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Phenology, population dynamics and habitat preferences of the Field-cricket (*Gryllus campestris* Linnaeus, 1758) in the Balaton Uplands (Hungary)

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Abstract

Between 1998 and 2001, the phenology, population dynamics and habitat preferences of *Gryllus campestris* were studied using pit fall traps in semi-natural grasslands in Transdanubia (Hungary). In nearly 6.000 samples 1.514 Field-cricket individuals were caught on eight sites with strong *G. campestris* populations. Based on this the main results are: (I) The Field-cricket reaches its population peak in the second half of August and has a second, but understated, peak in mid-October. (II) In the extreme dry year 2000, numbers were lower than usual and peaked one month earlier. (III) The densities are highest on nutrient-poor dry grassland with a vegetation cover of 40–50%.

Zusammenfassung

Von 1998 bis 2001 wurden die Phänologie, Populationsdynamik und Habitatpräferenzen von *Gryllus campestris* auf acht Magerrasen in Westungarn mittels Bodenfallen untersucht. In den fast 6.000 Proben wurden insgesamt 1.514 Individuen der Feldgrille gefangen. Aus den Daten lassen sich folgende Ergebnisse zusammenfassen: 1. Die Phänologie der Feldgrille ist durch einen Populationshöhepunkt im August und ein abgeschwächtes zweites Maximum Mitte Oktober gekennzeichnet. 2. Im sehr trockenen Jahr 2000 waren die Individuenzahlen meist deutlich geringer und erreichten etwa einen Monat früher ihr Maximum. 3. Die höchsten Dichten erreicht die Art auf trockenen Magerrasen mit einer Vegetationsbedeckung von 40 bis 50%.

Introduction

The Field-cricket (*Gryllus campestris* Linnaeus, 1758) is a European species. Its distribution ranges from North Africa to southern Russia in the south and to the line southern England–Denmark–Lithuania in the north (HELLER et al. 1998, HELLER 2004). Within the distribution range of *G. campestris* densities and patch occupancy are very different. The Field-cricket is generally widespread and frequent in Central and Southern Europe (KNECHTEL & POPOVICI-BÎZNOŞANU 1959, HARZ 1960, DREUX 1962, US 1967, 1992, BAZYLUK 1978, PRAVDIN & MISHTSHENKO 1980, HERRERA 1982, WILLEMSE 1984, STOROZHENKO & GOROCHOV 1992, KOCAREK et al. 1999, NAGY 2003, BUSCHMANN & BECKER 2004, HELLER 2004), while it is rather rare in northern and northwestern Europe (e.g. the North German lowland, MAAS et al. 2002). The differences in status described above can be explained both by climatic and land-use reasons. According to DREUX (1962), the

aridity of the habitat has no influence on distribution patterns of *G. campestris*; the species occurs in both dry and wetter habitats [the Field-cricket occurs only in dry sandy soils in the North German Lowland (Thomas Fartman, pers. comm.)].

According to DREUX (1962) the temperature seems to be the limiting factor for the distribution of the species. Hereof, the most determinant is the average temperature during the breeding period (July). The author states that the species does not occur below a mean July temperature of 15 C. The statements above are in line with the results of several other researchers (e.g. HARZ 1957, 1960, FUZEAU-BRAESCH 1965, KÖHLER & REINHARDT 1992, INGRISCH & KÖHLER 1998).

Due to the decline of typical habitats – semi-natural grasslands and forest clearings with short turf of xerophilous grasses, predominantly on southern aspects and with a high proportion of bare ground (10–50%) – the Field-cricket is becoming rare or disappearing in climatically suitable areas (HARZ 1960, NAGY 1988, UK BIODIVERSITY GROUP 1999). These habitats are mostly drawn into intensive land cultivation (GRUTTKE & HAUPT 2005). Because of the rotation of the soil and the usage of chemicals in large arable fields, it breeds only in the field margins (NAGY 1988). In severely fragmented habitats the connectivity of habitats is important for the survival of this species (HOCHKIRCH 1996). Mown ridges as ecological corridors play an outstanding role in the conservation of the species in intensively cultivated areas (SNOO 1994, ELSEN & SCHELLER 1995).

Hungary belongs to those areas with a high number of occupied patches within the distribution range of the species. Based on published and collection data, the Field-cricket is moderately frequent (RÁCZ 1998). However, on the basis of field experience it can generally be considered as widespread, with markedly large populations. The main reason for this difference is that faunistic data referring to orthopterans are predominantly based on sweep-netting, while pit-fall trapping or sound signal data recording is more successful in the case of *G. campestris.* The species breeds in a wide array of habitats in Hungary; it is occurring on pastures, on semi-dry grasslands, grassy fill slopes, forest clearings, as well as in less disturbed cultures with low vegetation. With regard to abundance data it is considered frequent on sunny slopes (NAGY 1988).

G. campestris feeds on both animals and mono- and dicotyledonous plants. More intensive chewing of vegetation can only be observed within 5–15 cm area around its dwelling holes (DUDINSZKY 1902, 1906; NAGY 1988, INGRISCH & KÖHLER 1998).

G. campetris has 11 larval stages (WALLASCHEK 1991) and hibernates in the 9th or 10th stage (KÖHLER & REINHARDT 1992). Adults appear already from the end of April onwards, mating and egg-laying occurring in May–June. Females lay their eggs one by one into the soil. The eggs start developing without diapauses, larvae hatch two weeks later and reach middle size by the end of the summer, then in the autumn they live in holes in the soil or under stones (NAGY 1988).

Larger Hungarian populations of *G. campestris* serve as an important food source for birds, like *Perdix perdix* L., 1758, *Numenius arquata* (L., 1758), *Numenius phaeopus* (L., 1758), *Aquila pomarina* C.L. Brehm, 1831 or *Falco vespertinus* L., 1766 (BERGER 1913, VERTSE et al. 1955, BERETZK et al. 1958, NAGY

1983). Beside this, the species' contribution to the diet of *Lanius excubitor* L., 1758 (NIKOLOV et al. 2003), and *Falco tinnunculus* (INGRISCH & KÖHLER 1998) can be significant. From the point of view of nature conservation it must be mentioned that the presence of – almost adult-sized – wintering larvae is important in the feeding of the outstandingly valuable *Vipera ursinii rakosiensis* Méhely, 1893 in the otherwise poor early spring food supply (ÚJVÁRI et al. 2000).

This article contributes to the better understanding of population dynamics, phenology and habitat preferences of *G. campestris* in Hungary.

Materials and methods

Populations of *G. campestris* were studied on eight sites (Hungary: Balaton Uplands: [I] Litér: Mogyorós Hill [3 sampling areas], [II] Királyszentistván: Hosszú-mező [2 sampling areas], [III] Vilonya: Külső Hill [3 sampling areas]) using pitfall traps from March to October for 4 years (1998–2001). All study sites are grasslands with a relatively close turf differing in exposure, vegetation and soil structure (Fig. 1, Tab. 1). Study sites mentioned as open dolomite rocky grasslands belong to the *Seseli leucospermi-Festucetum pallentis* Zólyomi (1936) 1958. Study sites mentioned as *Stipa* spp. dominated dolomite steppe grasslands (or steppe grasslands) are mosaic stands of variously overgrazed *Stipo eriocauli-Festucetum pallentis* (Zólyomi 1958) Soó 1964 and *Chrysopogono-Caricetum humilis* (Zólyomi 1950) 1958 stands (BAUER 2005).

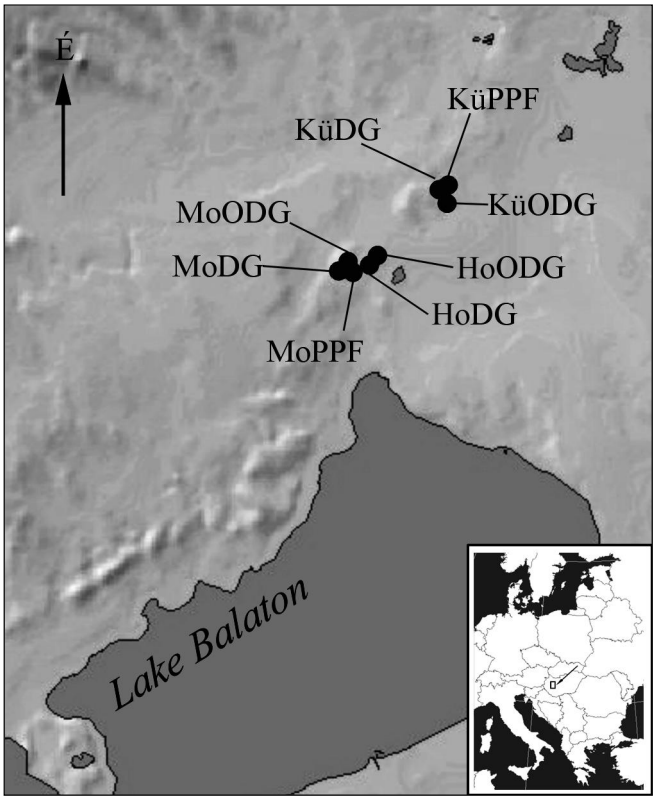


Fig. 1: Location of the study area and of the sampling sites in Hungary.

On each study site 15 pitfall traps were used. The traps were placed in a 3 x 5 arrangement, 5 meters away from each other in each direction. The diameter of the trap cups filled with ethylene-glycol was 9.5 cm, their depth was 12 cm. The samples were collected every two weeks. For the nearly 6.000 collected samples, the individual numbers of *G. campetris* were determined.

Tab. 1: Sampling sites in the Balaton Uplands (Hungary) (Vegetation cover: herb layer).

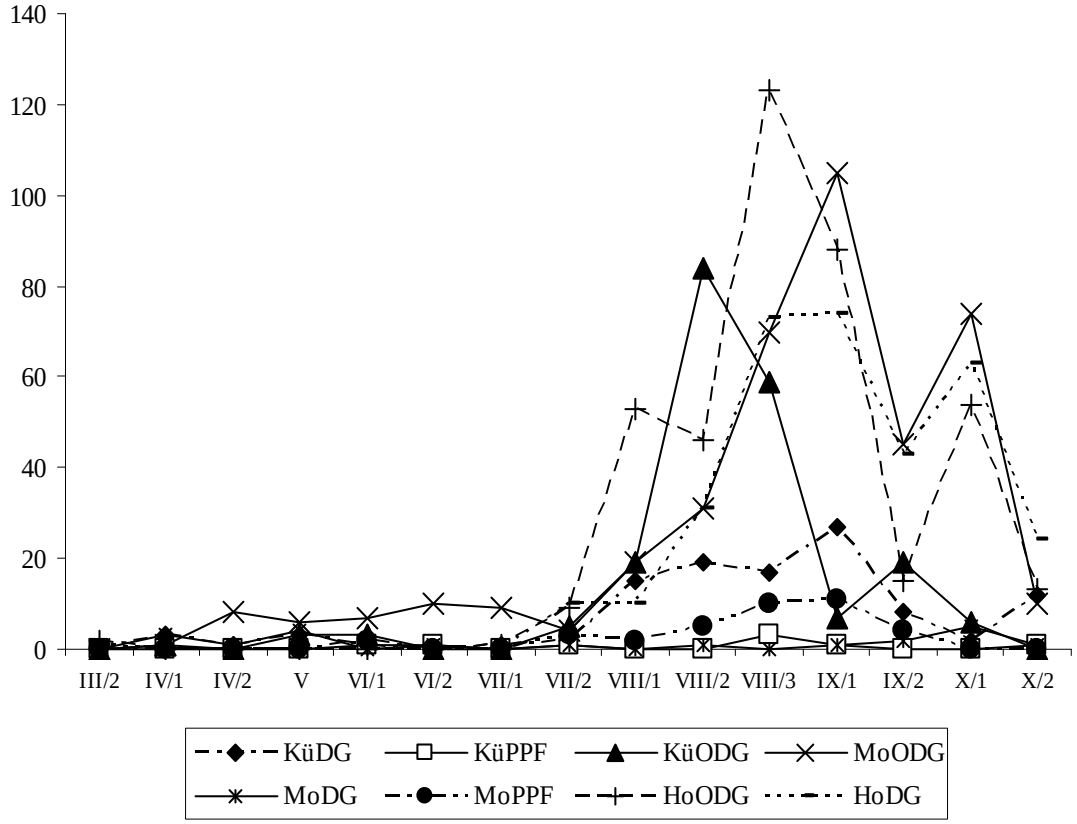
Settlement	Locality	Vegetation type	Vegetation cover (%)	Code
Litér	Mogyorós Hill	Open dolomite rocky-grassland	~50%	MoODG
Litér	Mogyorós Hill	*Stipa* spp. and *Carex humilis* dominated dolomite steppe grassland	~90%	MoDG
Litér	Mogyorós Hill	Planted pine (*Pinus nigra*) forest on open dolomite rocky-grassland	~50%	MoPPF
Királyszentistván	Hosszú-mező	Open dolomite rocky-grassland	~40%	HoODG
Királyszentistván	Hosszú-mező	*Stipa* spp. and *Carex humilis* dominated dolomite steppe grassland	~ 80%	HoDG
Vilonya	Külső Hill	Open dolomite rocky-grassland	~ 50%	KüODG
Vilonya	Külső Hill	*Stipa* spp. and *Carex humilis* dominated dolomite steppe grassland	~ 80%	KüDG
Vilonya	Külső Hill	Planted pine (*Pinus nigra*) forest on open dolomite rocky-grassland	~ 90%	KüPPF

Results

Altogether 1.514 *G. campestris* individuals were caught. Cricket activity densities differed significantly between the study sites (Fig. 2). Nearly two thirds of all individuals were caught on open dolomite rocky grasslands (HoODG: 404; MoODG: 399; KüODG: 206). Only one more closed dolomite grassland can be found at the top of the dominance rank (HoDG: 329). Among sites showing lower individual numbers, a closed dolomite grassland stands out (KüDG: 111). At the end of the ranking – with low individual numbers – two planted pine-woods and a more intensively grazed dry grassland can be found (MoPPF: 37, MoDG: 20, KüPPF: 8).

The observed overall differences in cricket numbers between the sites occurred every year in a similar manner (Fig. 3). However, the year 2000 was an exception. While the number of collected individuals decreased in nearly all sites, the open dolomite rocky grasslands on the Külső Hill (KüODG) showed the highest individual numbers during the whole study period and in comparison with the other sites. Moreover, the values of the open dolomite rocky grassland on Mogyorós Hill (MoODG) rose above the other sites and the numbers were comparable to those of the other years.

The phenology of *G. campestris* populations was more or less similar for each site and each year. The populations are characterised by low individual numbers until the beginning of August.



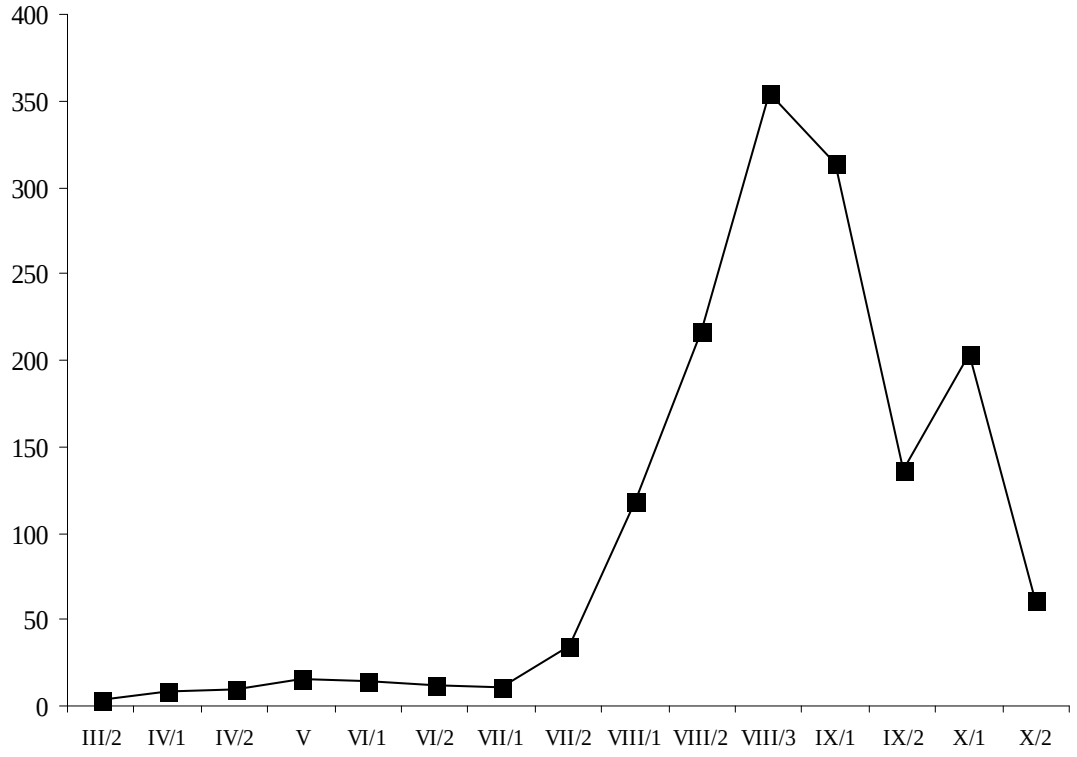


Fig. 2: Changes of individual numbers in *Gryllus campestris* populations for the period from 1998–2001 for each site (a, on top) and all sites (b, below).

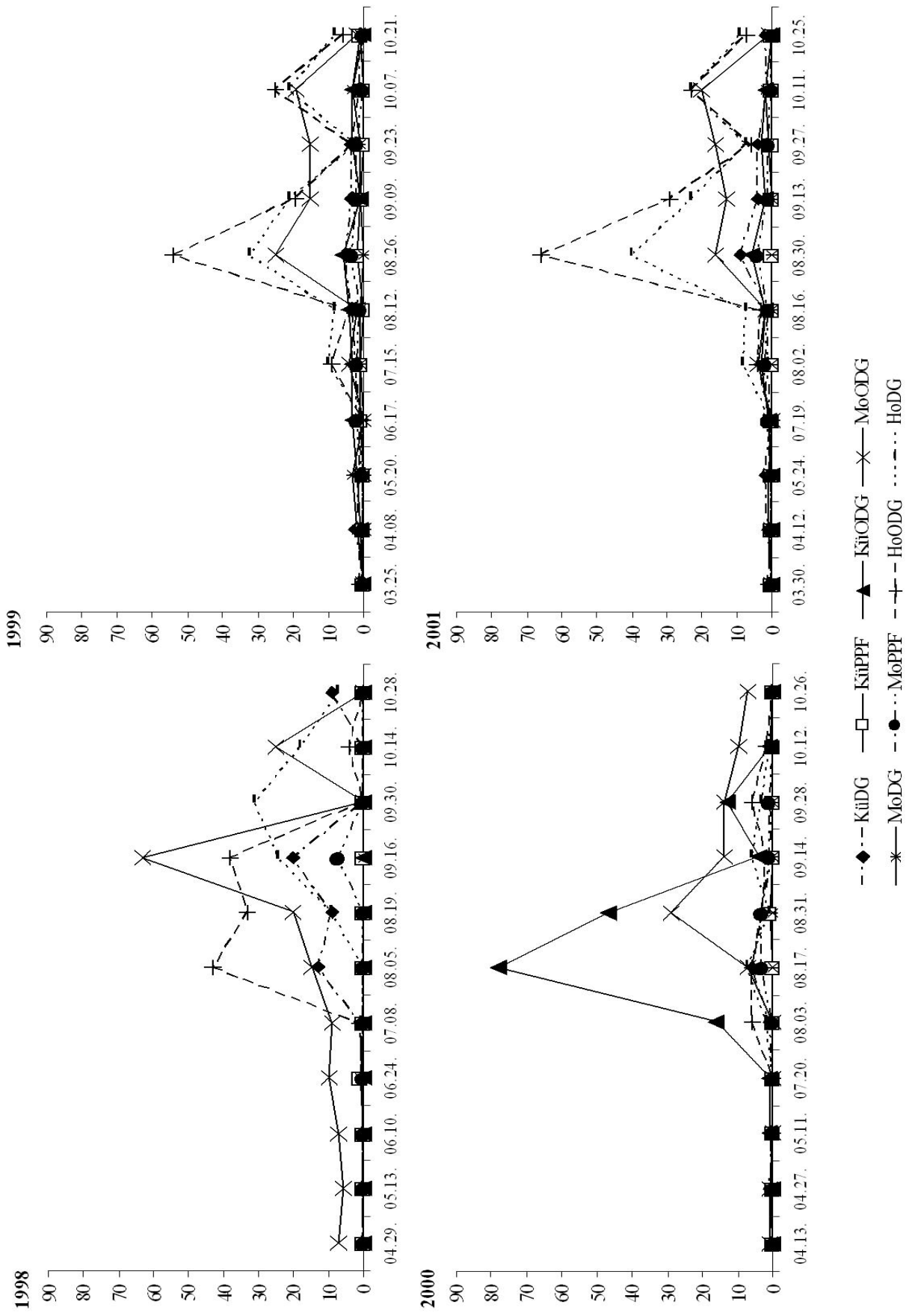


Fig. 3: Changes of individual numbers in *Gryllus campestris* populations between and within years.

Until the end of August individual numbers increased continuously and reached their peak, then till end-September the individual numbers decreased equally. In the first half of October cricket numbers increased remarkably, but in the second half they traced back to July values. The observations made above appeared in a similar way in 1998, 1999 and 2001. In the extremely arid year 2000 the cricket phenology was differed to this, except in the open dolomite rocky grassland on the Külső Hill (KüODG). Both peaks appeared one month earlier in the season.

G. campestris occurred in highest numbers in grasslands with 40–50% vegetation cover. The individual number of the species was smaller in closed grasslands and in open rocky grasslands which were planted over with black pine.

Discussion

Part of the results in the population dynamics point of view is in line with the findings of KÖHLER & REINHARDT (1992) from Thuringian populations. Population dynamics curves of the Field-cricket have two culmination points. The largest individual number is shown in the end of August. Before this peak point the number and activity of the Field-cricket continuously increase. The other culmination point of the density is in the middle of October, in a far lower level.

Arising from the ontogenetic features of the Field-cricket in the first third of the sampling period old larvae, later imagos were in the samples, young larvae reached high numbers in August.

The present study found that *G. campestris* numbers were highest in grasslands with 40–50% vegetation cover. This agrees very well with the results of previous studies (HARZ 1960, NAGY 1988, UK BIODIVERSITY GROUP 1999). However, our results are contrary to the statements of DREUX (1962). He found the Field-cricket in various habitat types with similar frequencies. Moreover, his findings are inconsistent with our observations that upland meadows (*Festuco rubrae-Cynosuretum*, *Polygalo-Nardetum*) are considered the most favourable habitats for the species in the Bükk Mountains (NAGY & RÁCZ 1996). These are i.e. predominantly closed grasslands. Egg-laying females and larvae favour bare ground, while the adults and old larvae preparing for hibernation rather prefer spots with clumps of grass (NAGY 1988). The open dolomite rocky grasslands in this study best combines these different habitat requirements best.

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