Faunistics and ecology of the grasshoppers and crickets (Saltatoria) of the dunes along the Belgian coast

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Abstract

Hitherto a total number of 23 species were recorded in the coastal dune area; this is about half of the Belgian Saltatoria fauna. Despite the overall deterioration of the former semi-natural dune landscape during the past decades, still 18 species were found after 1980. The actual presence of 3 additional species needs confirmation. Three species seem to have become extinct: *Decticus verrucivorus, Gryllus campestris* and *Mecostethus grossus*. Both in a Flemish and Belgian perspective, the coastal dunes still form a stronghold for several rare species, e.g. *Conocephalus discolor, Platycleis albopunctata, Tetrix ceperoi, Chorthippus albomarginatus* and *Oedipoda caerulescens*.
The importance of particular microclimatological conditions for the occurrence of most grasshoppers is stressed. The cessation in the beginning of the century of the agricultural practice of cattle grazing in the inner-dunes undoubtedly played an important role in the extinction process or the decrease of several species. An increased effort to remove considerable parts of dense scrub vegetations in former dune grasslands and the re-use of extensive grazing as a management practice can therefore strongly be recommended.

Résumé

La faune des criquets et sauterelles (Saltatoria) du district des dunes littorales comprend 23 espèces, soit environ la moitié de la faune belge. Malgré la détérioration complète des paysages semi-naturelles des dunes durant les dernières décennies, 18 espèces ont encore été observées après 1980. L'éventuelle présence de 3 autres espèces doit être confirmée. Trois espèces peuvent être considérées comme disparues: *Decticus verrucivorus, Gryllus campestris* et *Mecostethus grossus*. Du point de vue de la situation en région flamande et en Belgique, les dunes littorales englobent encore des populations importantes d'espèces rares, p.ex. *Conocephalus discolor, Platycleis albopunctata, Tetrix ceperoi, Chorthippus albomarginatus* et *Oedipoda caerulescens*.
L'importance des conditions micro-climatologiques pour la présence de la plupart des criquets et sauterelles est soulignée. L'abandon des pratiques agraires traditionnelles au début du siècle est probablement responsable de la disparition ou la raréfaction de plusieurs espèces. Le débroussaillage de superficies importantes et le paturage extensif constituent des mesures de gestion recommandées pour les dunes littorales.

Introduction

Most Saltatoria are thermophilous. Consequently, in countries with a temperate climate such as Belgium, grasshoppers are very strongly related to habitats with a warm and sunny microclimate. Chalk grasslands and habitats with open sandy soils, such as we find them in the dunes along the coast, or in the heathlands in the Campine area, are potentially very rich in species. The Saltatoria fauna of the Belgian chalk grassland district has already been discussed by HOFMANS *et al.* (1989). In this contribution we focuss on the dune habitats along the Belgian coast. Ancient records of grasshoppers were gathered by checking both literature and museum collections. On the other hand, since 1980, several grasshopper enthousiasts performed a lot of field work in the dunes. Results of these surveys will be discussed here in a historical and ecological context.

The deterioration of the Belgian coast

The Belgian coast line measures only 65 km. With the growing tourist industry along the coast and due to a failing physical planning, the original dune landscape changed dramatically since the beginning of the century. From the original 5000 ha of dunes only 2700 ha are left nowadays. Only 33 km of the coastline are still bordered by primary marram dune (VERMEERSCH, 1986). Fragmentation and isolation are not the only problems faced by the Belgian dunes. Due to water abstraction groundwater levels declined in formerly wet dune valleys. The original custom of the local inhabitants to use large parts of the inner dunes for cattle or horse grazing was abandoned in the beginning of the twentieth century. This resulted in a spontaneous dereliction of the grasslands and a drastic increase of shrub vegetations, combined with a strong tendency to increased stability of larger mobile dunes, and the disappearance of smaller patches of open sand (DE RAEVE, 1989). On the other hand a large recreational pressure has induced local erosion, combined with subsisting small patches of very short grassland (trampled and overgrazed by rabbits), apart from an overall disturbance of the remaining Belgian dunes. Finally, a lot of dune areas were afforested (mostly with pines). Recently, both the government and private organisations started to preserve as much dune habitat as possible by establishing nature reserves. However, by these efforts the damage inflicted on the Belgian dune ecosystem can only partly been repaired.

The fragmentation of the dune landscape is evident from fig. 1. Only in the east and especially in the west, some large dune areas do still exist. The dune areas in the middle part of the Belgian coast are mainly afforested and have therefore lost a great deal of their original ecological value. Except for some small areas, all Belgian dunes are characterised by calcareous soils.

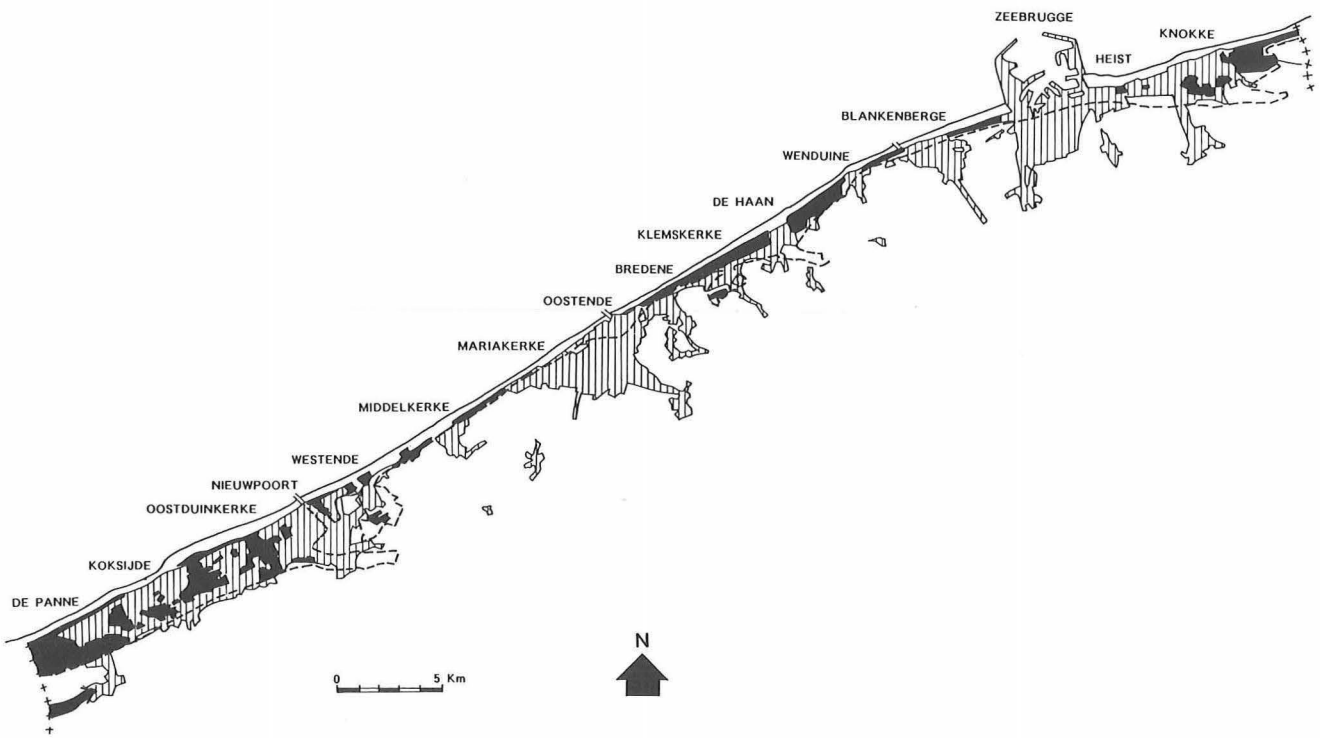

Fig. 1. Fragmentation of the Belgian dune landscape (black) by the explosive an chaotic growth of the coastal municipalities (shaded). The broken line indicates the geographical border of the dune region.

Faunistic account

Distinction was made between ancient records (roughly the period 1850-1950) and recent records (period after 1980). From the period between 1950 and 1980 only very few records were available.
In particular the collections of DE SELYS-LONGCHAMPS and GOETGHEBUER, preserved at the Royal Belgian Institute of Natural Sciences, were usefull as a source for ancient data on the distribution of this insect group along the coast. These records and other ancient data, mostly from the first half of the century, were already listed in DEVRIESE (1988). The maps published in DUIJM & KRUSEMAN (1983) were also consulted for reliable additional information. Records after 1980 mainly consist of unpublished data from both authors, supplemented with data kindly provided by some other orthopterists. Difficult species were checked by one of the authors before admission in this publication.

Table 1 summarizes all records of Saltatoria from the period 1850-1950 (most records originate from the turn of the century) and all records after 1980. A total number of 23 species were ever recorded in the Belgian dunes. Records from an additonal species (*Chorthippus mollis*) could not be confirmed by the authors up to now. Nevertheless, 23 species is about half the number of species ever recorded in Belgium (DEVRIESE, 1989) and about two thirds of the number of species ever recorded in Flanders (DECLEER *et al.*, 1989). This already gives an idea of the importance of the coastal dunes for this insect group in a wider geographical perspective.

Three, maybe five species seem to be extinct in the dunes nowadays: *Decticus verrucivorus, Gryllus campestris, Mecostethus grossus, Tetrix subulata* and *Omocestus viridulus*. The last two species are mentioned with some restriction since there are some recent data available but these could not be confirmed up to now.

After 1980, 18 species were recorded in the dunes. Two species were not found here previously: *Lepthophyes punctatissima* and *Gryllotalpa gryllotalpa*. In a Flemish perspective, 3 species are restricted to the coastal dunes: *Conocephalus discolor, Platycleis albopunctata* and *Tetrix ceperoi*. Of all 23 species, at least 14 are considered to be rare or endangered in Flanders. *Decticus verrucivorus* is even believed to be extinct in Flanders nowadays (DECLEER *et al.*, 1989).

Compared to the Dutch coast, which is much longer, only *Nemobius sylvestris* was never recorded in the Belgian dunes. On the other hand, *Conocephalus discolor* and *Omocestus rufipes* are unknown to the Dutch dunes up to now (KLEUKERS pers.comm.; DUIJM & KRUSEMAN, 1983). Coincidence or not, three species extinct along the Belgian coast seem also to be extinct along the Dutch coast: *Decticus verrucivorus, Gryllus campestris* and *Mecostethus grossus*.

It is also interesting to note that a few of the commoner species of the Belgian and Dutch coast have not crossed the Channel. Indeed, no single record from Britain is known of *Chorthippus biguttulus* and *Oedipoda caerulescens*.

Distribution and ecology

The habitat choice of most grasshoppers is well defined. Except for arboreal species such as *Leptophyes punctatissima* and *Meconema thalassinum* (and to a lesser extent also *Tettigonia viridissima*) most species in the dunes can be found in grassland habitats. Two factors are known

to be of major importance to explain the occurrence of a species: humidity and vegetation structure. The latter determines the microclimatological conditions which are essential for the development of both eggs and juvenile animals. By dividing both humidity and vegetation structure in three categories, nine different combinations of (simplified) ecological circumstances can be distinguished (table 2). Preferences for one or more of these combinations of all non-arboreal species are also presented in table 2, based on observations in the field and on literature data.

Details on the distribution and the ecology of the 14 rare, endangered or extinct species in Flanders will be discussed briefly.

Conocephalus discolor

The Belgian coast forms the northernmost limit of its distribution area on the continent. At the moment it is known from 3 different dune areas at the west and middle coast (De Panne, Bredene, Middelkerke). Habitats where this elusive species was found in considerable numbers are: tall sedges in a wet dune valley, tall grassy vegetation along pathways, amongst dense *Ammophila arenaria* vegetations in the fore-dunes (even on the sea-side), derelict grassland. In Belgium this species is further only known from the extreme south of the country (Gaume region), where it occurs in tall chalk grassland vegetation. Most probably, warm macroclimatological conditions form the limiting factor for its distribution in this part of Europe.

Decticus verrucivorus

In Flanders no recent records of this large bush-cricket are known. This species must have been widespread in the coastal dunes around the turn of the century (at least 6 localities are known: Knokke, Heist, Oostende, surroundings of Blankenberge, Nieuwpoort and De Panne). As far as we know the last record in the Belgian dunes dates from 1921 (Knokke). Everywhere in Western Europe the species is now considered as very much endangered because of its strong decline during the past decades (BELLMANN, 1985; DUIJM & KRUSEMAN, 1983; MARSHALL & HAES, 1988). From Wallonia no more than 3 recent records are available at the moment.
In grasslands *D. verrucivorus* is confined to mosaic vegetations with both very short, open turf (75%) and smaller patches of tussocky vegetation (25%), all exposed to a very warm and sunny microclimate (CHERRILL & BROWN, 1990). According to this publication, especially males and juveniles are mostly found in the patches of dense vegetation, while short (<5 cm) turf vegetation is needed for the ovipositioning females and afterwards for the development of the eggs. This vegetation pattern is a typical result of moderate to rather intensive grazing by cattle or horses in dune grassland with creeping willow or a result of rather extensive grazing of grassland in combination with intensive grazing by rabbits. Since this kind of agricultural management has disappeared in the dunes, the vegetation structure changed to a more dense and tall grassy vegetation invaded by shrubs. Apparently, small-scale grazing activities of rabbits were not able to sustain the presence of a suitable habitat for the species. Minor macroclimatological changes may have played a role in its extinction as well, although there is no clear evidence for this.

Apart from the inner dune grasslands, *D. verrucivorus* occurs also in other habitats such as heathland, chalk grassland and edges of extensively used agricultural fields, as long as the typical alternation of vegetation structure and the proper microclimatological conditions are available.

Metrioptera roeseli

The distribution pattern of this species in Belgium is very disjunct. The species is abundant in the youngest polder areas in the eastern part of the coastal area, connected with vast populations on the other side of the border. Along the Belgian coast the species becomes scarcer to the west and it has never been recorded beyond the river IJzer. Inland there are only scattered records available while, in the extreme south of the country, the species becomes more abundant again. Derelict grassland vegetations, both dry and moist, especially verges of roads and ditches, are its favourite habitat. This species is perhaps not a true dune species: most records originate from the transition zone dune-polder.

Platycleis albopunctata

In Belgium this species is recently only known from the coast and the chalk grassland region in the south. In the western and central dune areas *P.albopunctata* may occur in large numbers, while, for unknown reasons, in the east it seems to be much rarer. Except for the erosive fore-dunes at the sea-side, the species is mostly found in *Ammophila*-vegetations or all kinds of ruderal dry grassland.

Gryllus campestris

The Field-cricket used to be common in most parts of Belgium but showed a drastic decline during the past decades. Parts of the province Limburg are its last stronghold in Belgium, where it mainly occurs at warm and sunny spots in heath-land areas. In the dunes, *G. campestris* occupies more or less the same habitat as *D. verrucivorus*. Its presence was known from at least one locality (surroundings of Nieuwpoort, DUIJM & KRUSEMAN, 1983). Due to the almost complete loss of its habitat, the species was, apparently, not able to survive. The neighbouring countries have the same tendency of decline in common, which could, eventually, also be explained by a combination of habitat loss and macroclimatological events such as the occurrence of successive cold summers.

Gryllotalpa gryllotalpa

This large, but elusive animal is supposed to be rare in Belgium, but this may be an underestimation. Nowadays, the species is almost exclusively confined to horticultural areas and vegetable gardens with preference for slightly moist soils. Its underground way of living makes it a difficult species to monitor. Adults are supposed to have a good flight capacity. In the dunes the species was recently recorded at two localities. At Knokke, the species was attracted by the light of a moth trap; at De Haan it is known from a photograph of the bird *Upupa epops* with the Mole-cricket as a prey in its bill. Thus, for both localities, there is no absolute certitude that a population of the species really exists within the borders of the dune region.

Tetrix subulata

This small grasshopper lives in tall marsh vegetations and is widespread in Belgium, but rather rare in Flanders, especially in the western part. Most of the coastal dune valleys used to be very wet due to high groundwater levels and several temporal ponds used to be present. Due to water

abstraction most of the tall marsh vegetations which could be found in this situations have disappeared. Except for one ancient record (1901) from Heist, there are no data available for this species. As a consequence of habitat loss it may have died out in the dunes, although further investigations remain necessary to be sure of this.

Tetrix ceperoi

Closely resembling the previous species, *T. ceperoi* is extremely rare outside the coastal dunes. In wet dune slacks with sparse and short vegetation, however, it can be found in large numbers. The sandy soil in these dune slacks is permanently been blown out down to the groundwater table, so a suitable habitat for this species is nearly always guaranteed. It can be assumed that *T. ceperoi* has a good pioneering capacity, since it can also be found in young or small habitats.

Chorthippus albomarginatus

Outside the coastal dunes this species is very rare as well. In the dunes it is rather ubiquitous, but it never occurs in situations without vegetation. The few inland populations (most of them situated in the Campine area), however, are all located on marshy or moist grounds. Presumably the air moisture along the coast is sufficiently high to enable the species to survive on dry soil. This grasshopper can therefore be considered as a so-called 'diplostenoecious' species (sensu DUFFEY, 1968).

Chorthippus mollis

This rare grasshopper can only be identified with certainty by its song. The occurrence of this species in the dunes is most probable but, apart from some visual identifications by others, its song has never reliably been recorded up to now. Open, dry grounds with sparse vegetation are its favourite habitat. Outside the dunes the species only occurs in heathland. Along the Dutch coast, *C. mollis* has been recorded several times (KLEUKERS, pers.comm.).

Mecostethus grossus

This conspicuous grasshopper from marshy grounds has only been recorded from Heist (date unknown, GOETGHEBUER, 1953). The species belongs to the same ecological group as *Tetrix subulata*. Unfortunately, its probable habitat at Heist has been destroyed. Most certainly the species is now extinct in the coastal dunes. Large populations of this rare species fortunately still persist in some river valleys in different parts of the country (DECLEER, 1990).

Myrmeleotettix maculatus

Stable, open sandy soils with sparse vegetation and a warm and sunny microclimate are its usual habitat. Locally, this grasshopper is abundant in the dunes. Inland, it is confined to heathland areas.

Oedipoda caerulescens

This spectacular species with striking blue wings occurs in the same kind of habitat as the latter species, only, it needs a more extensive surface of suitable habitat and, except for some moss vegetations, the soil is often totally bare. The coastal dunes form an important stronghold for the species. In different dune areas large populations still persist, but large density fluctuations may occur from year to year.

Omocestus viridulus

Although this grasshopper is common in the southern half of Belgium, it is much rarer in the north, especially in the northwest. In the dunes there is only one ancient record available (De Panne, date unknown). Recent records (Knokke, De Panne, Oostduinkerke, De Haan) need confirmation since no one of the authors saw a specimen up to now. Confusion with green coloured forms of *Chorthippus biguttulus* is likely in most cases. Mesophilous grassland with sparse to dense vegetation is its favourite habitat.

Omocestus rufipes

One ancient record (Heist) and one recent record (Knokke) are available. The species is confined to heathland areas and chalk grasslands in the other parts of the country. The presence of both short and tall patchy vegetation is essential. It may well be considered as a relict species from the former extensive dune grasslands grazed by cattle. However, compared to *D. verrucivorus* and *G. campestris*, occasionally it can also be found in the transition zone to more dense and tall vegetations and even scrubs.

Conclusions

Despite the severe deterioration of the coastal dunes, a lot of grasshopper species were able to persist up to now. From the zoogeographical point of view, the Belgian dune region yields important meta-populations of several species: *Conocephalus discolor, Metrioptera roeseli, Platycleis albopunctata, Tetrix ceperoi, Chorthippus albomarginatus, Myrmeleotettix maculatus, Oedipoda caerulescens* and *Omocestus rufipes*. *Chorthippus mollis* may be added in the future. At short term, only *O. rufipes* must be considered as endangered. Removal of scrubs and restauration of the former grazing practices in some parts of the dunes can be recommended for the preservation of the species (the only record originates from the "Zwinbosjes" at Knokke). Species from open short turf grounds will also benifit from grazing management (e.g. *Chorthippus brunneus, Chorthippus mollis, Myrmeleotettix maculatus, Oedipoda caerulescens*). Unfortunately, two indicator species for this kind of habitats already died out during the past decades, possibly enhanced by the occurrence of some successive cold summers (*Decticus verrucivorus, Gryllus campestris*).

Wet dune slacks are the favourite habitat of a smaller group of grasshopper species. Unfortunately, *Mecostethus grossus*, already became extinct (and this could also be the case for *Tetrix subulata*). The loss of suitable habitat can be indicated as the main cause but, anyhow, it can be assumed that *M. grossus* never was very abundant in the dunes. Adequate conservation of this group of species should include that water abstraction is limited or abandoned.

The drastic change of the ancient dune landscape due to the cessation of the traditional agricultural management practices, probably had positive effects on the species which are confined to, or at least which are able to survive in taller and denser (and therefore colder) grassland vegetations and scrubs. *Tettigonia viridissima, Chorthippus albomarginatus, Chorthippus biguttulus* and *Chorthippus parallelus* are such (very) abundant ubiquists. The absence of ancient records of the arboreal *Leptophyes punctatissima* may also be seen as an illustration of this phenomenon.

In order to create an appropriate policy for the conservation of the Saltatoria fauna in the fragmented and isolated dune areas along the Belgian coast, studies will be very useful in the future on the dispersal power of the different species. It is of course essential that management plans should take the characteristic microclimatological requirements of each species into consideration. A lot of other (mostly rare) thermophilous invertebrates surely will benefit from a management policy partly based on Saltatoria.

To other countries, the example of the Belgian coast may be an illustration of the surprising "tolerance" of many species, in spite of the mass destruction that man performed to the original semi-natural dune landscape.

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Table 1. Faunistic account of the Saltatoria fauna of the Belgian coastal dunes (B) in the period 1850-1950 and after 1980, compared to the actual Dutch situation (NL) after KLEUKERS, pers.comm. For each species the exact number of known localities (dune areas) is given and between brackets the number of records. Symbols: - = no records available; x = species is recorded at least once; ? = record(s) need confirmation. Ancient Dutch records are presented between brackets (according to DUIJM & KRUSEMAN, 1983).
For each species a valuation category for Flanders is indicated according to DECLEER *et al.* (1989). Different categories: 1 = common everywhere; 2 = widespread; 3 = rare; 4 = endangered; 4? = possibly extinct.

	Valuation Category	B 1850-1950	B > 1980	NL
Tettigoniidae				
Conocephalus discolor	4	1	3(8)	-
Conocephalus dorsalis	2	5(9)	6(11)	x
Decticus verrucivorus	4?	6(7)	-	- (1)
Leptophyes punctatissima	2	-	6(6)	x
Meconema thalassinum	2	4(4)	2(2)	x
Metrioptera roeseli	3	2(3)	5(7)	x
Platycleis albopunctata	4	6(7)	18(31)	x
Tettigonia viridissima	1	3(4)	22(32)	x
Gryllidae				
Gryllus campestris	4	1	-	- (5)
Acheta domesticus	2	1	3(3)	x
Nemobius sylvestris	4	-	-	x
Gryllotalpidae				
Gryllotalpa gryllotalpa	4	-	2(3)	x
Tetrigidae				
Tetrix subulata	3	1	?	x
Tetrix ceperoi	4	3(4)	8(18)	x
Tetrix undulata	1	2(2)	6(7)	x
Acrididae				
Chorthippus albomarginatus	3	7(10)	9(14)	x
Chorthippus biguttulus	2	6(9)	26(49)	x
Chorthippus brunneus	2	3(3)	6(6)	x
Chorthippus mollis	3	1?	?	x
Chorthippus parallelus	1	4(4)	19(21)	x
Mecostethus grossus	4	1	-	- (1)
Myrmeleotettix maculatus	3	4(6)	11(22)	x
Oedipoda caerulescens	4	7(11)	7(10)	x
Omocestus viridulus	3	1	?	x
Omocestus rufipes	3	1	1	-
Minimum number of species		21	18	19
Maximum number of species		22	21	22

Table 2. Preferential ecological conditions of the non-arboreal Saltatoria species in the Belgian coastal dunes, defined by nine combinations of humidity and vegetation structure. Combinations between brackets are of minor importance.
Chorthippus mollis is not known with certainty from the Belgian dunes up to now, but its presence is suspected. *Acheta domesticus* is not mentioned in the table since it lives inside houses and other buildings.

Humidity	Vegetation structure		
	No vegetation	Sparse	Dense/High
Moist	1	2	3
Dry	4	5	6
Extremely dry	7	8	9

Tettigoniidae									
Conocephalus discolor	.	.	3	.	.	6	.	.	9
Conocephalus dorsalis	.	.	3	.	.	.	.	.	.
Decticus verrucivorus	.	.	.	.	5	.	.	8	.
Metrioptera roeseli	.	.	3	.	.	6	.	.	.
Platycleis albopunctata	.	.	.	.	.	6	.	.	9
Tettigonia viridissima	.	.	.	.	.	6	.	.	9
Gryllidae									
Gryllus campestris	.	.	.	.	5	.	.	8	.
Gryllotalpidae									
Gryllotalpa gryllotalpa	.	.	.	see text			.	.	.
Tetrigidae									
Tetrix subulata	.	2	3	.	.	.	.	.	.
Tetrix ceperoi	1	2	.	.	.	.	.	.	.
Tetrix undulata	1	2	(3)	4	5	(6)	.	.	.
Acrididae									
Chorthippus albomarginatus	.	2	3	.	5	6	.	8	9
Chorthippus biguttulus	.	.	.	(4)	5	6	(7)	8	9
Chorthippus brunneus	.	.	.	4	5	.	7	8	.
Chorthippus mollis	.	.	.	(4)	(5)	.	7	8	.
Chorthippus parallelus	.	2	3	.	5	6	.	8	9
Mecostethus grossus	.	2	3	.	.	.	.	.	.
Myrmeleotettix maculatus	.	.	.	(4)	(5)	.	7	8	.
Oedipoda caerulescens	.	.	.	4	(5)	.	7	(8)	.
Omocestus viridulus	.	(2)	(3)	.	5	6	.	.	.
Omocestus rufipes	.	.	.	.	5	6	.	.	.