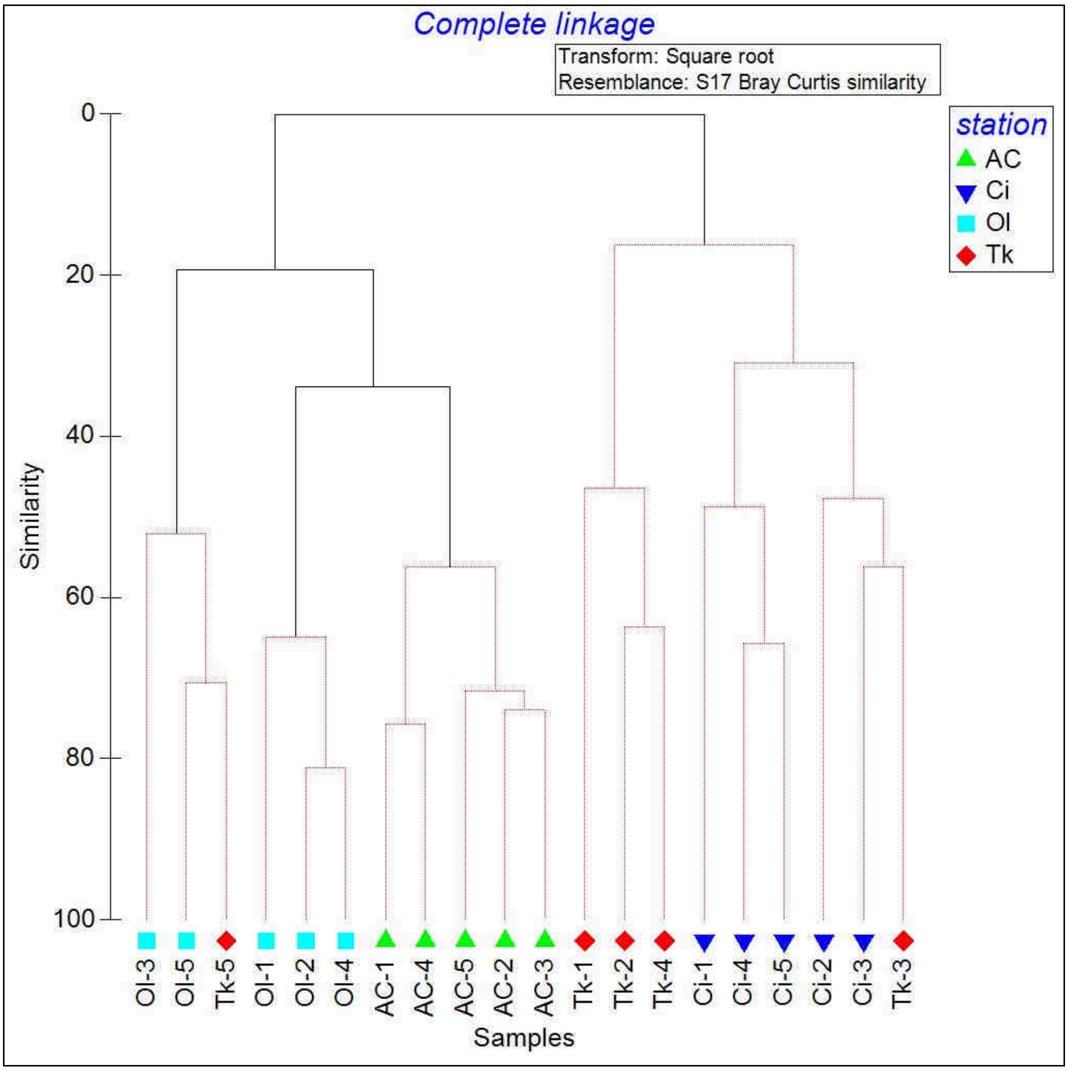
Average dissimilarity = 56,58

Family	Group Ol Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Tenebrionidae	14,7	4,47	7,29	2,14	12,89	12,89
Melolonthidae	6,53	0	4,85	2,19	8,56	21,45
Nitidulidae	10,1	3,95	4,48	2,81	7,91	29,37
Ptinidae	1,84	8,17	4,43	1,53	7,83	37,19
Silvanidae	0,51	6,39	4,15	1,87	7,34	44,54
Anthicidae	6,13	0,8	3,81	2,16	6,72	51,26
Melyridae	6,67	2,18	3,31	2,07	5,85	57,11
Staphylinidae	8,96	5,46	2,67	1,46	4,72	61,84
Carabidae	6,6	3,44	2,46	1,77	4,34	66,18
Curculionidae	4,65	1,54	2,3	2,42	4,07	70,25
Chrysomelidae	4,59	1,77	2,03	2,15	3,58	73,84
Elateridae	2,24	0,19	1,49	1,74	2,64	76,47
Hysteridae	2,21	0,23	1,47	1,31	2,6	79,07
Cryptophagidae	2,56	3,42	1,41	1,3	2,48	81,55
Aphodiidae	1,68	0,5	1,16	0,84	2,06	83,61
Buprestidae	1,33	0,64	1,05	1,72	1,85	85,46
Coccinellidae	1,34	0	0,99	2,49	1,74	87,2
Leiodiidae	0,88	1,3	0,83	1,38	1,47	88,68
Mordellidae	0,87	0,42	0,73	0,94	1,29	89,97
Orthoperidae	0,9	0,24	0,59	1,53	1,03	**91**

Tab. 9.1.11 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ol** and **Tk** for Families of Coleoptera more abundantly sampled; additional explanations in the text.

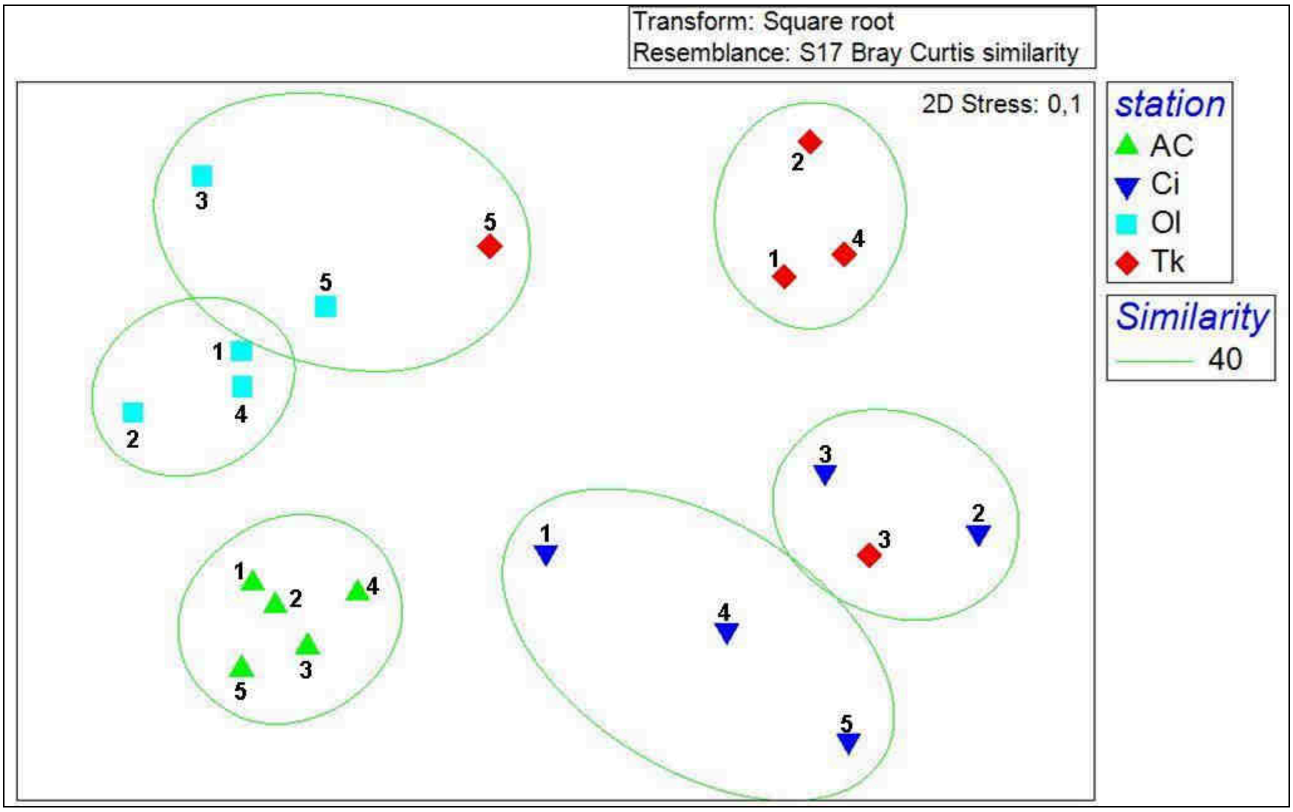
SPECIES OF CARABIDAE

Looking at the dendrogram of similarity among traps based on the index of Bray-Curtis in relation to species of Carabidae (graph. 9.1.7) it is evident that those clusters gouping traps of stations **AC**, **Ol** and trap **Tk-5** result different with each other in a statistically significance (p <0.5 at least %) according to the SIMPROF test, while those cluster grouping traps of station **Ci** and the remaining traps of station **Tk** are not statistically significant.

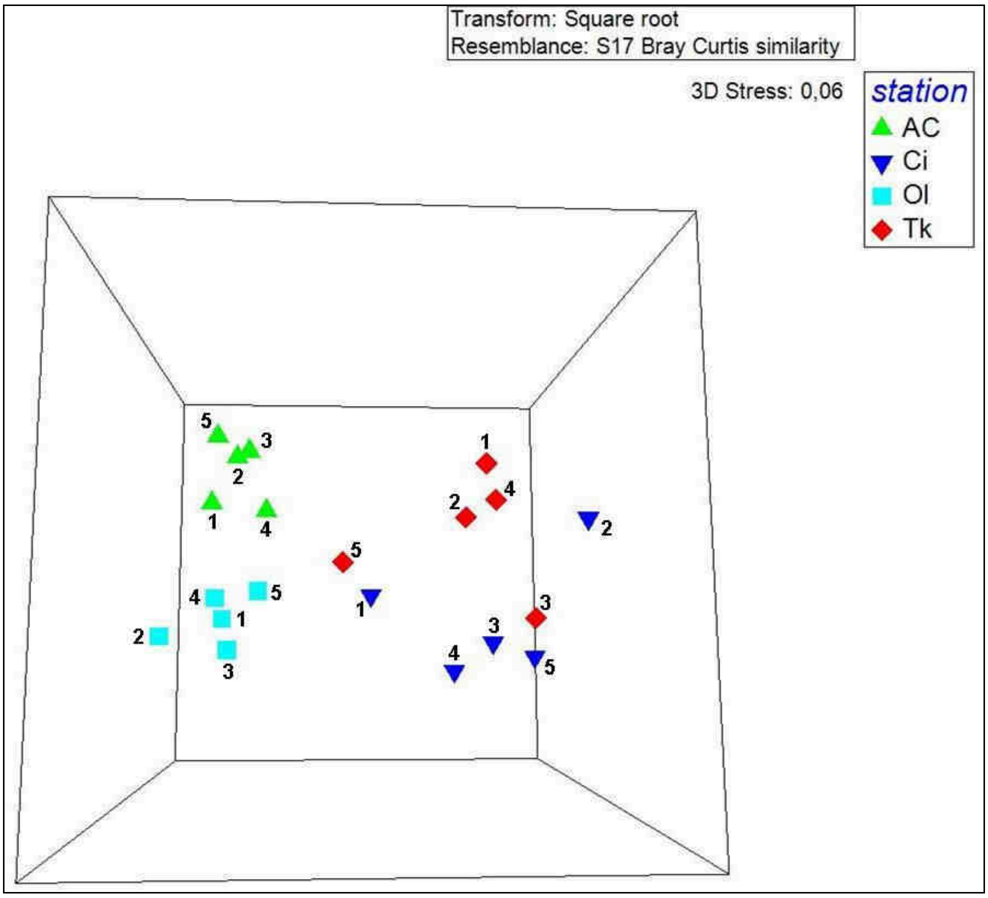


Graph. 9.1.7 – Dendrogram of values based on similarity index of Bray Curtis between the traps of stations investigated in relation to species of Carabidae. The black lines show the clusters that are statistically significantly different (at least p <0,5%) according to the SIMPROF test.

The Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps, in relation to species of Carabidae, both in 2 D (graph. 9.1.8) and 3 D (graph. 9.1.9) vision, shows (at a level of similarity around 40%) a cluster for traps of stations **AC**, the vicinity of traps of station **Ol** and trap **Tk-5**, the vicinity of traps of station **Ci** and trap **Tk-3**, the group of traps **Tk-1**, **Tk-2** and **Tk-4**.

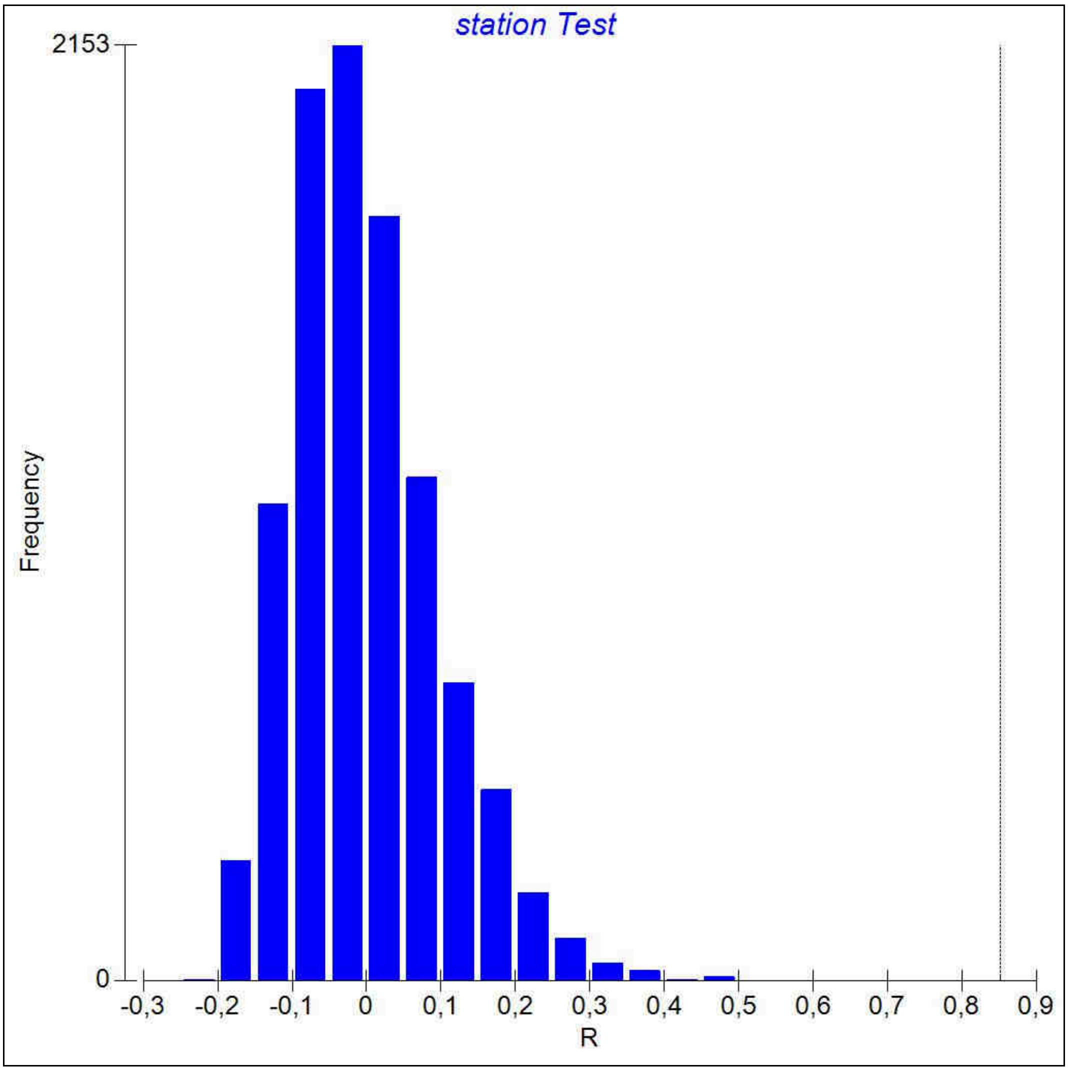


Graph. 9.1.8 – The Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps of investigated stations, in relation to species of Carabidae (2 D vision).



Graph. 9.1.9 – Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps of investigated stations, in relation to species of Carabidae (3 D vision).

The analysis shows that the traps of a station are, in most cases, more similar to each other than with the traps of other stations. The ANOSIM test (graph. 9.1.10) confirms this hypothesis with high statistical significance.



Graph. 9.1.10 – ANOSIM tests: distribution of expected frequencies of R (histogram) compared with the observed value of R (**0,85**) (continuous line) between the traps of the stations investigated in relation to species of Carabidae.

In tables 9.1.12-9.1.15 are shown the species of Carabidae that determine the similarity between the traps of each station. For each species is given the mean abundance in the traps (Av. Abund) and the mean similarity (Av. Sim) between them in relation to each single species. In the third column is shown the value of the ratio between similarity and standard deviation (Sim/SD), which provides an indication of the uniformity of distribution of the taxon in the samples: higher values indicate greater uniformity, lower values indicate little homogeneous distributions of catches. In the last two columns are shown the percentage contribution of each species of Carabidae in determining the overall average similarity between the traps (Contrib%) and the cumulative percentage of species in question (Cum%) up to the threshold of 90%.

From analysis cames out that in general are 5 species, although with different weight in relation to individual stations, which contribute most to the determination of the similarity between the traps: ***Calathus* (*Neocalathus*) *cinctus***, ***Laemostenus* (*Pristonychus*) *algerinus algerinus***, ***Pterostichus* (*Feronidius*) *melas italicus***, ***Carabus* (*Macrothorax*) *morbillosus alternans*** and ***Syntomus barbarus***.

Group AC

Average similarity: 67,65

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Calathus (Neocalathus) cinctus	15,25	39,39	8,25	58,23	58,23
Laemostenus (Pristonychus) algerinus algerinus	4,91	12,25	3,15	18,11	76,34
Licinus (Licinus) punctatulus	2,18	5,81	6,87	8,59	84,93
Metallina (Neja) ambigua	2,22	2,21	0,54	3,26	88,19
Syntomus barbarus	1,14	1,93	1,09	2,85	**91,04**

Tab. 9.1.12 – Average similarity between the traps and percentage contribution to the similarity of the species of Carabidae in the **AC** station; further explanations in the text.

Group Ci

Average similarity: 47,28

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Pterostichus (Feronidius) melas italicus	4,51	19,23	4,06	40,67	40,67
Laemostenus (Pristonychus) algerinus algerinus	2,3	10,62	5,86	22,47	63,14
Carabus (Macrothorax) morbillosus alternans	1,31	6,51	5,62	13,76	76,9
Asaphidion curtum curtum	1,34	2,98	0,62	6,3	83,19
Calathus (Neocalathus) cinctus	2,03	2,61	0,56	5,52	88,71
Ocys harpaloides	0,7	1,71	0,62	3,61	**92,32**

Tab. 9.1.13 – Average similarity between the traps and percentage contribution to the similarity of the species of Carabidae in the **Ci** station; further explanations in the text.

Group Ol

Average similarity: 64,81

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Calathus (Neocalathus) cinctus	6,61	52,65	4,55	81,23	81,23
Syntomus barbarus	1,07	7,76	1,12	11,97	**93,20**

Tab. 9.1.14 – Average similarity between the traps and percentage contribution to the similarity of the species of Carabidae in the **Ol** station; further explanations in the text.

Group Tk

Average similarity: 43,42

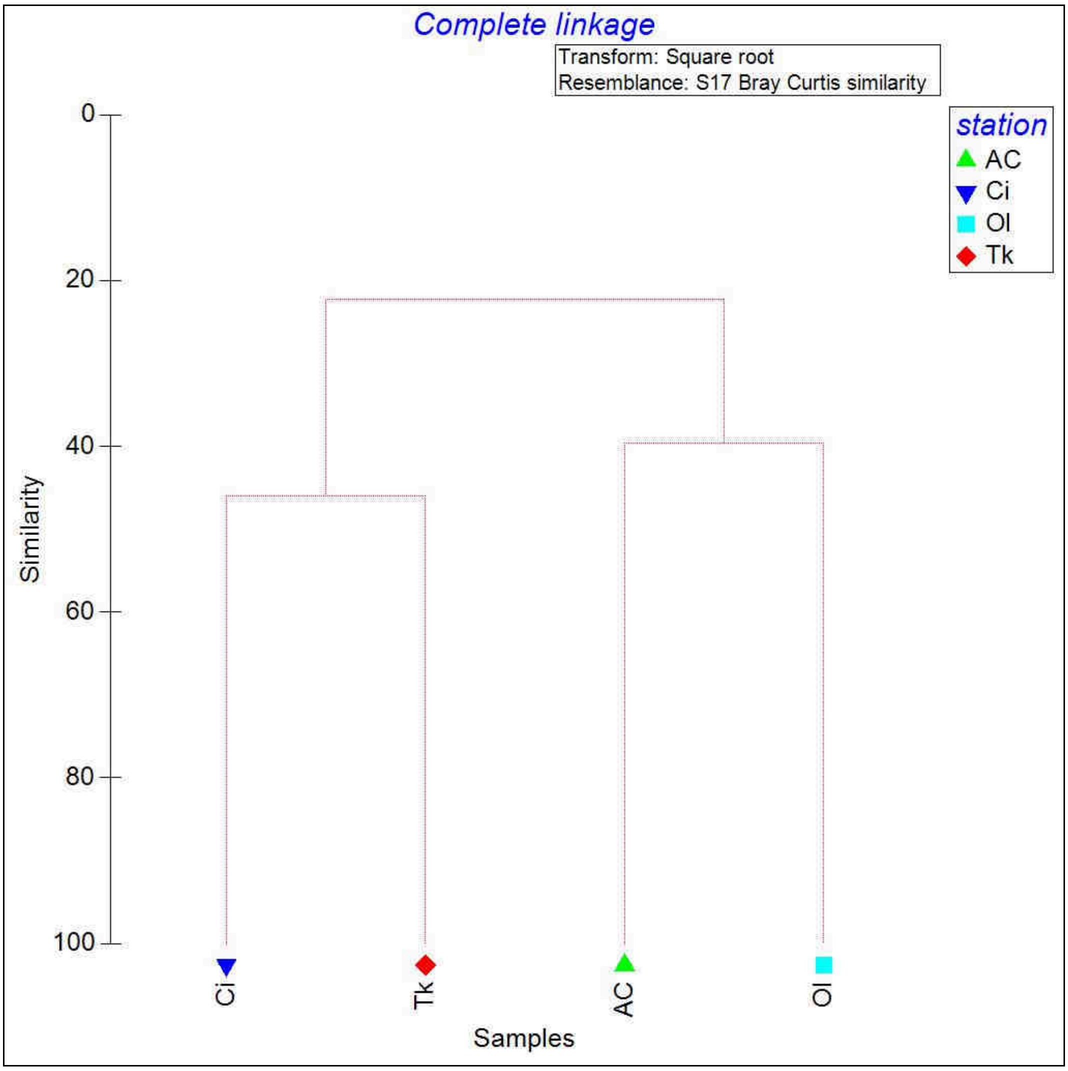
Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Laemostenus (Pristonychus) algerinus algerinus	2,23	37,45	3,2	86,25	86,25
Carabus (Macrothorax) morbillosus alternans	0,82	4,41	0,58	10,15	**96,40**

Tab. 9.1.15 – Average similarity between the traps and percentage contribution to the similarity of the species of Carabidae in the **Tk** station; further explanations in the text.

The statistical significance of differences between the stations was calculated using the Parwise test, based on comparison of observed and expected values of R between pairs of stations (tab. 9.1.16). The analysis shows that all stations highly (or mildly for **Ci/Tk**) significant differ from each other; these are grouped together according to the index of Bray-Curtis (graph. 9.1.11) into two clusters: the first with about 40% similarity includes the station **AC** and **Ol**, the second with about 45% similarity includes the station **Ci** and **Tk**.

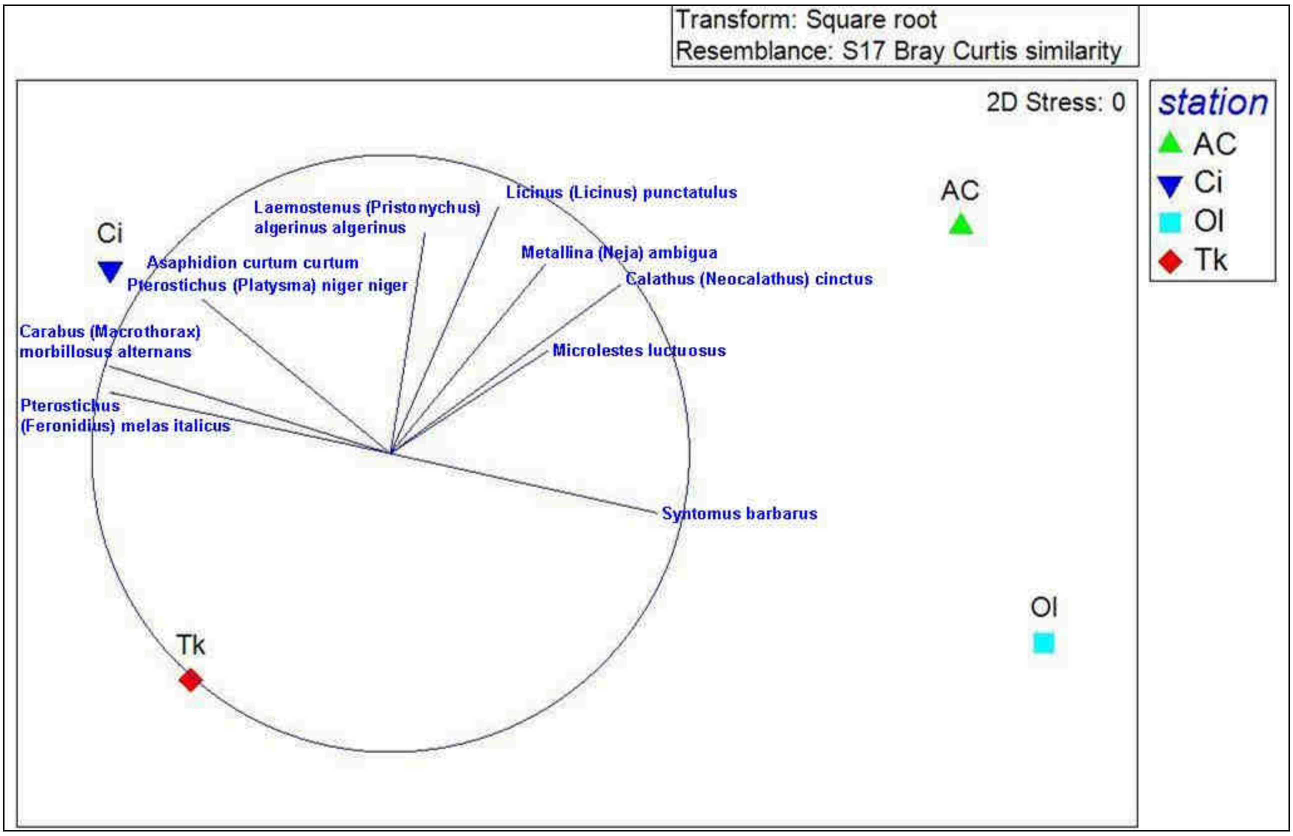
Groups	R Statistic	Significance Level %	Possible Permutations	Actual Permutations	Number >= Observed
AC/Ci	0,92	0,8	126	126	1
AC/Ol	0,96	0,8	126	126	1
AC/Tk	0,98	0,8	126	126	1
Ci/Ol	0,94	0,8	126	126	1
Ci/Tk	0,58	2,4	126	126	3
Ol/Tk	0,84	0,8	126	126	1

Tab. 9.1.16 - Pairwise tests based on the values of R observed for pair of stations in relation to species of Carabidae. The significance % refers to the number of values of R that fall within the range of expected frequencies compared to the total number of possible permutations.



Graph. 9.1.11 - Dendrogram of Bray Curtis similarity index values between the investigated stations of with regard to the species of Carabidae.

The Nonmetric Multi Dimensional Scaling (NMDS) in 2 D vision (graph. 9.1.12), elaborated on the Bray Curtis similarity matrix between stations, in relation to species of Carabidae indicates a strong dissimilarity between stations. ***Calathus* (*Neocalathus*) *cinctus***, ***Licinus* (*Licinus*) *punctatulus***, ***Microlestes luctuosus*** and ***Metallina* (*Neja*) *ambigua*** (this last exclusive of the station) are centered on station **AC** characterizing it clear from other stations. ***Asaphidion curtum curtum*** and ***Pterostichus* (*Platysma*) *niger niger*** are exclusive of station **Ci,** while ***Carabus (Macrothorax) morbillosus alternans*** and ***Pterostichus (Feronidius) melas italicus*** are in between the stations **Tk** and **Ci**, being more close to that last, differentiating that stations pair form the other. ***Laemostenus*** (***Pristonychus***) ***algerinus algerinus*** occupies an intermediate position between stations **AC** and **Ci**, and ***Syntomus barbarus*** results among the station **AC**, **Ol** and **Tk**.



Graph. 9.1.12 - Correlation between Nonmetric Multi Dimensional Scaling (NMDS) developed on the Bray Curtis similarity matrix between the stations and the species of Carabidae; in the figure are indicated only those most abundantly sampled and that determine the differences or similarities among the four stations.

In tables 9.1.17-9.1.22 are shown the species of Carabidae that determine the dissimilarity between the traps of each station. For each species is given the mean abundance in the traps (Av. Abund) and the mean dissimilarity (Av. Diss) between them in relation to each single species. In the fourth column is shown the value of the ratio between dissimilarity and standard deviation (Dis/SD), which provides an indication of the uniformity of distribution of the taxon in the samples: higher values indicate greater uniformity, lower values indicate little homogeneous distributions of catches. In the last two columns are shown the percentage contribution of each species of Carabidae in determining the overall average dissimilarity between the traps (Contrib%) and the cumulative percentage of species in question (Cum%) up to the threshold of 90%.

In general, the mean overall value of dissimilarity between stations varies from 62,07% of the pair **AC/Ol** and 84,19% of the pair **Ol/Tk**. By examination of the tables is also clear that for each comparison between pairs of stations already the first 2-3 species in order of abundance give a dissimilarity between stations with a contribution of about 50%.

Species that occur most frequently are: ***Calathus*** (***Neocalathus***) ***cinctus***, ***Laemostenus*** (***Pristonychus***) ***algerinus algerinus***, ***Pterostichus*** (***Feronidius***) ***melas italicus***, ***Carabus*** (***Macrothorax***) ***morbillosus alternans***, ***Syntomus barbarus***, ***Metallina*** (***Neja***) ***ambigua*** and ***Licinus*** (***Licinus***) ***punctatulus***.

Groups AC/Ci

Average dissimilarity = 79,25

Species	Group AC Av.Abund	Group Ci Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Calathus (Neocalathus) cinctus	15,25	2,03	26,47	3,37	33,4	33,4
Pterostichus (Feronidius) melas italicus	0	4,51	8,69	3,15	10,97	44,37
Laemostenus (Pristonychus) algerinus algerinus	4,91	2,3	5,64	1,42	7,11	51,48
Metallina (Neja) ambigua	2,22	0	4,14	1,03	5,22	56,71
Licinus (Licinus) punctatulus	2,18	0,4	3,74	2,12	4,72	61,43
Microlestes luctuosus	1,45	0	2,74	1,05	3,45	64,88
Asaphidion curtum curtum	0	1,34	2,59	1,15	3,27	68,15
Syntomus barbarus	1,14	0	2,22	1,6	2,8	70,95
Carabus (Macrothorax) morbillosus alternans	0,36	1,31	1,81	1,77	2,28	73,23
Pterostichus (Platysma) niger niger	0	0,97	1,72	0,71	2,17	75,41
Ocys harpaloides	0	0,7	1,36	1,18	1,71	77,12
Harpalus (Harpalus) distinguendus distinguendus	0,64	0	1,32	1,14	1,67	78,79
Platyderus (Platyderus) lombardii	0,45	0,51	1,28	1,05	1,62	80,41
Asaphidion rossii	0,2	0,63	1,26	0,82	1,59	82
Calathus (Neocalathus) mollis	0,59	0	1,24	1,15	1,56	83,56
Amara (Celia) montana	0,55	0	1,18	1,15	1,49	85,05
Laemostenus (Laemostenus) barbarus	0,63	0	1,17	0,78	1,48	86,53
Pseudoophonus (Pseudoophonus) rufipes	0	0,49	0,94	0,78	1,19	87,72
Trechus (Trechus) quadristriatus	0,44	0	0,91	0,75	1,14	88,86
Carabus (Eurycarabus) faminii sabellai	0,42	0	0,89	0,78	1,12	89,98
Platytarus faminii faminii	0	0,43	0,88	0,74	1,11	**91,09**

Tab. 9.1.17 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Ci** for species of Carabidae more abundantly sampled; additional explanations in the text.

Groups AC/Ol

Average dissimilarity = 62,07

Species	Group AC Av.Abund	Group Ol Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Calathus (Neocalathus) cinctus	15,25	6,61	19,63	2,68	31,62	31,62
Laemostenus (Pristonychus) algerinus algerinus	4,91	0,59	10,33	2,28	16,64	48,26
Licinus (Licinus) punctatulus	2,18	0	5,12	3,63	8,24	56,51
Metallina (Neja) ambigua	2,22	0	4,7	1,04	7,57	64,08
Microlestes luctuosus	1,45	0,18	3,07	1,14	4,95	69,02
Syntomus barbarus	1,14	1,07	1,64	1,22	2,64	71,67
Harpalus (Harpalus) distinguendus distinguendus	0,64	0	1,52	1,16	2,46	74,12
Calathus (Neocalathus) mollis	0,59	0,48	1,39	1,15	2,25	76,37
Amara (Celia) montana	0,55	0	1,36	1,16	2,19	78,56
Laemostenus (Laemostenus) barbarus	0,63	0	1,33	0,79	2,15	80,71
Platyderus (Platyderus) lombardii	0,45	0	1,14	0,77	1,84	82,55
Microlestes fissuralis	0,4	0,21	1,12	0,68	1,8	84,36
Olisthopus elongatus	0	0,44	1,04	0,77	1,68	86,04
Trechus (Trechus) quadristriatus	0,44	0	1,04	0,76	1,68	87,72
Carabus (Eurycarabus) faminii sabellai	0,42	0	1,02	0,79	1,65	89,37
Carabus (Macrothorax) morbillosus alternans	0,36	0	0,88	0,79	1,41	**90,78**

Tab. 9.1.18 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Ol** for species of Carabidae more abundantly sampled; additional explanations in the text.

Groups AC/Tk

Average dissimilarity = 82,17

Species	Group AC Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Calathus (Neocalathus) cinctus	15,25	0,42	37,39	7,07	45,5	45,5
Laemostenus (Pristonychus) algerinus algerinus	4,91	2,23	7,26	1,62	8,84	54,33
Licinus (Licinus) punctatulus	2,18	0	5,68	3,49	6,92	61,25
Metallina (Neja) ambigua	2,22	0	5,16	1,04	6,28	67,53
Microlestes luctuosus	1,45	0,45	3,32	1,22	4,04	71,57
Pterostichus (Feronidius) melas italicus	0	1,11	2,61	0,49	3,17	74,74
Syntomus barbarus	1,14	0,32	2,59	1,47	3,15	77,9
Carabus (Macrothorax) morbillosus alternans	0,36	0,82	1,93	1,14	2,35	80,25
Harpalus (Harpalus) distinguendus distinguendus	0,64	0	1,69	1,15	2,06	82,31
Laemostenus (Laemostenus) barbarus	0,63	0,24	1,64	0,92	2	84,31
Calathus (Neocalathus) mollis	0,59	0	1,59	1,16	1,93	86,24
Amara (Celia) montana	0,55	0	1,52	1,16	1,85	88,09
Platyderus (Platyderus) lombardii	0,45	0,29	1,51	0,89	1,83	89,92
Trechus (Trechus) quadristriatus	0,44	0	1,16	0,75	1,41	**91,34**

Tab. 9.1.19 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Tk** for species of Carabidae more abundantly sampled; additional explanations in the text.

Groups Ci/Ol

Average dissimilarity = 82,71

Species	Group Ci Av.Abund	Group Ol Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Calathus (Neocalathus) cinctus	2,03	6,61	19,49	1,72	23,57	23,57
Pterostichus (Feronidius) melas italicus	4,51	0	16,26	4,19	19,66	43,23
Laemostenus (Pristonychus) algerinus algerinus	2,3	0,59	6,26	2,13	7,57	50,8
Asaphidion curtum curtum	1,34	0	4,89	1,17	5,91	56,71
Carabus (Macrothorax) morbillosus alternans	1,31	0	4,89	6,59	5,91	62,62
Syntomus barbarus	0	1,07	4,28	1,63	5,17	67,79
Pterostichus (Platysma) niger niger	0,97	0	2,96	0,72	3,58	71,37
Ocys harpaloides	0,7	0	2,53	1,17	3,06	74,43
Asaphidion rossii	0,63	0	2,06	0,71	2,49	76,92
Platyderus (Platyderus) lombardii	0,51	0	2,05	0,79	2,48	79,4
Olisthopus elongatus	0	0,44	1,83	0,72	2,21	81,61
Calathus (Neocalathus) mollis	0	0,48	1,79	0,75	2,16	83,77
Pseudoophonus (Pseudoophonus) rufipes	0,49	0	1,77	0,79	2,14	85,91
Platytarus faminii faminii	0,43	0	1,74	0,71	2,1	88,01
Trechus (Trechus) rufulus	0,44	0	1,35	0,79	1,64	89,65
Licinus (Licinus) punctatulus	0,4	0	1,22	0,79	1,48	**91,13**

Tab. 9.1.20 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ci** and **Ol** for species of Carabidae more abundantly sampled; additional explanations in the text.

Groups Ci/Tk
Average dissimilarity = 67,80

Species	Group Ci Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Pterostichus (Feronidius) melas italicus	4,51	1,11	17,72	2,57	26,14	26,14
Calathus (Neocalathus) cinctus	2,03	0,42	8,43	1	12,44	38,57
Asaphidion curtum curtum	1,34	0	5,89	1,16	8,68	47,26
Carabus (Macrothorax) morbillosus alternans	1,31	0,82	3,9	1,47	5,75	53,01
Pterostichus (Platysma) niger niger	0,97	0	3,4	0,72	5,01	58,02
Laemostenus (Pristonychus) algerinus algerinus	2,3	2,23	3,22	1,48	4,75	62,78
Ocys harpaloides	0,7	0	3,02	1,15	4,45	67,23
Platyderus (Platyderus) lombardii	0,51	0,29	2,93	0,91	4,33	71,55
Asaphidion rossii	0,63	0	2,39	0,71	3,52	75,08
Platytarus faminii faminii	0,43	0	2,13	0,69	3,14	78,22
Pseudoophonus (Pseudoophonus) rufipes	0,49	0	2,12	0,79	3,13	81,35
Microlestes luctuosus	0	0,45	2,06	0,75	3,03	84,38
Trechus (Trechus) rufulus	0,44	0	1,55	0,79	2,29	86,67
Syntomus barbarus	0	0,32	1,46	0,47	2,15	88,82
Licinus (Licinus) punctatulus	0,4	0	1,41	0,79	2,07	**90,90**

Tab. 9.1.21 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ci** and **Tk** for species of Carabidae more abundantly sampled; additional explanations in the text.

Groups Ol/Tk
Average dissimilarity = 84,19

Species	Group Ol Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Calathus (Neocalathus) cinctus	6,61	0,42	39,1	3,27	46,45	46,45
Laemostenus (Pristonychus) algerinus algerinus	0,59	2,23	11,03	2,03	13,11	59,55
Syntomus barbarus	1,07	0,32	6,53	1,43	7,76	67,31
Pterostichus (Feronidius) melas italicus	0	1,11	5,83	0,48	6,93	74,24
Carabus (Macrothorax) morbillosus alternans	0	0,82	5,1	0,99	6,05	80,3
Olisthopus elongatus	0,44	0	3,19	0,71	3,79	84,09
Microlestes luctuosus	0,18	0,45	3,09	0,9	3,67	87,76
Calathus (Neocalathus) mollis	0,48	0	2,86	0,76	3,4	**91,16**

Tab. 9.1.22 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ol** and **Tk** for species of Carabidae more abundantly sampled; additional explanations in the text.

Species of Tenebrionidae

Looking at the dendrogram of similarity among traps based on the index of Bray-Curtis in relation to species of Tenebrionidae (graph. 9.1.13) it is evident that some of the clusters identified result different with each other in a statistically significance (p <0.5 at least %) according to the SIMPROF test.

5 clusters are individuated (at different level of similarity between 15% and 65%), significantly different from each, grouping:

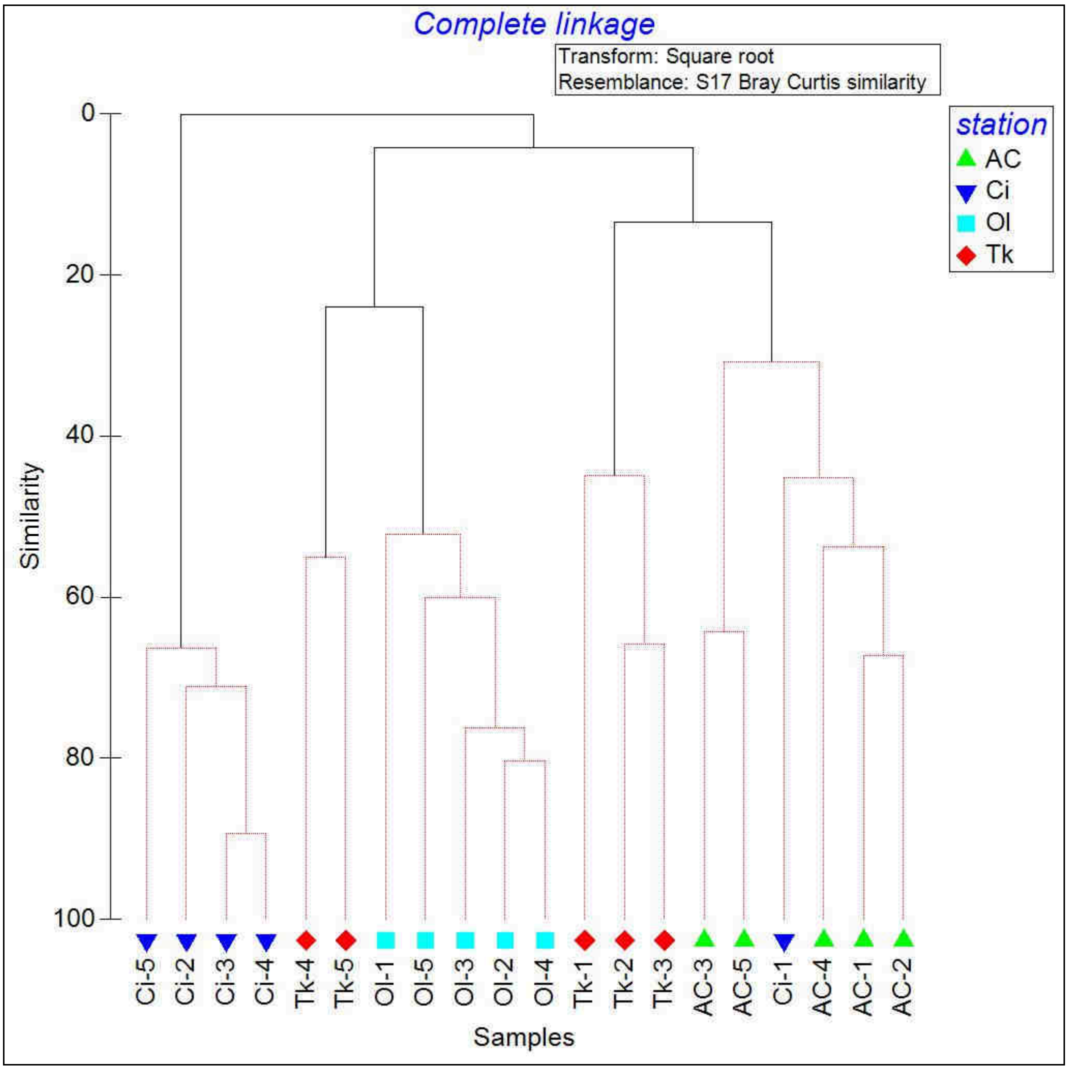
1. traps **Ci-2, Ci-3, Ci-4, Ci-5**;

2. traps **Tk-4** and **Tk-5**;

3. **all traps** of station **Ol**;

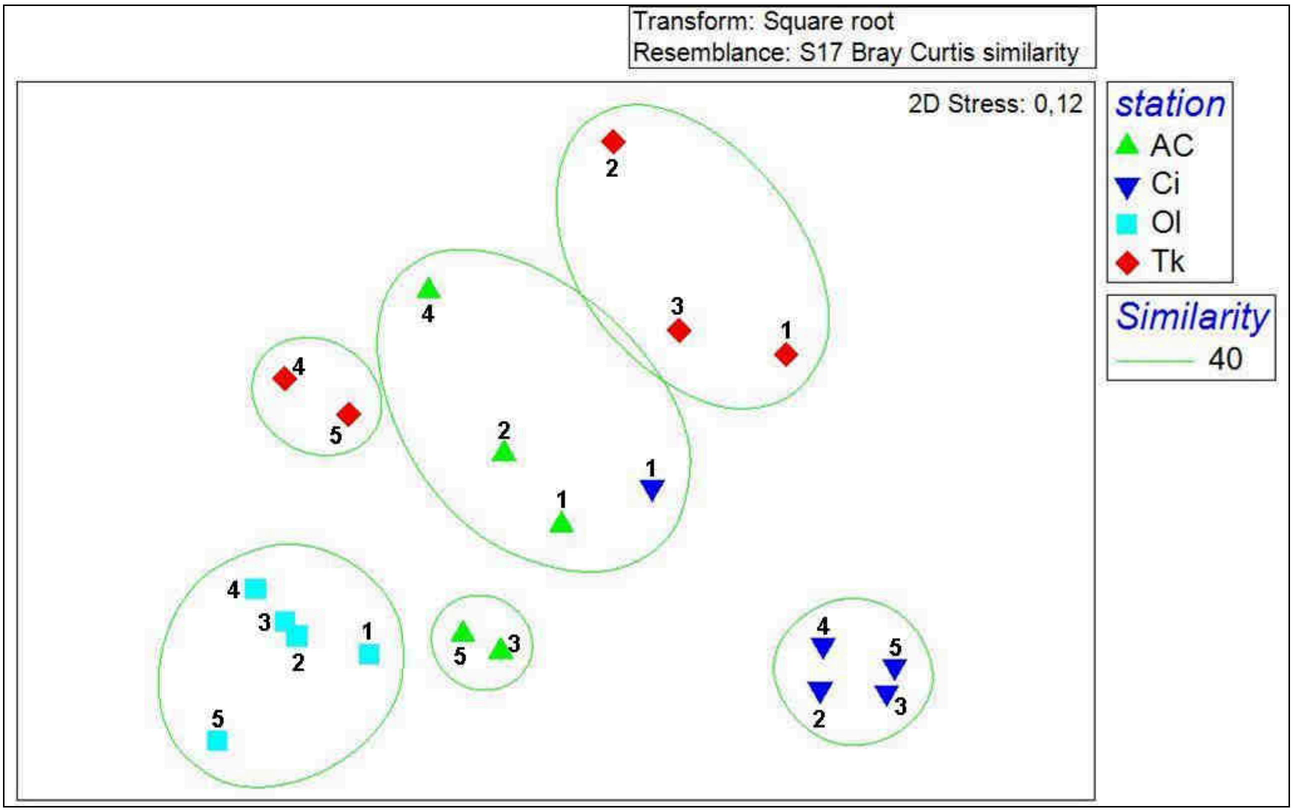
4. traps **Tk-1**, **Tk-2**, **Tk-3**;

5. **all traps** of station **AC** and trap **Ci-1**.

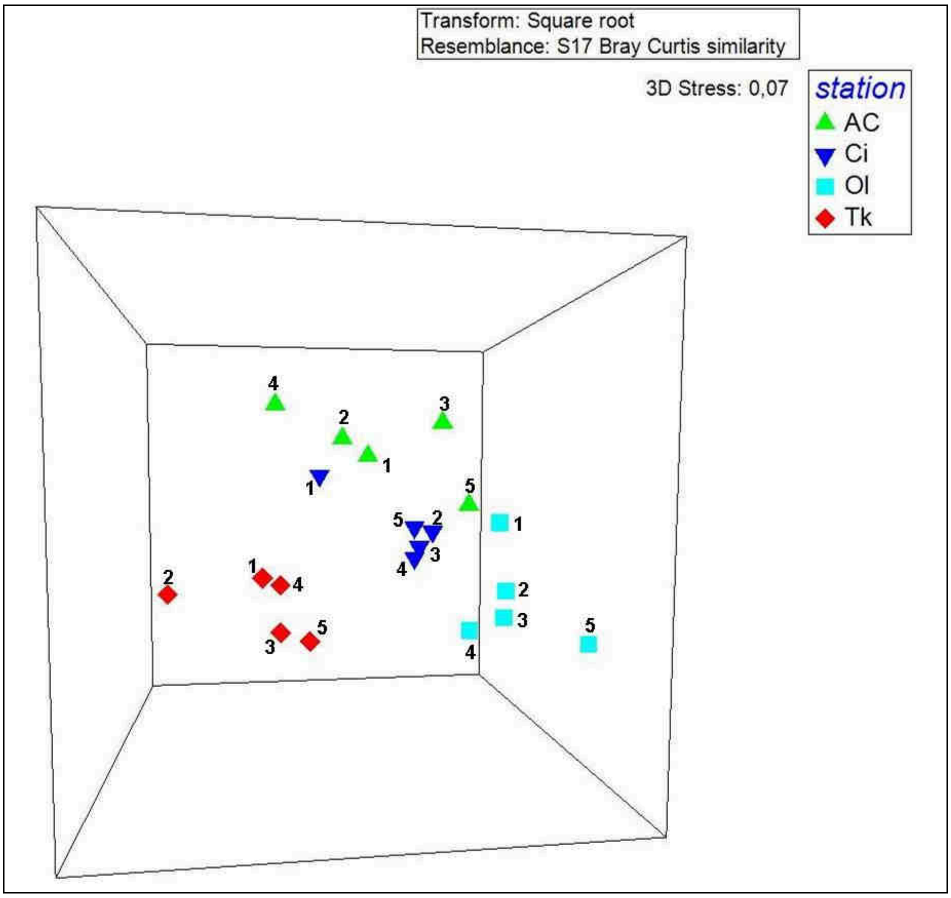


Graph. 9.1.13 – Dendrogram of values based on similarity index of Bray Curtis between the traps of stations investigated in relation to species of Tenebrionidae. The black lines show the clusters that are statistically significantly different (at least p <0,5%) according to the SIMPROF test.

The Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps, in relation to species of Tenebrionidae, both in 2 D (graph. 9.1.14) and 3 D (graph. 9.1.15) vision, shows (at a level of similarity around 40%) a cluster for traps of stations **Ol**, the two clusters for strap of station **Tk**, the two clusters for traps of station **AC** (with one that includes the trap **Ci-1**), the cluster of **Ci-2**, **Ci-3**, **Ci-4** and **Ci-5** away from all other.

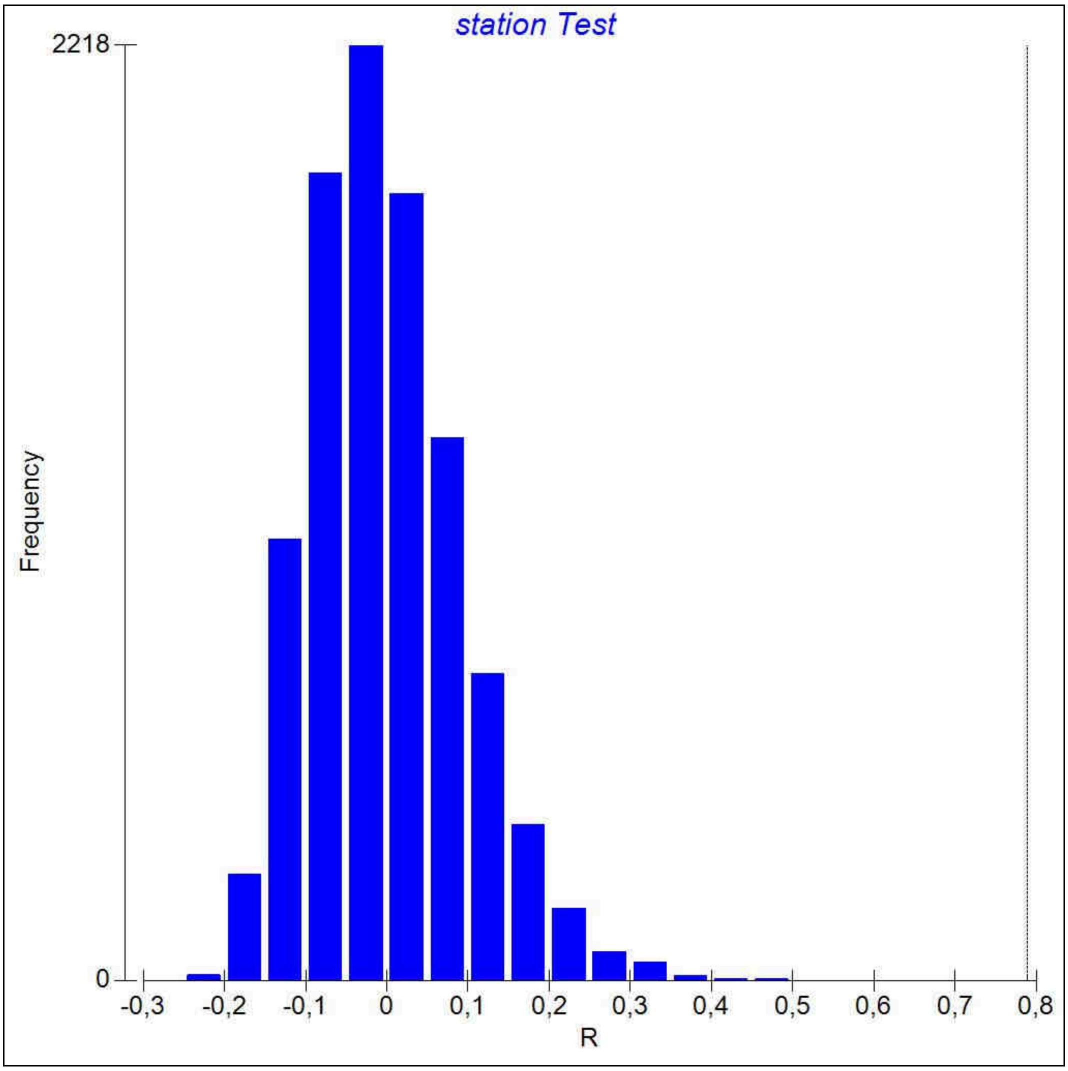


Graph. 9.1.14 – The Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps of investigated stations, in relation to species of Tenebrionidae (2 D vision).



Graph. 9.1.15 – Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps of investigated stations, in relation to species of Tenebrionidae (3 D vision).

The analysis shows that the traps of a station are, in most cases, more similar to each other than with the traps of other stations. The ANOSIM test (graph. 9.1.16) confirms this hypothesis with high statistical significance.



Graph. 9.1.16 – ANOSIM tests: distribution of expected frequencies of R (histogram) compared with the observed value of R (**0,79**) (continuous line) between the traps of the stations investigated in relation to species of Tenebrionidae.

In tables 9.1.23-9.1.26 are shown the species of Tenebrionidae that determine the similarity between the traps of each station. For each species is given the mean abundance in the traps (Av. Abund) and the mean similarity (Av. Sim) between them in relation to each single species. In the third column is shown the value of the ratio between similarity and standard deviation (Sim/SD), which provides an indication of the uniformity of distribution of the taxon in the samples: higher values indicate greater uniformity, lower values indicate little homogeneous distributions of catches. In the last two columns are shown the percentage contribution of each species of Tenebrionidae in determining the overall average similarity between the traps (Contrib%) and the cumulative percentage of species in question (Cum%) up to the threshold of 90%.

From analysis cames out that in general are 7 species, although with different weight in relation to individual stations, which contribute most to the determination of the similarity between the traps: ***Alphasida grossa sicula***, ***Akis spinosa spinosa***, ***Stenosis sardoa sardoa***, ***Stenosis melitana***, ***Tentyria grossa grossa***, ***Pimelia rugulosa sublaevigata*** and ***Zophosis punctata punctata***.

Group AC

Average similarity: 56,73

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Alphasida grossa sicula	5,17	18,97	3,98	33,44	33,44
Stenosis melitana	3,63	10,02	2,11	17,66	51,1
Akis spinosa spinosa	2,14	6,52	2,13	11,49	62,59
Stenosis sardoa sardoa	3,01	5,95	1,06	10,48	73,07
Tentyria grossa grossa	1,77	4,54	4,47	8,01	81,08
Scaurus striatus	1,58	3,32	1,15	5,85	86,93
Zophosis punctata punctata	2,33	1,35	0,59	2,38	89,31
Scaurus atratus	0,93	1,35	0,61	2,37	**91,68**

Tab. 9.1.23 – Average similarity between the traps and percentage contribution to the similarity of the species of Tenebrionidae in the **AC** station; further explanations in the text.

Group Ci

Average similarity: 59,70

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Stenosis sardoa sardoa	4,28	55,07	2,44	92,24	**92,24**

Tab. 9.1.24 – Average similarity between the traps and percentage contribution to the similarity of the species of Tenebrionidae in the **Ci** station; further explanations in the text.

Group Ol

Average similarity: 67,33

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Zophosis punctata punctata	10,53	20,44	3,41	30,35	30,35
Tentyria grossa grossa	6,12	15,93	3,33	23,66	54,01
Pimelia rugulosa sublaevigata	5,5	14,77	4,12	21,93	75,94
Alphasida grossa sicula	2,69	5,97	2,34	8,86	84,8
Stenosis sardoa sardoa	1,63	4,07	2,75	6,05	**90,85**

Tab. 9.1.25 – Average similarity between the traps and percentage contribution to the similarity of the species of Tenebrionidae in the **Ol** station; further explanations in the text.

Group Tk

Average similarity: 36,92

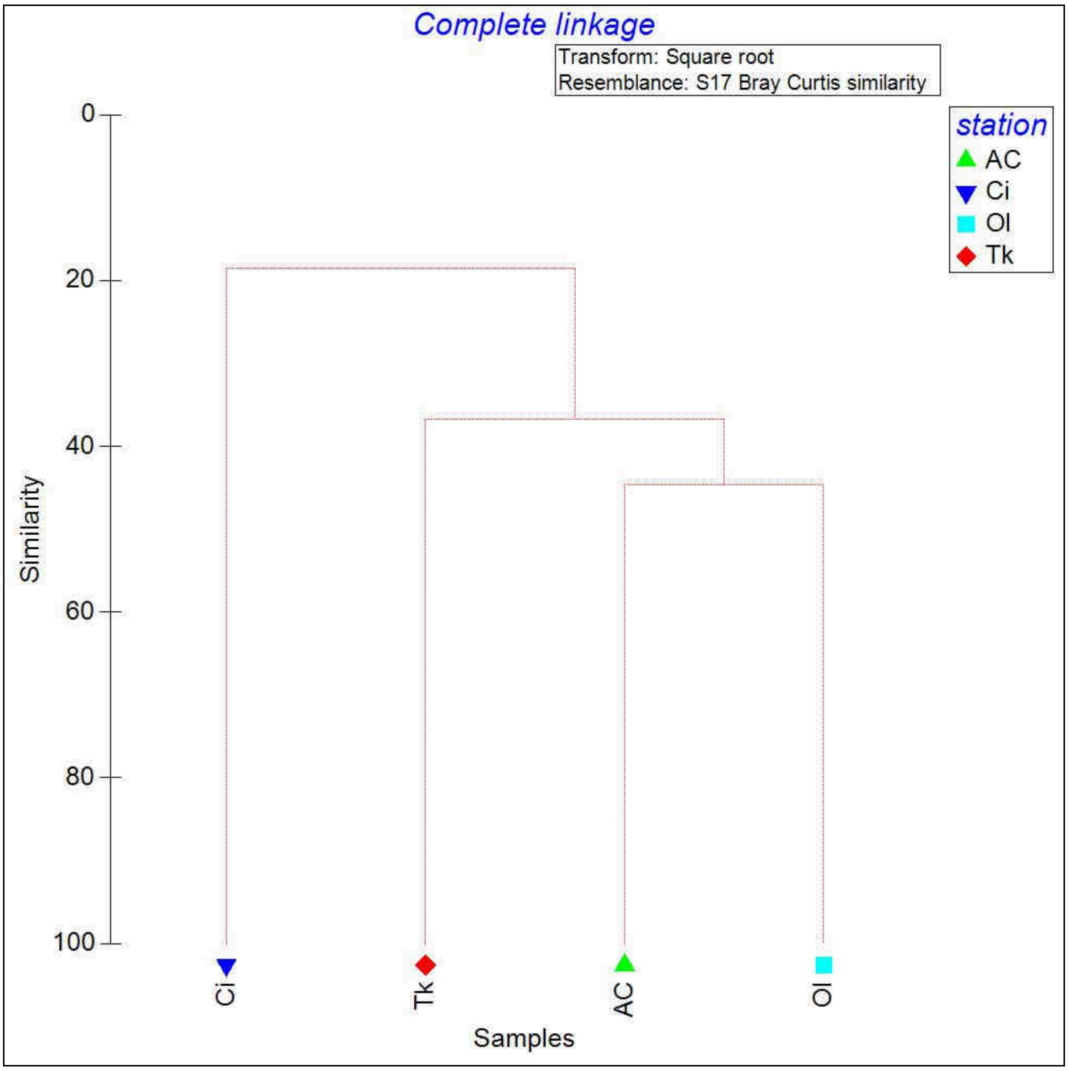
Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Akis spinosa spinosa	1,46	11,45	4,03	31,02	31,02
Dendarus lugens	1,52	9,32	0,61	25,24	56,26
Alphasida grossa sicula	1,07	6,05	1,03	16,39	72,65
Stenosis sardoa sardoa	0,86	4,05	0,55	10,97	83,62
Erodius siculus siculus	0,92	1,11	0,32	3,02	86,64
Scaurus tristis	1	1,11	0,32	3,02	89,66
Scaurus striatus	1,02	1,11	0,32	3,01	**92,67**

Tab. 9.1.26 – Average similarity between the traps and percentage contribution to the similarity of the species of Tenebrionidae in the **Tk** station; further explanations in the text.

The statistical significance of differences between the stations was calculated using the Parwise test, based on comparison of observed and expected values of R between pairs of stations (tab. 9.1.27). The analysis shows that all stations highly significant differ from each other; these are grouped together according to the index of Bray-Curtis (graph. 9.1.17) into three clusters: the first with about 45% similarity includes the station **AC** and **Ol**, the second with about 35% similarity includes the cluster **AC/Ol** and the station **Tk**, the third with about 20% similarity includes the cluster **AC/Ol/Tk** and the station **Ci**.

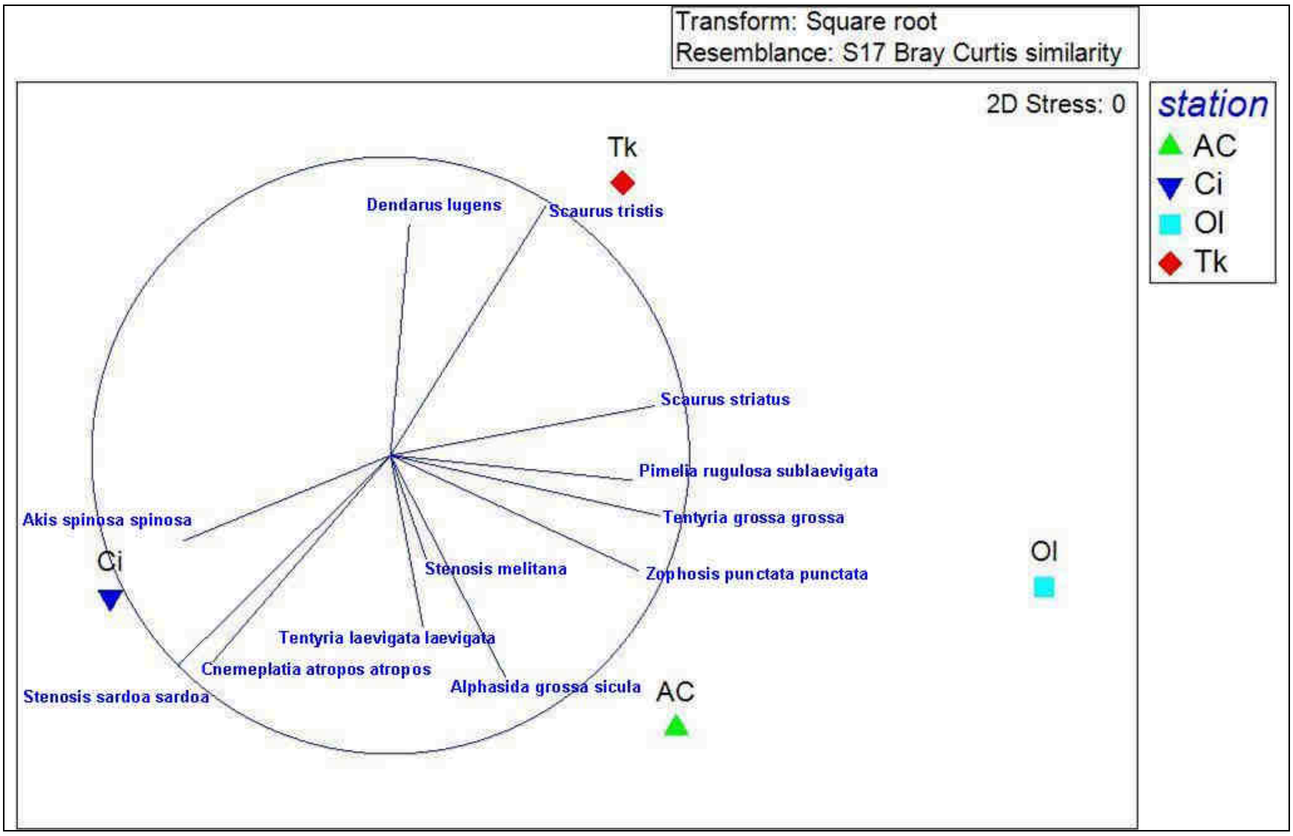
Groups	R Statistic	Significance Level %	Possible Permutations	Actual Permutations	Number >= Observed
AC/Ci	0,904	0,8	126	126	1
AC/Ol	0,908	0,8	126	126	1
AC/Tk	0,56	0,8	126	126	1
Ci/Ol	1	0,8	126	126	1
Ci/Tk	0,668	0,8	126	126	1
Ol/Tk	0,716	0,8	126	126	1

Tab. 9.1.27 - Pairwise tests based on the values of R observed for pair of stations in relation to species of Tenebrionidae. The significance % refers to the number of values of R that fall within the range of expected frequencies compared to the total number of possible permutations.



Graph. 9.1.17 - Dendrogram of Bray Curtis similarity index values between the investigated stations of with regard to the species of Tenebrionidae.

The Nonmetric Multi Dimensional Scaling (NMDS) in 2 D vision (graph. 9.1.18), elaborated on the Bray Curtis similarity matrix between stations, in relation to species of Tenebrionidae indicates a strong dissimilarity between stations. ***Dendarus lugens*** and ***Scaurus tristis*** are centered on station **Tk**; ***Zophosis punctata punctata***, ***Tentyria grossa grossa*** and ***Pimelia rugulosa sublaevigata*** characterize the station **Ol**; ***Stenosis melitana***, ***Alphasida grossa sicula*** and ***Tentyria laevigata laevigata*** (this last exclusive of the station **AC**), are centered on station **AC**. ***Cnemeplatia atrops*** and ***Stenosis sardoa sardoa*** occupies an intermediate position between stations **AC** and **Ci**.



Graph. 9.1.18 - Correlation between Nonmetric Multi Dimensional Scaling (NMDS) developed on the Bray Curtis similarity matrix between the stations and the species of Tenebrionidae; in the figure are indicated only those most abundantly sampled and that determine the differences or similarities among the four stations.

In tables 9.1.28-9.1.33 are shown the species of Tenebrionidae that determine the dissimilarity between the traps of each station. For each species is given the mean abundance in the traps (Av. Abund) and the mean dissimilarity (Av. Diss) between them in relation to each single species. In the fourth column is shown the value of the ratio between dissimilarity and standard deviation (Dis/SD), which provides an indication of the uniformity of distribution of the taxon in the samples: higher values indicate greater uniformity, lower values indicate little homogeneous distributions of catches. In the last two columns are shown the percentage contribution of each species of Tenebrionidae in determining the overall average dissimilarity between the traps (Contrib%) and the cumulative percentage of species in question (Cum%) up to the threshold of 90%.

In general, the mean overall value of dissimilarity between stations varies from 65,60% of the pair **AC/Ol** and 86,16% of the pair **Ci/Ol**. By examination of the tables is also clear that for each comparison between pairs of stations already the first 3-5 species in order of abundance give a dissimilarity between stations with a contribution of about 50%.

Among the families that occur most frequently are: ***Alphasida grossa sicula, Akis spinosa spinosa***, ***Stenosis sardoa sardoa***, ***Stenosis melitana***, ***Tentyria grossa grossa***, ***Pimelia rugulosa sublaevigata***, ***Zophosis punctata puntata*** and ***Dendarus lugens***.

Groups AC/Ci

Average dissimilarity = 74,89

Species	Group AC Av.Abund	Group Ci Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Alphasida grossa sicula	5,17	1,06	13,87	2	18,52	18,52
Stenosis melitana	3,63	0	11,56	2,61	15,43	33,95
Stenosis sardoa sardoa	3,01	4,28	7,57	0,86	10,11	44,06
Akis spinosa spinosa	2,14	0,92	7,36	2,22	9,82	53,88
Zophosis punctata punctata	2,33	0	5,47	0,78	7,3	61,18
Tentyria grossa grossa	1,77	0	5,17	3,29	6,91	68,09
Scaurus striatus	1,58	0	4,3	1,93	5,74	73,83
Tentyria laevigata laevigata	1,25	0	3,23	0,97	4,31	78,14
Opatroides punctulatus punctulatus	0,98	0	2,6	1,19	3,47	81,61
Cnemeplatia atropos atropos	0,66	0,55	2,46	0,98	3,29	84,9
Scaurus atratus	0,93	0	2,36	1,16	3,15	88,05
Allophylax picipes	0,6	0	2,11	1,06	2,82	**90,87**

Tab. 9.1.28 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Ci** for species of Tenebrionidae more abundantly sampled; additional explanations in the text.

Groups AC/Ol

Average dissimilarity = 65,60

Species	Group AC Av.Abund	Group Ol Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Zophosis punctata punctata	2,33	10,53	15,04	1,52	22,93	22,93
Pimelia rugulosa sublaevigata	0,17	5,5	9,55	3,09	14,56	37,49
Tentyria grossa grossa	1,77	6,12	7,88	1,98	12,02	49,51
Stenosis melitana	3,63	0	6,38	2,43	9,72	59,23
Alphasida grossa sicula	5,17	2,69	4,36	1,8	6,65	65,88
Stenosis sardoa sardoa	3,01	1,63	3,55	2,07	5,41	71,29
Akis spinosa spinosa	2,14	0,7	2,66	1,51	4,06	75,35
Tentyria laevigata laevigata	1,25	0	1,97	0,93	3	78,35
Scaurus striatus	1,58	1,55	1,81	1,17	2,76	81,11
Erodius siculus siculus	0	0,89	1,62	1,01	2,47	83,58
Opatroides punctulatus punctulatus	0,98	0,23	1,53	1,19	2,33	85,91
Scaurus atratus	0,93	0	1,46	1,17	2,22	88,12
Scaurus tristis	0	0,83	1,45	0,94	2,21	**90,34**

Tab. 9.1.29 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Ol** for species of Tenebrionidae more abundantly sampled; additional explanations in the text.

Groups AC/Tk

Average dissimilarity = 71,94

Species	Group AC Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Alphasida grossa sicula	5,17	1,07	12,39	2,58	17,22	17,22
Stenosis melitana	3,63	0,63	8,86	1,9	12,32	29,54
Stenosis sardoa sardoa	3,01	0,86	6,67	1,86	9,27	38,81
Zophosis punctata punctata	2,33	0	5,13	0,77	7,13	45,93
Dendarus lugens	0,35	1,52	4,75	1,01	6,6	52,54
Scaurus striatus	1,58	1,02	4,08	1,43	5,67	58,21
Tentyria grossa grossa	1,77	0,72	3,98	1,75	5,53	63,74
Akis spinosa spinosa	2,14	1,46	3,16	1,44	4,39	68,13
Tentyria laevigata laevigata	1,25	0	3,01	0,96	4,18	72,31
Scaurus tristis	0	1	2,58	0,7	3,58	75,89
Erodius siculus siculus	0	0,92	2,43	0,7	3,38	79,27
Opatroides punctulatus punctulatus	0,98	0	2,41	1,18	3,36	82,62
Scaurus atratus	0,93	0	2,2	1,16	3,06	85,68
Allophylax picipes	0,6	0	1,91	1,07	2,66	88,34
Probaticus tomentosus	0,48	0	1,73	0,65	2,41	**90,75**

Tab. 9.1.30 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Tk** for species of Tenebrionidae more abundantly sampled; additional explanations in the text.

Groups Ci/Ol

Average dissimilarity = 86,16

Species	Group Ci Av.Abund	Group Ol Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Zophosis punctata punctata	0	10,53	25,65	2,47	29,78	29,78
Tentyria grossa grossa	0	6,12	15,87	3,73	18,42	48,2
Pimelia rugulosa sublaevigata	0	5,5	14,43	3,88	16,74	64,94
Stenosis sardoa sardoa	4,28	1,63	7,03	2,13	8,16	73,11
Alphasida grossa sicula	1,06	2,69	5,69	1,29	6,6	79,7
Scaurus striatus	0	1,55	3,89	1,84	4,52	84,22
Akis spinosa spinosa	0,92	0,7	3,41	0,97	3,96	88,18
Erodius siculus siculus	0	0,89	2,4	1,03	2,79	**90,97**

Tab. 9.1.31 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ci** and **Ol** for species of Tenebrionidae more abundantly sampled; additional explanations in the text.

Groups Ci /Tk

Average dissimilarity = 79,67

Species	Group Ci Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Stenosis sardoa sardoa	4,28	0,86	21,35	2,32	26,8	26,8
Dendarus lugens	0	1,52	11,13	1,13	13,97	40,78
Akis spinosa spinosa	0,92	1,46	10,55	2,19	13,25	54,02
Alphasida grossa sicula	1,06	1,07	6,71	1,26	8,42	62,44
Scaurus striatus	0	1,02	4,72	0,73	5,92	68,36
Scaurus tristis	0	1	4,61	0,74	5,78	74,14
Erodius siculus siculus	0	0,92	4,42	0,72	5,54	79,69
Stenosis melitana	0	0,63	3,57	0,79	4,48	84,16
Tentyria grossa grossa	0	0,72	3,46	0,7	4,34	88,5
Cnemeplatia atropos atropos	0,55	0	3,33	0,74	4,18	**92,68**

Tab. 9.1.32 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ci** and **Tk** for species of Tenebrionidae more abundantly sampled; additional explanations in the text.

Groups Ol/Tk

Average dissimilarity = 77,06

Species	Group Ol Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Zophosis punctata punctata	10,53	0	23,99	2,38	31,13	31,13
Tentyria grossa grossa	6,12	0,72	13,19	2,55	17,12	48,25
Pimelia rugulosa sublaevigata	5,5	0,51	12,25	3,07	15,89	64,14
Alphasida grossa sicula	2,69	1,07	4,47	1,12	5,8	69,94
Dendarus lugens	0	1,52	4,01	1,13	5,21	75,15
Scaurus striatus	1,55	1,02	3,5	1,56	4,55	79,69
Scaurus tristis	0,83	1	2,81	1,12	3,65	83,34
Erodius siculus siculus	0,89	0,92	2,77	1,2	3,59	86,94
Stenosis sardoa sardoa	1,63	0,86	2,45	1,37	3,17	**90,11**

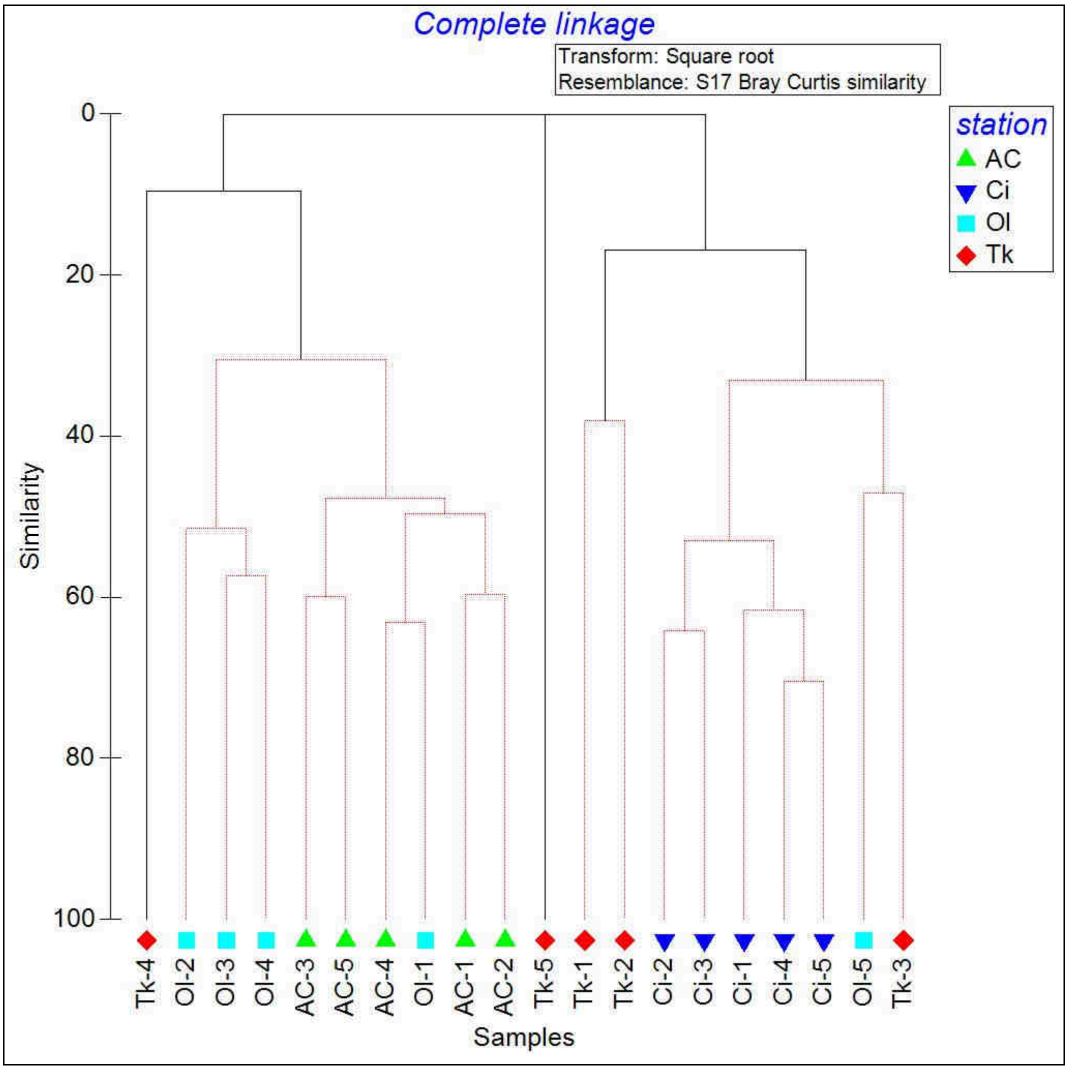
Tab. 9.1.33 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ol** and **Tk** for species of Tenebrionidae more abundantly sampled; additional explanations in the text.

SPECIES OF STAPHYLINIDAE

Looking at the dendrogram of similarity among traps based on the index of Bray-Curtis in relation to species of Staphylinidae (graph. 9.1.19) it is evident that some of the clusters identified result different with each other in a statistically significance (p <0.5 at least %) according to the SIMPROF test.

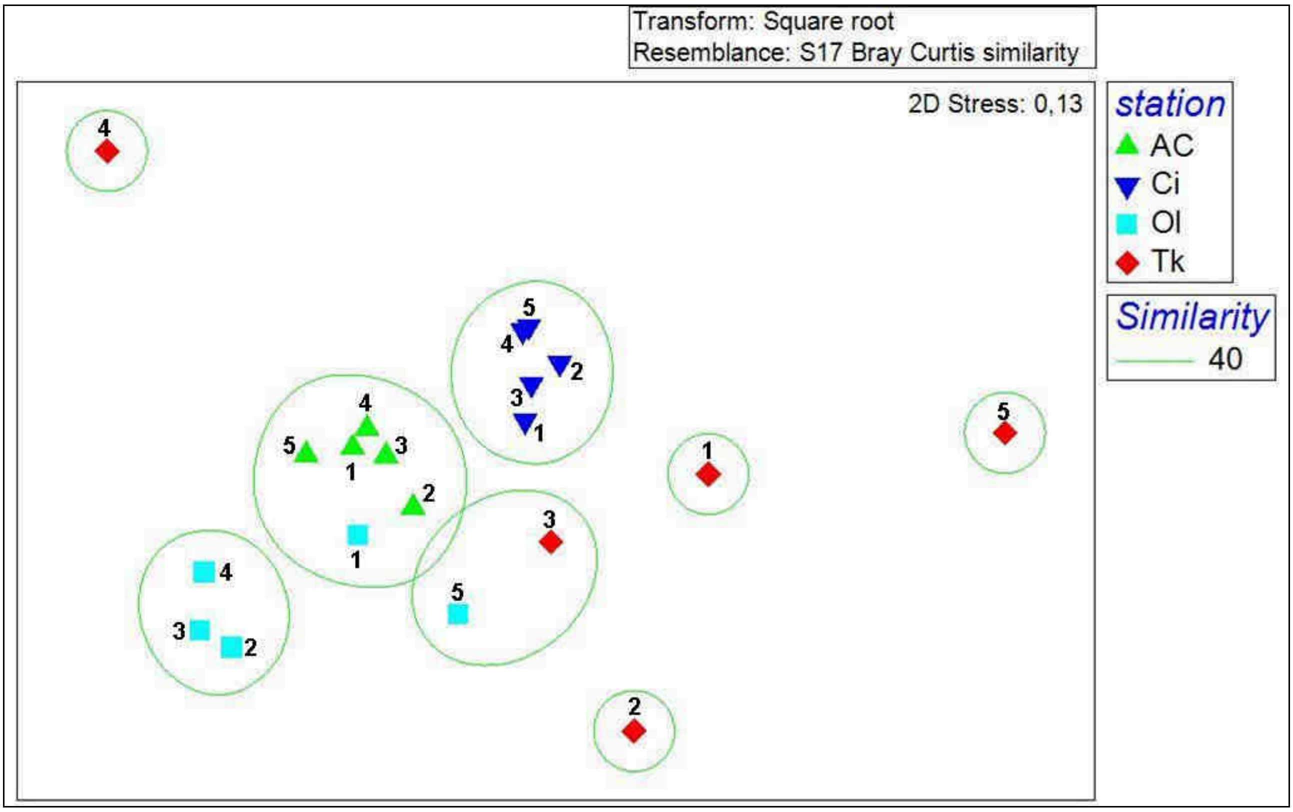
5 clusters are individuated (at level of similarity about 30%), significantly different from each, grouping:

1. trap **Tk-4**;
2. **all traps** of station **AC** and traps **Ol-1**, **Ol-2**, **Ol-3** and **Ol-4**;
3. trap **Tk-5**;
4. traps **Tk-1** and **Tk-2**;
5. all traps of station **Ci** and traps **Ol-5** and **Tk-3**.

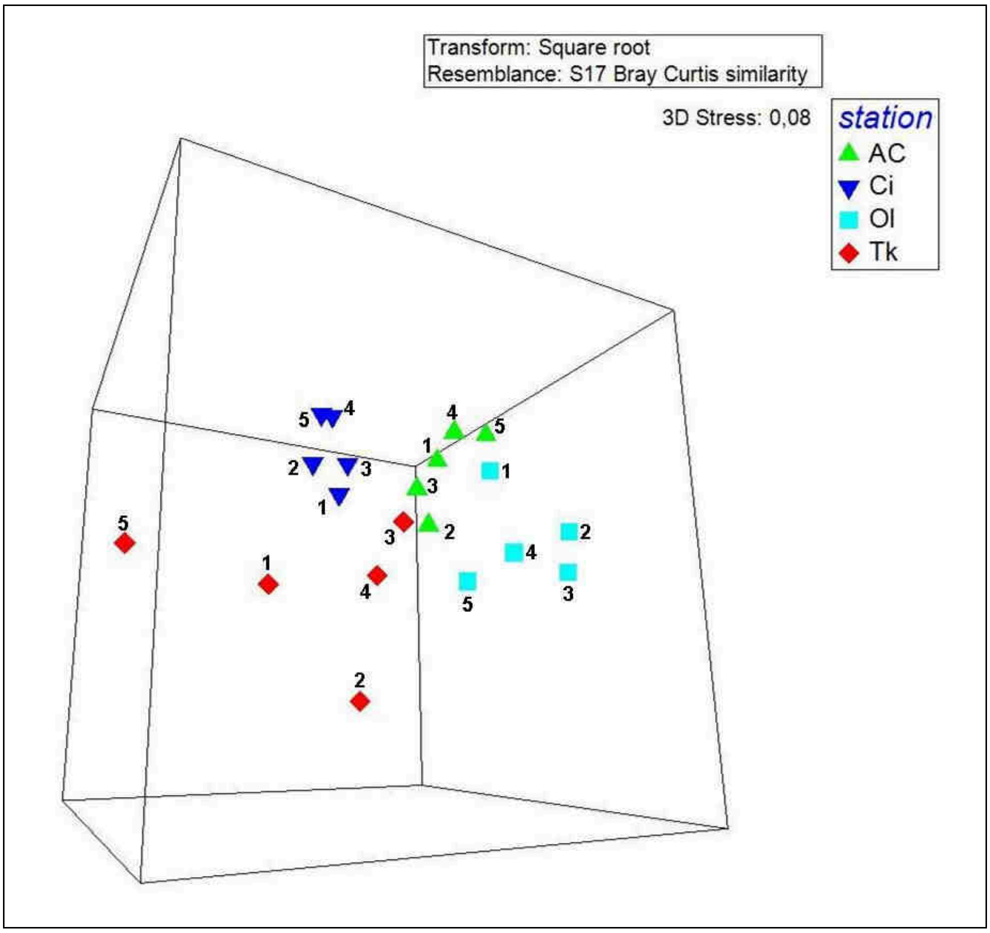


Graph. 9.1.19 – Dendrogram of values based on similarity index of Bray Curtis between the traps of stations investigated in relation to species of Staphylinidae. The black lines show the clusters that are statistically significantly different (at least p <0,5%) according to the SIMPROF test.

The Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps, in relation to species ofStaphylinidae, both in 2 D (graph. 9.1.20) and 3 D (graph. 9.1.21) vision, shows (at a level of similarity around 40%) the cluster for traps of stations **Ci**, the cluster for the entire station **AC** and **Ol-1**, the cluster for traps **Ol-1**, **Ol-2** and **Ol-4**, the cluster for traps **Ol-5** and **Tk-3**, and traps **Tk-1**, **Tk-2**, **Tk-4** and **Tk-5** individually highly isolated.

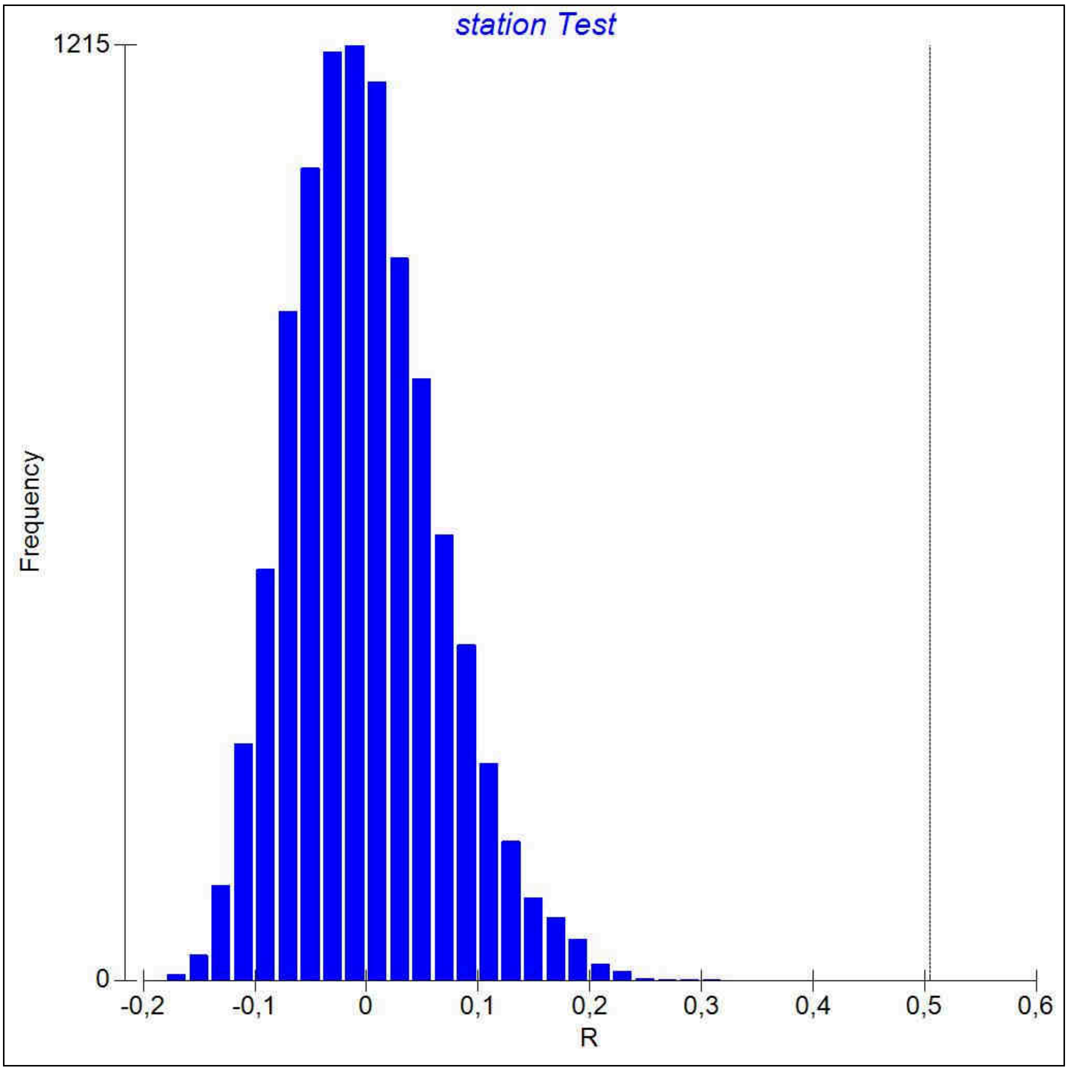


Graph. 9.1.20 – The Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps of investigated stations, in relation to species of Staphylinidae (2 D vision).



Graph. 9.1.21 – Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between the traps of investigated stations, in relation to species of Staphylinidae (3 D vision).

The analysis shows that the traps of a station are, in most cases, more similar to each other than with the traps of other stations. The ANOSIM test (graph. 9.1.22) confirms this hypothesis with medium statistical significance.



Graph. 9.1.22 – ANOSIM tests: distribution of expected frequencies of R (histogram) compared with the observed value of R (**0,51**) (continuous line) between the traps of the stations investigated in relation to species of Staphylinidae.

In tables 9.1.34-9.1.37 are shown the species of Staphylinidae that determine the similarity between the traps of each station. For each speies is given the mean abundance in the traps (Av. Abund) and the mean similarity (Av. Sim) between them in relation to each single species. In the third column is shown the value of the ratio between similarity and standard deviation (Sim/SD), which provides an indication of the uniformity of distribution of the taxon in the samples: higher values indicate greater uniformity, lower values indicate little homogeneous distributions of catches. In the last two columns are shown the percentage contribution of each species of Staphylinidae in determining the overall average similarity between the traps (Contrib%) and the cumulative percentage of species in question (Cum%) up to the threshold of 90%.

From analysis cames out that in general are 6 species, although with different weight in relation to individual stations, which contribute most to the determination of the similarity between the traps: ***Ocypus* (*Ocypus*) *olens olens***, ***Sepedophilus nigripennis***, ***Anotylus speculifrons***, ***Anotylus inustus***, ***Paraphloeostiba gayndahensis*** and ***Tachyporus nitidulus***.

Group AC
Average similarity: 58,51

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Ocypus (Ocypus) olens olens	5,15	21,09	4,44	36,04	36,04
Sepedophilus nigripennis	3,45	11,86	4,75	20,28	56,32
Anotylus speculifrons	2,41	9,53	6,3	16,29	72,61
Megalinus glabratus	1,38	5,25	2,91	8,97	81,58
Xantholinus (Typholinus) graecus graecus	1,16	3,02	1,09	5,17	86,74
Xantholinus (Calolinus) rufipennis	0,97	1,76	0,62	3,01	89,76
Tachyporus nitidulus	0,94	1,61	0,61	2,76	**92,52**

Tab. 9.1.34 – Average similarity between the traps and percentage contribution to the similarity of the species of Staphylinidae in the **AC** station; further explanations in the text.

Group Ci
Average similarity: 59,76

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Ocypus (Ocypus) olens olens	8,12	34,64	7,16	57,96	57,96
Sepedophilus nigripennis	1,61	6,41	5,28	10,72	68,68
Paraphloeostiba gayndahensis	2,05	5,48	1,09	9,17	77,85
Anotylus speculifrons	1,42	5,33	6,25	8,92	86,77
Tasgius (Tasgius) pedator siculus	1,07	3,31	1,14	5,53	**92,30**

Tab. 9.1.35 – Average similarity between the traps and percentage contribution to the similarity of the species of Staphylinidae in the **Ci** station; further explanations in the text.

Group Ol
Average similarity: 43,21

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Sepedophilus nigripennis	2,8	15,29	3,36	35,38	35,38
Ocypus (Ocypus) olens olens	2,49	8,81	1,92	20,4	55,78
Anotylus inustus	1,94	8,39	3,59	19,41	75,19
Xantholinus (Typholinus) graecus graecus	1,14	4,87	1,14	11,26	86,45
Anotylus speculifrons	0,59	1,88	0,6	4,35	**90,80**

Tab. 9.1.36 – Average similarity between the traps and percentage contribution to the similarity of the species of Staphylinidae in the **Ol** station; further explanations in the text.

Group Tk
Average similarity: 15,57

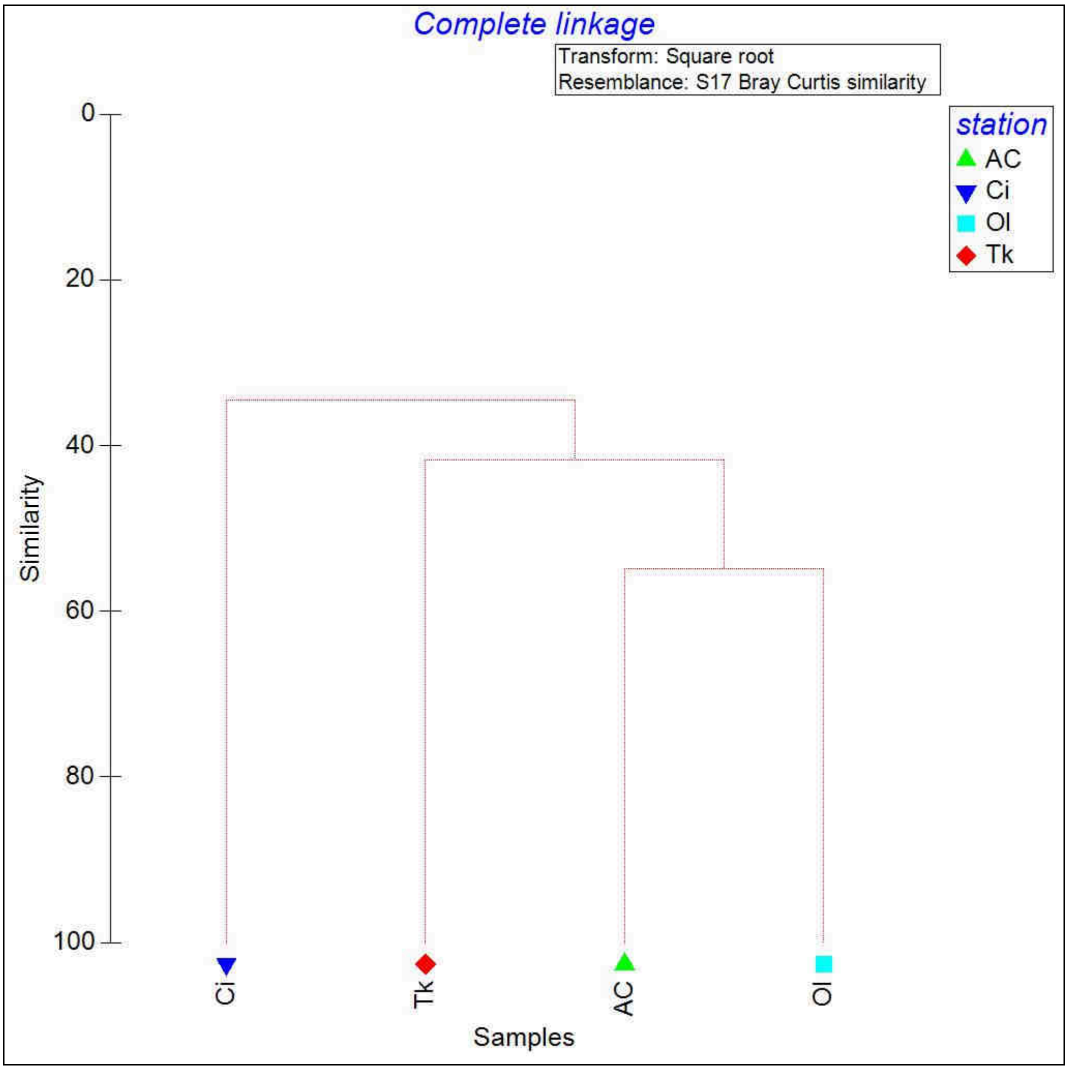
Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Ocypus (Ocypus) olens olens	2,49	8,76	0,6	56,24	56,24
Paraphloeostiba gayndahensis	0,88	3	0,32	19,29	75,53
Tachyporus nitidulus	0,49	2,18	0,32	14	89,53
Ocypus (Ocypus) ophthalmicus	0,36	0,88	0,32	5,63	**95,16**

Tab. 9.1.37 – Average similarity between the traps and percentage contribution to the similarity of the species of Staphylinidae in the **Tk** station; further explanations in the text.

The statistical significance of differences between the stations was calculated using the Parwise test, based on comparison of observed and expected values of R between pairs of stations (tab. 9.1.38). The analysis shows that all stations highly significant differ from each other; these are grouped together according to the index of Bray-Curtis (graph. 9.1.23) into three clusters: the first with about 55% similarity includes the station **AC** and **Ol**, the second with about 45% similarity includes the cluster **AC/Ol** and the station **Tk**, the third with about 35% similarity includes the cluster **AC/Ol/Tk** and the station **Ci**.

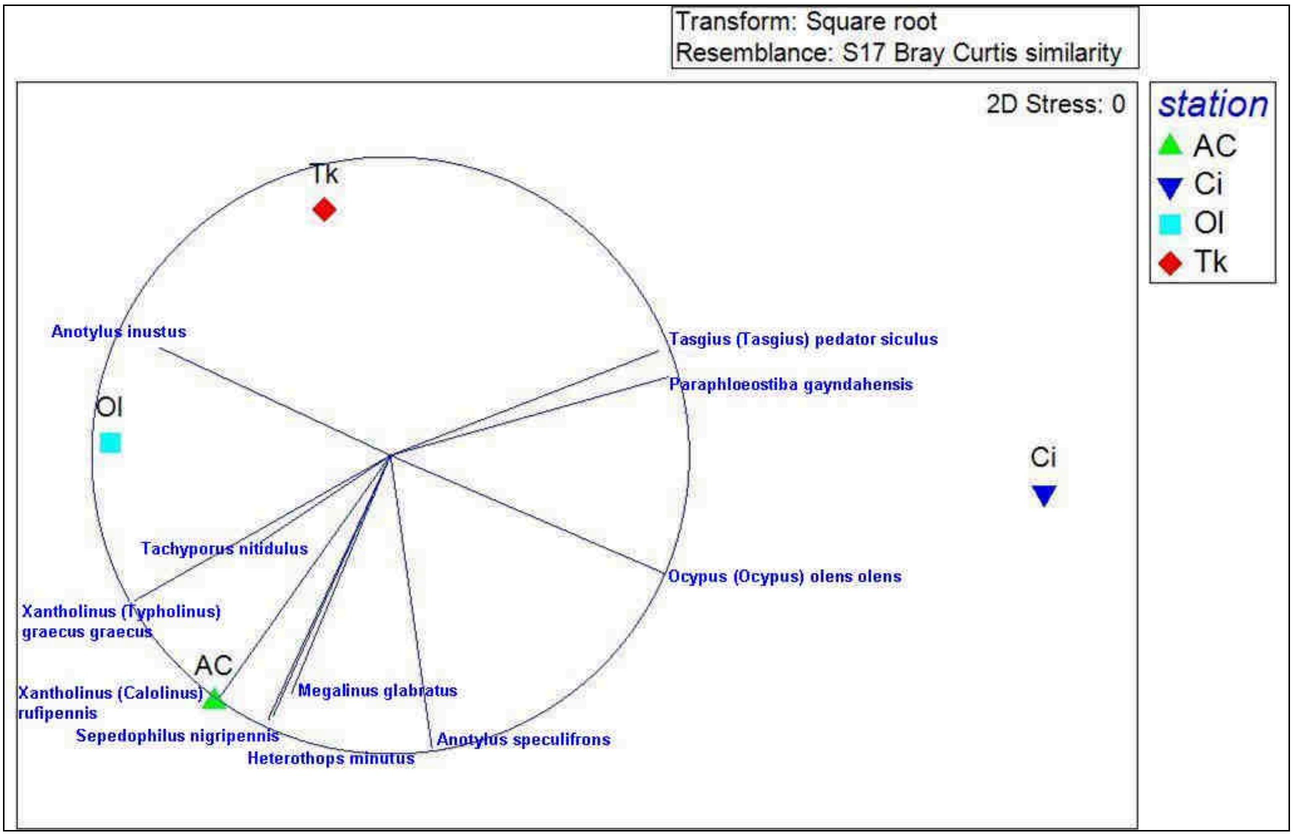
Groups	R Statistic	Significance Level %	Possible Permutations	Actual Permutations	Number >= Observed
AC/Ci	0,98	0,8	126	126	1
AC/Ol	0,508	1,6	126	126	2
AC/Tk	0,404	0,8	126	126	1
Ci/Ol	0,84	0,8	126	126	1
Ci/Tk	0,322	1,6	126	126	2
Ol/Tk	0,374	0,8	126	126	1

Tab. 9.1.38 - Pairwise tests based on the values of R observed for pair of stations in relation to species of Staphylinidae. The significance % refers to the number of values of R that fall within the range of expected frequencies compared to the total number of possible permutations.



Graph. 9.1.23 - Dendrogram of Bray Curtis similarity index values between the investigated stations of with regard to the species of Staphylinidae.

The Nonmetric Multi Dimensional Scaling (NMDS) in 2 D vision (graph. 9.1.24), elaborated on the Bray Curtis similarity matrix between stations, in relation species of Staphylinidae indicates a strong dissimilarity between stations. ***Tasgius* (*Tasgius*) *pedator siculus*** and ***Paraphloeostiba gayndahensis*** are centered on station **Ci**; ***Ocypus* (*Ocypus*) *olens olens*** occupies an intermediate position between stations **AC** and **Ci;** even ***Anotylus speculifrons*** results among those two stations, although more close to **AC**. ***Heterothops minutus***, ***Xantholinus* (*Calolinus*) *rufipennis*** and ***Megalinus glabratus***, (this last exclusive of the station **AC**), are centered on station **AC**. ***Xantholinus* (*Typholinus*) *graecus graecus*** and ***Tachyporus nitidulus*** occupies an intermediate position between stations **AC** and **Ol**, while ***Anotylus inustus*** in between the stations **Ol** and **Tk**.



Graph. 9.1.24 - Correlation between Nonmetric Multi Dimensional Scaling (NMDS) developed on the Bray Curtis similarity matrix between the stations and the species of Staphylinidae; in the figure are indicated only those most abundantly sampled and that determine the differences or similarities among the four stations.

In tables 9.1.39-9.1.44 are shown the species of Staphylinidae that determine the dissimilarity between the traps of each station. For each species is given the mean abundance in the traps (Av. Abund) and the mean dissimilarity (Av. Diss) between them in relation to each single species. In the fourth column is shown the value of the ratio between dissimilarity and standard deviation (Dis/SD), which provides an indication of the uniformity of distribution of the taxon in the samples: higher values indicate greater uniformity, lower values indicate little homogeneous distributions of catches. In the last two columns are shown the percentage contribution of each species of Staphylinidae in determining the overall average dissimilarity between the traps (Contrib%) and the cumulative percentage of species in question (Cum%) up to the threshold of 90%.

In general, the mean overall value of dissimilarity between stations varies from 58,76% of the pair **AC/Ol** and 81,47% of the pair **Ol/Tk**. By examination of the tables is also clear that for each comparison between pairs of stations already the first 3-5 species in order of abundance give a dissimilarity between stations with a contribution that varies from about 40% to 50%.

Among the families that occur most frequently are: ***Ocypus* (*Ocypus*) *olens olens*, *Sepedophilus nigripennis*, *Paraphloeostiba gayndahensis*, *Anotylus speculifrons*** and ***Anotylus inustus***.

Groups AC/Ci
Average dissimilarity = 58,95

Species	Group AC Av.Abund	Group Ci Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Ocypus (Ocypus) olens olens	5,15	8,12	7,19	1,79	12,19	12,19
Paraphloeostiba gayndahensis	0,21	2,05	4,67	1,44	7,92	20,11
Sepedophilus nigripennis	3,45	1,61	4,36	1,42	7,4	27,51
Megalinus glabratus	1,38	0	3,43	2,71	5,82	33,33
Anotylus speculifrons	2,41	1,42	2,75	1,65	4,67	38
Xantholinus (Typholinus) graecus graecus	1,16	0	2,73	1,65	4,63	42,63
Tasgius (Tasgius) pedator siculus	0	1,07	2,53	1,86	4,29	46,92
Xantholinus (Calolinus) rufipennis	0,97	0	2,26	1,1	3,83	50,75
Tachyporus nitidulus	0,94	0	2,23	1,11	3,79	54,54
Stenus cfr. elegans	0	0,95	2,22	1,14	3,76	58,3
Heterothops minutus	0,73	0,21	1,92	0,89	3,25	61,55
Rugilus (Rugilus) orbiculatus	0	0,65	1,53	0,79	2,6	64,15
Anotylus complanatus	0,61	0,24	1,47	0,89	2,49	66,64
Sepedophilus marshami	0,59	0	1,44	1,15	2,45	69,09
Tachyporus pusillus	0,56	0	1,38	0,71	2,34	71,43
Mycetoporus baudueri	0,47	0	1,24	0,76	2,11	73,54
Platystethus (Craetopycrus) nitens	0	0,42	1,13	0,79	1,91	75,44
Sunius (Sunius) algiricus	0	0,42	1	0,78	1,69	77,14
Anotylus sculpturatus	0,41	0	0,97	0,79	1,65	78,79
Tachinus flavolimbatus	0	0,4	0,96	0,78	1,64	80,42
Anotylus inustus	0,36	0	0,81	0,78	1,38	81,8
Quedius (Quedius) levicollis	0	0,37	0,79	0,79	1,33	83,13
Euryporus aeneiventris	0	0,34	0,71	0,49	1,21	84,34
Omalium rugatum	0,34	0	0,69	0,49	1,17	85,51
Domene (Domene) stilicina	0	0,24	0,67	0,49	1,13	86,64
Quedius (Raphirus) humeralis	0,23	0	0,63	0,48	1,06	87,7
Proteinus atomarius	0	0,23	0,62	0,49	1,06	88,76
Anotylus nitidulus	0	0,21	0,56	0,49	0,94	89,7
Gabrius nigritulus	0	0,21	0,56	0,49	0,94	**90,64**

Tab. 9.1.39 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Ci** for species of Staphylinidae more abundantly sampled; additional explanations in the text.

Groups AC/Ol
Average dissimilarity = 58,76

Species	Group AC Av.Abund	Group Ol Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Ocypus (Ocypus) olens olens	5,15	2,49	8,86	1,44	15,08	15,08
Anotylus speculifrons	2,41	0,59	5,15	2,36	8,77	23,85
Anotylus inustus	0,36	1,94	4,54	1,3	7,73	31,58
Megalinus glabratus	1,38	0	4,03	2,63	6,87	38,45
Sepedophilus nigripennis	3,45	2,8	3,77	1,33	6,42	44,86
Tachyporus nitidulus	0,94	0	2,61	1,11	4,45	49,31
Xantholinus (Calolinus) rufipennis	0,97	0,24	2,55	1,1	4,34	53,65
Xantholinus (Typholinus) graecus graecus	1,16	1,14	2,36	1,35	4,01	57,67
Heterothops minutus	0,73	0,26	2,29	0,89	3,9	61,56
Tachyporus pusillus	0,56	0,63	2,24	0,97	3,81	65,37
Mycetoporus baudueri	0,47	0,47	1,79	1,01	3,05	68,42
Sepedophilus marshami	0,59	0,27	1,79	1,18	3,05	71,47
Ocypus (Pseudocypus) sericeicollis	0	0,62	1,61	0,73	2,73	74,2
Micropeplus staphylinoides	0,27	0,47	1,51	0,86	2,57	76,77
Anotylus complanatus	0,61	0	1,49	0,76	2,53	79,3
Astenus (Astenopleuritus) melanurus	0	0,52	1,37	0,78	2,33	81,63
Astenus (Astenus) lyonessius	0,19	0,42	1,34	0,88	2,29	83,92
Anotylus sculpturatus	0,41	0	1,14	0,78	1,93	85,85
Philonthus (Philonthus) concinnus	0	0,44	1,09	0,49	1,85	87,7
Omalium rugatum	0,34	0	0,78	0,49	1,33	89,04
Quedius (Raphirus) humeralis	0,23	0	0,75	0,48	1,28	**90,31**

Tab. 9.1.40 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Ol** for species of Staphylinidae more abundantly sampled; additional explanations in the text.

Groups AC/Tk
Average dissimilarity = 78,12

Species	Group AC Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Ocypus (Ocypus) olens olens	5,15	2,49	13,64	1,55	17,46	17,46
Sepedophilus nigripennis	3,45	0,24	11,2	3	14,33	31,8
Anotylus speculifrons	2,41	0	8,9	3,61	11,4	43,19
Megalinus glabratus	1,38	0	5,23	2,59	6,7	49,89
Xantholinus (Typholinus) graecus graecus	1,16	0,18	3,78	1,49	4,84	54,74
Paraphloeostiba gayndahensis	0,21	0,88	3,48	0,93	4,46	59,2
Xantholinus (Calolinus) rufipennis	0,97	0	3,33	1,07	4,26	63,45
Tachyporus nitidulus	0,94	0,49	3,17	1,23	4,06	67,51
Heterothops minutus	0,73	0,17	2,93	0,91	3,76	71,27
Tachyporus pusillus	0,56	0,24	2,34	0,79	3	74,27
Anotylus inustus	0,36	0,53	2,33	0,85	2,99	77,25
Sepedophilus marshami	0,59	0,18	2,1	1,07	2,69	79,94
Mycetoporus baudueri	0,47	0	1,96	0,74	2,51	82,45
Anotylus complanatus	0,61	0	1,83	0,77	2,35	84,79
Anotylus sculpturatus	0,41	0	1,46	0,77	1,87	86,66
Proteinus atomarius	0	0,43	1,32	0,78	1,69	88,36
Micropeplus staphylinoides	0,27	0,2	1,28	0,69	1,64	90
Ocypus (Ocypus) ophthalmicus	0	0,36	1,2	0,77	1,53	**91,53**

Tab. 9.1.41 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **AC** and **Tk** for species of Staphylinidae more abundantly sampled; additional explanations in the text.

Groups Ci/Ol

Average dissimilarity = 71,75

Species	Group Ci Av.Abund	Group Ol Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Ocypus (Ocypus) olens olens	8,12	2,49	16,72	2,12	23,3	23,3
Paraphloeostiba gayndahensis	2,05	0	5,97	1,38	8,32	31,62
Anotylus inustus	0	1,94	5,6	1,74	7,8	39,42
Sepedophilus nigripennis	1,61	2,8	3,69	1,23	5,15	44,57
Xantholinus (Typholinus) graecus graecus	0	1,14	3,46	1,5	4,82	49,39
Tasgius (Tasgius) pedator siculus	1,07	0,18	2,76	1,6	3,85	53,24
Stenus cfr. elegans	0,95	0	2,63	1,12	3,67	56,91
Anotylus speculifrons	1,42	0,59	2,42	1,36	3,37	60,28
Rugilus (Rugilus) orbiculatus	0,65	0,24	1,97	0,89	2,75	63,03
Tachyporus pusillus	0	0,63	1,66	0,75	2,32	65,35
Ocypus (Pseudocypus) sericeicollis	0	0,62	1,63	0,73	2,28	67,63
Mycetoporus baudueri	0	0,47	1,55	0,78	2,16	69,79
Philonthus (Philonthus) concinnus	0,18	0,44	1,39	0,64	1,94	71,73
Astenus (Astenopleuritus) melanurus	0	0,52	1,39	0,78	1,94	73,67
Platystethus (Craetopycrus) nitens	0,42	0	1,37	0,78	1,91	75,59
Micropeplus staphylinoides	0	0,47	1,34	0,76	1,87	77,46
Astenus (Astenus) lyonessius	0	0,42	1,24	0,77	1,73	79,19
Sunius (Sunius) algiricus	0,42	0	1,19	0,77	1,66	80,85
Tachinus flavolimbatus	0,4	0	1,15	0,77	1,61	82,46
Domene (Domene) stilicina	0,24	0,23	1,15	0,65	1,6	84,06
Heterothops minutus	0,21	0,26	1,02	0,67	1,42	85,48
Ocypus (Ocypus) ophthalmicus	0,2	0,18	0,92	0,65	1,28	86,76
Quedius (Quedius) levicollis	0,37	0	0,91	0,79	1,27	88,03
Euryporus aeneiventris	0,34	0	0,82	0,49	1,15	89,18
Sepedophilus marshami	0	0,27	0,78	0,48	1,09	**90,27**

Tab. 9.1.42 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ci** and **Ol** for species of Staphylinidae more abundantly sampled; additional explanations in the text.

Groups Ci /Tk

Average dissimilarity = 74,81

Species	Group Ci Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Ocypus (Ocypus) olens olens	8,12	2,49	22,9	1,82	30,62	30,62
Paraphloeostiba gayndahensis	2,05	0,88	6,47	1,2	8,65	39,27
Anotylus speculifrons	1,42	0	5,27	3,15	7,04	46,31
Sepedophilus nigripennis	1,61	0,24	4,97	2,39	6,64	52,95
Tasgius (Tasgius) pedator siculus	1,07	0,24	3,54	1,47	4,74	57,69
Stenus cfr. elegans	0,95	0	3,38	1,08	4,52	62,21
Rugilus (Rugilus) orbiculatus	0,65	0	2,34	0,78	3,13	65,34
Tachyporus nitidulus	0	0,49	2	0,77	2,67	68,01
Platystethus (Craetopycrus) nitens	0,42	0	1,85	0,78	2,47	70,48
Proteinus atomarius	0,23	0,43	1,8	0,84	2,41	72,89
Ocypus (Ocypus) ophthalmicus	0,2	0,36	1,57	0,82	2,1	74,99
Anotylus inustus	0	0,53	1,54	0,48	2,06	77,05
Sunius (Sunius) algiricus	0,42	0	1,54	0,76	2,06	79,1
Tachinus flavolimbatus	0,4	0	1,5	0,76	2,01	81,11
Quedius (Quedius) levicollis	0,37	0	1,12	0,79	1,5	82,62
Domene (Domene) stilicina	0,24	0	1,1	0,48	1,47	84,09
Heterothops minutus	0,21	0,17	1,08	0,68	1,45	85,53
Omalium cinnamomeum	0	0,24	1,06	0,48	1,42	86,95
Euryporus aeneiventris	0,34	0	1,01	0,49	1,35	88,3
Anotylus nitidulus	0,21	0	0,9	0,48	1,21	89,51
Gabrius nigritulus	0,21	0	0,9	0,48	1,21	**90,72**

Tab. 9.1.43 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ci** and **Tk** for species of Staphylinidae more abundantly sampled; additional explanations in the text.

Groups Ol/Tk

Average dissimilarity = 81,47

Species	Group Ol Av.Abund	Group Tk Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Sepedophilus nigripennis	2,8	0,24	12,56	2,37	15,42	15,42
Ocypus (Ocypus) olens olens	2,49	2,49	12,13	1,72	14,89	30,31
Anotylus inustus	1,94	0,53	9,03	1,6	11,08	41,39
Xantholinus (Typholinus) graecus graecus	1,14	0,18	5,67	1,3	6,95	48,35
Paraphloeostiba gayndahensis	0	0,88	4,56	0,75	5,6	53,95
Anotylus speculifrons	0,59	0	3,19	1,04	3,92	57,87
Tachyporus pusillus	0,63	0,24	3,01	0,88	3,69	61,56
Mycetoporus baudueri	0,47	0	2,95	0,76	3,63	65,18
Tachyporus nitidulus	0	0,49	2,71	0,72	3,32	68,51
Ocypus (Pseudocypus) sericeicollis	0,62	0	2,59	0,74	3,18	71,68
Micropeplus staphylinoides	0,47	0,2	2,52	0,83	3,09	74,77
Astenus (Astenopleuritus) melanurus	0,52	0	2,23	0,78	2,74	77,51
Astenus (Astenus) lyonessius	0,42	0	2,1	0,76	2,58	80,09
Ocypus (Ocypus) ophthalmicus	0,18	0,36	1,77	0,81	2,17	82,26
Heterothops minutus	0,26	0,17	1,71	0,68	2,1	84,35
Sepedophilus marshami	0,27	0,18	1,69	0,63	2,07	86,42
Philonthus (Philonthus) concinnus	0,44	0	1,68	0,48	2,06	88,49
Proteinus atomarius	0	0,43	1,68	0,77	2,06	**90,54**

Tab. 9.1.44 – Average dissimilarity between stations and percentage contribution to the dissimilarity between the stations of **Ol** and **Tk** for species of Staphylinidae more abundantly sampled; additional explanations in the text.

10 COMPARISON AMONG INVESTIGATED STATIONS DURING THE PRESENT RESEARCH AND STATIONS OF A PREVIOUS RESEARCH (BOCCHIERI 2009)

10.1 METHODS

The results obtained from the present field research have been compared with the result of a previous research conducted, from July to December 2007, using the same method within the same area (R.N.O. "Pino d'Aleppo") in different habitat typology: 3 natural *Pinus halepensis* woods, 1 maquis, 2 garrigues, 1 meadow, 1 artificial Pine reforestation (BOCCHIERI 2009). Figure 10.1.1 shows the location of these stations, together with the four station so far discussed.

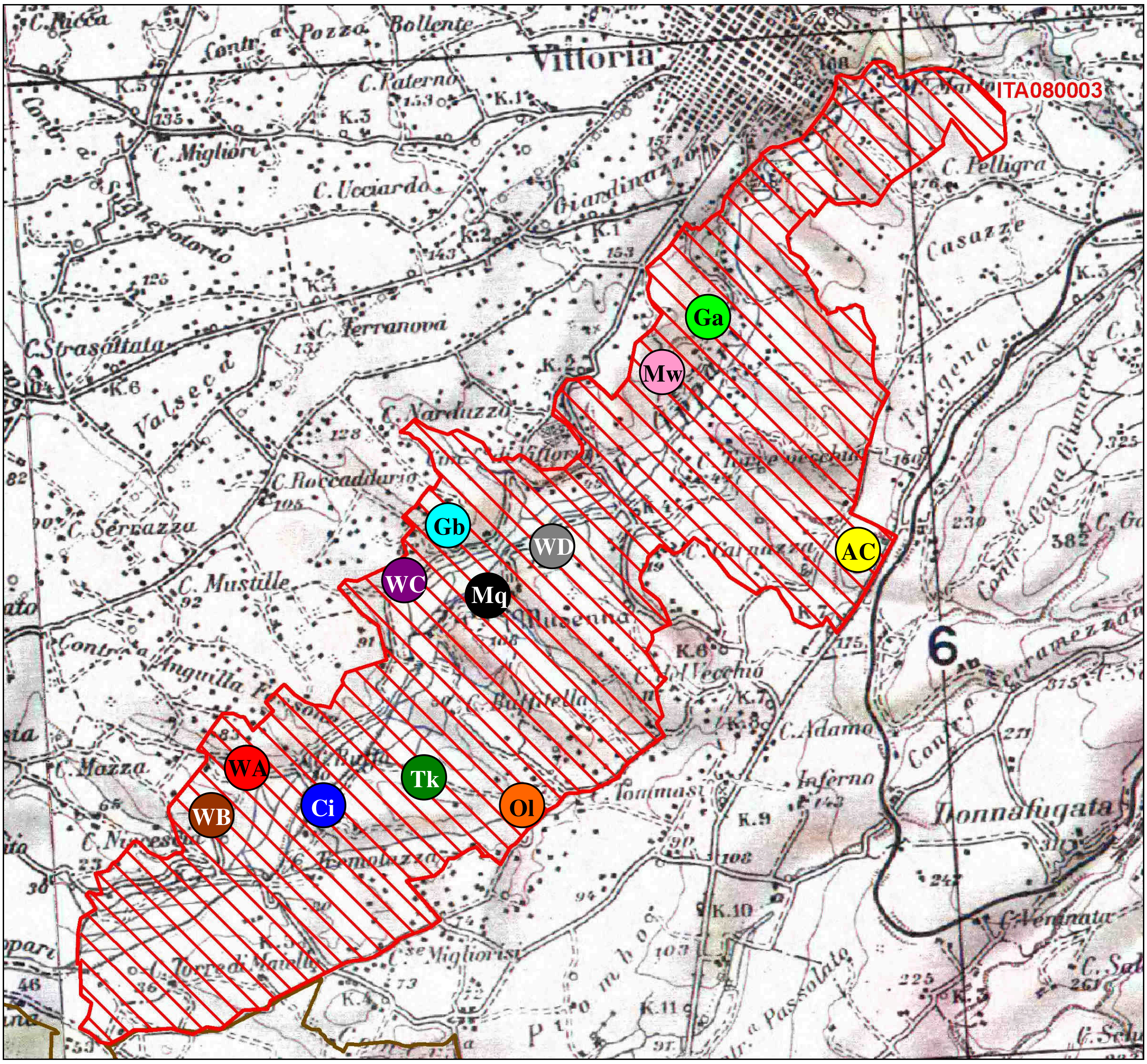


Fig. 10.1.1 – Position of researching stations. Brown: **WB** (*P. halepensis* Wood 2); Red: **WA** (*P. halepensis* Wood 1); Bleu: **Ci** (Citrus-grove); Green: **Tk** (*P. halepensis -Q. calliprinos* Thicket); Orange: **Ol** (Olive-grove); Violet: **WC** (*P. halepensis* Wood 3); Black: **Mq** (Maquis); light Bleu: **Gb** (Garrigue 2); Grey: **WD** (Pine artificial reforestation); Yellow: **AC** (Arable-land with Carob trees); Pink: **Mw** (Meadow); light Green: **Ga** (Garrigue 1).

The comparison was conducted in terms of species of Carabidae, Tenebrionidae and Staphylinidae (excluding Aleocharinae) frequencies during 5 period identified with the months of July, August, September, October and December.

10.2 BRIEF DESCRIPTION OF STUDY-2009 STATIONS

Station WA (*P. halepensis* Wood 1)

Pinus halepensis natural forest on flat sandy substrate with abundant litter: is a residual of natural forest of *Pinus halepensis* inserted into a complex and articulated mosaic which includes cultivated areas (olive trees, citrus trees and crops), Pine and Eucalyptus artificial reforestation, fallows and scrubland.

Station WB (*P. halepensis* Wood 2)

Pinus halepensis natural forest on a slight sloping characterized by large clearings: is a small residual of natural forest *Pinus halepensis* very sparse, part of a complex and articulated mosaic which includes crops, greenhouses, artificial reforestations of Pine and Eucalyptus, ornamental gardens, fallows and scrubland.

Station WC (*P. halepensis* Wood 3)

Pinus halepensis natural forest on very steep ground with little litter: is a natural forest of *Pinus halepensis* on steep ground, with marly substrate and low accumulation of litter. It is inserted in a relatively complex environmental mosaic which includes arable land, ruderal vegetation, small villages, low scrub with wild olive, mastic and cistus.

Station WD (Pine artificial reforestation)

Reforestation of recent planting on burned land: is an *Pinus halepensis* recent reforestation on burned soil relatively steep. It is inserted in a relatively complex environmental mosaic which includes arable land, small villages, scrubland with *Erica multiflora*, bushes and brambles and woodland of natural Aleppo pine.

Station Mq (Maquis)

Scrubs on high sloping ground with calcareous substrates: this is a bush environment inserted in a mosaic complex and articulated including crops, orchards, olive groves, small villages, arid grasslands, bushes, brambles and scrubs with wild olive and mastic.

Station Ga (Garrigue 1)

Scrubland on steep and calcareous soils: this is garrigue with mastic and dwarf palm, placed in a highly fragmented and complex environmental mosaic which includes crops, greenhouses, orchards, carrubeti, complex crops systems, ruderal vegetation, artificial Pine reforestation, meadows and fallows.

Station Gb (Garrigue 2)

Scrubland on a slight slope and sandy soil with poor litter substrate: this is a natural formation of *Pinus halepensis* on steep ground, with marly substrate soil and little accumulation of litter. It is inserted in a relatively complex environmental mosaic which includes arable land, olive groves, agricultural complex systems, small villages, shrubs and bushes, low scrub with wild olive, mastic, *Pinus halepensis*.

Station Mw (Meadow)

Meadow on limestone terrain with poor cover by *Ononis ramosissima*: this is a dry grassland with cover dominated by *Ononis ramosissima*, inserted into a mosaic which includes crops, greenhouses, orchards, agricultural complex systems, artificial Pine reforestation, fallows and scrubland.

10.3 GENERAL RESULTS ANALYSIS

During the compared period in the 12 stations considered within the Riserva Naturale Orientata "Pino d'Aleppo" were surveyed a total, expressed in CSD, of **3.930,8** captures, cumulative of Carabidae, Tenebrionidae and Staphylinidae (with exclusion of Aleocharinae) which are representative of **87** species and subspecies (tab. 10.3.1).

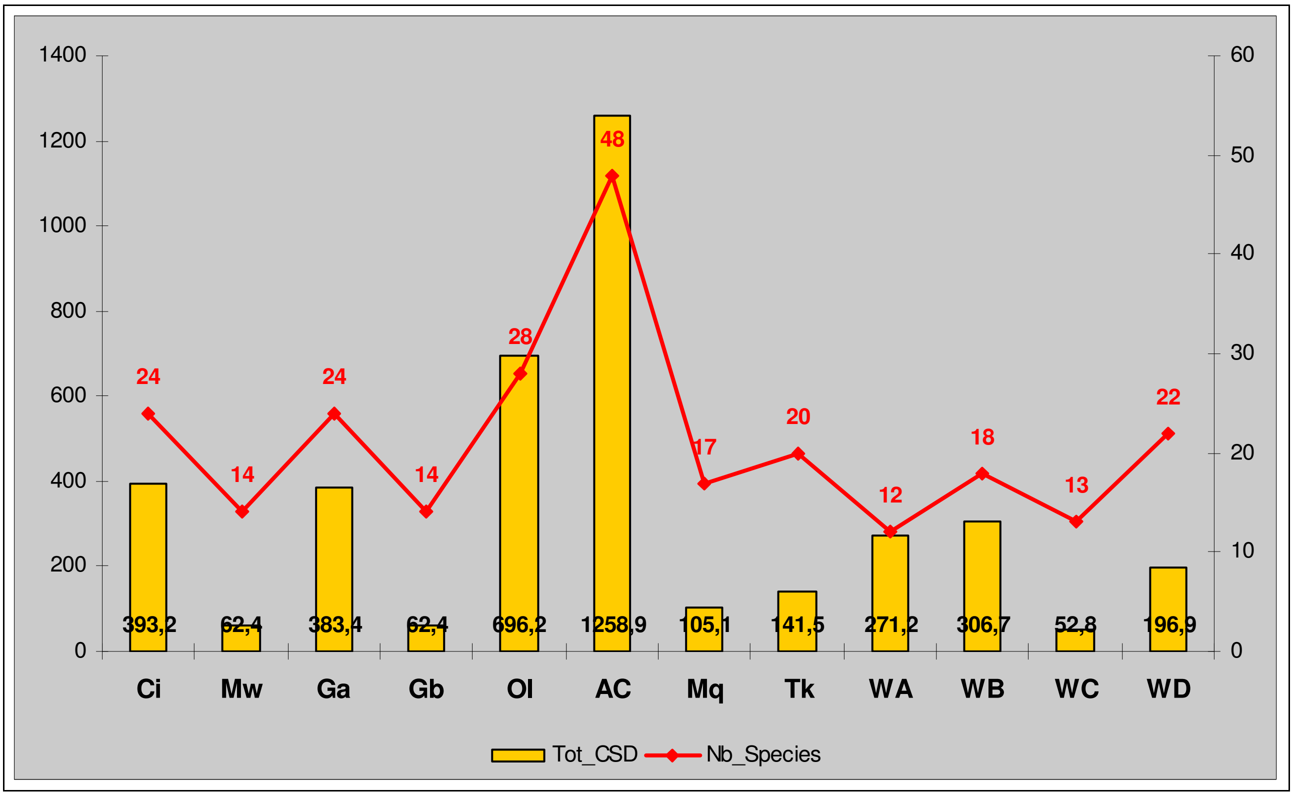
SPECIES	Ci	Mw	Ga	Gb	Ol	AC	Mq	Tk	WA	WB	WC	WD	Tot_CSD
Calathus (Neocalathus) cinctus	23,9		10,9	8,6	175,2	808,9				55,8	5,5	14,6	1.103,3
Ocypus (Ocypus) olens olens	188,7	24,1	4,9	4,9	37,2	86,3	3,6	48,1		14,4	1,1	105,6	518,7
Stenosis sardoa sardoa	24,4	16,2	13,0	2,3	2,0	0,7	1,1	3,9	176,8	69,7			310,2
Laemostenus (Pristonychus) algerinus algerinus	12,9	2,4	37,5	12,2	1,7	63,1	21,4	14,8	18,7	48,8	2,2	22,8	258,6
Tentyria grossa grossa			54,4		173,0	2,5		5,2	2,5	18,4			256,1
Zophosis punctata punctata			15,6		177,3	23,2							216,2
Alphasida grossa sicula		2,3		2,4	17,4	67,5	3,3	2,1	46,1	12,9			154,1
Pterostichus (Feronidius) melas italicus	74,5							28,9		5,9		4,8	114,1
Scaurus tristis			74,2	2,5	5,8		11,7			14,4	5,1		113,8
Scaurus striatus			17,4		7,3	10,3	18,6	7,6	1,1	36,5			98,9
Pimelia rugulosa sublaevigata			34,3	3,6	45,1	0,7	7,8			1,7	1,6		94,9
Dixus clypeatus			84,1									3,1	87,2
Akis spinosa spinosa	11,9		1,2	2,2	2,9	12,9	19,9	2,1	2,7	6,2	14,4		76,4
Sepedophilus nigripennis	2,6	1,2	8,2		10,2	36,9							59,0
Stenosis melitana						41,2							41,2
Anotylus inustus					14,2	1,5		6,7				9,0	31,4
Tasgius (Tasgius) pedator siculus	5,8	1,1	1,1	1,2	0,7		4,7			1,2	7,6	5,8	29,3
Ocypus (Ocypus) ophthalmicus	0,9	1,2		8,4	0,7		2,4	1,5	1,2	2,4	8,2		27,1
Paraphloeostiba gayndahensis	17,1					1,0		6,9			1,5		26,6
Dendarus lugens						1,3		3,0	15,4	3,5			23,2
Anotylus speculifrons	1,8				2,9	15,3							20,0
Pseudomasoreus canigoulensis		1,2	2,7	2,2		0,7			1,1	11,4			19,5
Licinus (Licinus) punctatulus	0,9					13,6						2,4	17,0
Pterostichus (Platysma) niger niger	13,0												13,0
Xantholinus (Typholinus) graecus graecus					3,9	6,6		0,7					11,3
Microlestes luctuosus			6,1		0,7	1,5	1,2				1,5		11,1
Megalinus glabratus			3,3			6,5						1,2	11,0
Olisthopus elongatus		1,1	3,3				1,2					3,7	9,3
Ophonus (Hesperophonus) rotundatus		3,5										5,8	9,3
Probaticus tomentosus				4,8		2,0	1,2			1,2			9,2
Scaurus atratus		1,2	2,8			3,8	1,1						8,8
Opatroides punctulatus punctulatus						5,5						3,2	8,7
Acinopus (Acinopus) ambiguus		3,5	1,6				2,3				1,1		8,6
Tachyporus nitidulus			1,1					1,5	2,3	1,1	1,6		7,7
Xantholinus (Calolinus) rufipennis						6,7							6,7
Erodius siculus siculus					5,1		1,2						6,2
Tentyria laevigata laevigata						6,0							6,0
Blaps lethifera				5,9									5,9
Tasgius (Rayachelia) globulifer evitendus	0,9	2,2										2,2	5,4
Carabus (Macrothorax) morbillosus alternans	0,7					0,7		2,3	1,5				5,4
Philonthus (Philonthus) concinnus	0,7				4,6								5,3
Micropeplus staphylinoides			1,6			0,7				1,2		1,1	4,7
Allophylax picipes			1,2		0,7		2,4						4,3
Sepedophilus marshami					0,7	2,8		0,7					4,2
Mycetoporus baudueri					1,8	1,8							3,7
Notiophilus geminatus		1,2				1,8							3,1
Dichillus pertusus						3,0							3,0
Pseudoophonus (Pseudoophonus) rufipes	3,0												3,0

Crypticus gibbulus						0,7						2,2	3,0
Ocys harpaloides	2,8												2,8
Anotylus complanatus						2,8							2,8
Omalium rugatum						2,8							2,8
Calathus (Calathus) fuscipes graecus						1,5						1,2	2,7
Amara (Celia) montana						2,4							2,4
Laemostenus (Laemostenus) barbarus						0,9		1,3					2,2
Platytarus faminii faminii	2,2												2,2
Metallina (Neja) ambigua						2,2							2,2
Proteinus atomarius								2,2					2,2
Broscus politus						0,7						1,1	1,9
Calathus (Bedelinus) circumseptus	0,9					0,9							1,8
Quedius (Raphirus) humeralis			1,6										1,6
Tachyporus caucasicus									1,5				1,5
Carterus (Carterus) dama												1,5	1,5
Ditomus tricuspidatus												1,5	1,5
Tachyporus scrobiculatus												1,5	1,5
Ophonus (Ophonus) ardosiacus						1,5							1,5
Cnemeplatia atropos atropos	0,7					0,7							1,5
Omalium cinnamomeum								1,3					1,3
Notiophilus substriatus				1,2									1,2
Xantholinus (Helicophallus) rufipes												1,2	1,2
Pedinus helopioides					1,2								1,2
Pimelia grossa			1,2										1,2
Calathus (Neocalathus) solieri											1,1		1,1
Ophonus (Hesperophonus) pumilio												1,1	1,1
Dichillus socius					1,0								1,0
Sunius (Sunius) algiricus	1,0												1,0
Anotylus tetracarinatus						0,9							0,9
Carabus (Eurycarabus) faminii sabellai						0,9							0,9
Ocypus (Pseudocypus) sericeicollis					0,9								0,9
Philorhizus melanocephalus	0,9												0,9
Quedius (Raphirus) semiobscurus semiobscurus					0,9								0,9
Syntomus barbarus						0,9							0,9
Trechus (Trechus) quadristriatus						0,9							0,9
Chlaenius (Claeinus) velutinus auricollis	0,7												0,7
Astenus (Astenus) lyonessius					0,7								0,7
Platyderus (Platyderus) lombardii						0,7							0,7
Heterothops minutus								0,7					0,7
Tot_CSD	**393,2**	**62,4**	**383,4**	**62,4**	**696,2**	**1258,9**	**105,1**	**141,5**	**271,2**	**306,7**	**52,8**	**196,9**	**3.930,8**
Num_Species	**24**	**14**	**24**	**14**	**28**	**48**	**17**	**20**	**12**	**18**	**13**	**22**	**87**

Tab. 10.3.1 - Trends in catches of the considered species contingent at each station expressed as CSD value..

13 are the most abundant species (4 Carabidae, 8 Tenebrionidae, 1 Staphylinidae), having a capture frequency at least of about 2% of the total CSD value: ***Calathus* (*Neocalathus*) *cinctus*** (CSD: 28,1%), ***Ocypus* (*Ocypus*) *olens olens*** (CSD: 13,2%), ***Stenosis sardoa sardoa*** (CSD: 7,9%), ***Laemostenus* (*Pristonychus*) *algerinus algerinus*** (CSD: 6,6%), ***Tentyria grossa grossa*** (CSD: 6,5%), ***Zophosis punctata punctata*** (CSD: 5,5%), ***Alphasida grossa sicula*** (CSD: 3,9%), ***Pterostichus* (*Feronidius*) *melas italicus*** (CSD: 2,9%), ***Scaurus tristis*** (CSD: 2,9%), ***Scaurus***

striatus (CSD: 2,5%), ***Pimelia rugulosa sublaevigata*** (CSD: 2,4%), ***Dixus clypeatus*** (CSD: 2,2%) and ***Akis spinosa spinosa*** (CSD: 1,9%), representing the **86,5%** of the entire sample considered.
Regarding the table 10.1.1 one can observe that just 1 species, ***Laemostenus (Pristonychus) algerinus algerinus***, resulted present in all the 12 stations; 5 species are present at least in 75% (9) of stations: ***Ocypus (Ocypus) olens olens***, ***Stenosis sardoa sardoa***, ***Akis spinosa spinosa***, ***Tasgius (Tasgius) pedator siculus***; 7 species are present at least in 50% (6) of stations; 21 species are present in 2 or 3 stations; 40 species (45,98%) are exclusive of 1 station.
Considering the general trend of the capture frequency within the 12 stations (graph. 10.3.1), **AC** shows the highest value of CSD (32,03%) while **WC** has the minimum CSD value (1,34%); regarding the number of species sampled is observed that the greatest number of species (**48**) has been surveyed in the **AC** station and the minimum (**12**) in **WA** station.

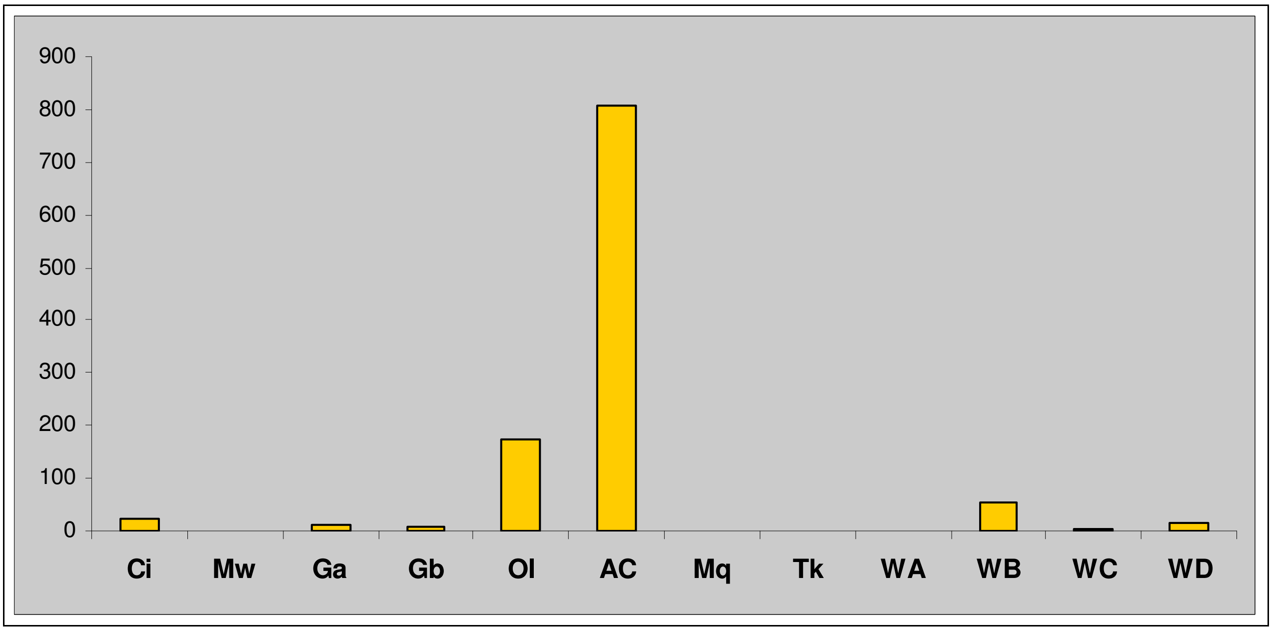


Graph. 10.3.1 - Overall trend of catches of the species contingent (Tot_CSD) and number of species (Nb_species) sampled at each station.

Below are considered the most abundant sampled species of Carabidae, Tenebrionidae and Staphylinidae in relation to their distribution in the stations and their frequency of capture during the sampling period.

Calathus* (*Neocalathus*) *cinctus

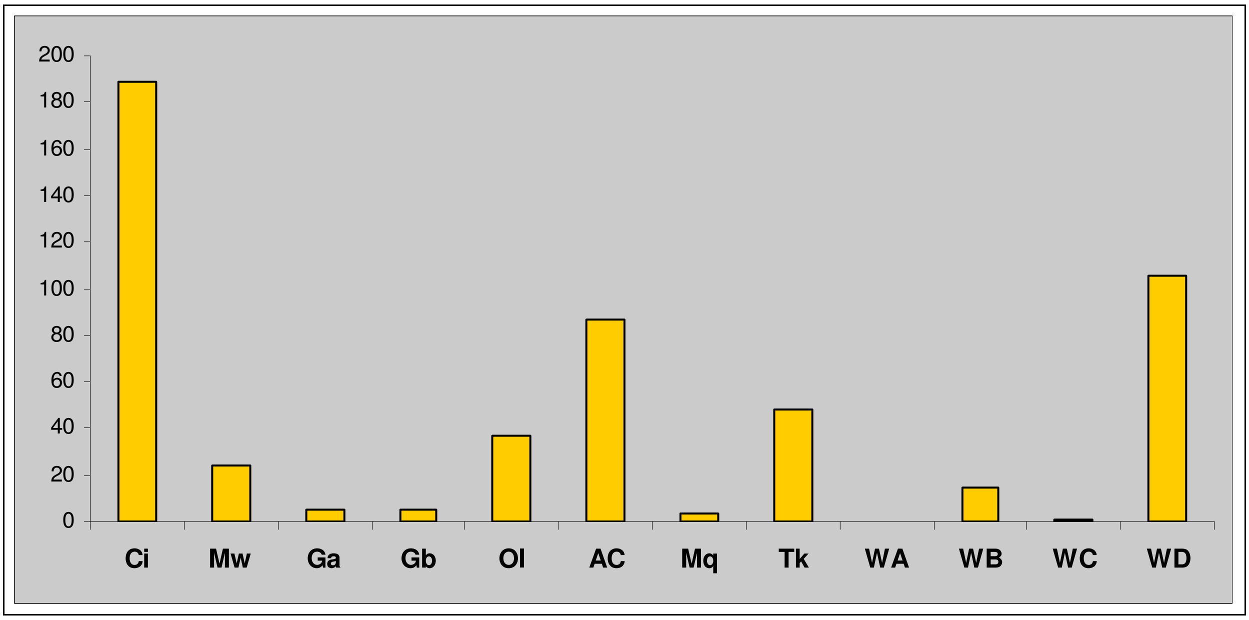
This is the species with the highest value of CSD, which represents 28,07% of the entire sample of considered species. The maximum (73,31%) of the catch was recorded in the **AC** station, while the minimum (0,50%), where present, is found in the station **WC** (graph. 10.3.2). The species has not been sampled in the **Mw**, **Mq**, **Tk** and **WA** stations.



Graph. 10.3.2 - Trend of capture frequency (CSD) for *Calathus* (*Neocalathus*) *cinctus* within the single station.

Ocypus* (*Ocypus*) *olens olens

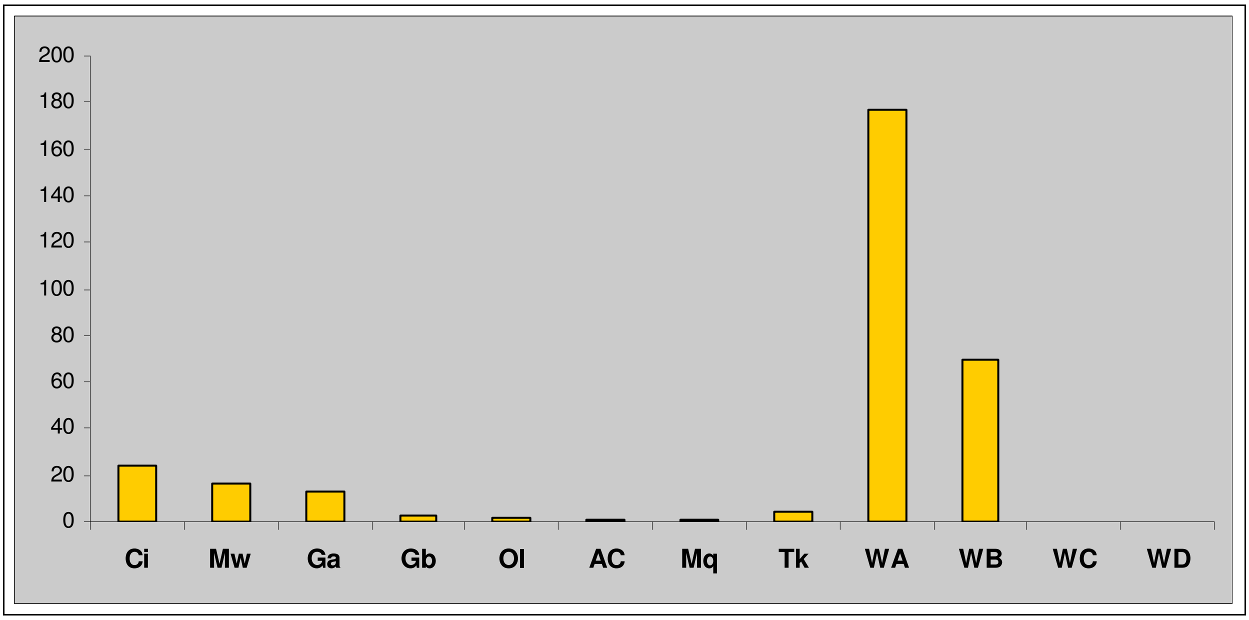
This is the species with the second value of CSD, which represents 13,20% of the entire sample of considered species. The maximum (36,37%) of the catch was recorded in the **Ci** station, while the minimum (0,22%), where present, is found in the station **WC** (graph. 10.3.3). The species has not been sampled only in the **WA** station.



Graph. 10.3.3 - Trend of capture frequency (CSD) for *Ocypus* (*Ocypus*) *olens olens* within the single station.

Stenosis sardoa sardoa

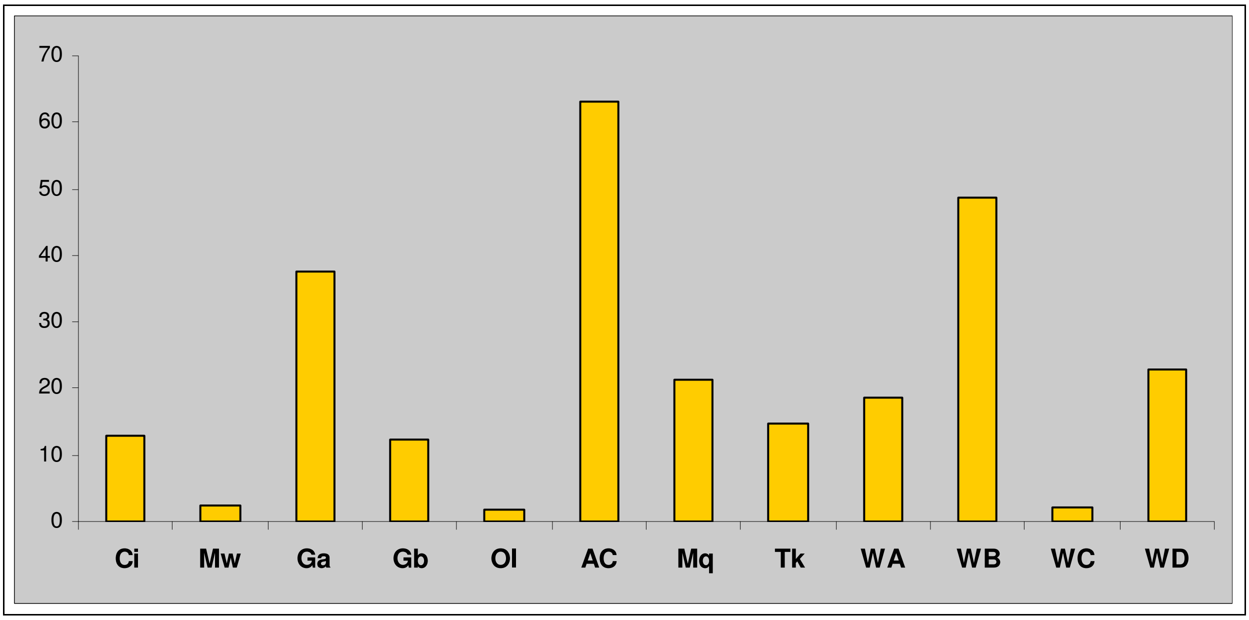
This is the species with the third value of CSD, which represents 7,89% of the entire sample of considered species. The maximum (57%) of the catch was recorded in the **WA** station, while the minimum (0,24%), where present, is found in the station **AC** (graph. 10.3.4). The species has not been sampled in the **WC** and **WD** stations.



Graph. 10.3.4 - Trend of capture frequency (CSD) for *Stenosis sardoa sardoa* within the single station.

Laemostenus (*Pristonychus*) *algerinus algerinus*

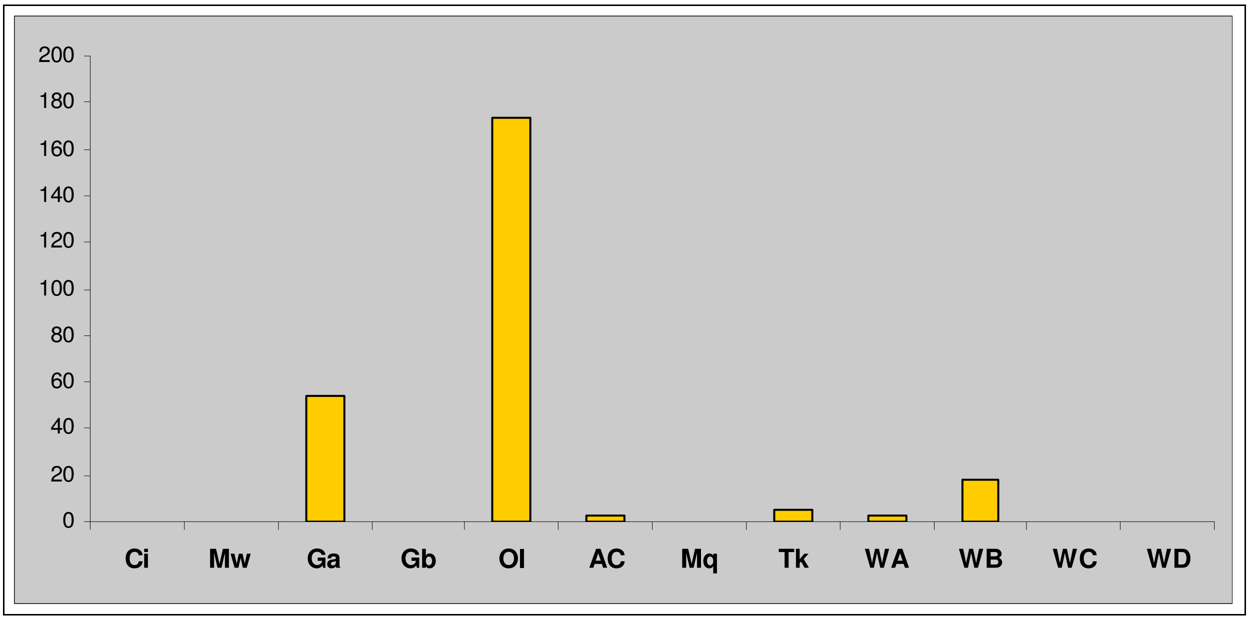
This is the species with the fourth value of CSD, which represents 6,58% of the entire sample of considered species. The maximum (24,41%) of the catch was recorded in the **AC** station, while the minimum (0,64%) is found in the station **Ol** (graph.10.3.5).



Graph. 10.3.5 - Trend of capture frequency (CSD) for *Laemostenus* (*Pristonychus*) *algerinus algerinus* within the single station.

Tentyria grossa grossa

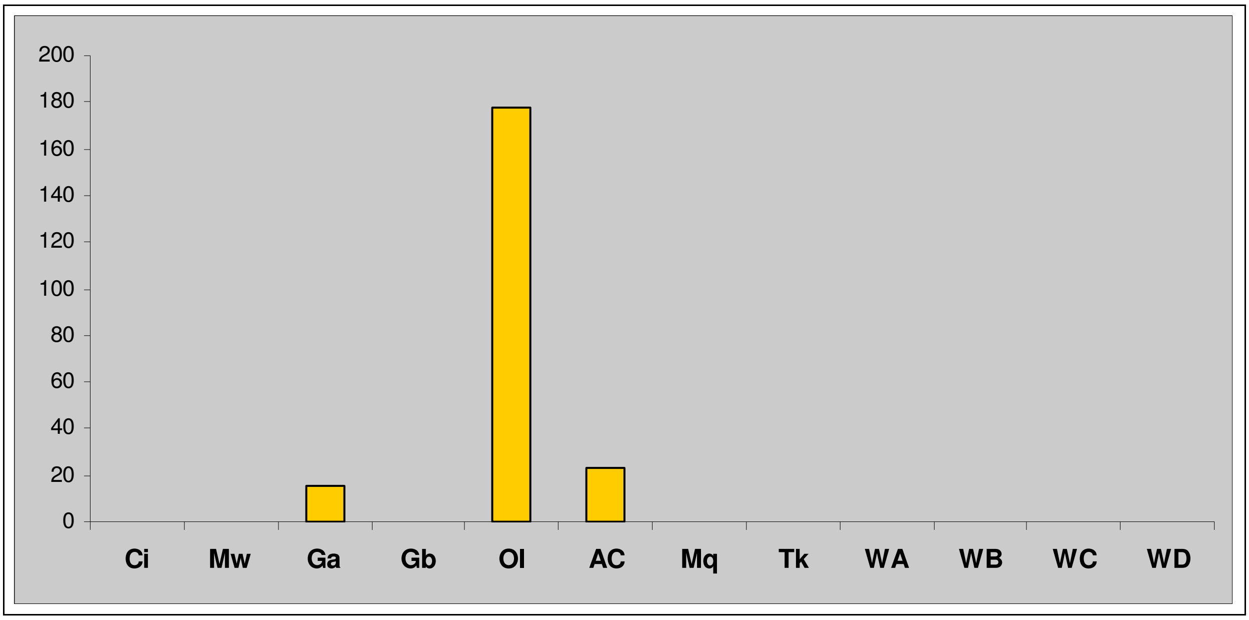
This is the species with the fifth value of CSD, which represents 6,51% of the entire sample of considered species. The maximum (67,57%) of the catch was recorded in the **Ol** station, while the minimum (0,99%), where present, is found in the station **AC** and **WA** (graph. 10.3.6). The species has not been sampled in the **Ci**, **Mw**, **Gb**, **Mq**, **WC** and **WD** stations.



Graph. 10.3.6 - Trend of capture frequency (CSD) for *Tentyria grossa grossa* within the single station.

Zophosis punctata punctata

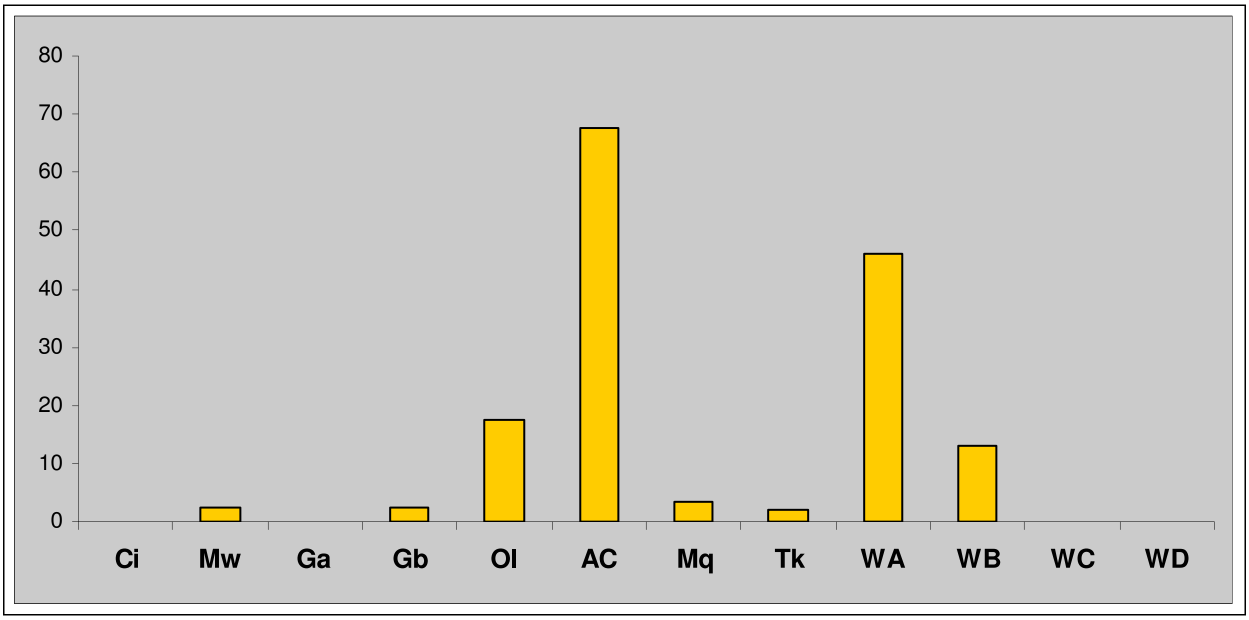
This is the species with the sixth value of CSD, which represents 5,50% of the entire sample of considered species. It has sampled only in three stations (**Ga**, **Ol** and **AC**) with the maximum (82,04%) of the catch in the **Ol** station, while the minimum (7,24%) is found in the station **Ga** (graph. 10.3.7).



Graph. 10.3.7 - Trend of capture frequency (CSD) for *Zophosis punctata punctata* within the single station.

Alphasida grossa sicula

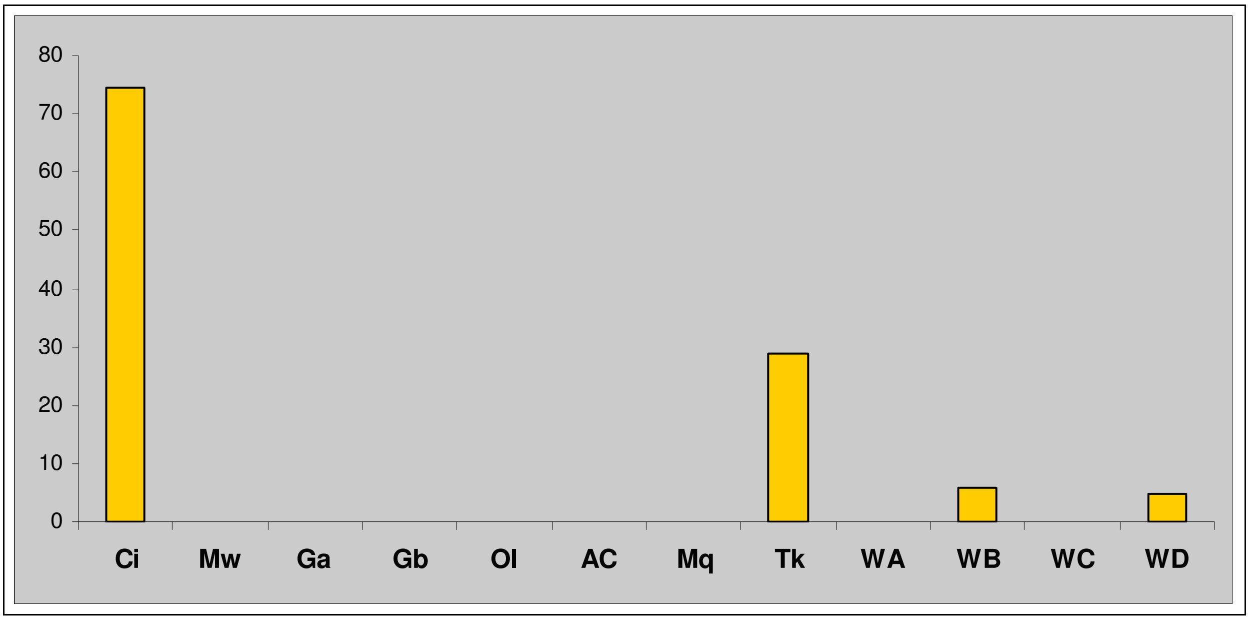
This is the species with the seventh value of CSD, which represents 3,92% of the entire sample of considered species. The maximum (43,83%) of the catch was recorded in the **AC** station, while the minimum (1,39%), where present, is found in the station **Tk** (graph. 10.3.8). The species has not been sampled in the **Ci**, **Ga**, **Mq**, **WC** and **WD** stations.



Graph. 10.3.8 - Trend of capture frequency (CSD) for *Alphasida grossa sicula* within the single station.

Pterostichus* (*Feronidius*) *melas italicus

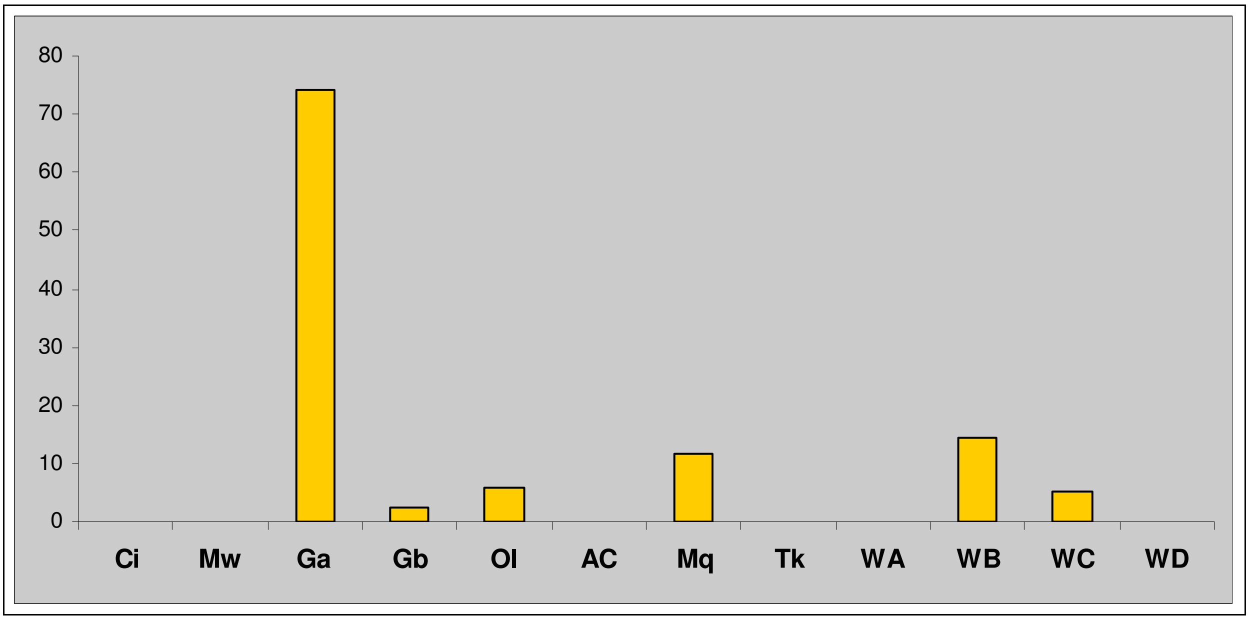
This is the species with the eighth value of CSD, which represents 2,90% of the entire sample of considered species. It has sampled only in four stations (**Ci**, **Tk**, **WB** and **WD**) with the maximum (65,32%) of the catch in the **Ci** station, while the minimum (4,20%) is found in the station **WD** (graph. 10.3.9).



Graph. 10.3.9 - Trend of capture frequency (CSD) for *Pterostichus* (*Feronidius*) *melas italicus* within the single station.

Scaurus tristis

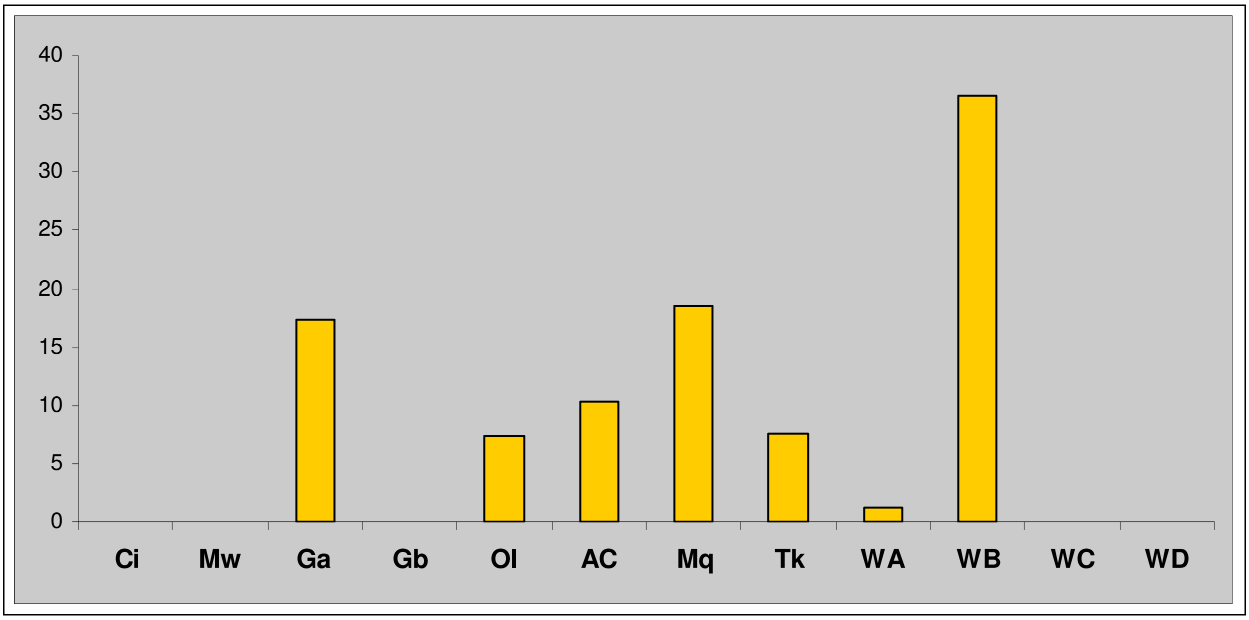
This is the species with the ninth value of CSD, which represents 2,89% of the entire sample of considered species. The maximum (65,26%) of the catch was recorded in the **Ga** station, while the minimum (2,22%), where present, is found in the station **Gb** (graph. 10.3.10). The species has not been sampled in the **Ci**, **Mw**, **AC**, **Tk**, **WA** and **WD** stations.



Graph. 10.3.10 - Trend of capture frequency (CSD) for *Scaurus tristis* within the single station.

Scaurus striatus

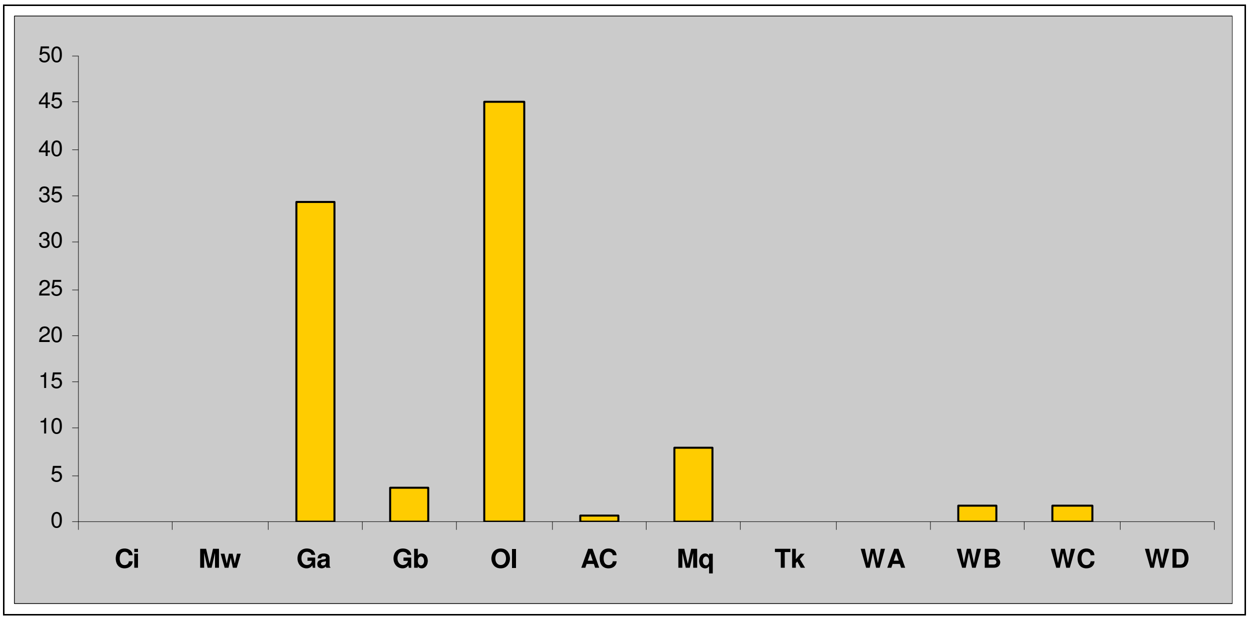
This is the species with the tenth value of CSD, which represents 2,52% of the entire sample of considered species. The maximum (36,95%) of the catch was recorded in the **WB** station, while the minimum (1,13%), where present, is found in the station **WA** (graph. 10.3.11). The species has not been sampled in the **Ci**, **Mw**, **Gb**, **WC** and **WD** stations.



Graph. 10.3.11 - Trend of capture frequency (CSD) for *Scaurus striatus* within the single station.

Pimelia rugulosa sublaevigata

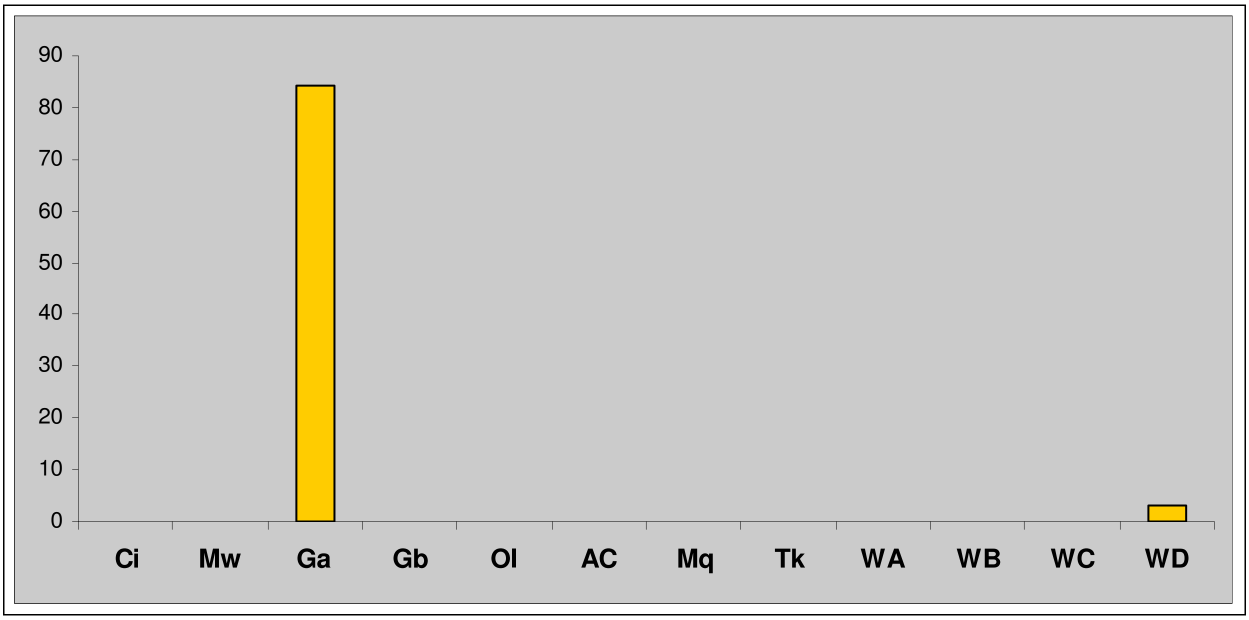
This is the species with the eleventh value of CSD, which represents 2,42% of the entire sample of considered species. The maximum (47,49%) of the catch was recorded in the **Ol** station, while the minimum (0,78%), where present, is found in the station **AC** (graph. 10.3.12). The species has not been sampled in the **Ci**, **Mw**, **Tk**, **WA** and **WD** stations.



Graph. 10.3.12 - Trend of capture frequency (CSD) for *Pimelia rugulosa sublaevigata* within the single station.

Dixus clypeatus

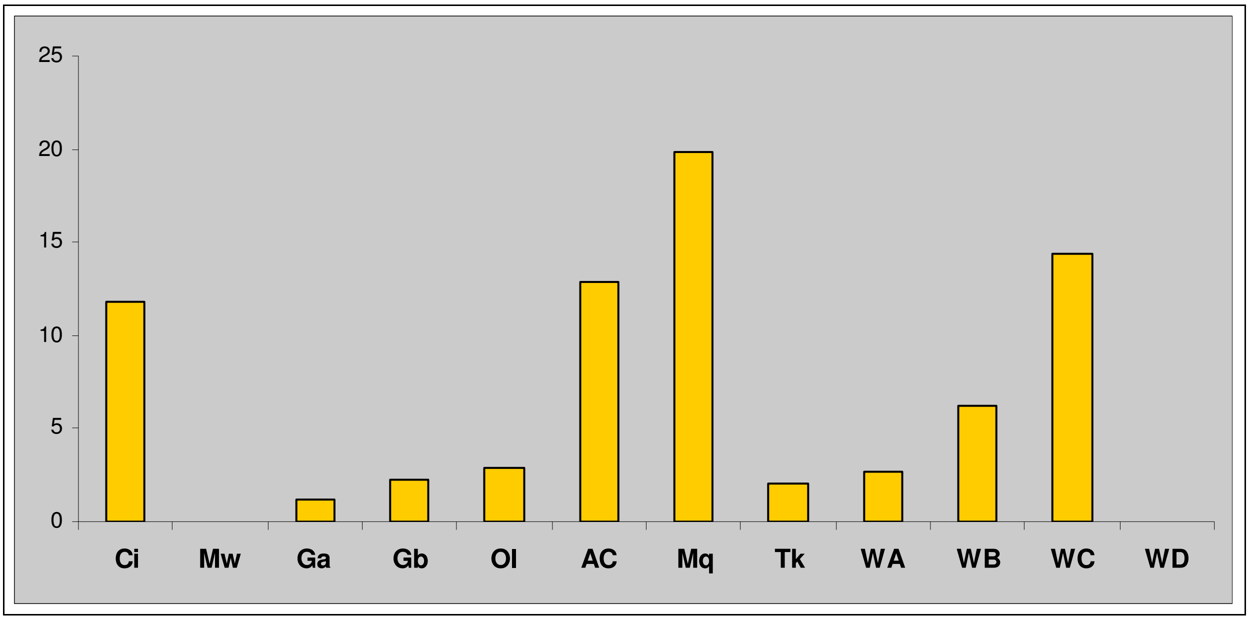
This is the species with the twelfth value of CSD, which represents 2,22% of the entire sample of considered species. It has sampled only in two stations (**Ga** and **WD**) with the maximum (96,48%) of the catch in the **Ga** station and the minimum (3,52%) found in the station **WD** (graph. 10.3.13).



Graph. 10.3.13 - Trend of capture frequency (CSD) for *Dixus clypeatus* within the single station.

Akis spinosa spinosa

This is the species with the thirteenth value of CSD, which represents 1,94% of the entire sample of considered species. The maximum (26,04%) of the catch was recorded in the **Mq** station, while the minimum (1,51%), where present, is found in the station **Ga** (graph. 10.3.14). The species has not been sampled in the **Mw** and **WD** stations.



Graph. 10.3.14 - Trend of capture frequency (CSD) for *Akis spinosa spinosa* within the single station.

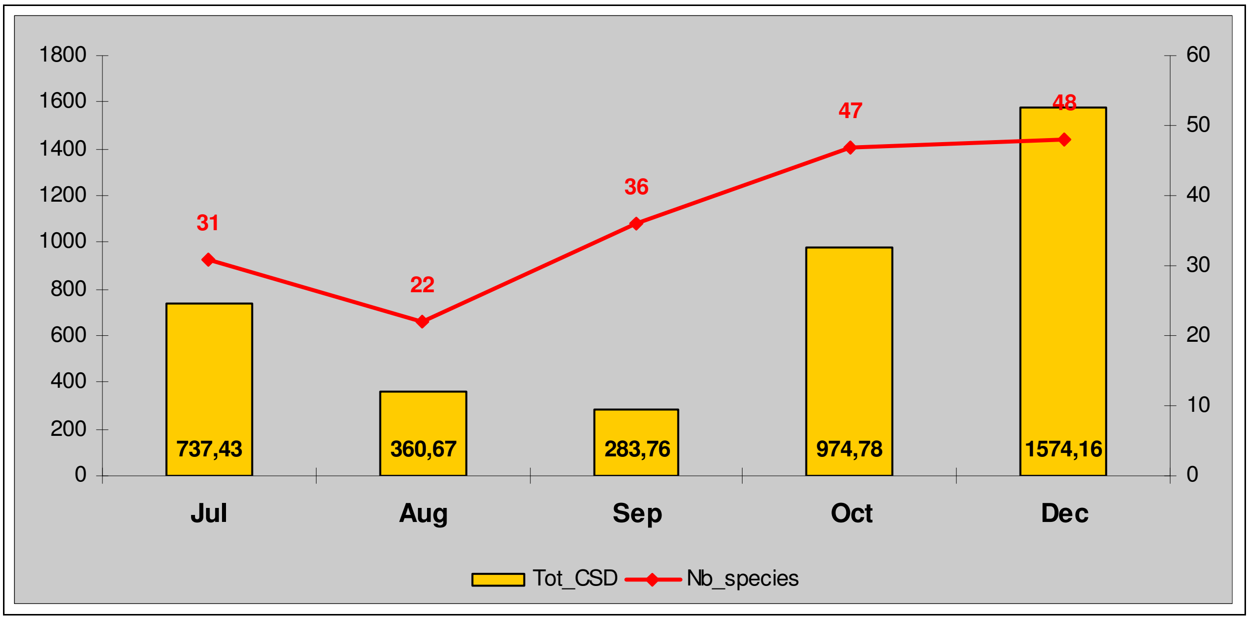
Looking at the trend of frequency of capture of species distributed in the single sampling month (tab. 10.3.2 and graph. 10.3.15), we observe that **December** is the month with the maximum value for frequency (**1.574,16** CSD) of captures and number of species (**48**), while **August** registers the minimum values for CDS (**360,67**) and for number of species (**22**).

SPECIES	Jul	Aug	Sep	Oct	Dec	Tot_CSD
Calathus (Neocalathus) cinctus	5,47	1,69	2,68	211,47	882,02	1.103,33
Ocypus (Ocypus) olens olens			4,38	252,11	262,25	518,74
Stenosis sardoa sardoa	250,19	48,32	7,58	4,08		310,18
Laemostenus (Pristonychus) algerinus algerinus	5,75	2,53	1,98	77,92	170,42	258,60
Tentyria grossa grossa	86,65	66,36	89,70	13,37		256,08
Zophosis punctata punctata	104,19	99,18	12,80			216,16
Alphasida grossa sicula	30,74		13,75	71,59	38,00	154,09
Pterostichus (Feronidius) melas italicus	1,15		6,23	87,38	19,31	114,08
Scaurus tristis	38,96	21,17	21,95	26,79	4,90	113,76
Scaurus striatus	27,17	17,28	25,03	29,37		98,86
Pimelia rugulosa sublaevigata	29,85	6,75	7,13	38,97	12,24	94,94
Dixus clypeatus	19,17	46,81	18,98	2,23		87,18
Akis spinosa spinosa	22,87	19,40	20,91	13,19		76,37
Sepedophilus nigripennis			7,29	7,40	44,35	59,04
Stenosis melitana	37,44	3,80				41,24
Anotylus inustus		1,69		21,47	8,27	31,43
Tasgius (Tasgius) pedator siculus	1,15	1,01	2,98	11,52	12,65	29,31
Ocypus (Ocypus) ophthalmicus				8,73	18,36	27,09
Paraphloeostiba gayndahensis	20,38	4,54	0,74		0,92	26,58
Dendarus lugens	10,89	6,33	4,88	1,12		23,21
Anotylus speculifrons			1,19	9,63	9,20	20,02
Pseudomasoreus canigoulensis	1,15		3,56	11,90	2,86	19,47

Licinus (Licinus) punctatulus				5,37	11,65	17,02
Pterostichus (Platysma) niger niger				12,03	0,92	12,95
Xantholinus (Typholinus) graecus graecus				6,66	4,60	11,26
Microlestes luctuosus	2,68	3,80	2,67	0,74	1,22	11,12
Megalinus glabratus				3,70	7,25	10,95
Olisthopus elongatus				1,12	8,16	9,28
Ophonus (Hesperophonus) rotundatus	8,05				1,22	9,27
Probaticus tomentosus	6,62	2,53				9,15
Scaurus atratus	3,31	1,27	1,49	1,12	1,63	8,81
Opatroides punctulatus punctulatus	2,55	1,69	4,46			8,70
Acinopus (Acinopus) ambiguus	2,30		1,19	2,23	2,86	8,57
Tachyporus nitidulus				4,83	2,86	7,69
Xantholinus (Calolinus) rufipennis				6,66		6,66
Erodius siculus siculus	6,21					6,21
Tentyria laevigata laevigata	2,02	2,53	1,49			6,04
Blaps lethifera				2,23	3,67	5,90
Tasgius (Rayachelia) globulifer evitendus				5,39		5,39
Carabus (Macrothorax) morbillosus alternans	3,22		1,41	0,74		5,37
Philonthus (Philonthus) concinnus			0,74		4,60	5,34
Micropeplus staphylinoides				1,86	2,86	4,71
Allophylax picipes	1,15		2,37	0,74		4,26
Sepedophilus marshami				1,48	2,76	4,24
Mycetoporus baudueri					3,68	3,68
Notiophilus geminatus					3,06	3,06
Dichillus pertusus			2,98			2,98
Pseudoophonus (Pseudoophonus) rufipes			2,98			2,98
Crypticus gibbulus				2,97		2,97
Ocys harpaloides				0,93	1,84	2,77
Anotylus complanatus					2,76	2,76
Omalium rugatum					2,76	2,76
Calathus (Calathus) fuscipes graecus				1,48	1,22	2,71
Amara (Celia) montana				1,48	0,92	2,40
Laemostenus (Laemostenus) barbarus					2,23	2,23
Platytarus faminii faminii			2,23			2,23
Metallina (Neja) ambigua				2,22		2,22
Proteinus atomarius				2,22		2,22
Broscus politus				1,86		1,86
Calathus (Bedelinus) circumseptus					1,84	1,84
Quedius (Raphirus) humeralis					1,63	1,63
Carterus (Carterus) dama	1,53					1,53
Ditomus tricuspidatus	1,53					1,53
Tachyporus caucasicus	1,53					1,53
Tachyporus scrobiculatus	1,53					1,53
Ophonus (Ophonus) ardosiacus			1,49			1,49
Cnemeplatia atropos atropos			0,74	0,74		1,48
Omalium cinnamomeum					1,31	1,31
Notiophilus substriatus					1,22	1,22
Xantholinus (Helicophallus) rufipes					1,22	1,22
Pedinus helopioides			1,19			1,19
Pimelia grossa			1,19			1,19
Calathus (Neocalathus) solieri				1,12		1,12
Ophonus (Hesperophonus) pumilio				1,12		1,12
Dichillus socius		1,01				1,01

Sunius (Sunius) algiricus		1,01				1,01
Anotylus tetracarinatus					0,92	0,92
Carabus (Eurycarabus) faminii sabellai					0,92	0,92
Ocypus (Pseudocypus) sericeicollis					0,92	0,92
Philorhizus melanocephalus					0,92	0,92
Quedius (Raphirus) semiobscurus semiobscurus					0,92	0,92
Syntomus barbarus					0,92	0,92
Trechus (Trechus) quadristriatus					0,92	0,92
Chlaenius (Claeinus) velutinus auricollis			0,74			0,74
Astenus (Astenus) lyonessius				0,74		0,74
Platyderus (Platyderus) lombardii				0,74		0,74
Heterothops minutus			0,66			0,66
Tot_CSD	**737,43**	**360,67**	**283,76**	**974,78**	**1574,16**	**3.930,80**
Nb_species	**31**	**22**	**36**	**47**	**48**	**87**

Tab. 10.3.2 - Trends in capture rates of species contingent spread over the individual sampling month.

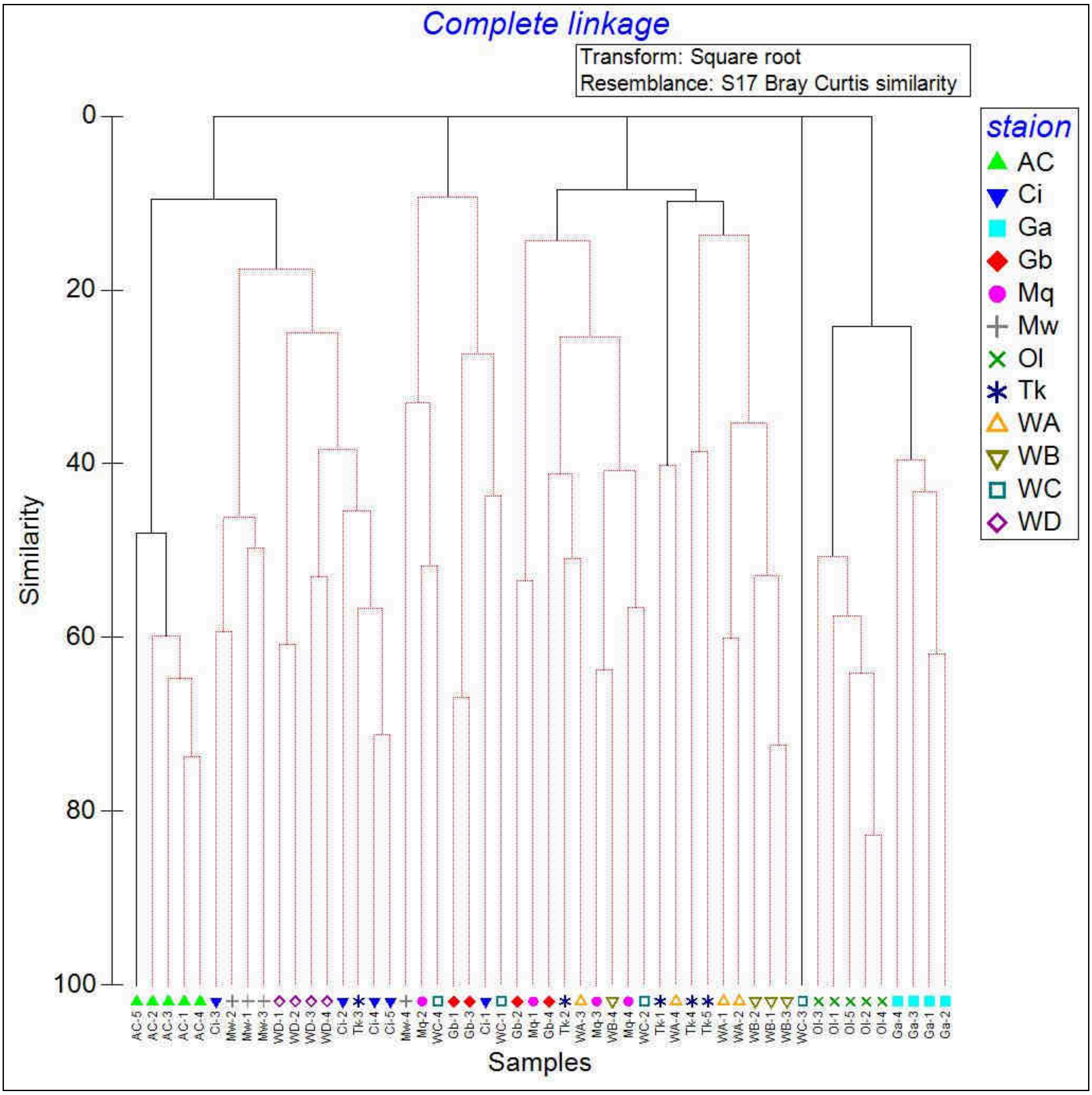


Graph. 10.3.15 - Trends in capture frequencies (CSD) of species contingent in individual sampling month and number of species sampled.

10.4 MULTIVARIATE ANALYSIS OF THE COMMUNITIES: non-metric Multi Dimensional Scaling based on the Bray-Curtis matrix

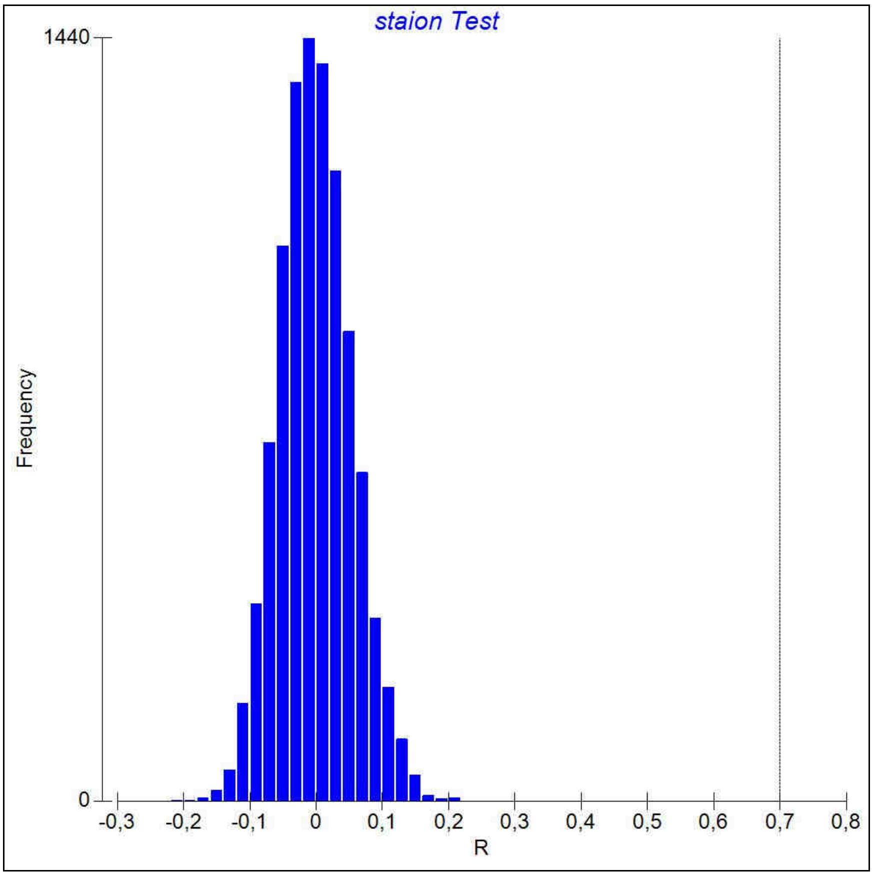
Looking at the dendrogram of similarity among traps based on the index of Bray-Curtis in relation to considered species (graph. 10.4.1) it is evident that some of the clusters identified result different with each other in a statistically significance (p <0.5 at least %) according to the SIMPROF test.
Those with statistically significance (although at different level of similarity) are 8:

1. **all traps** of station **AC**;
2. **all traps** of station **WD**, traps **Ci-2**, **Ci-3, Ci-4**, **Ci-5**, **Tk-3**, **Mw-1**, **Mw-2**, **Mw-3**;
3. traps **Mw-4**, **Mq-2**, **WC-1**, **WC-4**, **Gb-1**, **Gb-2**, **Gb-3**, **Ci-1**;
4. traps **Gb-2**, **Gb-4**, **Mq-1**, **Mq-3**, **Mq-4**, **Tk-2**, **WA-3**, **WB-4**, **WC-2**;
5. traps **Tk-1**, **Tk-4**, **Tk-5**, **WA-1**, **WA-2**, **WA-4**, **WB-1**, **WB-2**, **WB-3**;
6. trap **WC-3**;
7. **all traps** of station **Ol**;
8. **all traps** of station **Ga**.



Graph. 10.4.1 - Dendrogram of values based on similarity index of Bray Curtis between the traps of stations investigated in relation to species considered. The black lines show the clusters that are statistically significantly different (at least p <0,5%) according to the SIMPROF test.

Then, analysis shows that the traps of a station are, in most cases, more similar to each other than with the traps of other stations. The ANOSIM test (graph. 10.4.2) confirms this hypothesis with high statistical significance.



Graph. 10.4.2 – ANOSIM tests: distribution of expected frequencies of R (histogram) compared with the observed value of R (**0,7**) (continuous line) between the traps of the stations investigated in relation to species considered.

The examination of the Bray-Curtis index of similarity in relation to all the considered species (tab. 10.4.1), shows a medium-low or low similarity (values under 50% similarity) between almost all stations: the mean value is 31,54 (SD 10,11). Only five comparisons between stations recorded values just a little higher than 50% of similarity, in decreasing order as follows: **WC/Mq, Mq/Gb, WC/Gb, WB/WA, WB/Ga**.

Station	AC	Ci	Ga	Gb	Mq	Mw	Ol	Tk	WA	WB	WC	WD
AC												
Ci	29,32											
Ga	30,65	23,10										
Gb	19,12	29,04	33,27									
Mq	23,29	25,42	45,72	51,78								
Mw	16,14	31,94	27,89	38,14	38,49							
Ol	42,57	26,49	44,20	26,89	31,49	20,49						
Tk	28,74	43,28	25,52	31,84	34,20	32,35	32,37					
WA	21,87	22,80	24,00	30,59	29,24	29,11	18,43	40,61				
WB	35,18	37,72	50,54	47,51	50,13	32,70	41,32	45,71	51,07			
WC	14,49	28,72	27,94	51,28	52,29	23,77	21,68	22,85	17,68	34,24		
WD	29,45	41,87	27,32	25,29	22,83	32,29	21,40	33,66	9,84	30,16	20,05	

Tab. 10.4.1 – Bray-Curtis index of similarity between the stations studied in relation to species considered. In green are marked the values equal to or greater than 50; in light blue those under 50.

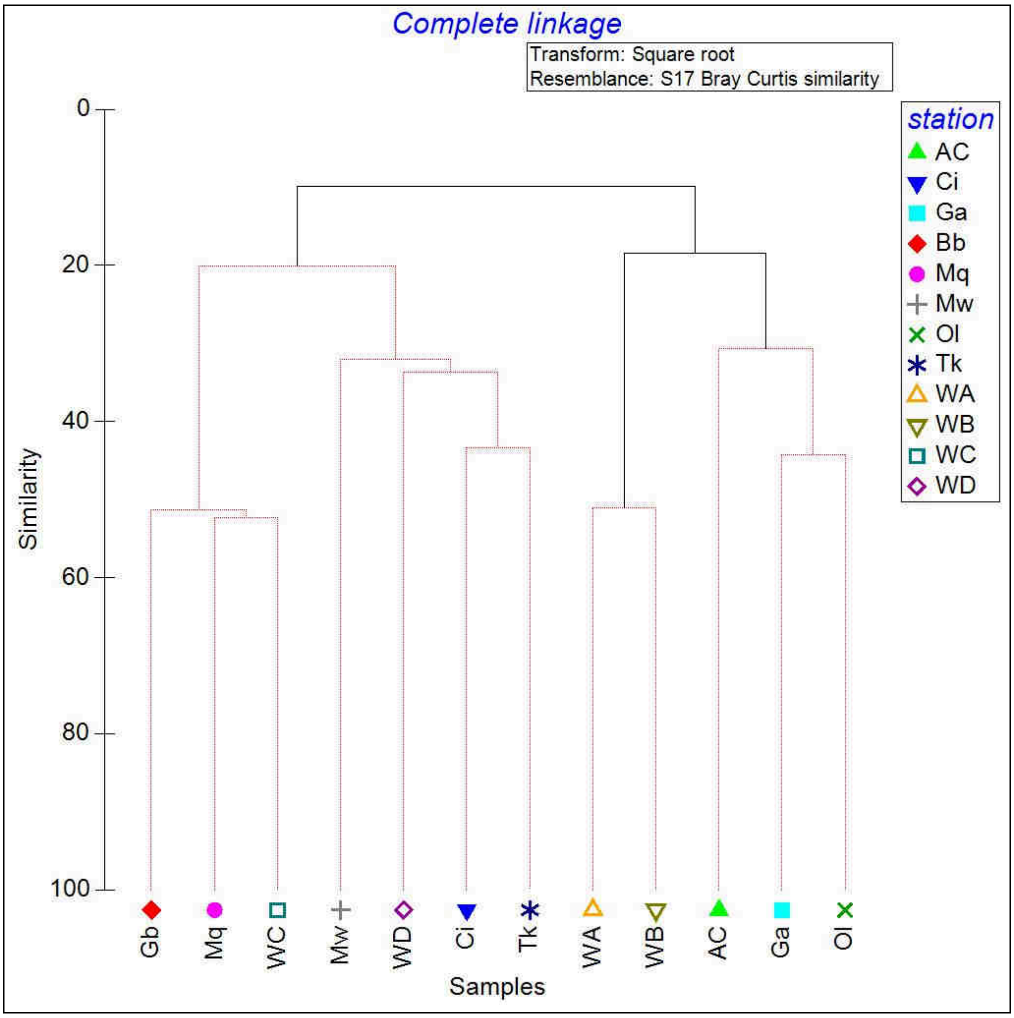
Looking at the dendrogram of similarity among stations based on the index of Bray-Curtis in relation to species considered (graph. 10.4.3) it is evident that some of the clusters identified result different with each other in a statistically significance (p <0.5% at least) according to the SIMPROF test. At different similarity level between 30% and 50% are individuated:

2 clusters significantly different from each, grouping:

1. stations **WA** and **WB**;
2. stations **AC**, **Ga** and **Ol**.

2 clusters non-significantly different from each, grouping:

3. stations **Gb**, **Mq** and **WC**;
4. stations **Mw**, **WD**, **Ci** and **Tk**.



Graph. 10.4.3 - Dendrogram of Bray Curtis similarity index values between the investigated stations with regard to considered species.

The species in common, although with different weight in relation to individual stations, which contribute to determinate the aggregation for stations are as follows:

Cluster 1: stations **WA** and **WB**

Laemostenus (*Pristonychus*) *algerinus algerinus*
Stenosis sardoa sardoa
Akis spinosa spinosa
Alphasida grossa sicula
Scaurus striatus
Tentyria grossa grossa

Pseudomasoreus canigoulensis
Tachyporus nitidulus
Dendarus lugens

Cluster 2: stations **AC**, **Ga** and **Ol**

Laemostenus (*Pristonychus*) *algerinus algerinus*
Ocypus (*Ocypus*) *olens olens*
Stenosis sardoa sardoa
Akis spinosa spinosa
Calathus (*Neocalathus*) *cinctus*
Scaurus striatus
Pimelia rugulosa sublaevigata
Tentyria grossa grossa
Sepedophilus nigripennis
Zophosis punctata punctata

Cluster 3: stations **Gb**, **Mq** and **WC**

Laemostenus (*Pristonychus*) *algerinus algerinus*
Ocypus (*Ocypus*) *olens olens Akis spinosa spinosa*
Tasgius (*Tasgius*) *pedator siculus*
Ocypus (*Ocypus*) *ophthalmicus*
Pimelia rugulosa sublaevigata
Scaurus tristis

Cluster 4: stations **Mw**, **WD**, **Ci** and **Tk**

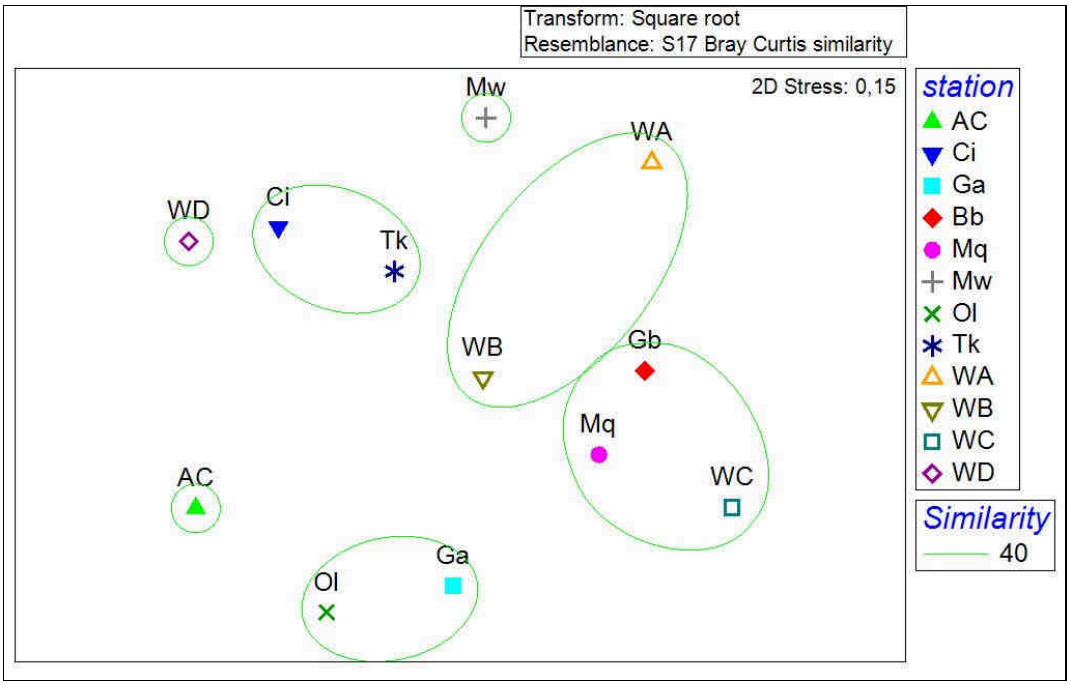
Laemostenus (*Pristonychus*) *algerinus algerinus*
Ocypus (*Ocypus*) *olens olens*

Regarding the number of species in common for pairs of stations and its percentage on the cumulative number of species for the two stations (tab. 10.4.2) **AC/Ol** is the pair with the maximum value for number of species and **Gb/WB** is the pair with the maximum value for percentage, while **WA/WD** is the pair with the minimum value both for number of species and for percentage. It is to emphasize how only for **11** (16,67%) the percentage value is ≥ 40%, of wich just 3 (4,55%) have a percentage value ≥ 50%: **Gb/WB**, **Ga/Mq** and **WA/WB** all representing natural environments.

Station	AC	Ci	Ga	Gb	Mq	Mw	Ol	Tk	WA	WB	WC
Ci	**12** *(20,0)*										
Ga	**15** *(26,3)*	**7** *(17,1)*									
Gb	**9** *(17,0)*	**7** *(22,6)*	**9** *(31,0)*								
Mq	**10** *(18,2)*	**6** *(17,1)*	**14** *(50,0)*	**10** *(47,6)*							
Mw	**8** *(14,8)*	**7** *(22,6)*	**9** *(31,0)*	**7** *(33,3)*	**8** *(36,4)*						
Ol	**17** *(28,8)*	**9** *(21,4)*	**14** *(36,8)*	**10** *(31,3)*	**13** *(40,6)*	**7** *(20,0)*					
Tk	**14** *(25,9)*	**8** *(22,2)*	**8** *(21,6)*	**6** *(21,4)*	**7** *(23,3)*	**5** *(17,2)*	**11** *(29,7)*				
WA	**9** *(17,6)*	**5** *(16,1)*	**7** *(24,1)*	**6** *(30,0)*	**6** *(26,1)*	**5** *(23,8)*	**7** *(21,2)*	**10** *(45,5)*			
WB	**13** *(24,5)*	**8** *(23,5)*	**13** *(22,8)*	**12** *(60,0)*	**11** *(45,8)*	**7** *(28,0)*	**12** *(35,3)*	**11** *(40,7)*	**10** *(50,0)*		
WC	**7** *(13,0)*	**7** *(23,3)*	**10** *(37,0)*	**8** *(42,1)*	**9** *(42,9)*	**5** *(22,7)*	**9** *(28,1)*	**6** *(22,2)*	**4** *(19,0)*	**9** *(40,9)*	
WD	**11** *(18,6)*	**7** *(17,9)*	**8** *(21,1)*	**4** *(12,5)*	**4** *(11,4)*	**6** *(20,0)*	**5** *(11,1)*	**4** *(10,5)*	**1** *(3,0)*	**6** *(17,6)*	**4** *(12,9)*

Tab. 10.4.2 – Number of species in common for pairs of stations (in **bold**) and its percentage on the cumulative number of species (in *italic*). In green are marked the highest values, in light blue the lowest values, in fuchsia the percentage value≥ 40%.

The Nonmetric Multi Dimensional Scaling (NMDS) in 2 D vision (graph. 10.4.4), elaborated on the Bray Curtis similarity matrix between stations, in relation to species indicates again the level of clustering between stations.



Graph. 10.4.4 - The Nonmetric Multi Dimensional Scaling (NMDS) elaborated on the Bray Curtis similarity matrix between station investigated stations, in relation to species considered (2 D vision).

The statistical significance of differences between the stations (R average = **0,7**) was calculated using the Parwise test, based on comparison of observed and expected values of R between pairs of stations. The differences about R (and the relative significance level) for stations pair are shown in table 10.4.3 and is clear how different is the situation depending of station pair itself (values from -0,006 to 1); 81,82% of stations pair combination gives a difference value ≥ 0,5 while 18,18% of stations pair combination gives a difference value < 0,5.

Groups	R Statistic	Significance Level %	Possible Permutations	Actual Permutations	Number >= Observed
AC/Ga	1	0,8	126	126	1
AC/ Ol	1	0,8	126	126	1
Ci/ Ga	1	0,8	126	126	1
Ci/Ol	1	0,8	126	126	1
Ga/WD	1	2,9	35	35	1
Ol/WA	1	0,8	126	126	1
Ol/WD	1	0,8	126	126	1
AC/Gb	0,994	0,8	126	126	1
WA/WD	0,99	2,9	35	35	1
AC/WB	0,988	0,8	126	126	1
Gb/Ol	0,988	0,8	126	126	1
AC/WD	0,981	0,8	126	126	1
Ol/WB	0,981	0,8	126	126	1
Ga/Gb	0,969	2,9	35	35	1
WB/WD	0,958	2,9	35	35	1
Ci, WB	0,956	0,8	126	126	1
Ci/Gb	0,944	0,8	126	126	1
AC/Ci	0,94	0,8	126	126	1
Ci/WA	0,931	0,8	126	126	1
Mw/Ol	0,931	0,8	126	126	1

AC/WA	0,925	0,8	126	126	1
Ga/WA	0,917	2,9	35	35	1
Gb/WD	0,917	2,9	35	35	1
AC/Mw	0,9	0,8	126	126	1
Ga/Ol	0,9	0,8	126	126	1
Ga/Mw	0,896	2,9	35	35	1
AC/Mq	0,888	0,8	126	126	1
Ci/Mq	0,869	0,8	126	126	1
Mq/Ol	0,869	0,8	126	126	1
Mq/WD	0,813	2,9	35	35	1
AC/WC	0,769	0,8	126	126	1
Ol/WC	0,763	0,8	126	126	1
Gb/WB	0,75	2,9	35	35	1
Ol/Tk	0,74	0,8	126	126	1
Mw/WB	0,729	2,9	35	35	1
Ci/WD	0,713	0,8	126	126	1
Ci/WC	0,706	0,8	126	126	1
Gb/WA	0,698	2,9	35	35	1
Ga/WB	0,688	2,9	35	35	1
Ga/Mq	0,667	2,9	35	35	1
Mw/WA	0,667	2,9	35	35	1
WC/WD	0,646	2,9	35	35	1
AC/Tk	0,644	0,8	126	126	1
Ga/WC	0,635	2,9	35	35	1
Mw/WC	0,635	2,9	35	35	1
Mw/WD	0,635	2,9	35	35	1
WA/WC	0,635	2,9	35	35	1
Ga/Tk	0,606	0,8	126	126	1
Mq/WA	0,573	2,9	35	35	1
Mq/Mw	0,542	2,9	35	35	1
WA/WB	0,531	2,9	35	35	1
WB/WC	0,531	2,9	35	35	1
Ci/Mw	0,5	0,8	126	126	1
Gb/Mw	0,5	5,7	35	35	2
Mq/WB	0,417	2,9	35	35	1
Gb/Mq	0,406	5,7	35	35	2
Tk/WD	0,363	5,6	126	126	7
Ci/Tk	0,348	3,2	126	126	4
Tk/WC	0,325	4	126	126	5
Mw/Tk	0,281	6,3	126	126	8
Gb/Tk	0,269	7,9	126	126	10
Tk/WB	0,269	10,3	126	126	13
Gb/WC	0,177	14,3	35	35	5
Mq/Tk	0,125	20,6	126	126	26
Mq/WC	0,104	37,1	35	35	13
Tk/WA	-0,006	50	126	126	63

Tab. 10.4.3 - Pairwise tests based on the values of R observed for pair of stations in relation to species considered. The significance % refers to the number of values of R that fall within the range of expected frequencies compared to the total number of possible permutations.

From analysis with the SIMPER test is assessed the dissimilarity between station; the values are synthesized in table 10.4.4, and it is evident that the level of dissimilarity between stations is high (78,98; SD 7,75) with the maximum for **AC/WC** (91,06) and the minimum for **Ci/WD** (60,70).

Station	AC	Ci	Ga	Gb	Mq	Mw	Ol	Tk	WA	WB	WC	WD
AC												
Ci	77,47											
Ga	80,74	85,57										
Gb	83,68	79,32	82,32									
Mq	83,42	82,41	71,71	69,28								
Mw	86,76	68,91	86,15	74,35	80,76							
Ol	64,02	84,84	62,97	83,02	82,67	88,69						
Tk	83,89	74,48	85,36	76,02	75,40	79,57	86,85					
WA	84,91	83,45	83,39	78,84	78,18	81,92	90,54	73,17				
WB	68,65	74,73	62,45	67,56	64,98	78,56	66,06	73,69	69,55			
WC	91,06	88,15	86,51	73,27	74,04	89,56	88,88	86,13	88,83	79,61		
WD	72,86	60,70	84,84	76,55	82,13	77,35	82,05	78,37	88,87	73,96	87,54	

Tab. 10.4.4 – Dissimilarity values between stations pair assessed by SIMPER test. In dark red is marked the maximum value, in yellow the minimum value.

11 INDEX OF FAUNAL VALUE FOR STATIONS (INV) BASED ON SPECIES OF CARABIDAE

The presence of animals in the landscape is pervasive. Mobility and / or their elusiveness does not allow any stable spatial identification of species populations, which usually escape to an immediate perception. The identification of the role played by territories, with habitat types able to satisfy the ecological requirements of the various fauna components, is still an important objective, to organize an appropriate policy for the protection and land management.
The determination of the “faunal value” for habitats and its representation on a map is, for several reasons, difficult to achieve as adequate and complete. First, as already mentioned, the direct interception of animal species is not always easy and comprehensive. In addition, wildlife surveys (because of methodology and skills needed) are unlikely to lead to appropriate knowledge in a short time even for limited territories.
Thus, one possible approach is to identify “fractions” of the fauna component that permit to characterize certain areas from bio-ecological knowledge on species that, due to heterogeneous and complex relations with the physical environment and with other biotic components, establish important interaction with other cultures and territories deeply transformed by man. The determination of the “faunal value” for areas can provide a significant support during territorial planning operations.
In this context, the elaboration of data collected during a study such as this, can be extended to the evaluation of bio-ecological characteristics of the species concerned, not being restricted only to the analysis of the diversity of species surveyed in terms of presence / absence or number of specimens; these features may reflect a greater or lesser environmental suitability of the habitats investigated as a function of the adaptive-evolutionary aspects of the individual species.
For determining the fauna community value (**INV**) of the 12 surveyed patches within the R.N.O. Pineta di Vittoria, Coleoptera Carabidae were used following the methodology proposed by BRANDMAYR et alii(2005). The bio-ecological characteristics of reference for each individual species are: the chorology and condition of endemic species, the distribution in Italy, the dispersal capacity (based on the development of the wings) and the fidelity to habitat. Compared to the methodology indicated by BRANDMAYR et alii (2005), among the categories of bio-ecological characteristics was not considered the diet, while added the distribution in Italy and the fidelity to habitat.
The categories used, with the related classes of merit, for the calculation of the faunal value (**INV**) are summarized in tables 11.1a – 11.1d:

a) **Chorology** (in the case of subspecies we referred to the distribution of the latter and not to that of species s. l.) (from VIGNA TAGLIANTI, in BRANDMAYR et alii 2005):

Regional endemic species	I
Italian endemic species	II
Euro-mediterranean species	IIIm
European species	III
Euroasiatic or eurosibiric species	IV
Palearctic or Holarctic species	V

Tab. 11.1a - References for evaluation of habitat faunal value (INV) based on chorology of the species.

b) **Distribution in Italy** (from VIGNA TAGLIANTI, in BRANDMAYR et alii 2005):

Only in Sicily	I
Only in Sicily and Sardinia	II
South Italy and Sicily	III
South Italy, Sicily and Sardinia	IV
North and South Italy and Sicily	IVs
North and South Italy, Sicily and Sardinia	V

Tab. 11.1b - References for evaluation of habitat faunal value (INV) based on distribution in Italy of the species.

c) **Dispersal capacity** (based on development of wings) (from BRANDMAYr et alii 2005, CASALE et alii 1993, MIGLIORINI & BERNINI 2001, RATTI & BUSATO 2000)

Apterous/brachypterous	I
Pteridomorphus	II
Macropterous	III

Tab. 11.1c - References for evaluation of habitat faunal value (INV) based on dispersal capacity of the species.

d) **Fidelity to habitat** (based on habitat selection degree) (from PESARINI & MONZINI 2010, SABELLA & ZANETTI 2004, RUFFO & STOCH 2005, STOCH 2000-2005, BRANDMAYR at alii 2005, CASALE et alii 1993, RATTI & BUSATO 2000)

Selective	I
Medium selective	II
Unselective	III

Tab. 11.1d - References for evaluation of habitat faunal value (INV) based on fidelity to habitat of the species.

For each site was also estimated the "information content" expressed as Equipartition, which relates the number of specimens for species and for station, the total number of specimens counted for station and the total number of species recorded:

$$\text{Equipartition (E)} = I / \ln(sp)$$

with: I (information) = $-\sum p * \ln(p)$

where the summation is done for the species, **p** is the ratio between specimens of a species and specimens in the total site, **sp** is the number of species surveyed in the site.
The calculation of the faunal value (**INV**) is done by means of the processing parameters presented in table 11.2.

1	n° species class I / n° total species in the station, in %
2	n° specimens class I / n° Tot specimens, in %
3	n° species class I / n°Tot species class I for the whole area, in %
4	% equipartition for the station

Tab. 11.2 – Scheme of the parameters used to calculate the faunal value of habitats (INV).

In table 11.3 for the 12 patches are shown the values of CSD (for the period July-December) of each species registered and the relative class of category.

	STATIONS												*CATEGORIES*			
SPECIES	**Ci**	**Mw**	**Ga**	**Gb**	**Ol**	**AC**	**Mq**	**Tk**	**WA**	**WB**	**WC**	**WD**	***CHR***	***D_IT***	***DSP***	***H_FID***
Acinopus (Acinopus) ambiguus		3,5	1,6				2,3				1,1		IIIm	I	III	II
Amara (Celia) montana						2,4							IIIm	V	III	I
Broscus politus						0,7						1,1	IIIm	I	I	I
Calathus (Bedelinus) circumseptus	0,9					0,9							IIIm	V	I	I
Calathus (Calathus) fuscipes graecus						1,5						1,2	IIIm	V	II	I
Calathus (Neocalathus) cinctus	23,9		10,9	8,6	175,2	808,9				55,8	5,5	14,6	V	V	III	II
Calathus (Neocalathus) solieri											1,1		IIIm	II	I	I
Carabus (Eurycarabus) faminii sabellai						0,9							I	I	I	I
Carabus (Macrothorax) morbillosus alternans	0,7					0,7		2,3	1,5				IIIm	III	I	III
Carterus (Carterus) dama												1,5	IIIm	V	III	II
Chlaenius (Claeinus) velutinus auricollis	0,7												IIIm	IV	I	I
Ditomus tricuspidatus												1,5	IIIm	IV	III	II
Dixus clypeatus			84,1									3,1	IIIm	V	III	II
Laemostenus (Laemostenus) barbarus						0,9		1,3					IIIm	III	I	I
Laemostenus (Pristonychus) algerinus algerinus	12,9	2,4	37,5	12,2	1,7	63,1	21,4	14,8	18,7	48,8	2,2	22,8	IIIm	V	I	II
Licinus (Licinus) punctatulus	0,9					13,6						2,4	IIIm	IV	I	II
Metallina (Neja) ambigua						2,2							IIIm	IV	I	I
Microlestes luctuosus			6,1		0,7	1,5	1,2				1,5		IV	V	I	III
Notiophilus geminatus		1,2				1,8							IIIm	V	I	II
Notiophilus substriatus				1,2									III	V	III	II
Ocys harpaloides	2,8												IIIm	V	I	II
Olisthopus elongatus		1,1	3,3				1,2					3,7	IIIm	II	I	I
Ophonus (Hesperophonus) pumilio												1,1	IV	IIIm	III	II
Ophonus (Hesperophonus) rotundatus		3,5										5,8	V	IIIm	III	II
Ophonus (Ophonus) ardosiacus						1,5							IIIm	V	III	II
Philorhizus melanocephalus	0,9												V	IV	III	I
Platyderus (Platyderus) lombardii						0,7							I	I	I	I
Platytarus faminii faminii	2,2												V	IV	I	II
Pseudomasoreus canigoulensis		1,2	2,7	2,2		0,7			1,1	11,4			IIIm	III	I	II
Pseudoophonus (Pseudoophonus) rufipes	3,0												V	V	III	III
Pterostichus (Feronidius) melas italicus	74,5							28,9		5,9		4,8	III	IVs	I	II
Pterostichus (Platysma) niger niger	13,0												IV	V	I	I
Syntomus barbarus						0,9							IIIm	I	I	I
Trechus (Trechus) quadristriatus						0,9							IV	V	III	III
Tot_CSD	**136,5**	**12,9**	**146,3**	**24,2**	**177,6**	**904,1**	**26,2**	**47,4**	**21,4**	**121,9**	**11,5**	**63,7**				
Num_species	**12**	**6**	**7**	**4**	**3**	**18**	**4**	**4**	**3**	**4**	**5**	**12**				
Equipartition (E)	**59,1**	**93,5**	**61,8**	**78,2**	**7,3**	**16,7**	**48,1**	**65,9**	**41,8**	**78,8**	**86,5**	**78,5**				

Tab. 11.3 – CSD value for stations and category classes (CHR: Chorology, D_IT: Distribution in Italy, DSP: Dispersal capability, H_FID: Fidelity to habitat) for single species of Carabidae. The last row reports the equipartition value.

Attributing the percentage values obtained for each parameter to the range classes of 20%:

class 1 = 1-20%
class 2 = 21-40%
class 3 = 41-60%
class 4 = 61-80%
class 5 = 81-100%

their arithmetic mean corresponds to the index of faunal value (INV: Index of Natural Value; in PIZZOLOTTO 1993, PIZZOLOTTO 1994b, BRANDMAYR et alii 2005) for each station investigated.

Assuming "5" as the maximum for the INV, the individual values were associated with one of the following 5 quality classes:

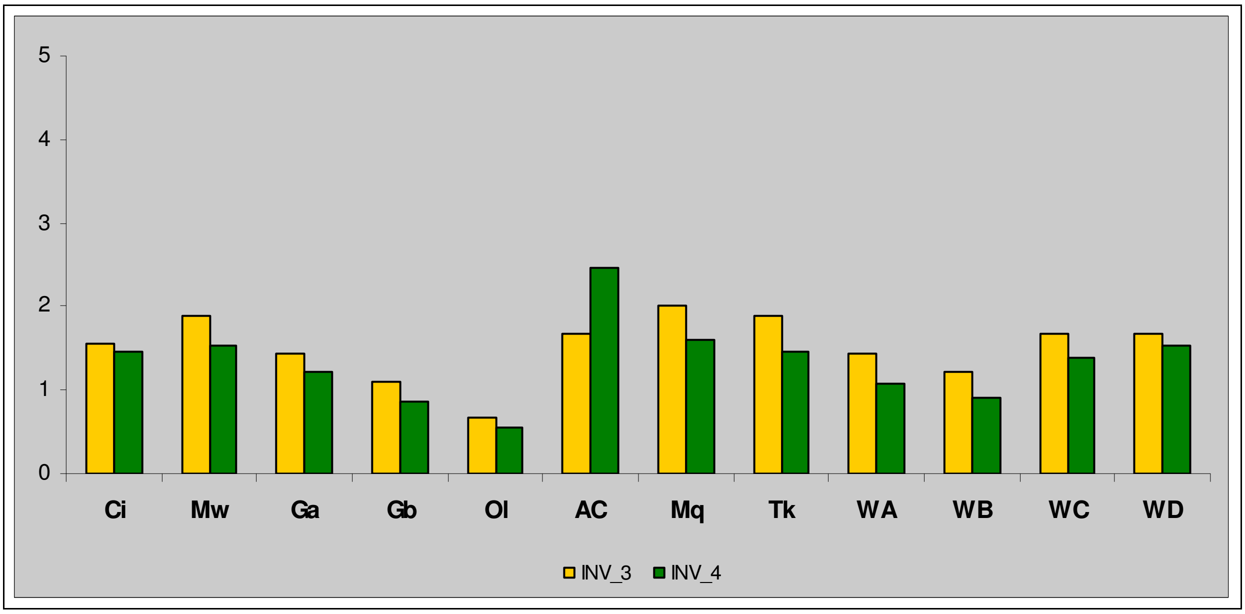
0 - 1: **low**
1,1 – 2: **medium-low**
2,1 – 3: **medium**
3,1 – 4: **medium-high**
4,1 – 5: **high**.

In table 11.4 are compared two methods for calculating **INV**: the first (**INV_3**) considers only 3 parameters of calculation (1 +2 +4 see tab. 11.2), while the second (**INV_4**) considers all 4 parameters shown in table 11.2.

STATIONS	***INV_3***	Rank-order INV_3	***INV_4***	Rank-order INV_4
Ci	*1,56*	7	*1,46*	5
Mw	*1,89*	2	*1,54*	3
Ga	*1,44*	8	*1,23*	8
Gb	*1,11*	11	*0,85*	11
Ol	*0,67*	12	*0,54*	12
AC	*1,67*	6	*2,46*	1
Mq	*2,00*	1	*1,61*	2
Tk	*1,89*	2	*1,46*	5
WA	*1,44*	8	*1,08*	9
WB	*1,22*	10	*0,92*	10
WC	*1,67*	4	*1,38*	7
WD	*1,67*	4	*1,54*	3

Tab. 11.4 – Values of INV (INV_3: with 3 calculation parameters; INV_4: with 4 calculation parameters), and relative Rank-order, for the12 station considered.

The graph. 11.1 shows the comparison of INV values (INV_3 and INV_4) determined for the 12 station considered.



Graph. 11.1 – Comparison between the values of INV found in the 12 stations considered. In **yellow** values of INV_3, in **green** those of INV_4. Further explanations in the text.

Comparing INV_3 with INV_4, we noted that the general situation of the stations did not vary substantially with the only exception of the station **AC**, where INV_3 shows the 6th rank-value while INV_4 shows the 1st. This is due (considering combinations of parameters as in tab. 11.2) to the fact that the INV_4 reveals, more than INV_3 does, the presence of endemic species in the single station respect to the total number of endemic species in the entire study area from the sampling station. Indeed, **AC** is the only station that detected 100% (2 species) of the endemic species sampled. For subsequent considerations it is therefore considered more appropriate to use the value of INV_4.

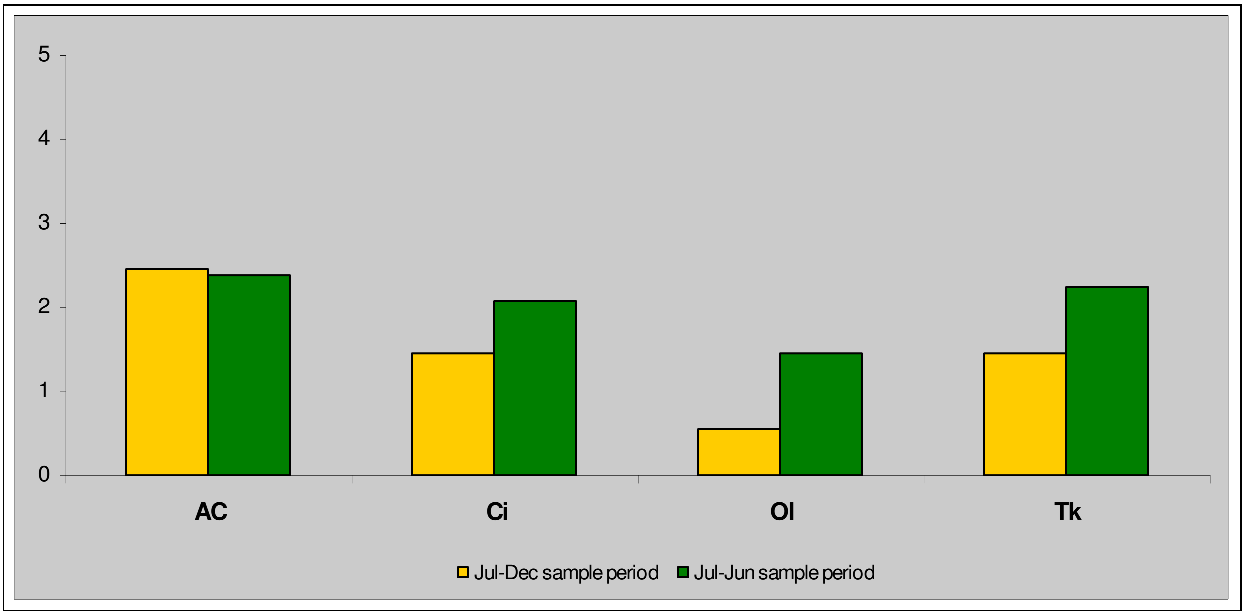
The examination of table 11.4 and graph 11.1 shows how all the stations fall within the classes ranging from medium to low. More specifically, only the **AC** station falls in the class of **medium** values (8,33% of total), 8 stations: **Ci**, **Mw**, **Ga**, **Mq**, **Tk**, **WA**, **WC** and **WD** (66,67% of total) in the **medium-low** class values, and 3 stations: **Gb**, **Ol** and **WB** (25% of total) in the class of **low** value.

The INV has also been calculated only for the 4 stations sampled during this study (**AC**, **Ci**, **Ol** and **Tk**) considering the entire annual period (July-June) of the sample. Values, compared with those for the period July-December, are summarized in table 11.5.

STATIONS	*Jul-Dec sample period*	Rank-order Jul-Dec	*Jul-Jun sample period*	Rank-order Jul-Jun
AC	*2,46*	1	*2,38*	1
Ci	*1,46*	2	*2,08*	3
Ol	*0,54*	4	*1,46*	4
Tk	*1,46*	2	*2,23*	2

Tab. 11.5 – Comparison between the values of INV recorded for the period July-December and July-June, and its rank-order for the 4 stations considered.

The examination of table 11.5 and graph 11.2 shows that between the two series of values are not observed, in general, significant differences in terms of rank-order, with the maximum value observed for **AC**, similar intermediate values for **Ci** and **Tk**, and the minimum found for **Ol**.



Graph. 11.2 – Comparison between the values of INV recorded for the period July-December and July-June for the 4 stations considered.

Instead, the situation changes (except for the **AC** station that falls in the class of **medium** values in both periods) if one take into account the value of INV. Stations **Ci** and **Tk** pass, in fact, from the class of **medium-low** values, for the period July-December, to the **medium** class, for the period July-June; while the station **Ol** passes from **low** class value to that of **medium-low**: this "adjustment" is to associate with the fact that the number of species counted during the longer sampling period is greater, therefore likely to be more representative than the shorter period.

The indices of faunal value (**INV**) thus obtained were then transferred to a geodatabase and linked, by means of a *join* procedure, to the Vegetation chart for the preparation of thematic maps in order to display "on the territory" the value of habitats monitored in this study (Annex I – Map of Naturality and Faunal value index. Representation of INV class value for the investigated patches and land typologies for the entire "Pino d'Aleppo" Natural Reserve).

12 CONCLUSIONS

From the faunistic point of view, the research has permitted to report three new species for the Sicilian fauna: ***Microlestes fissuralis*** (Reitter 1901), ***Pterostichus* (*Platysma*) *niger niger*** (Schaller 1783) and ***Micropeplus porcatus*** Paykull 1789.

Based on the research conducted, it is possible to illustrate some interesting conclusions.

1. The biodiversity of ground fauna occurs with different aspects depending on the stations and groups considered.

Biodiversity appears to be in some cases depending on the intrinsic structure of single stations, while in other cases on the group of animals taken into consideration, factors that can provide significantly different frameworks within each station (BÜCHS et alii, 2003, BERENDSE et alii 2009).

With regard to the complex of Coleoptera **Families**, station **AC** shows the minimum values for indices of Simpson and Shannon as for evenness index, and the penultimate for index of Margalef; for the highest values is station **Tk** for the Simpson's index (together with station **Ol**) and for the Margalef's index, station **Ol** for the Shannon's index, and stations **Ci** and **Tk** for the Pielou's index.

For **Carabidae** the station **Ol** shows clear minimum values for all α-biodiversity and evenness indices, while the maximum values for the indices of α- biodiversity are recorded in **Ci** station, and in station **Tk** for that of evenness.

For **Tenebrionidae** the minimum values of α-biodiversity are registered in station **Ci,** while the maximum for Margalef's index occurs in station **AC**, and that for Simpson and Shannon in station **Tk**. The Pielou evenness index show the maximum value in station **AC** and the minimum in station **Ol**.

Regarding **Staphylinidae** the progress of values shows the maximum of Margalef's index in station **Ci** and in station **Ol** for those of Simpson, Shannon and Pielou, while minimum values are observed in station **Tk** (Margalef's index) and station **Ci** (indices of Simpson, Shannon and Pielou).

The examination of Carabidae, Tenebrionidae and Staphylinidae coenosis seems to confirm the different responses by individual groups to the determination of biodiversity and evenness indices even within the same Order, as each taxon presents a slightly different aspect of the α-biodiversity and evenness in the single stations.

Data suggest that the assessment of biodiversity levels at one site should be interpreted with great caution, taking into account the component under investigation, which generally represents a fraction, more or less ample, of the total animal diversity, which reflects the characteristics of bio-ecological species considered and their ecological plasticity (DIEKÖTTER et alii 2008, BALOG et alii 2009).

It is therefore not possible to draw general considerations by examining just one or a few animal groups, although some areas may present intrinsic structural features that give a strong and homogeneous connotation to the composition and characteristics of the ground fauna. That represents a limitation for the biocoenotic analysis which can be partially solved by a multi-taxa approach (KOTZE & SAMWAYS 1999, DE ARANZABAL et alii 2008), which should be used to perform preliminary studies in order to elaborate concrete management procedures for natural and semi-natural environments and for agro-ecosystems, aimed at protecting biodiversity (YASUDA 2010).

2. Biodiversity is distributed in different temporal domains.

Although the periods of August-September and February-March show the minimum values of total CSD, a closer analysis of the most abundantly censed Families of Coleoptera shows different peaks of CSD value for each of them in different periods of sampling.

Tenebrionidae were registered throughout the year with trapping frequencies concentrated especially in spring and summer, peaking in May and June and showing minimum values of CSD in the period between December and March. **Carabidae** resulted present in all month of the year

except August; they are dominant in the month of December and abundant in autumn and winter months. **Staphylinidae**, also sampled throughout the year, show predominant activity in autumn, winter and early spring. **Nitiduludae**, **Ptinidae** and **Anthicidae** were present during all period as well, with **Nitidulidae** showing a concentration of trapping frequencies especially in December and January, while **Ptinidae** and **Anthicidae** show a more homogeneous trend of CSD values, slightly increasing in spring and summer.
The general scarcity of captures in August and September is easily explained by considering the general ecological context of the area characterized by xeric summer, and the tendential hygrophily of ground fauna, whose life cycle and/or vagility generally is related to a certain degree of soil moisture.
Regarding Coleoptera **Carabidae**, ***Calathus* (*Neocalathus*) *cinctus*** is the most abundantly captured species representing about 72% of the entire sample of that Family; it shows a clear concentration (about 90% of captures) between October and January with a peak in December (57,2%). Then ***Laemostenus* (*Pristonychus*) *algerinus algerinus*** (9% of the entire sample of Carabidae) shows a capture concentration (about 90%) between October and February, with a maximum value in December (27%). ***Pterostichus* (*Feronidius*) *melas italicus*,** representing 7,1% of the entire sample of Coleoptera Carabidae, indicates a clear concentration of CSD (more than 62%) in October and a sensibile decrease in the other months, being even null in July and August. ***Metallina* (*Neja*) *ambigua*** (2,2% of the entire sample of Coleoptera Carabidae) shows a distinct concentration of capture frequencies (92%) in April and May, while it results absent in the other month with exception of June and October, when however it registers CDS values a little significant.
With regard to the Coleoptera **Tenebrionidae**, among the most abundant species sampled is ***Zophosis punctata puntata*,** representing about 42% of the entire sample of Tenebrionidae with an evident concentration of capture frequencies (more than 98%) in summer months with a peak in June (49,2%), as well as ***Tentyria grossa grossa*** (12% of the entire sample of Tenebrionidae) which however shows CSD value peak in July. ***Alphasida grossa sicula*,** with 10,58% of the entire sample of Tenebrionidae, is present almost throughout the year, with higher CSD values in spring (where April presents the maximum CSD value, 30,61%) and autumn. ***Stenosis sardoa sardoa*** (9,5% of the entire sample of Tenebrionidae) shows a concentration of capture frequencies (83,52%) between April and June, with a peak in May; likewise ***Pimelia rugulosa sublaevigata*** (8,5% of the entire sample of Tenebrionidae) presents more than 69% of CSD concentrated between April and May, while for ***Stenosis melitana***, representing about 4,5% of the entire sample of Tenebrionidae, one can observe a peak of CSD (89,51%) in June and July, but null values between September and April.
Among **Staphylinidae**, ***Ocypus* (*Ocypus*) *olens olens*** (representing the most abundant species in terms of specimens captures, with 58,1% of the entire sample of Staphylinidae) appears with 94,7% of CSD concentrated in late autumn and winter months with a peak in October (23%); ***Sepedophilus nigripennis*** (12,6% of the entire sample of Coleoptera Staphylinidae) is registered with high values in winter (December-February), including 62,3% of total CSD for this species. For ***Anotylus speculifrons*,** with 4,46% of the entire sample of Coleoptera Staphylinidae, are observed two periods where most of the capture frequency are concentrated: the first between October and December, with 44% of the total CSD, and the second, between March and May, which registers 51,2% of capture frequencies. Then ***Paraphloeostiba gayndahensis***, representing 3,9% of the entire sample of Coleoptera Staphylinidae, shows a concentration of CSD (78,3%) between June and August, with a peak in July.
The asynchrony of captures peak for species of Carabidae, Tenebrionidae and Staphylinidae most abundantly sampled is an additional aspect of biodiversity. The phenology of the species permit to identify in the summer, characterized by the limiting factors (e.g. temperature and humidity) of primary importance in the mediterranean contest, the critical period for Carabidae and Staphylinidae but not for Tenebrionidae, coherently with the bio-ecological characteristics of these Families. The fraction of ground fauna of agro-ecosystems examined in this study shows a complex

structure through which it can occupy the most temporal ambits with different species that follow one another over time. This diversity, as the results of recent studies demonstrate (e. g. DUELLI et alii 1999, PURTAUF et alii 2005, BENNET et alii 2006, ZAMORA et alii 2007), is favored by the structure of the landscape mosaic.
The species of Coleoptera Carabidae, Tenebrionidae and Staphylinidae most abundantly sampled during this study, show, generally, a clear preference for a station where they recorded high values of CSD, while they are absent or present, with low values of CSD, in the other stations. Their presence is therefore linked to some patches, rather than others, and is thus made possible precisely by the environmental mosaic that characterizes the study area.

3. The biodiversity of ground fauna observed within the investigated agro-ecosystems is not as high on average, both for Families and for the species complex of Carabidae, Tenebrionidae and Staphylinidae, than that found in natural habitats within the same area.

The results obtained from the present field research have been compared with the data of a previous research conducted from July to December 2007 using the same method within the same area (R.N.O. "Pino d'Aleppo") in different habitat typology: 3 natural *Pinus halepensis* woods, 1 maquis, 2 garrigues, 1 meadow, 1 artificial Pine reforestation (BOCCHIERI 2009). In tables 12.1a-12.1d are presented the indices of Simpson, Shannon and Pielou referred to the all 12 stations (4 investigated in this study and 8 in the previous study) relative to the complex of Coleoptera Families and species of Carabidae, Tenebrionidae and Staphylinidae (excluding Aleocharinae).

Family

	STATIONS											
Index	Ci	Ol	AC	Tk	Mq	Ga	Gb	Mw	WA	WB	WC	WD
Simpson	0.81	0.83	0.79	0.83	0.86	0.80	0.83	0.90	0.6	0.59	0.87	0.86
Shannon	0.90	0.95	0.85	0.93	2.16	2.04	2.20	2.47	1.21	1.42	2.25	2.22
Pielou	0.64	0.63	0.58	0.64	0.75	0,72	0.67	0.81	0.64	0.46	0.79	0.75

Tab. 12.1a – Indices of Simpson, Shannon and Pielou relative to the complex of Coleoptera Families, at the 12 studied stations.

With regard to the Families complex can be observed that the Shannon's index values presented by agro-ecosystems is significantly lower than that of stations in natural environments, as well as for evenness index with the exception of station **WB**.

Carabidae

	STATIONS											
Index	Ci	Ol	AC	Tk	Mq	Ga	Gb	Mw	WA	WB	WC	WD
Simpson	0.75	0.15	0.32	0.72	0.40	0.65	0.63	0.92	0.24	0.65	0.70	0.84
Shannon	0.80	0.19	0.35	0.66	0.74	1.08	1.36	1.85	0.46	1.16	1.13	2.07
Pielou	0.64	0.20	0.26	073	0.53	0.78	0.59	0.95	0.42	0.72	0.82	0.81

Tab. 12.1b – Indices of Simpson, Shannon and Pielou relative to species of Carabidae, at the 12 studied stations.

The same for **Carabidae**, the indices of Shannon and Pielou show values sensibly lower for the agro-ecosystem than for the natural environments.

Tenebrionidae

	STATIONS											
Index	Ci	Ol	AC	Tk	Mq	Ga	Gb	Mw	WA	WB	WC	WD
Simpson	0.47	0.58	0.84	0.89	0.82	0.91	0.81	0.24	0.53	0.77	0.72	0.57
Shannon	0.39	0.53	0.93	0.97	1.89	2.03	1.80	0.45	0.92	1.71	1.23	0.63
Pielou	0.64	0.47	0.72	0.93	0.79	0.98	0.72	0.41	0.52	0.74	0.89	0.92

Tab. 12.1c – Indices of Simpson, Shannon and Pielou relative to species of Tenebrionidae, at the 12 studied stations.

Even with regard to **Tenebrionidae**, the Shannon's index for agro-ecosystem shows values significantly lower than that of natural environments with the exception of station **Mw**. The index of evenness also shows values significantly lower than that of the stations in natural environments with the exception of stations **Mw** e **WA**.

Staphylinidae

	STATIONS											
Index	Ci	Ol	AC	Tk	Mq	Ga	Gb	Mw	WA	WB	WC	WD
Simpson	0.39	0.83	0.74	0.55	0.88	0.81	0.91	0.59	0.94	0.75	0.82	0.32
Shannon	0.48	0.94	0.82	0.60	1.65	1.63	2.23	1.31	1.88	1.84	1.72	0.80
Pielou	0.34	0.71	0.61	0.52	0.92	0.84	0.90	0.63	0.96	0.74	0.83	0.35

Tab. 12.1d – Indices of Simpson, Shannon and Pielou relative to species of Staphylinidae, at the 12 studied stations.

As for Staphylinidae should be noted that they present a model of biodiversity indices values significantly different from the previous. For example, stations **Ol** and **AC** show the Shannon's index values higher than those recorded for stations **WD** and **Tk**, where in the latter appears the minimum value of this index. Similarly, the evenness index shows values significantly higher for stations **Ol** and **AC** compared to stations **Tk** and **WD** where there is a minimum value of the index. We must consider that among the most abundant Staphylinidae species sampled many are ubiquitous as ***Ocypus*** **(*Ocypus*)** ***olens olens*** and especially phyto- or zoo-saprophytic as ***Anotylus*** spp., ***Paraphloeostiba gayndahensis***, ***Sepedophilus nigripennis***, etc., connected to temporary microhabitats characterized by strong seasonal fluctuations, and provided with good dispersal ability related to active flight.

4. The stations differ significantly in community structure at any level they are investigated.

The examination of the indices of similarity and the Non Metric Muldimensional Scaling, based on the index of Bray-Curtis, show a general homogeneity between the traps of each of the 4 stations investigated in relation to biocoenosis of ground fauna at any level they are investigated. The ANOSIM tests confirms, with values always statistically significant for all groups considered, that traps of each station are more similar to each other than to those of other stations.

This homogeneity is accompanied by a slight similarity between the stations, as evidenced by the qualitative index of Sørensen and the Non Metric Muldimensional Scaling. In particular, the parwise test shows, for all groups investigated, that the dissimilarities between stations are, with few exceptions, statistically significant.

Each station shows an own structure of quality and quantity of ground fauna at all investigated levels (Families and species of Coleoptera Carabidae, Tenebrionidae and Staphylinidae).

In particular, for the Family of Coleoptera, **Silvanidae** are centered on station **Tk**, **Carabidae** and **Aphodidae** on station **AC**, while **Tenebrionidae** are centered on station **Ol**, together with **Melolonthidae**, that are exclusive of the station. **Anthicidae**, **Nitidulidae** and **Curculionidae** are centered on the pair of station **AC/Ol** contributing to determine their similarities and to differentiate them from the other stations.

As for **Carabidae,** ***Calathus*** **(*Neocalathus*)** ***cinctus***, ***Licinus*** **(*Licinus*)** ***punctatulus****,* ***Microlestes luctuosus*** and ***Metallina*** **(*Neja*)** ***ambigua*** (this last exclusive of the station) are centered on station **AC**, while ***Asaphidion curtum curtum*** and ***Pterostichus*** **(*Platysma*)** ***niger niger*** are exclusive of station **Ci**, while ***Carabus (Macrothorax) morbillosus alternans*** and ***Pterostichus (Feronidius) melas italicus*** are between the stations **Tk** and **Ci**, being more close to that last.

In relation to **Tenebrionidae**, ***Dendarus lugens*** and ***Scaurus tristis*** are centered on station **Tk**; ***Zophosis punctata punctata****,* ***Tentyria grossa grossa*** and ***Pimelia rugulosa sublaevigata*** characterize the station **Ol**; ***Stenosis melitana****,* ***Alphasida grossa sicula*** and ***Tentyria laevigata laevigata*** (this last exclusive of the station) are centered on station **AC**. ***Cnemeplatia atrops*** and ***Stenosis sardoa sardoa*** occupies an intermediate position between **AC** and **Ci** stations.

Among **Staphylinidae**, ***Tasgius*** **(*Tasgius*)** ***pedator siculus*** and ***Paraphloeostiba gayndahensis*** are centered on station **Ci;** ***Ocypus*** **(*Ocypus*)** ***olens olens*** occupies an intermediate position between stations **AC** and **Ci**. ***Heterothops minutus***, ***Xantholinus*** **(*Calolinus*)** ***rufipennis*** and ***Megalinus glabratus*** (this last exclusive of the station) are centered on station **AC**. ***Xantholinus*** **(*Typholinus*)** ***graecus graecus*** and ***Tachyporus nitidulus*** occupies an intermediate position between stations **AC** and **Ol**, while ***Anotylus inustus*** is between the stations **Ol** and **Tk**.

Even moving to comparisons between the 4 stations object of this study with the 8 investigated previously, the examination of the indices of similarity and the Non Metric Muldimensional Scaling shows a general uniformity (supported by the statistically significance by ANOSIM tests) among the traps of each of the 12 stations explored, in relation to biocoenosis of ground fauna at any level they are investigated.

The relative homogeneity of traps is reflected in this case as well in a slight similarity between the stations, as appears by the qualitative index of Sørensen and the Non Metric Muldimensional Scaling. Even for that the parwise test shows (for all groups investigated) that the dissimilarity between the stations is, with few exceptions, statistically significant and each station has its own qualitative and quantitative structure of ground fauna at all investigated levels (Families and species of Coleoptera Carabidae, Tenebrionidae e Staphylinidae).

The study points out that all considered stations differ significantly from each other for the structure of coenosis investigated, both in terms of quality and quantity, and that each has such features able to maintain different fractions of ground fauna, thereby contributing to preserve significant and peculiar portions of biodiversity.

5. The contribution of this biodiversity, and the stability of agro-ecosystems remains to be defined.

While the study highlighted the specificity of ground zoocoenosis within the individual stations investigated and their contribution to the conservation of territorial biodiversity, still remain to define the effects of this biodiversity on the stability of agro-ecosystems. This is a much debated topic and currently not all the authors agree to evaluate positively the effects of biodiversity present in natural areas on agro-ecosystems species communities.

It is controversial, for example, the possibility that natural areas may favor the diffusion of generalist predators which could play the role of regulators of the population of harmful species in the agro-ecosystems, limiting therefore the need to use pesticides; besides is actually discussed the role as ecological corridors played by natural and semi-natural areas within an environmental mosaic (WITH & CRIST 1995, KAREIVA & WENNERGREN 1995, DUELLI 1997, DUELLI & OBRIST 1998, HADDAD 1999, ALTIERI 1999, TSCHARNTKE et alii 2005, ROSCHEWITZ et alii 2005, DIEKÖTTER et alii 2008).

Even so, many authors agree on the importance of the landscape patch structure in determining the stability of the single agro-ecosystem (ATAURI & DE LUCIO 2001, ÖSTMAN et alii 2001, RENJIFO

2001, WITH et alii 2002, DAILY et alii 2003, EILU et alii 2003, WEIBULL & ÖSTMAN 2003, BENNETT et alii 2006, ERNOULT et alii 2006, ZAMORA et alii 2007, DE ARANZABAL et alii 2008).

6. In prospect of a correct land management, considering that the land investigated is a protected area, the patches should be protected to maintain significant levels of biodiversity.

The study highlights the strategic role of the environmental mosaic for the preservation of adequate levels of biodiversity of ground fauna in the area in question. In order to plan a correct policy for the preservation of biodiversity and management of protected areas, based on scientific criteria and not only aesthetic, maintaining high levels of heterogeneity of the landscape is therefore an important principle and a strategy to pursue.

The computation of the faunal value index for habitats (INV), based on species of Coleoptera Carabidae according the methodology proposed by BRANDMAYR et alii (2005), shows that the station with the highest value (medium class) is the agro-ecosystem **AC (Arable land with Carob trees)** followed by stations with medium-low class value, that in decreasing order are: **Mq** (**Maquis**), **Mw** (**Meadow**) and **WD** (**Pine artificial reforestation**), **Ci** (**Citrus grove**) and **Tk** (***P. halepensis* – *Q. calliprinos* thicket**), **WC** (***P. halepensis* wood 3**), **Ga** (**Garrigue 1**) and **WA** (***P. halepensis* wood 1)**, while only three stations: **WB** (***P. halepensis* wood 2)**, **Gb** (**Garrigue 2**) and **Ol** (**Olive grove**) show low class values for fauna quality.

The properties of the natural mosaic at a landscape scale and its significance for the conservation of biodiversity have been recently investigated (BÜCHS et alii, 2003, BENNET et alii 2006) in order to have a valid scientific basis for the study and the preparation of measures for protection and land management. The studies underline three main properties that affect biocoenosis: the extension of the habitat, the composition of the mosaic and the spatial configuration of the elements. In particular, the extension of the habitat influences the presence of individual species. The structure of the mosaic, seen as a proportion of habitat present, has important effects on the composition of the whole fauna. In our case, the extreme fragmentation, the small size and their relative isolation give to the natural landscape patches of the Pineta di Vittoria a marked ecotonal facies, which affects the structure and stability of the biological communities in the single patch. This could explain, for example, the low affinity found between the four residuals of *Pinus halepensis* forest, or between the two fragments of mediterranean maquis. The extension of such patches of natural landscape would therefore be an important purpose towards the biodiversity conservation and the recovery of a more stable and homogeneous biocoenosis of scrub and forest environments.

Whereas some studies have shown different properties of the environmental mosaic characterized by good or poor ecological connectivity and different responses depending on the groups investigated (DIEKÖTTER et alii 2008), the conservation strategies should be guided by flexible principles and based on appropriate preliminary studies.

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ANNEX I – MAP OF NATURALITY AND FAUNAL VALUE INDEX