Thermophilous grasslands of southeastern Europe

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Abstract

A large proportion of grasslands found in southeastern Europe are thermophilous in the sense that they grow in the low elevation zone and are dominated by the warm season perennial grasses *Chrysopogon gryllus* and *Dichanthium ischaemum* (=*Bothriochloa ischaemum*). In fact, they are transitional between the typical Mediterranean grasslands dominated by annual grasses and the temperate grasslands dominated by perennial cold season grasses. In this paper, their distribution as well as their phytosociological, ecological and economic aspects are reviewed and discussed. They are distributed in the Quercetalia pubescentis zone, mostly in the Ostryo-Carpinion orientalis subzone, in large openings and represent the last stage of grassland colonization after the destruction of forests. Phytosociologically, these grasslands are classified in many associations or plant communities (e.g. Chrysopogono-Caricetum humilis, Thymo urumovii–Chrysopogonetum) mainly of the Festucetalia valesiacae order (Festuco-Brometea class), but also in other orders and classes such as Helianthemetea guttati, depending on their floristic composition. They are very productive grasslands with high grazing value for livestock. Because of their high plant diversity and the threat of vegetation succession, these semi-natural grasslands are under protection status in several areas (e.g. "Ponto-Sarmatic steppes", which are a priority habitat type under the EU Directive 92/43).

Key-words: *Chrysopogon gryllus, Dichanthium ischaemum,* transitional grasslands, Balkan peninsula, grazing value

Introduction

Grasslands are an important vegetation type in southeastern Europe both from the ecological and economic point of view. They are distributed throughout the region, from the sea level up to the peak of the mountains. With the exception of those found in the alpine zone of the mountains, which can be considered as climax plant communities, all the other grasslands are successional in the sense that they have been derived mainly from forests after their destruction by human activities. In the low elevation zone of the southern Greek peninsula and the islands as well as in the coastal areas bordering the Aegean, Ionian and Dalmatic seas, where the climate is typical Mediterranean, grasslands are dominated by annual grasses. However, as we move to higher elevations and inland, the annual are gradually replaced by perennial grasses. In the sub-mediterranean zone

as well as in the warmer part of the continental zone, the dominant perennial grasses are *Chrysopogon gryllus* and *Dichantium ischaemum* (=*Bothriochloa ischaemum*), which are C_4 plants thus forming a distinct type of warm season or thermophilous grasslands. These grasslands are transitional between the typical mediterranean grasslands dominated by annual grasses and temperate grasslands dominated by cool season perennial grasses (C_3 plants).The aim of this paper was to review and discuss their phytosociology, ecology and grazing value so that their importance for conservation is demonstrated.

Phytosociological aspects

Horvat et al. (1974) classified thermophilous grasslands in the association Chrysopogonetum grylli despite their high variation in floristic composition from one area to another. According to Drăgulescu and Schumacher (2006), it is very easy to say that all these plant communities (with *Chrysopogon gryllus*) belong to the Chrysopogonetum grylli, but actually, only in Romania, there are four to six different vegetation types in this association. Until now, almost 23 different plant communities and associations with *Chrysopogon gryllus* have been described in this country. The association Chrysopogono-Caricetum humilis (=Stipo-Caricetum humilis) seem to occur in an altitude of about 400-500 m a.s.l.; it is also recorded in the western periphery of Western Carpathians, but without *Dichanthium ischaemum*. In addition, the Salvio nemorosae-Festucetum rupicolae and some other associations (Festuco valesiacae-Stipetum capillatae and Astragalo austriaci-Festucetum sulcatae) are also represented in the western Carpathians and the northern Pannonian Basin (Dúbravková et al. 2010). They include several continental species in contrast to the same grasslands of the central and southern Balkans where several sub-Meditteranean and Mediterranean species are found. In the Danube plain of Bulgaria, these transitional grasslands are found at 100 m a.s.l. and classified in the Festucion(-etalia) valesiacae (Festuco-Brometea) as Thymo urumovii-Chrysopogonetum grylli (Tzonev 2009).

According to Kojić et al. (2005), there are more than 13 described associations of hill meadows and pastures which have *Chrysopogon gryllus* as dominant species in Serbia and Montenegro; the most widespread of these associations are (a) Agrostio-Chrysopogonetum grylli (western and central Serbia) with acidophil and acido-neutrophil character, and (b) Teucrio-Chrysopogonetum grylli (eastern Serbia) on south exposures. Apostolova and Meshinev (2006) mention that the mesophytic-character grasslands with *Chrysopogon gryllus* and *Dichanthium ischaemum* are

included inside the Agrostideto-Chrypogonetum grylli (Chrysopogono-Danthonion calycinae, Festucetalia valesiacae). This association is also strongly connected with *Quercus* forests as it is usually found in openings or in clear cut forests of these species. Apostolova and Meshinev (2006) claims that the widely distributed Botriochloetum ischaemi thymetosum pannonici (Festucion valesiacae) includes the grasslands dominated by *Dichanthium ischaemum* and *Chrysopogon gryllus* in Bulgaria. Except from these vegetation types, *Chrysopogon gryllus* and *Dichanthium ischaemum* occur also in other associations and transitional plant communities, such as Poo-Achilleetum pseudopectinatae (Trifolion cherleri, Heliantemetalia(-etea) guttati) (Sopotlieva 2009).

In Greece, vegetation units in which these two species occur are sometimes classified in Thero-Brachypodietea (Dafis et al. 2001), because of the high abundance of annual species. High abundance of annual species (almost up to 45%) has been also recorded in the steppe-like grasslands with *Chrysopogon gryllus* and *Dichanthium ischaemum* studied by Pirini et al. (2006) in the area of Vegoritida-Petron, northwestern Greece. In the same region, in grasslands where both of these species are found, a plant community, which had not more than 25% of annual species, was also classified in Festuco-Brometea (Pirini et al. 2006). In the same area, Pirini (2011) described the *Chrysopogon gryllus-Dichanthium ischaemum* comm. and classified it in Astragalo-Potentilletalia and in Festuco-Brometea.

Ecological aspects

Although both *Chrysopogon gryllus* and *Dichanthium ischaemum* are warm season grasses they do not have identical growth patterns. *Chrysopogon gryllus* flowers in late spring and gets dry in the summer much earlier than *Dichanthium ischaemum*. In addition, the latter flowers again during summer if it is rainy while the former does not (Papanastasis 1990). On the other hand, both species are very productive but *Dichanthium ischaemum* has higher productivity and better correlation with air temperature and rainfall (Papanastasis 1981). Finally, *Dichanthium ischaemum* is more flexible and a more affective colonizer that *Chrysopogon gryllus* (Papanastasis 1998).

Thermophilous grasslands have a very high plant cover (Tzonev 2009) and are very rich in plant species, both annual and, especially, perennial. In central Macedonia, northern Greece, it was found that annuals were more abundant in the low election zone (about 50 m a.s.l.), where *Chrysopogon gryllus* and *Dichanthium ischaemum* were the only perennial grasses present, than in the middle elevation zone (about 600 m a.s.l.), where other

perennial cool season grasses were also present (Papanastasis 1982). In the Danube plain of Bulgaria, several species, mostly perennial, are found in these grasslands, such as *Eryngium campestre* and *Teucrium polium* (Tzonev 2009), while in Romania *Thymus pannonicus* and *Dorycnium herbaceum* are also recorded (Drăgulescu and Schumacher 2006). Finally, high abundance of the same two species is also found in serpentine soils of northern Greece (Tsiripidis et al. 2010); in this case, several xerophytic species, such as *Thymus sibthorpii, Teucrium capitatum,* and several legumes (more than 9 taxa) and grasses (more than 15 taxa) are found.

According to the Directive 92/43/EEC, thermophilous grasslands constitute the priority habitat type "6240* Sub-pannonic steppic grasslands" (European Commission 2007). Also, according to the same directive, many vegetation types of Thero-Brachypodietea (including these with *Chrysopogon gryllus* and *Dichanthium ischaemum*) are listed as priority habitat types (European Commission 2007). These grasslands are sometimes in association with broadleaved deciduous forests and with the priority habitat type "62C0* Ponto-Sarmatic steppes" (European Commission 2007). It seems that grazing keeps these grasslands open and when the grazing ceases the vegetation succession begins resulting in deciduous forests.

Economic aspects

Despite the fact that thermophilous grasslands have a high number of plant species, Kojić et al. (2005) believe that they have less economic value than other grassland plant communities (e.g. Brometum erecti). Nevertheless, thermophilous grasslands are important grazing areas for domestic animals, in late spring, summer and early autumn months. *Chrysopogon gryllus* and *Dichantium ischaemum* are both readily grazed by cattle and horses, while sheep prefer them when they are at the vegetative stage and before they develop their flowers stalks. Their nutritive content is comparable to other perennial grasses, but their value lies on the fact that they stay green in the summer when the other grasses have already matured (Papanastasis 1990). Also, they are both very resistant to heavy grazing (Koukoura 1978).

Conclusions

Thermophilous grasslands dominated by *Chrysopogon gryllus* and *Dichantium ischaemum* are: (a) xerophytic steppe-like grasslands, phytosociologically classified mainly in Festuco-Brometea class and probably in the Balkan Astragalo-Potentilletalia order; (b) of very high plant

diversity suggesting a high ecological value, (c) of very high economic value as grazing areas because they have favorable to animals floristic composition and high quantities of biomass (given the xerophytic nature of these grasslands), (d) distributed in low (in the northern part of their distribution) to medium (in the southern part of their distribution) altitudes indicating their adaptation to harsh and continuous anthropogenic impact, (e) connected with forest vegetation since they are found inside forest openings or have a pre-forest character; and (f) are protected under the Directive 92/43/EEC due to their high ecological value, with at least three different priority habitat types in the south, central and north Balkan Peninsula. The most serious threat for these grasslands is vegetation succession, while grazing seems to be the most important factor for their conservation.

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