

# Phytosociological research of the *Erica* heathlands and evergreen broadleaved shrublands at the north side of Mount Cholomon

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## Abstract

Mediterranean *Erica* heathlands and evergreen broadleaved shrublands consist considerably degraded communities primarily due to overgrazing and repetitive fires. A phytosociological analysis of these communities was carried out at the north side of Mount Cholomon (Chalkidiki, N. Greece) using the Braun-Blanquet method. The classification of the vegetation units was achieved through Twinspan analysis on 80 relevés and resulted in one community and one association. The evergreen broadleaved shrublands are assigned to the Quercetea (-alia) ilicis, as *Arbutus unedo-Erica arborea* community, and the *Erica manipuliflora* heathlands to the Cisto-Micromerietea julianae, as *Ericetum verticillatae* association. The floristic composition of the research area consist of 176 taxa comprising high number of taxa belonging to the classes Thero-Brachypodietea and Festuco-Brometea that confirm the intense degradation.

**Key words.** Syntaxonomy, vegetation, *Erica manipuliflora*, Chalkidiki

## Introduction

Heathlands and evergreen broadleaved shrublands in the Mediterranean area are highly degraded primarily due to overgrazing and repetitive fires. Phytosociological research in Greece in this type of ecosystems is very limited (Oberdorfer 1954, Krause et al. 1963, Knapp 1965, Horvat et al. 1974, Raus 1979, Bergmeier 1990, Konstantinidis 1990, Athanasiadis et al. 1998, Stamou 2004, Theodoropoulos et al. 2011).

The research area is situated at the north side of mount Cholomon in Chalkidiki (Northern Greece). Geologically, the area belongs to the Vertiscos Range of the Serbomacedonian massif (Mountrakis 1985), and the substrate consists of igneous acid rocks (granites, granodiorites, monzonites) (I.G.M.E. - Institute of Geology and Mineral Exploration 1983).

The climate of the area is classified as the "Csa climatic type" according to Köppen's classification, representing Mediterranean climate with "very hot and dry summers and mild winters" (Theodoropoulos 1991; source of data: Meteorological Station of Arnea).

The vegetation of the area is mostly consisted of Mediterranean type ecosystems and the results of the longlasting and intense anthropogenic influence (overgrazing, fires) are obvious everywhere in the study area.

The aim of this study is to: (1) classify the heathlands and evergreen broadleaved shrublands at the north side of the mount Cholomon, and (2) describe their floristic composition, as well as the environmental factors related to the defined vegetation units.

### **Materials and Methods**

Data from 80 sample plots were recorded in May and June of 2008 using the Braun-Blanquet approach (Braun-Blanquet 1964). Selected sites for sampling were homogenous in species composition and environmental conditions. Plot size was 100 m<sup>2</sup> according to Chytrý & Otýpková (2003). Physiographic data i.e. elevation, exposure, slope, macro- and microrelief were recorded for each sample plot as well as shrub and herb ground cover. Two classification layers of the plants have been chosen: (a) the herbaceous layer (H), which includes all herbaceous species and woody species up to 0.50 m; (b) the shrub layer (S), which includes all woody species from 0.50 m up to 5 m.

Vascular plants were identified using Flora Europaea 1-5 (Tutin et al. 1968-1980, 1993), and Flora Hellenica 1 & 2 (Strid and Tan 1997, 2002). Furthermore, selected taxonomic literature was used (Zohary and Heller 1984, Scholz 1986). The nomenclature of taxa follows Euro+Med (2006-2011), Flora Hellenica 1, 2 (Strid and Tan 1997, 2002), Med-Checklist 1, 3, 4 (Greuter et al. 1984-1989) and Flora Europaea 1-5 (Tutin et al. 1968 -1980, 1993).

The relevés were stored in the TURBOVEG database (Hennekens and Schaminée 2001). For cover-abundance values the seven-degree Braun-Blanquet scale was used. Vegetation data were processed using JUICE 6.5 software (Tichý 2002). Two-way indicator species analysis (Twinspan) (Hill 1979) was applied, as a classification technique. In addition hand sorting was considered necessary to achieve the final phytosociological table.

The syntaxonomy was conducted on the basis of Knapp (1965), Horvat et al. (1974), Raus (1979), Bergmeier (1990), Athanasiadis et al. (1998), Stamou (2004), Mucina et al. (2009), Theodoropoulos et al. (2011). The nomenclature of vegetation units follows Weber et al. (2000).

## Results

Phytosociologically, one community and one association as well as inferior vegetation units were distinguished (Table 1). The syntaxonomy, the structure and the synecology of the distinguished phytosociological units are discussed.

The plant list contains 176 taxa; the floristic composition of the *Erica manipuliflora* heathlands consists of 118 taxa and the evergreen broadleaved shrublands of 141 taxa.

### *Syntaxonomic synopsis*

CLASS: Quercetea ilicis Br.-Bl. ex A. de Bolòs y Vayreda 1950

ORDER: Quercetalia ilicis Br.-Bl. ex Molinier 1934

ALLIANCE: Erico-Quercion ilicis S. Brullo et al. 1977

COMMUNITY: *Arbutus unedo-Erica arborea* community

VARIANT: with *Satureja vulgaris-Rubus canescens*

CLASS: Cisto-Micromerietea julianae Oberd. 1954

ORDER: Poterietalia spinosi Eig 1939

ALLIANCE: Hyperico olympici-Cistion cretici (Oberd. 1954) R. Jahn et Bergmeier in

Mucina et al. 2009

ASSOCIATION: Ericetum verticillatae (= manipuliflorae) Oberd. 1954

VARIANT: with *Psilurus incurvus-Trifolium campestre*

### ***Arbutus unedo-Erica arborea* community (Quercetea ilicis)**

The community is characterized by a shrub layer with a cover degree of 50-90% in which *Arbutus unedo*, *Erica arborea*, *Juniperus oxycedrus* subsp. *oxycedrus* and *Erica manipuliflora* participate mainly, while other species as *Quercus pubescens*, *Phillyrea latifolia* and *Arbutus andrachne* participate at a lower degree (Table 1: I & II). The maximum height of shrubs in the plots is 1-5 m and the average height of the 10 highest shrubs per plot is 0.8-3.3 m.

The herb layer is rich in species (13-41 per plot) with a cover degree of (50)65-95%. Apart from the above mentioned woody taxa, the following were also identified in the particular structure: *Genista carinalis*, *Dorycnium graecum*, *Teucrium chamaedrys*, *Leontodon hispidus*, *Stipa bromoides*, *Luzula campestris*, *Scabiosa triniifolia*, *Cytisus triflorus*, *Hypericum montbretii*, *Carex flacca* subsp. *serrulata*, *Ferulago sylvatica*, *Thesium divaricatum*, *Brachypodium pinnatum* subsp. *pinnatum*, *Physospermum*

*cornubiense*, *Aira elegantissima*, *Scleranthus perennis* subsp. *dichotomus*, *Chrysopogon gryllus*, *Thesium humile*, *Muscari neglectum*, *Trifolium arvense*, *Vulpia myuros*, *Pilosella piloselloides*, *Teesdalia coronopifolia*, *Thymus sibthorpii* and others. A significant number of herbs are diagnostic of classes Thero-Brachypodietea and Festuco-Brometea.

The *Arbutus unedo-Erica arborea* community occurs at an altitude of 386-665 m a.s.l. (386-400: 12.1%, 401-500: 54.5%, 501-600: 18.2%, 601-665: 15.2%), at various exposures (NW and NE: 69,7%, E: 18,2%, W: 9,1% and SSE: 3%), at slopes of inclination 1-50% (1-30%: 67%, 31-50%: 33%), and on acid soils which developed on granite (type Arneas). The 87.9% of the plots found in the lower or middle part of the slope and with varying microrelief.

In the *Arbutus unedo-Erica arborea* community, the variant with *Satureja vulgaris-Rubus canescens* was distinguished (Table 1: I). The variant is differentiated by a group of 14 differential species. The shrub layer cover is 65-85%, while this of the herb layer is 70-95%. The maximum height of shrubs of the variant is 1.6-5 m and the average height of the 10 highest shrubs per plot is 1.1-3.3 m. Number of taxa per plot is 24-41. The variant was found at the altitude of 386-472 m a.s.l., with northern exposures, mainly at the lower or middle part of even or concave slopes and at inclination of 4-42%. Physiographic factors of the variant reveal better soil-water conditions and suggest that the variant occurs in the best ecological locations, occupied by the community.

### ***Ericetum verticillatae (Cisto-Micromerietea julianae)***

The structure of the *Ericetum verticillatae* association is characterized by the high presence and constancy of *Erica manipuliflora* (Table 1: III & IV). The cover of the shrub layer is (15)30-70%. Except from *Erica manipuliflora*, *Quercus coccifera*, *Arbutus unedo*, *Anthyllis hermanniae*, *Cistus salvifolius*, *Cistus creticus* participate with lower cover and presence values. The maximum height of shrubs is 0.7-3.2 m and the average height of the 10 highest shrubs per plot is 0.6-1.4 m.

The herb layer is very dense covering 60-85% of the surface with 10-41 taxa per plot. Species of the genus *Cistus* and characteristic taxa of the classes Thero-Brachypodietea and Festuco-Brometea were identified characterized by high presence and cover.

The association is found at an altitude of 372-585 m a.s.l., mainly between 400-500 m (74.5%). There is no special preference for the exposure, and the inclinations vary from 4% to 34% (1-30%: 85.1%, 31-34%:

14.9%). The soils are acid developing on granite (Noidou 2003). The 87.2% of the plots were found in the lower or middle part of the slope and with varying microrelief.

In the *Ericetum verticillatae* association, the variant with *Psilurus incurvus-Trifolium campestre* was distinguished (Table 1: IV). The variant is differentiated by a group of 23 species. Cover of shrub layer reaches 15-65%, while the herbs layer the 60-85%. The maximum height of shrubs at the plots of the variant is 0.7-2.5 m and the average height of the 10 highest shrubs per plot is 0.6-1.1 m. Number of taxa per plot varies from 16 to 41. The variant was found at the altitude of 372-525 m a.s.l., mainly at the lower part of slopes and at inclinations of 4-32%. Physiographic factors of the variant reveal that it occurs in the most degraded locations of the research area.

## Conclusions

The evergreen broadleaved shrublands are assigned to the Quercetea (-alia) *ilicis*, as *Arbutus unedo-Erica arborea* community, and the *Erica manipuliflora* heathlands to the Cisto-Micromerietea *julianae*, as *Ericetum verticillatae* association.

High presence and cover of species of the classes Thero-Brachypodietea and Festuco-Brometea confirm the intense degradation of the vegetation.

The floristic composition of the *Erica manipuliflora* heathlands (118 taxa) and the evergreen broadleaved shrublands (141 taxa) of the research area consist of 176 taxa.

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