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ON THE SOCIOLOGY OF *CHRYSOPOGON*
GRYLLUS IN YUGOSLAVIA

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According to different authors the species *Chrysopogon gryllus* has different synecologic (diagnostic) validity in dry grasslands in Yugoslavia, namely as the character species of several associations or of higher syntaxonomic units, or as the differential species or companion.

A comparative analysis of plant communities containing *Chrysopogon gryllus* in Yugoslavia shows that this plant has its sociological optimum in the communities of the order *Festucetalia valesiacae* (class *Festuco-Brometea*). Consequently, it can be designated as the character species of this order, and in other communities of the class *Festuco-Brometea* as the transgressive character species of the class.

Introduction

The species *Chrysopogon gryllus* (L.) Trin. (*Poaceae*) is considered, with regard to its distribution, as paleo-subtropical (Fournier 1961: 43), mediterranean-pontic (Horvatić 1963: 128), southeuropean-southwestasian (Ilijanić et al. 1972: 162—163) or pontic-mediterranean (Cincović and Kojić 1976: 271) floral element.

It is distributed in Yugoslavia mostly in dry grasslands in submediterranean coastal regions from Slovenia to Macedonia as well as in the eastern inland regions (Serbia), and more rarely in the western inland region in Slovenia and Croatia (cf. Schlosser and Vukotinović 1869, Soklić 1943, Mayer 1952, Kovačević and Brzac 1960, Ilijanić et al. 1972).

Recently (1989), *Chrysopogon gryllus* was found on new localities in northeastern Croatia at Bistrinci near Belišće in Podravina and sporadically in Baranja (J. Topić, B. Panjković). Also, it was found in the surroundings of Krško in Slovenia a few years ago (Lj. Ilijanić and Lj. Marković). These finds, not yet published, complete to a certain extent the picture of the distribution of *Chrysopogon gryllus* in Croatia and Slovenia.

As this plant is the dominant species in many plant communities and its synecologic (sociologic) amplitude is wide (cf. e.g. Koch 1943, Kojić 1954, 1957, 1959, Horvatić 1963, Lorenzoni 1965, Csűrös and Niedermaier 1966, Antoniotti 1970, Loisel 1970, Aubert and Loisel 1971, Ilijanić et al. 1972, Micevski 1972, 1973, 1977, Meyer 1976 a.o.) different authors give it rather different diagnostic validity (sociologic status).

On the basis of synecological data from Yugoslavia, we wanted to establish the location of its ecologic (sociologic) optimum and its diagnostic (syntaxonomic) significance in the grassland communities containing *Chrysopogon gryllus* in Yugoslavia.

Methods

To determine the sociological amplitude of *Chrysopogon gryllus* and communities with the optimum of its distribution in Yugoslavia, we made a comparative constancy table. The communities with *Chrysopogon gryllus* described by different authors have been taken into consideration for the table.

The upper part of the Table shows full names of vegetation classes, orders and alliances (according to the authors of these syntaxonomic units). As there are numerous associations, they are marked only by number in the upper part of the Table. Their full names, authors and the area where they have been investigated are entered in the lower part of the Table. Also, authors of papers taken from the data in the Table are given, as well as the syntaxonomic status (diagnostic validity) of *Chrysopogon gryllus* as determined by the authors of cited papers (Table 1).

Results and Discussion

As shown in Table 1 the species *Chrysopogon gryllus* is present in numerous grassland communities in Yugoslavia. From the syntaxonomic standpoint these communities belong to different higher vegetation units (alliances, orders and classes).

Different authors have given the species *Chrysopogon gryllus* various syntaxonomic status (diagnostic validity). Horvatić (1963) included it in the associations of the submediterranean order *Scorzoneroides-Chrysopogonetalia* as the character species of this order (Table 1, ass. no. 1—4 and 6—8), also did Šegulja (1969) in the association *Narcissoides-Asphodeletum microcarpi* (Table 1, no 5) and Ilijanić (1970) as a common plant of the alliance (*Scorzonerion villosae*) and order (Table 1, no. 9).

Table 1.

CLASS	BRACHYPODIO-CHRYSOPOGONETEA H-ic (1956) 1958																							FESTUCO			
	SCORZONERO-CHRYSOPOGONETALIA H-ic et Ht (1956) 1958										CYMBOPOGO-BRACHYPODIE-TALIA H-ic 1958												ASTRAGALO-POTENTILLETALIA Micev. 1970				
ORDER	CHRYSOPOGONO-SATUREION Ht. et H-ic 1934					SCORZONERION VILLOSAE H-ic 1949					VULPIO-LOTION H-ic 1960	TRIFOLION CHERLERI Micev. 1970				SCABIOSO-TRIFOLION DALMATICI H-ic et Rand. 1973		SATU-REIO-THY-MION Micev. 1970	KOELE-RIO-FES-TUCION Ruž. et Rand. 1982	CHRYSOPOGONO-DANTHONION CALYCO							
	ASSOCIATION*	1	2	3	4	5	6	7	8	9		10	11a	11b	12a	12b	13			14	15	16	17a	17b	17c	17d	17e
NUMBER OF RELEVÉS	12	4	16	12	8	17 + 5	20	22	1	9	32	53	29	22	10	21	44	11	35	—	23	10	15	17	14		
CONSTANCY and C.-A. DEGREE of CHRYSOPOGON	I ²	1 ⁺	V ²⁻³	V ³	V ¹⁻²	IV + V ²⁻³	V ³	IV ²⁻³	1 ⁺	V ³	I ⁺⁻²	III ⁺⁻⁴	IV ⁺⁻⁴	V ¹⁻⁴	V ⁺⁻³	IV ⁺⁻³	II ⁺⁻²	I ⁺	V ³⁻⁵	V ³⁻⁵	V ⁺⁻⁵	V ²⁻⁴	V ²⁻⁴	V ³⁻⁵	V ¹⁻⁵		
DIAGNOSTIC VALIDITY OF CHRYSOPOGON GRYPILLUS	Char. O.	Char. O.	Char. O.	Char. O.	Char. O.	Char. O.	Char. O.	Char. O.	Char. All. et. O.	Transgr. Cl.	Char. Cl.	Char. Cl.	Char. Cl.	Diff. Subass.	Char. Cl.	Char. Cl.	Char. Cl. (see text)	Char. Cl.	Char. O. + Cl.	Char. Ass.	Comp.	Domin.	Char. O. + Cl.	Char. Cl.			

- *1. *Stipo-Salvietum officinalis* H-ic (1956) 1958 — Croat. (Medit.) (Horvatić 1963)
 2. *Helichryso-Armerietum dalmaticae* H-ic 1963 — Croat. (Medit.) (Horvatić 1963)
 3. *Festuco-Koelerietum splendentis* H-ic 1963 — Croat. (Medit.) (Horvatić 1963)
 4. *Asphodelo-Chrysopogonetum grylli* H-ic (1956) 1958 — Croat. (Medit.) (Horvatić 1963)
 5. *Narcisso-Asphodelatum microcarpi* Seg. 1969 — Croat. (Medit.) (Segulja 1969)
 6. *Ononido-Brometum condensati* H-ic (1956) 1958 — Croat. (Medit.) (Horvatić 1963)
 7. *Chrysopogono-Euphorbietum nicaensis* H-ic (1956) 1958 — Croat. (Medit.) (Horvatić 1963)
 8. *Danthonio-Scorzoneretum villosae* H-ic (1956) 1958 — Croat. (Medit.) (Horvatić 1963)
 9. *Andropogono-Diplachnetum serotinae* H-ic 1963 — Croat. (Medit.) (Ilijanić 1970)
 10. *Chrysopogono-Airetum capillaris* H-ic (1956) 1958 — Croat. (Medit.) (Horvatić 1963)
 11a. *Erysimo-Trifolietum onobrychietosum* Micev. 1977 — Macedonia (Micevski 1977)
 11b. *Erysimo-Trifolietum* Micev. 1977 — Macedonia (Micevski 1977)
 12a. *Helianthemo-Euphorbietum thessalae* Micev. 1973 — Macedonia (Micevski 1973)
 12b. *H.-E. th. chrysopogonetosum* Micev. 1978 — Macedonia (Micevski 1978)
 13. *Trifolio-Lotetum angustissimi* H-ic et Rand. 1973 — Serbia (Randelović 1978)
 14. *Astragalo-Calaminthetum alpinae* H-ic et Rand. 1973 — Serbia (Randelović 1978)
 15. *Brachypodio-Onobrychietum pindicola* Micev. 1971 — Macedonia (Micevski 1971)
 16. *Festuco-Plantagnetum serpentini* Ruž. et Rand. 1982 — Serbia (Randelović, Ružić 1983)
 17a. *Agrostio-Chrysopogonetum grylli* Kojić 1959 — Serbia (Kojić 1959)
 17b. *Agr.-Chr. grylli* Kojić 1959 — Serbia (Jovanović-Dunjić et al. 1986)
 17c. *Agr.-Chr. grylli* Kojić 1959 — Serbia (Gajić 1961)
 17d. *Agr.-Chr. grylli* Kojić 1959 — Serbia (Tatić 1969)
 17e. *Agr.-Chr. grylli* Kojić 1959 — Serbia (Diklić, Nikolić 1972)
 18a. *Trifolio-Trisetetum flavescens* Rand. 1975 — Serbia (Randelović 1975)
 18b. *Festuco-Chrysopogonetum grylli* Rand. (1975) 1977 (= *Trifolio-Trisetetum flavescens* Rand. 1975) — Serbia (Ružić 1983)
 19. *Chrysopogonetum grylli* Vučković 1983 — Vojvod. (Serbia) (Vučković 1983)
 20. *Teucrio-Chrysopogonetum grylli* R. Jov. 1954 — Serbia (Horv. Glav. Ellenb. 1974)
 21. *Trifolio-Chrysopogonetum grylli* Veljović 1967 — Serbia (Veljović 1967)
 22. *Bromo (suarosi)-Chrysopogonetum grylli* Kojić 1959 — Serbia (Kojić 1959)
 23. *Chrysopogono-Festucetum valesiaca* Veljović 1971 — Serbia (Veljović 1971)
 24. *Chrysopogonetum panonicum* Stjep.-Vesel. 1953 — Vojvod. (Serbia) (Horv. Glav. Ellenb. 1974)
 25. *Thymo-Chrysopogonetum grylli* S. Stojanović 1983 — Vojvod. (Serbia) (Stojanović 1983)
 26. *Chamaecytiso austriaca-Chrysopogonetum* Butorac 1989 — Vojvod. (Serbia) (Butorac 1989)
 27. *Centaureo sadleriana-Chrysopogonetum* Parab. et Stoj. 1985 — Vojvod. (Serbia) (Parabučki, Stojanović 1985)
 28. *Trifolio campestre-Chrysopogonetum grylli* Butorac 1989 — Vojvod. (Serbia) (Butorac 1989)
 29. *Festuco-Potentilletum arenariae* Stjep.-Vesel. 1953 — Vojvod. (Serbia) (Horv. Glav. Ellenb. 1974)
 30. *Inulo-Chrysopogonetum grylli* V. Stev. 1984 — Vojvod. (Serbia) (Stevanović 1984)
 31. *Botriochloo-Euphorbietum glareosae chrysopogonetosum grylli* V. Stev. 1984 — Vojvod. (Serbia) (Stevanović 1984)
 32. *Koelerio-Festucetum wagneri* Stjep.-Vesel. 1953 — Vojvod. (Serbia) (Horv. Glav. Ellenb. 1974)
 33. *Taraxaco serotini-Festucetum valesiaca* S. Stojanović 1983 — Vojvod. (Serbia) (Stojanović 1983)
 34. *Crambo-Artemisietum campestris* V. Stojanović 1984 — Vojvod. (Serbia) (Stevanović 1984)
 35. *Agropyro-Kochietum prostratae* Zolyomi 1958 — Vojvod. (Serbia) (Stojanović 1983)
 36. *Globulario-Chrysopogonetum grylli* Ilijanić et al. 1972 — W. Croatia (Ilijanić et al. 1972)
 37. *Festucetum vaginatae deliblaticum* Stjep.-Vesel. 1953 — Vojvod. (Serbia) (Horv. Glav. Ellenb. 1974)
 38. *Corynephoro-Festucetum vaginatae croaticum* Soklić 1943 — N. Croatia (Soklić 1943)
 39. *Genisto-Callunetum* Ht. 1931 *chrysopogonetosum* Ilijanić et al. 1972 — W. Croatia (Ilijanić et al. 1972)

CO-BROMETEA Br.-Bl. et Tx. 1943

FESTUCE-
TEA
VAGIN. Soó
1968 em.
Vicher. 1972

NARDO-CALLU-
NETEA Preis. 1944

FESTUCETALIA VALESIIACAE Br.-Bl. et Tx. 1943

BROME-
TALIA
VAGIN.
Soó 1929

CALLUNO-ULI-
CETALIA
(Quant) Tx. 1933

CINAE Kojić 1957

FESTU-
CION VA-
LESIIACAE
Klika 1931

FESTUCION RUPICOLAE Soó 1940 (= *F. sulcatae*)

ARTE-
MISIO-
KOCHION
Soó 1959

BROMION
ERECTI
Br.-Bl. 1936

FESTUCI-
ON VAGI-
NATAE
Soó 1929

CALLUNO-FEST.
CAPILLATAE
Ht. 1959

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
15	10	23	15	5	25	30	20	15	17	25	20	15	20	20	10	15	4	40	38	4
V ¹⁻³	V	V ²⁻⁴	V ²⁻⁴	V ³⁻⁵	V ¹⁻⁴	V ⁺⁴	V ¹⁻⁴	V ⁺³	V ⁺³	IV ¹⁻³	V ⁺⁴	V ²⁻⁴	III ⁺²	II ⁺¹	II ⁺	I ⁺¹	4 ³⁻⁴	I ⁺	I ⁺	4 ³
Char. O.	Char. O. + Cl.	Char. Ass.	Char. Ass.	Char. Ass.	Char. O. + Cl.	Char. O.	Char. Ass.	Char. O.	Char. Ass.	Char. O. + Cl.	Char. comb.	Diff. Subass.	Char. O. + Cl.	Char. O.	Char. O.	Char. O.	Domin.	Char. O. + Cl.	Accid.	Domin.

Legend:

- Char. Ass. — Character species of association
- Char. All. — Character species of alliance
- Char. O. — Character species of order
- Char. Cl. — Character species of class
- Transgr. Cl. — Transgressive character species of class
- Diff. Subass. — Differential species of subassociation
- Domin. — Dominant species
- Comp. — Companion species
- Accid. — Accidental species
- Char. comb. — Characteristic combinations of species
- C.-A. degree — Cover-abundance degree
- Croat. — Croatia
- Medit. — Mediterranean region (s. 1.)
- Vojvod. — Vojvodina

Chrysopogon gryllus was designated by Horvatić (1963) as the transgressive character species of the class *Brachypodio-Chrysopogonetea* in the association *Chrysopogono-Airetum capillaris* (Table 1, no. 10).

In Macedonia (and some southern parts of Serbia) *Chrysopogon gryllus* is mainly distributed in the communities of the east-submediterranean order *Astragalo-Potentilletalia* Micev. (Table 1, no 11 a — 16). Still undecided to which class to assign the order *Astragalo-Potentilletalia*, in his description of the association *Brachypodio-Onobrychietum pindicolae* (Micevski 1971) and *Helianthemo-Euphorbietum thessalae*, Micevski (1973) indicated *Chrysopogon gryllus* among common species of the classes *Brachypodio-Chrysopogonetea*, *Thero-Brachypodietea* and *Festuco-Brometea* (Table 1, no. 12a and 15). In the subassociation *Helianthemo-Euphorbietum thessalae chrysopogonetosum* (Table 1, no. 12b) Micevski (1978) counted it as a differential species of this subassociation.

After being included the order *Astragalo-Potentilletalia* in the class *Festuco-Brometea*, *Chrysopogon gryllus* was designated (in the communities of this order) as the character species of the class (Micevski 1977, also Ranđelović 1978, Ranđelović and Ružić 1983).

Some authors (cf. Kojić 1959, Horvat, Glavač, Ellenberg 1974, Ranđelović 1975) put it in the group of common character species of the order (*Festucetalia valesiaca*) and the class (*Festuco-Brometea*, Table 1, no. 17a, 18a, 20, 24, 29, 32) or as the character species of the class *Festuco-Brometea* (Table 1, no. 18b, Ružić 1983). Other authors (Vučković 1983, Stojanović 1983, Stevanović 1984, Parabućski and Stojanović 1985) designate it as the character species of the order *Festucetalia valesiaca* (Table 1, no. 19, 25, 27, 33, 34, 35).

Within the same order (*Festucetalia*), some authors (Kojić 1959, Gajić 1961, Veljović 1967, 1971, Butorac 1989) take *Chrysopogon gryllus* as the character species of various associations (Table 1, no. 17c, 21, 22, 23, 26, 28).

Chrysopogon gryllus is less constant in the communities of the order *Festucetalia vaginatae*. Horvat, Glavač, Ellenberg (1974) included it in the association *Alyso-Festucetum vaginatae* Stjep.-Vesel. (= *Festucetum vaginatae delibaticum* Stjep.-Vesel.) in the group of common character species of the order *Festucetalia vaginatae* and of the class *Festucetea vaginatae* (Table 1, no. 37).

This plant species was noticed in some communities (Table 1, no. 17e, 36, 39) also as the dominant species (Diklić and Nikolić 1972, Ilijanić et al. 1972), or companion (Table 1, no. 17d, Tatić 1969) and accidental species (Table 1, no. 38, cf. Soklić 1943) too. It was noted in a few other communities syntaxonomically not classified by cited authors (cf. Kojić and Ivanović 1953, Gajić 1952, Stjepanović-Veseličić 1953, Kovačević and Brzac 1960). Those have not been taken into consideration for our Table.

A comparative analysis of the grassland communities mentioned (Table 1) shows that the species *Chrysopogon gryllus* is chiefly present in communities of the class *Festuco-Brometea*, and its ecologic (sociologic) optimum is in the associations of the eastcontinental order *Festucetalia valesiaca*. As a transgressive species of the class *Festuco-Brometea* it has an important role in some communities of the orders *Scorzonero-Chrysopogonetalia* H-ić and *Astragalo-Potentilletalia* Micev. too, showing (with other common species of the same ecologic feature) the synecologic and phytogeographic relationship of the three orders mentioned.

Therefore we consider it more naturally as the order *Scorzonero-Chrysopogonetalia* H-ić (or at least the majoriti of associations of this order) subordinate to the class *Festuco-Brometea*, and no to the class *Brachypodio-Chrysopogonetea* H-ić where it was subordinated previously. Within the class *Brachypodio-Chrysopogonetea* Horvatić (1958, 1963) united submediterranean and mediterranean-montane grassland communities of the order *Scorzonero-Chrysopogonetalia* with analogous eumediterranean grassland vegetation of the order *Cymbopogo-Brachypodietalia*. Later, he realized that this solution was not quite accurate and he revised his earlier standpoint (Horvatić 1973, 1975). It seems, however, that the new division was not made quite consistently either.

With regard to the order *Astragalo-Potentilletalia* Micev., the earlier hesitation concerning its syntaxonomical position (cf. Micevski 1970), was resolved by the author (Micevski) himself. He included this order, accurately on our opinion, in the class *Festuco-Brometea* (cf. Micevski 1973, 1977).

The species *Chrysopogon gryllus*, with regard to its sociological (synecological) optimum, could be designated, on the basis of the present analysis, as the character species of the order *Festucetalia valesiacae*, while in the communities of the orders *Scorzonero-Chrysopogonetalia* H-ić and *Astragalo-Potentilletalia* Micev. it has diagnostic validity as the transgressive character species of the class *Festuco-Brometea*.

The question arises whether all plant communities of the class *Festuco-Brometea* where the species *Chrysopogon gryllus* (with other plants of the same sociologic feature) has a significant role, could be united as a distinct synecologic unit (subclass within *Festuco-Brometea*, or perhaps, as a distinct class?).

A certain answer to this question would require a much more detailed comparative synecological analysis of all *Festuco-Brometea* and related plant communities. However, this exceeds the frame of our paper.

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S A Ž E T A K

FITOCENOLOŠKI ODNOSI VRSTE *CHRYSOPOGON GRYPILLUS* U JUGOSLAVIJI

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Pontsko-mediteranska (južnoevropsko-zapadnoazijska) vrsta *Chrysopogon gryllus* rasprostranjena je na području Jugoslavije u prvom redu kao element suhih submediteranskih i istočnokontinentalnih travnjaka. Rjeđe je rasprostranjena u travnjačkoj vegetaciji izvanmediteranskih zapadnih područja naše zemlje.

S obzirom na razmjerno široku fiteocenološko-ekološku amplitudu, razni autori pridaju toj biljci različito sintaksonomsko dijagnostičko značenje. Jedni je smatraju karakterističnom vrstom pojedinih asocijacija, dok je drugi označavaju karakterističnom vrstom viših vegetacijskih jedinica, dominantnom vrstom ili pratilicom (usp. engleski tekst i tab. 1).

Komparativna analiza zajednica s *Chrysopogon gryllus* (tab. 1) pokazuje da je ta vrsta u našoj zemlji nazočna pretežno u zajednicama razreda *Festuco-Brometea* s optimumom u fitocenozaama istočnokontinentalnog reda *Festucetalia valesiaca* Br.-Bl. et Tx., a veliko značenje ima i u različitim asocijacijama submediteranskih redova *Scorzonero-Chrysopogonetalia* Hič i *Astragalo-Potentilletalia* Micev., pa (uz ostale ekološki slične biljke indicira fitocenološko-ekološku i fitogeografsku srodnost zajednica triju navedenih vegetacijskih redova.

Stoga smo mišljenja da red *Scorzonero-Chrysopogonetalia* H-ić (1956) 1958 (barem najvećim dijelom) prirodnije pripada razredu *Festuco-Brometea* Br.-Bl. et Tx. nego razredu *Brachypodio-Chrysoponetea* H-ić. kako ga je prvobitno shvatio Horvatić (1958, 1963), ujedinivši submediteranske i eumediteranske suhe travnjake u zajednički razred. Kasnije je i sam uvidio da to rješenje nije dobro, pa je revidirao svoje ranije gledište i dio zajednica reda *Scorzonero-Chrysopogonetalia* kao novi red *Scorzoneretalia villosae* podredio razredu *Festuco-Brometea* (Horvatić 1973, 1975). Daljnja komparativna fitocenološka i ekološka istraživanja pokazat će je li novo rješenje, kako ga je predložio Horvatić, u cijelosti prihvatljivo. Čini nam se da nije dovoljno dosljedno provedeno.

Što se tiče reda *Astragalo-Potentilletalia* Micev. 1970. prvobitne nedoumice u pogledu njegovog sintaksonomskog položaja (Micevski 1970), autor je naknadno, po našem mišljenju pravilno, riješio tako da je taj red jednoznačno priključio razredu *Festuco-Brometea* (Micevski 1973, 1977).

Na temelju ovdje prikazane komparativne fitocenološke analize može se *Chrysopogon gryllus* po našem mišljenju označiti karakterističnom vrreda *Festucetalia valesiaca*, dok u zajednicama redova *Scorzonero-Chrysopogonetalia* i *Astragalo-Potentilletalia* predstavlja transgresivnu karakterističnu vrstu razreda *Festuco-Brometea*. Mjestimično, u pojedinim područjima, ulazi ona i u sastav nekih zajednica drugih vegetacijskih razreda. često kao dominantna pratilica, odnosno diferencijalna vrsta koja indicira fitogeografske i sinekološke veze sa zajednicama razreda *Festuco-Brometea*.

Nameće se pitanje, ne bi li zajednice razreda *Festuco-Brometea* u kojima značajnu ulogu ima vrsta *Chrysopogon gryllus* (uz druge vrste sličnih fitocenoloških odnosno ekoloških karakteristika) trebalo izdvojiti kao zasebnu skupinu fitocenoza (podrazred u okviru *Festuco-Brometea* ili možda čak zaseban razred?).

Za sigurniji odgovor na to pitanje potrebna je, dakako, mnogo detaljnija i opsežnija fitocenološka komparativna analiza razreda *Festuco-Brometea* kao i srodnih zajednica u cijelom arealu. Međutim, takva analiza prelazi okvire ovoga priloga.

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