GÖTTINGER ZENTRUM
FÜR BIODIVERSITÄTSFORSCHUNG UND ÖKOLOGIE
– GÖTTINGEN CENTRE FOR BIODIVERSITY AND ECOLOGY –

Long-term development of different grassland insect communities in Central Europe since the 1950s

Dissertation zur Erlangung des Doktorgrades der
Mathematisch-Naturwissenschaftlichen Fakultäten der
Georg-August-Universität Göttingen

vorgelegt von

Dipl. biol.

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Göttingen, Mai 2011

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Tag der mündlichen Prüfung: 14. Juli 2011

Table of contents

Summary

Central European landscape considerably changed during the second half of the 20th century. These changes are probably mainly caused by modern agriculture. Today, Central Europe consists of a patchwork of intensively used arable fields and grasslands (~50% of total land cover) mixed with forests (mainly plantations, ca. 30%), human settlements, and nature reserves. The implications of the long-term changes in the landscape structure (i.e. effects of fragmentation, of diminishing population sizes, edge effects etc.) are largely understood, but very few empirical studies give data on the long-term consequences for the native fauna. In this context the insects are a very good example. Although the insects comprise a wide range of taxa and are often the most dominant group in a given ecosystem, very little is known about the real-world development of insect populations during the last five decades, in which the most pronounced changes in agricultural practices occurred.

The aim of this thesis was to detect long-term shifts in species richness, species composition, and species abundance of various insect groups. It was based on the results of two historical studies. The first one was conducted by Marchand in 1951, while the second survey was done by Schiemenz between 1963 and 1967. Both studies were repeated independently between 2008 and 2010 using the same sampling techniques at the same sites during a similar time frame as in the historical data. In the first study, Auchenorrhyncha, Heteroptera, and Orthoptera were re-sampled at nine sites (mainly pastures) in Lower-Saxony (federal state of northern Germany). In the second, auchenorrhynchan and orthopteran assemblages were investigated in dry grasslands of eastern Germany. Here, 26 sites were re-sampled, which were equally distributed in Brandenburg, Thuringia and Saxony. Whereas original data (including abundance) of the pastures study were completely available, the abundance data for Orthoptera of dry grassland unfortunately were incomplete and no quantitative comparisons were possible. However, dry grassland data on Auchenorrhyncha

were preserved and could thus be compared to our new, in this case quantitative survey. A comparison capturing three years (1964 to 1966 vs. 2008 to 2010) additionally allowed us to assess interannual variability of auchenorrhynchan abundance.

In the first investigation – based on Marchand's work – we found that the insect communities exhibited no consistent trends between years. Species richness of Auchenorrhyncha and Heteroptera increased on the plot as well as on landscape level but it remained unchanged for Orthoptera. While the abundance of auchenorrhynchans and orthopterans decreased significantly, the quantity of Heteroptera increased. There was a strong trend towards homogenisation in species composition for Heteroptera and also, albeit weaker, for Auchenorrhyncha. The frequency and abundance of species preferring disturbed and/or eutrophic habitats increased, whereas the number of species preferring low-productive habitats declined. This trend is especially pronounced in Auchenorrhyncha. Moreover, generalistic species were more abundant in relative proportions as well as in absolute numbers. We hypothesize that these trends arise from alterations of Central European landscapes due to agricultural intensification over the last several decades, which were also apparent with respect to the comparison of current vegetation samples with the brief historical description of the vegetation available for our sites.

In the second investigation – based on Schiemenz' work – we found that species richness on both the plot level and on the landscape level hardly differed between the two periods for Auchenorrhyncha as well as for Orthoptera. However, for Auchenorrhyncha some new species occurred, and species composition changed. The orthopteran community composition exhibited minor changes, which were mainly correlated with evidence of woody plant encroachment as inferred from historical aerial images. The frequency (share of sites were a given species was present) of some caeliferan species decreased from the 1960s to 2008/2009 with one species inhabiting bare soils (*Myrmeleotettix maculatus*) showing the strongest decline. Some Ensifera, especially two species inhabiting open woodland and scrub

(*Tettigonia viridissima, Phaneroptera falcata*) exhibited increases. For Auchenorrhyncha, population densities markedly declined. On average, only 27 % of the total individuals caught between 1964 and 1966 were recorded in the years 2008 to 2010. Especially, the decline in abundance of some species known to be very common dry grassland specialists suggested a trend for a general change. A comparison of weather conditions and long-term climatic trends revealed that the abundance differences could not be simply explained by climate change effects. Instead, nutrient input and introduction of modern land use practices which induced the closing of formerly open grassland swards, and also habitat losses are presumably responsible for the abundance decline in auchenorrhynchan communities.

Introduction

Why is long-term research necessary?

The anthropogenic influence on European landscapes during the second half of the 20th century is unprecedented. Introduction of modern agriculture resulted in land use intensification and emerged as a serious threat to biodiversity (Robinson & Sutherland 2002). This induced habitat degradation as a consequence of application of fertilizers and other chemicals, changed crop rotation systems, and decreasing non-crop plants (Dallimer *et al.* 2009). Now, large parts of Central Europe are dominated by intensively managed annual crop fields or species poor perennial grasslands. These intensive forms of agricultural practices caused losses in plant diversity and habitat types (Treweek *et al.* 1997; Joyce & Wade 1998; Prach 2008), and also induced declines in insect species richness (Hendrickx *et al.* 2007; Ryszkowsky *et al.* 2009) and abundance (Benton *et al.* 2002). Several studies indicate a decline in species richness in a range of insect groups in different habitat types and across several central European countries (Maes & Van Dyck 2001; Nickel 2002; Irmler 2003; Biesmeijer *et al.* 2006; Kosior *et al.* 2007). Despite the high diversity of insects and their fundamental importance for ecosystem functioning, very little is known about long-term trends (i. e. developments over several decades) in European insect communities. The lack of data is especially severe in terms of population dynamics, and next to nothing is known about long-term trends in insect population densities. There is some evidence that insect densities of several taxa decreased due to the intensification of farming practices during the last three to four decades (Benton *et al.* 2002). Nevertheless, sufficient data for the majority of insect groups and habitats are missing. Moreover, climate change was especially pronounced during the last forty years, and evidence is accumulating that it has had an impact on insect communities (Masters *et al.* 1998; Hickling *et al.* 2006). However, comparable field-data for

long-term research are missing. Given the background of altered land use practices and a changing climate, the need for studies about the long-term development of insect communities covering the last five decades is obvious. It is very important to know whether and how long-term impact of a changing environment altered the composition of the insect fauna.

General problems in long-term research

The major problem in long-term research is if there are reliable data available to base on. Phytosociological studies in Central Europe, for example, have been done for over one hundred years. Thus, a lot of data on plants are available offering a great potential for long-term comparisons, because most relevés reflect plant community composition relatively accurate (Wesche *et al.* 2009). That is why it is partly well understood how Central European flora altered during the past 50 years (cf. Albrecht & Bachthaler 1990; Baessler & Klotz 2006). In contrast, reliable data on insect communities are very scarce. Furthermore, in entomology there are a number of problems which additionally have to be considered:

1.) Insects are the most diverse terrestrial group. They occur in all kinds of habitats often in high species richness and abundance, and show a wide variety of ecological characteristics. Due to this enormous diversity an entomologist has to focus on a few insect orders or even on smaller taxonomic subdivisions. Consequently, most surveys of the past focussed on limited parts of the whole insect population of an investigated type of habitat, and investigations were also regionally very restricted.

2.) Sampling methods are insufficient. Getting reliable information about an insect community is not an easy task, because huge differences in sizes and mobility of the single taxa strongly influence sampling success. Hence, there is no all purpose optimal sampling method. The sweep net, for example, is the standard tool for entomological field research because it is simple to use and relative effective. Nevertheless, sweep netting in some cases is less comprehensive than suction sampling (Buffington & Redak 1998). Suction sampling

alone, however, does not capture ground-dwelling insects as completely as the insects of the herb layer (Sanders & Entling 2011). This example demonstrates the need for employing task-specific sampling strategies. As a consequence, there is no standardised sampling approach and many studies are, unlike in for example the phytosociological research, not comparable with others.

3.) Phenology varies enormously between insect species: there are adult forms of some species that only occur in spring and others that are exclusively found in autumn. Moreover, some species appear only for a few weeks, while others can be found during the whole growing season. Catching all species (or at least the majority) occurring in one habitat requires sampling over multiple times during the growing season.

4.) Many insect species show a high interannual variability. The abundance of single species can differ considerably between years (Hollier *et al.* 2005). If long-term trends in abundance have to be assessed, one sampling site has to be sampled repeatedly over several years ensuring that long-term patterns are not masked by interannual variability.

5.) Historical insect studies often exhibit limited data quality. In most cases, original species lists are lost and information about location of the study is insufficient. Moreover, taxonomic problems may add to this.

Due to all these problems suitable historical insect data are hardly available. Thus, the data quality for different taxa is inconsistent (Thomas *et al.* 2004; Biesmeijer *et al.* 2006), and large-scale comparisons are rare. If historical data are available, studies usually do not go back for more than three decades (cf. Irmler 2003; González-Megías *et al.* 2008; Schlicht *et al.* 2009).

Previous entomological long-term research

The majority of the long-term research on insect communities was done in Britain (Table 1). Here, the most intensively studied insect order is Lepidoptera, because butterflies were frequently collected by both professional and amateur entomologists in the past (Maes & Van Dyck 2001). Thus, there are survey data available covering whole countries, like Britain, but also – to a lesser extent – the Netherlands and Belgium. Lepidoptera is the only group, in which long-term developments across many habitat types and many different countries were investigated with studies covering up to 99 years. These studies about Lepidoptera all indicate long-term declines in diversity or abundance.

The rest of the studies known to the author allow no generalisations of long-term developments across entire insect orders or habitat types. Table 1 gives an overview about relevant studies on long-term trends in Central European taxa. In general, studies on species richness (eleven studies) are more common than those covering abundance (six studies). Only two studies are based on qualitative as well as on quantitative data. Nine out of all studies indicate long-term declines in species richness or abundance, four indicate increases, and three suggest no changes. There are various investigated habitat types. The time scales are not consistent, covering one decade up to one century. Long-term studies in Germany are all regionally very restricted and do not focus on special insect groups or habitat types. Interestingly, these case studies mainly indicate long-term increases in species richness.

Table 1 List of studies on long-term developments in the Central European insect fauna. For these 15 studies, the investigated insect order, the study period, changes in species richness and species abundance, the investigated habitat type, the location (country), the authors, and the year of publication are listed.

Investigated insect orders	Investigation period	Species richness	Abun-dance	Habitat type	Study located in	Author(s)
12 insect orders	1972 - 1998	-	Decline	Farmland	Scotland	Benton et al., 2002
Auchenorrhyncha	1971 - 1996	Increase	-	Marshlands	Germany	Nickel, 2002
Auchenorrhyncha	1984 - 1995	Constant	-	Dunes	Germany	Stöckmann & Niedring-haus, 2004
Chrysomelidae, Curculionoidea, Orthoptera	1972 - 1989	Increase	Increase	Xero-thermic meadows	Germany	Perner & Köhler, 1998
Coleoptera (ground beetles)	1985 - 1995	Increase	-	Arable fields	Germany	Irmler, 2003
Diptera (hoverflies) and Hymenoptera (bees)	Pre/post-1980	Decline	-	Various grasslands	Britain and the Netherlands	Biesmeijer et al., 2006
Heteroptera and Auchenorrhyncha	1934 - 1988	Increase	-	Dunes	Germany	Bröring & Niedringhaus, 1989
Hymenoptera (bumble bees and cuckoo bees)	Pre/post-1950	Decline	-	Various	Western and Central Europe	Kosior et al., 2007
Lepidoptera (butterflies and burnet moths)	1980 - 2003	Decline	-	Semi-natural grassland	Sweden	Öckinger et al., 2006
Lepidoptera (butterflies)	Pre/post-1991	Decline	-	Various	Belgium	Maes & Van Dyck, 2001
Lepidoptera (butterflies)	1972 - 1999	Decline	-	Various	Britain	Thomas et al., 2004
Lepidoptera (butterflies)	1901 - 1980	-	Decline	Abandoned meadows	The Netherlands	Van Swaay, 1990
Lepidoptera (macro-moths)	1968 - 2002	-	Decline	Various	Britain	Conrad et al., 2004
Orthoptera	1946 - 1978	Constant	Constant	Dry grassland	Germany	Heusinger, 1980
Various insect orders	1973 - 2002	-	Decline	Various	Britain	Shortall et al., 2009

Chapter outline

The aim of this work was to detect long-term shifts in species richness, species composition, and species abundance of various insect groups. Of special interest was to include insect abundance, since such an approach was not performed for Germany so far. The following chapters are based on three historical studies, one conducted by Marchand (1953) and two conducted by Schiemenz (1969a, b), which were partly repeated in 2008 to 2010 using the

same sampling techniques at the same sites during a similar time frame. The historical datasets had been stored in the library of the Department of Zoology, University of Kiel, and in the archive of the Zoological Museum of Dresden. As the original species lists were not published in journals we were lucky that they had been preserved.

The study described in **chapter 1** is based on data by Marchand (1953). In his study he investigated three insect groups as indicators of different grassland types: Auchenorrhyncha (planthoppers and leafhoppers), Heteroptera (true bugs) and Orthoptera (grasshoppers and bush crickets). The study was located on twelve sites near Stolzenau and Leese (Germany, Lower-Saxony). The sites had been sampled during the growing season of 1951 and were re-sampled for this study in 2009. Thus, qualitative and quantitative data covering three insect orders of a 59-year-intervall could be compared.

The studies described in **chapter 2 and 3** are based on data by Schiemenz (1969a, b). Schiemenz investigated orthopteran and auchenorrhynchan assemblages of Central European dry grasslands. He was especially interested in the phenology of auchenorrhynchan species. His studies were located on 59 dry grassland sites in eastern Germany. The sites had been sampled during the growing seasons of the years 1963 to 1967 and 26 of them were re-sampled for this study in the years 2008 to 2010. Chapter 2 describes long-term changes in the orthopteran populations, and chapter 3 focuses on those in auchenorrhynchan communities. As no abundance data for Orthoptera were available, chapter 2 is a qualitative study regarding species richness and species composition. For Auchenorrhyncha, quantitative data additionally allowed us to compare species abundance for the years 1964 to 1966, and 2008 to 2010 in addition to comparisons for species richness and species composition.

Chapter 1

Long-term population trends in three grassland insect groups: a comparative analysis of the years 1951 and 2009

Journal of Applied Entomology (in press)

Long-term population trends in three grassland insect groups: a comparative analysis of 1951 and 2009

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Keywords: *Auchenorrhyncha, Heteroptera, Orthoptera, abundance, species richness, species composition*

Abstract

Development of farming practices has caused drastic changes in European agricultural landscapes during the past 50 years. As a consequence of these changes insect diversity is widely expected to decline. We performed a comparative analysis with long-term data of three insect groups: Auchenorrhyncha, Heteroptera and Orthoptera. In 2009 we revisited nine grassland sites in northern Germany that were originally sampled in 1951 using the same techniques and during a similar time frame. We found that the insect community exhibited no consistent trends between years. Species richness of Auchenorrhyncha and Heteroptera increased on plot- as well as on landscape-level but remained unchanged for Orthoptera. Abundance of Auchenorrhyncha and Orthoptera significantly decreased, while Heteroptera increased. There is a strong trend towards homogeneity in community composition for Heteroptera and a weak one for Auchenorrhyncha. The frequency and abundance of species preferring disturbed and/or eutrophic habitats increased, whereas the number of species preferring low-productive habitats declined. Generalist species were more abundant in relative proportions as well as in absolute numbers. We hypothesize that these trends arise from alterations of Central European landscapes due to agricultural intensification over the last several decades.

Introduction

Agriculture has drastically changed the natural landscape of Europe during the past 60 years, particularly in grassland habitats. In large areas of northern Germany more than 50% of the original wet meadows that existed in the 1950s and 1960s are gone (Wesche *et al.* 2009). Of the extant grasslands, more than 80% are intensively used and species-poor (Krause *et al.* 2011). Such strong declines of oligotrophic grasslands also occurred in other European countries such as the Czech Republic (Prach 2008), England (Treweek *et al.* 1997) and

Hungary (Joyce & Wade 1998). As a consequence of shifts in land use, insect diversity in these habitats is widely expected to decline (Watkinson & Ormerod 2001; Biedermann *et al.* 2005). Indeed, there is ample evidence that more intensive agricultural practices, such as mowing, grazing or fertilization, result in changes in species occurrence, community structure and diversity of insects (Morris 1981; Prestidge 1982; Kruess & Tscharntke 2002; Nickel & Hildebrandt 2003). Haddad *et al.* (2000) found that increased nitrogen deposition indirectly caused auchenorrhynchan species richness to decline via decreased plant species richness. This type of loss could potentially create homogeneous insect communities due to a general decline in habitat diversity or also decrease number of specialists due to the loss of specific host plants.

Support for the idea that altered land-use practices affect insect communities comes from many studies that demonstrate a decline in insect diversity during the last decades (Conrad *et al.* 2004; Thomas *et al.* 2004; Biesmeijer *et al.* 2006), and it has been suggested that land use intensification may now be having a greater impact on common, generalist species (Van Dyck *et al.* 2009). While trends in species richness are seemingly obvious, these are not necessarily analogous to trends in insect abundance, which are far less clear. Losses in common species are largely going undetected until they cause local extinction (Gaston & Fuller 2007). The problem is especially severe in invertebrate communities, where few data are available. This lack of long-term records of insect abundance is related to the sparseness of data from the 1950s to the 1970s, when only a few entomologists used standardized sampling methods and conducted reproducible studies. There are only a few assessments of truly long-term changes (considering at least three decades) in insect abundance in Central Europe, and those available usually cover only single taxa. Conrad *et al.* (2004) studied common macro-moths of Great Britain with data covering 35 years and found that 54 % of the species significantly decreased in abundance, while just 22 % increased. A study from Bavaria demonstrated that the number of night-active butterflies from standardized light-trap-

captures continuously decreased from approximately 250 individuals per month in 1969 to 50 in 1995 (Reichholf 2005), while species richness remained largely unaffected. These studies suggest that a strong decline in insect populations can remain undetected if just species richness is considered.

To reveal trends in insect abundance and richness, we present a comparative study with original data from a grassland survey conducted in 1951 (Marchand 1953). Marchand used standardised sweep netting, which is easily mimicked and thus comparable for abundance data, and he examined three insect groups: Auchenorrhyncha (planthoppers and leafhoppers), Heteroptera (true bugs) and Orthoptera (grasshoppers and bush crickets). These three groups are very abundant in grasslands and constitute the dominant herbivore groups, with Auchenorrhyncha at densities frequently exceeding 1000 individuals per square meter (Waloff & Thompson 1980; Nickel & Hildebrandt 2003). The ecology of Central European Auchenorrhyncha species is well known, including over-wintering stage, voltinism (number of generations per year) or the range of host plants (Nickel 2003). Similarly extensive ecological information is available for Heteroptera (Wachmann et al. 2004). We used information about species characteristics to interpret long-term changes in species abundance; for example, how the ratio of specialists to generalists changed. We also analysed historical and current aerial images and took vegetation samples to quantitatively assess driving factors of faunal change.

Specifically, we asked the following questions:

(1) Are there substantial long-term developments in the diversity and abundance of the three investigated grassland insect groups? (2) Are there patterns in the species composition of these groups which suggest land use intensification to be a crucial factor for long-term changes? (3) Are changes in local plant communities or landscape level habitat characteristics able to explain developments in the investigated insect communities?

Material and methods

Study sites and sampling

To perform a comparative analysis of auchenorrhynchan (A), heteropteran (H) and orthopteran (O) communities, we sampled at nine out of the original twelve sites that were studied between May and October 1951 (Marchand 1953). All sites are located near Stolzenau and Leese (Lower Saxony) in the lowlands of northern Germany. Marchand selected his sites according to a moisture gradient with the result that there are three types of habitat (Table 1): (1) dry grassland (sites I and II), (2) mesic grassland (sites III - IV), and (3) moist grassland (sites X - XII). The mode and extent of agricultural land use were also recorded. Four of the plots were not mown or grazed in 2009, while in 1951 each plot was mown at least once a year (Table 1). Marchand gave brief descriptions of the plant communities present in 1951, which were helpful in rediscovering the plots. Some of these plots have changed severely during the past 60 years. Three sites (VII, VIII and IX) had been converted to arable fields since 1951 and could not be included in the study. In all other cases sufficiently similar habitats were still present to permit sampling. The weather in both sampling periods was largely comparable: the mean annual precipitation of Germany was 751 mm in 1951 and 813 mm in 2009 (data retrieved from Deutscher Wetterdienst). Mean spring and summer precipitation slightly differed by 7 mm and 8 mm between both periods. In contrast, mean autumn precipitation was 48 mm higher in 2009 compared to 1951. Mean annual temperature rose from 8.7 in 1951 to 9.2 °C in 2009. Hereby, mean spring temperature was much lower in 1951 than in 2009 (7.0 °C / 9.9 °C), whereas mean summer and autumn temperatures only slightly differed (both 0.7 °C warmer in 2009 than in 1951).

Table 1 Land use and vegetation types (community, alliance) for nine different plots near Stolzenau, sampled in 1951 and sampled again in 2009.

		Land use practices		Vegetation			
				Community		Alliance	
		1951	2009	1951	2009	1951	2009
Dry	I	Sheep grazing	Ungrazed	Corynephoretum cladonietosum	Arrhenatherethum elatioris	Corynephorion canescentis	Arrhenatherion elatioris
	II	Sheep grazing	Ruderalized	Corynephoretum agrostidetosum	Corynephoretum agrostidetosum aridae	Corynephorion canescentis	Corynephorion canescentis
Mesic	III	Mown twice	Paddock	Arrhenatheretum elatioris	*Ranunculus repens* - *Alopecurus pratensis* comm.	Arrhenatherion elatioris	Arrhenatherion elatioris
	IV	Mown twice	Ruderalized (horses)	Arrhenatheretum elatioris	*Ranunculus repens* - *Alopecurus pratensis* comm.	Arrhenatherion elatioris	Arrhenatherion elatioris
	V	Mown twice	Mown once (edges)	Arrhenatheretum elatioris	Arrhenatherethum elatioris	Arrhenatherion elatioris	Arrhenatherion elatioris
	VI	Mown twice	Cattle grazing	Arrhenatheretum elatioris	Arrhenatherethum elatioris	Arrhenatherion elatioris	Arrhenatherion elatioris
Moist	X	Mown twice	Mown twice	Bromus racemosus-Senecio aquaticus	*Ranunculus repens* - *Alopecurus pratensis* comm.	Calthion palustris	Arrhenatherion elatioris
	XI	Mown twice	Mown twice	Bromus racemosus-Senecio aquaticus	*Ranunculus repens* - *Alopecurus pratensis* comm.	Calthion palustris	Arrhenatherion elatioris
	XII	Mown once	Mown twice	Cariceto canescentis-Agrostidetum caninae	Phragmiteteum australis	Caricion nigrae	Phragmition australis

We sampled eight times at each site beginning in May and ending in September 2009, trying to match sampling dates of Marchand as closely as possible. Marchand sampled with a sweep net (Ø 30 cm; 100 beats per sampling); we used the same method and assume that comparisons between years are justifiable. Research has shown that transect surveys by different teams at the same sites but on different routes may produce similar rankings in insect species abundance (Schlicht et al. 2009). For A and H, sampling by sweep net is an adequate technique to obtain reliable information about insect community composition and abundance in grassland and scrub habitats (Törmälä 1982; Buffington & Redak 1998; Standen 2000). For O, the use of sweep nets is less effective and it is recommended to supplement sampling with other methods such as acoustical surveys. No other methods besides sweep nets were employed in 1951 and therefore only sweep nets were used in 2009; as a result, information on species identity in O communities should be considered with caution. However, recent work indicates that using sweep nets to sample O can still be valid in comparisons of abundance (Gardiner *et al.* 2005).

Only some vegetation samples from the 1950s were available. In 2009 in each site we sampled one 10 x 10 m plot and recorded all vascular plants and an estimate of their cover along with exact locality information. We compared aerial photographs of the 1950s with photographs from 2008 to assess the development of the vegetation in the plots and their immediate surroundings, i. e. changes in size of arable fields, wood cover and grassland cover. We compiled relevant life history traits for each species based on Nickel (2003) and Wachmann *et al.* (2004). For A, we examined four traits: degree of host plant specialism (monophagous: one host plant species; second degree monophagous: one host plant genus; oligophagous: one host plant family; second degree oligophagous: two host plant family or up to four host plant species each belonging to up to four different families; polyphagous: various host plants from many different families), voltinism (usually one or two generations per year), over-wintering stage (egg, nymph or adult), and dispersal ability (flightless short-

winged brachypterous or mobile long-winged macropterous morphs). For H, we included habitat requirements (preference for dry, mostly dry, dry or wet, mostly wet or wet conditions), over-wintering stage (egg or adult; over-wintering juveniles were not present), feeding type (phytophagous, phytozoophagous or zoophagous), and voltinism. For O, species identity and ecological characteristics were not considered.

Data analysis

We calculated estimates of alpha (α), beta (β) and gamma (γ) species richness first considering only species presence/absence, and second using species abundance. When considering presence/absence, α species richness was defined as plot-level species richness, Whittaker's β species richness (total number of species / mean species richness) was used as a simplified definition of among-plot differentiation (Tuomisto 2010), and γ species richness was used to denote the total number of species caught in each year. Abundance was considered at both the plot level and for the entire sample. Combining species numbers and abundance values, α Shannon diversity was used to describe plot-level patterns, mean Bray-Curtis distance among samples provided an estimate for among-plot differentiation, and γ Shannon diversity (based on the total sample) was used to describe diversity on the landscape level.

Data were visualised using DCA (Detrended Correspondence Analysis) which provided evidence for moderately long faunistic gradients (length of gradient = 3.1 and 4.1, equivalent to less than one species turnover (McCune et al. 2002)), and prompted us to use asymmetric dissimilarity measures (Sörensen / Bray Curtis similarity). We used boxplots (median and interquartile ranges) to summarise data on species abundance per year and insect group. Differences were tested with Wilcoxon test (paired samples). We used an indicator species analysis (ISA) to test for species that were significantly associated with one sampling period or the other (Dufréne & Legendre 1997). Relationships between A and H communities in

1951 and 2009 were tested with a Mantel-Test (Bray-Curtis similarity). Data were analysed using R (R Development Core Team) and PC-ORD (McCune & Mefford 2006).

Results

Community composition

We detected 94 species with 21,887 individuals of Auchenorrhyncha (A), 88 species with 3,246 individuals of Heteroptera (H) and 15 species with 460 individuals of Orthoptera (O) in 1951 and 2009 combined.

When considering presence/absence, only H showed a significant increase in α species richness (V = 5, p = 0.04, Table 2). β species richness slightly increased (1951: 2.8 (A) and 3 (O); 2009: 3 and 3.7) for A and O but decreased for H (3.7 to 3.1). Total species numbers increased for all three groups; in 2009 they were 36 % higher in A and 20 % each in both H and O.

Table 2 Total number and medians of species (s) per plot; beta species richness, total number, and medians of individuals (i) per plot (first to third line: Auchenorrhyncha, Heteroptera and Orthoptera). Numbers refer to sweep net samples from 1951 and 2009 (eight samples each year, 100 sweeps per visit).

	Total #s		Median #s		β species richness		Total #i		Median #i	
	1951	2009	1951	2009	1951	2009	1951	2009	1951	2009
	55	75	20	25	2.8	3.0	16088	5799	1762	710
	52	63	14	19	3.7	3.3	1426	1820	108	172
	9	11	3	3	3.0	3.7	335	125	31	5

#s= number of species *#i = number of individuals*

Median numbers of individuals per plot declined significantly in both A and O (Fig. 1 A, C; table 2, A: V = 44, p = 0.01; O: V = 43, p = 0.01), while median numbers in H significantly increased (Fig. 1 B; table 2, V = 45; p = 0.004). Total numbers of individuals of A and O exhibited strong declines by about 64 % each, while H increased by about 28 %.

Plot-level based Shannon diversity did not change significantly over time for any of

the three groups. Mean Bray-Curtis distances (abundances log (x+1) transformed) declined from 0.61 to 0.57 in A, from 0.75 to 0.55 in H, and increased from 0.77 to 0.83 in O.

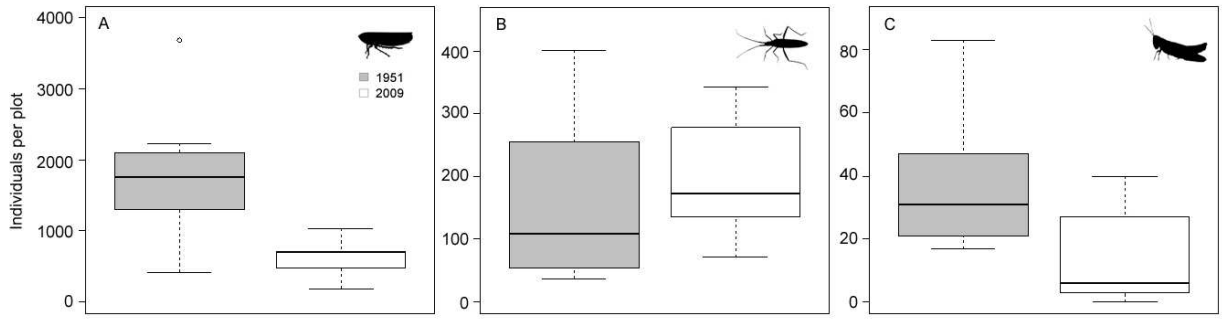

Figure 1 Boxplots showing mean number of individuals on plot-level for the whole sampling periods of 1951 and 2009; Auchenorrhyncha (A), Heteroptera (B) and Orthoptera (C).

Ordinations for A (Fig. 2 A) as well as for H (Fig. 2 B) indicated that the species composition in 2009 was less heterogeneous than in 1951. In the DCAs, the plot records of 2009 cluster more and the records of 1951 are more widely distributed in the ordination space. For example, in 1951 differences between plot I (dry habitat) and plot X (wet habitat) for both A and H corresponded to about one species turnover along the main axis (about four SD-units), while dissimilarities between the same plots in 2009 were half that large (less than two SD-units). The pattern was similar for presence/absence data (graphs not shown). For O, there was also a weak trend for homogenisation. γ Shannon diversity for the entire data set declined clearly in A, while it remained somewhat constant in H and O.

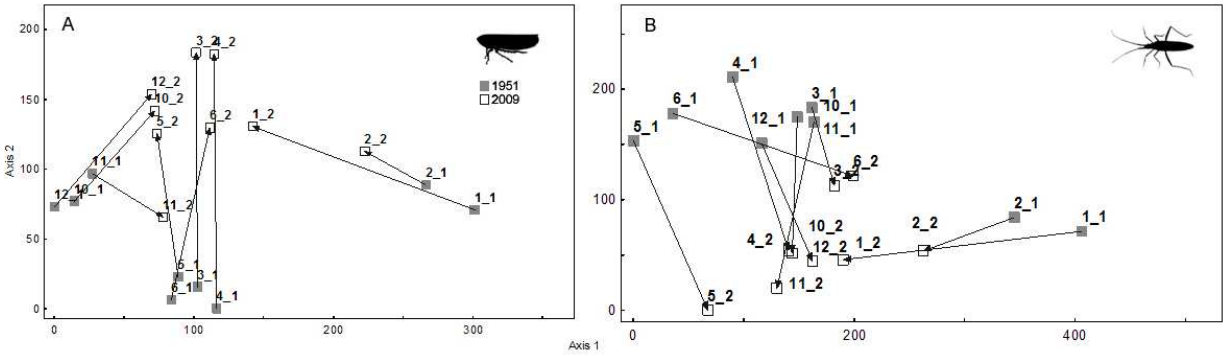

Figure 2 DCA ordinations of insect communities at the nine different plots (all species, abundance log (x-1) transformed, downweighting of rare species, detrending by segments). A) Auchenorrhyncha (eigenvalue / length of gradient axis 1 0.49 / 3.1; axis 2 0.24 / 1.8; axis 3 0.09 / 1.9). B) Heteroptera (eigenvalue / length of gradient axis 1 0.57 / 4.1; axis 2 0.21 / 2.1; axis 3 0.12 / 1.8).

Mantel tests comparing the relationship between pair-wise auchenorrhynchan Sörensen dissimilarity and heteropteran Sörensen dissimilarity indicated a strong correlation in 1951 ($r_M = 0.71$, $p = 0.003$, 4999 permutations), while the relationship in 2009 was not as strong ($r_M = 0.42$, $p = 0.036$).

Individual species

Frequency and abundance of several species differed significantly between the two years (Table 3). Two A species, *Balclutha punctata* and *Zyginidia scutellaris*, did not occur in 1951, but were present on every plot in 2009.

Table 3 Frequency (%) and number of individuals of auchenorrhynchan and heteropteran species with marked differences between 1951 and 2009. Indicator species analysis, * indicating significant differences between years at $p < 0.05$, and (*) trends at $0.1 > p > 0.05$.

	Frequency (% of all plots)		Individuals (per 9 plots)			
	1951	2009	1951	2009	p	
Balclutha punctata	0	100	0	47	0.001	*
Zyginidia scutellaris	0	100	0	332	0.001	*
Elymana sulphurella	67	0	288	0	0.008	*
Eupteryx notata	67	0	17	0	0.009	*
Forcipata forcipata	67	0	185	0	0.009	*
Jassargus pseudocellaris	100	67	1154	209	0.018	*
Macrosteles sexnotatus	67	89	8	410	0.019	*
Athysanus argentarius	67	22	100	4	0.021	*
Dicranotropis hamata	0	56	0	39	0.023	*
Psammotettix alienus	0	56	0	42	0.033	*
Philaenus spumarius	78	44	886	18	0.033	*
Psammotettix confinis	78	100	61	323	0.050	*
Megadelphax sordidula	78	56	1368	47	0.065	(*)
Cercopis vulnerata	0	44	0	15	0.068	(*)
Javesella pellucida	100	100	2031	823	0.073	(*)
Javesella dubia	0	44	0	23	0.082	(*)
Xanthodelphax straminea	0	44	0	34	0.083	(*)
Florodelphax leptosoma	44	0	409	0	0.086	(*)
Megamelus notula	44	0	126	0	0.088	(*)
Stenocranus major	0	44	0	7	0.08	(*)
						
Amblytylus nasutus	0	78	0	261	0.004	*
Stenodema calcarata	78	100	24	144	0.004	*
Stenodema laevigata	44	100	15	119	0.005	*
Leptopterna dolobrata	11	78	2	76	0.006	*
Capsus ater	11	67	2	39	0.011	*
Megaloceroea recticornis	11	78	2	71	0.011	*
Aelia acuminata	0	67	0	33	0.011	*
Dolycoris baccarum	0	56	0	5	0.036	*
Stenotus binotatus	11	56	4	108	0.053	(*)
Nabis pseudoferus	89	100	22	72	0.074	(*)

Dicranotropis hamata and *Psammotettix alienus* did not occur in 1951, but were found in 56 % of all plots in 2009; *Macrosteles sexnotatus* and *Psammotettix confinis* were also significantly more common in 2009. *Xanthodelphax straminea* was not present in 1951, but occurred in 44 % of 2009 samples. In contrast, two formerly common species (frequency > 65 %), *Elymana sulphurella* and *Forcipata forcipata*, completely disappeared, and *Athysanus argentarius* declined from 67 % to 22 %. The usually very common species *Jassargus pseudocellaris*, *Philaenus spumarius* and *Athysanus argentarius* decreased in abundance and frequency.

Among H, only 7 out of 88 species underwent changes, all of them increased in numbers from 1951 to 2009. *Amblytylus nasutus*, *Aelia acuminata* and *Dolycoris baccarum* did not occur in 1951, but were present in more than two thirds of all samples of 2009. The frequencies of *Leptopterna dolobrata*, *Megaloceroea recticornis* and *Capsus ater* also increased markedly.

Species characteristics

In 2009, about 12% of A individuals were monophagous (summed first and second degree), whereas their proportion had been 30% in 1951 (Table 4). Relative number of oligophagous and polyphagous individuals increased, while absolute numbers decreased for all A feeding groups. The relative proportion of macropterous individuals slightly increased as well as relative proportion of bivoltine species. Adult over-wintering A occurred in 2009, but were completely absent in 1951. For H, number of individuals with dry habitat requirements decreased over time in relative as well as absolute numbers (Table 4). Absolute numbers increased for nearly all ecological groups of H (except for bivoltine species); however, the relative numbers of bivoltine individuals and those over-wintering as adults decreased. The relative proportion of the trophic types did not differ between years.

Table 4 Ecological characteristics of Auchenorrhyncha and Heteroptera from 1951 and 2009, calculated for the sum of all individuals. First, Auchenorrhyncha: degree of host plant specialism (for explanations see text), voltinism (generations per year), overwintering stage and dispersal ability (short-winged = brachypterous; long-winged = macropterous). Second, Heteroptera: habitat requirements, voltinism, feeding type, overwintering stage. In % = percentage of the total numbers of individuals.

		Individuals		In %	
Ecological characteristics		1951	2009	1951	2009
	Total	16088	5799		
Hostrange	Monophagous	2794	511	17	9
	M. 2nd degree	1981	183	12	3
	Oligophagous	7638	3464	47	60
	Olig. 2nd degree	438	150	3	3
	Polyphagous	3237	1491	20	26
Dispersal ability	Brachypterous	4764	1370	30	24
	Macropterous	11324	4429	70	76
Generations per year	One	3784	680	24	12
	1.5	2806	863	17	15
	Two	9498	4256	59	73
Over-wintering stage	Egg	11221	4066	70	70
	Nymph	4867	1326	30	23
	Adult	0	407	0	7
	Total	1426	1820		
Habitat requirements	Dry	491	287	34	16
	Mainly dry	53	145	4	8
	Dry and wet	760	1090	53	60
	Mainly wet	82	256	6	14
	Wet	40	42	3	2
Feeding type	Phytophagous	1293	1621	91	89
	Zoophytophagous	27	46	2	3
	Zoophagous	106	153	7	8
Generations per year	One	753	1155	53	63
	Two	673	665	47	37
Over-wintering stage	Egg	561	953	39	52
	Adult	865	867	61	48

Insect habitat specificity

In 2009, detailed vegetation samples were available that allowed us to test the extent of habitat specificity of A and H. The Mantel test of Sörensen dissimilarities in current plant community composition and A communities yielded an r_M of 0.75 ($p < 0.001$), while for H the r_M was 0.21 ($p > 0.1$). This indicates that H communities in 2009 were less specific with respect to vegetation communities.

Vegetation and surrounding landscape

In 1951, two sites were dry sandy grasslands with *Corynephorus canescens*; only one of these was preserved while the other one became ruderalized with an increase in mesic plant species (Table 1). The mesic *Arrhenatherum elatius* grasslands remained relatively unchanged and still belong to the same phytosociological alliance. The two wet meadows with *Bromus racemosus* developed into a mesic *A. elatius* grassland; and the moistest stand, which formerly was dominated by small sedges, such as *Carex canescens,* has fallen fallow and is now dominated by *Phragmites australis*.

On the basis of these data, we calculated a rank-based index of phytosociological similarity (same community, different community, different alliance, etc). In A, changes in Sörensen dissimilarity on a given plot over time (abundance log-transformed) were rank-correlated with changes in phytosociological classifications (rho = 0.67, p = 0.05), while changes in H were not related to changes in the vegetation (rho < 0.01, ns).

Analysis of aerial photographs indicated that few major structural changes occurred in the last 60 years concerning cover of woody perennials or agriculturally used land.

Discussion

We aimed to detect long-term changes in species richness, species composition and abundance of insect communities in grasslands that were mainly used as pastures. Two conspicuous trends are apparent: species richness was mostly unchanged whereas overall population density tended to decline. In addition, insect communities became more homogenous and the percentage of generalists increased.

Community composition

In contrast to previous studies (Conrad *et al.* 2004; Thomas *et al.* 2004; Biesmeijer *et al.* 2006), we did not observe a general decline in insect diversity during the past several

decades. α and γ species richness of A and H increased from 1951 to 2009, while orthopteran species richness remained almost constant (Table 5). We have recently documented a similarly constant O diversity for dry grasslands in eastern Germany over a similar time period (Schuch *et al.* 2011), indicating that O are relatively tolerant to environmental changes. However, temporal trends of species richness in the more specialised Rhynchota are not that easily explained. Both A and H appear to have benefited from landscape change, but DCA and β species richness, especially for H, suggest that communities have become more similar. Such homogenisation trends are in line with general observations for European flora (Smart *et al.* 2006) and parts of insect fauna (Ekroos *et al.* 2010). Most notably, these trends were also observed for the flora of the Central European grasslands of the studied region (Wesche *et al.* 2009).

Table 5 Comparison of species richness, Shannon diversity (and mean Bray-Curtis distance) and population density of Auchenorrhyncha, Heteroptera and Orthoptera for the years 1951 and 2009. +: increase, -: decrease, =: no change; brackets indicate weak or non-significant (if tested) trends; PL = plot level; LL = landscape level.

	Species richness			Shanon diversity			Abundance	
	A	β*	γ	α	β**	γ	PL	LL
	(+)	(+)	+	(+)	(-)	-	-	-
	+	-	+	(+)	-	(+)	+	+
	=	=	(+)	+	+	=	-	-

*Whittaker's β, **mean Bray-Curtis distance, PL=plot level, LL=landscape level

β-diversity (mean Bray-Curtis distance) and γ Shannon diversity clearly decreased during the last 60 years. This decline is due to the second major trend in A communities, where abundance was significantly lower even for formerly dominant, common and widespread species. In 2009, α Shannon diversity and mean Bray-Curtis distance of O were higher, while their abundance was significantly lower. The loss in abundance of A and O may indicate a long-term decline, although with only two years in our study it is difficult to know conclusively. Studies indicate that planthopper populations fluctuate strongly within and among seasons in the same patch as well as among spatially distant patches (Denno &

Roderick 1990). Müller (1978) found that A diversity can be surprisingly constant, with strong fluctuations in the abundance of single species. Hollier *et al.* (2005) demonstrated that the local plant community and geographical location had a high explanatory value for the composition of communities of A, while the influence of year was small, even though single species abundance differed between years. We recently compared A communities from northern German dry grasslands from 1964–1966 and 2008–2010. Numbers of individuals were lower in the second period for any year to year comparison (see Chapter 3), adding to the evidence for an overall decline of auchenorrhynchan densities. The respective Mantel-Tests, and univariate analyses imply that the different insect groups behaved at least partly different, rendering it unlikely that the decline of A and O is caused only by unfavourable climatic conditions in 2009.

The communities of A and H were more closely correlated in 1951 than they are today. The sparse vegetation data yielded sufficient information about changes in the plant communities. Even though our approach is crude, we still detected a significant response of A, while H composition was not correlated to vegetation change. In general, A communities are more closely linked to the vegetation, because many species depend on special host plants. H communities are now more strongly dominated by species that are less dependent on special vegetation.

In H, the most common species in 2009 were as frequent as in 1951 and several generalist species became more dominant. In accordance with our data, Di Giulio *et al.* (2001) found that intensively managed meadows were dominated by more widespread and less specialised H species.

Species and their ecological characteristics

A and H species that prefer disturbed and eutrophic sites increased, whereas species occurring on low-productive sites decreased. This trend is evident both in terms of frequency

and number of individuals and appears to be rather independent from annual fluctuations in abundance. For A, the omnipresence of *Zyginidia scutellaris* and *Balclutha punctata* in 2009 is notable because these species did not occur in 1951. Both species inhabit many types of habitats, with *Z. scutellaris* preferring dry ruderal sites and *B. punctata* moderately shady sites (Nickel 2003). The significant increase of *M. sexnotatus* in 2009 also indicates more ruderalized conditions at present. Marchand caught very few individuals of *Macrosteles* (1 ‰), while in 2009 about 12 % of all individuals belonged to this genus. Species of *Macrosteles* are known to depend on disturbed habitats (Kirby 1992), and to be pioneers in fertilized pastures (Nickel 2003). Several other species that prefer disturbed habitats also showed increased densities, including *Dicranotropis hamata*, *Psammotettix alienus* and *Psammotettix confinis*.

In contrast, all A species that significantly decreased (e.g. *Elymana sulphurella*, *Forcipata forcipata*, *Jassargus pseudocellaris, Athysanus argentarius* and *Philaenus spumarius*) prefer low-productive habitats (Nickel 2003). These types of habitats are currently disappearing at least partly due to agricultural fertilization. Haddad *et al.* (2000) found long-term effects of increased nitrogen loading in food plants leading to lowered herbivore insect diversity, but increased abundance. This is in partial contrast to our findings of decreased density of A and O, suggesting that other ecological factors have come into play. One explanation posits that egg mortality may be one of the key factors for the population dynamics of A (Waloff & Thompson 1980). Lower moisture conditions are another known key factor (Kontkanen 1950). The absolute and relative decrease in A monophagous individuals supports the appearance of development toward a more generalized insect community with more oligophagous and polyphagous species. In this context, Novotný (1994) found that average host plant range was wider in ruderal, highly dynamic habitats as compared to more constant habitats. The slight increase of macropterous morphs in 2009 is evidence for the A community being more adapted to dynamic habitats. The increase in

bivoltine individuals implies that production of a second generation is advantageous at present times, which might be made possible by a prolonged growing season that lengthened by 5 days from 1951 to 1990 (Menzel *et al.* 2001; Bale *et al.* 2002). In climate experiments, Masters *et al.* (1998) detected an effect of mild winters on the age structure of A, suggesting that these insects mature earlier. They hypothesise that a prolonged activity period could favour bivoltine or multivoltine species. However, in our study bivoltine species declined in absolute (not in relative) numbers. More data are needed to understand climate change effects on real-world A communities.

For H, the trend towards an increase in species that prefer disturbed and eutrophic sites is not as evident, but there are some parallels. There is a significant increase in individuals of the species *Leptopterna dolobrata* and *Megaloceroea recticornis,* which prefer eutrophic habitats (Wachmann *et al.* 2004). When all species that increase in abundance are pooled, they account for about 42 % of all individuals recorded in 2009. These eight species are generalists that feed mainly on grasses. In 1951, the same species constituted only 3 % of all individuals. Zurbrügg & Frank (2006) also recorded more generalistic H species on meadows and pastures in comparison to more natural areas. Most of these species belonged to the Miridae, which are also the dominant group in our study area. Repeated vegetation surveys from the same region have shown that pastures lost flowering herbs and became more dominated by perennial grasses since the 1950s (Wesche *et al.* 2009). Species characteristic analysis revealed that the number of H requiring dry habitats decreased, although total number of individuals increased. This suggests that dry habitats were less suitable for H in 2009. It is possible that these habitats became more saturated in recent times, but current data is lacking.

Conclusion

This study documented several patterns of concern for evaluating the long-term impact of global change on insect communities. First, the assumption of a general long-term decline in insect species richness is not always supported as our study indicates. Global warming can increase survival rates of species migrating to temperate regions (Bale *et al.* 2002; Hickling *et al.* 2006), and nitrogen deposition generally has positive effects on the individual performance of phytophagous insects (Throop & Lerdau 2004). Both factors can potentially lead to increased species richness. Second, insect abundance is an important measure to assess long-term changes in insect communities. Species richness alone is not sufficient to infer temporal changes. In our study, changes in abundance indicate homogenisation and an increased proportion of generalists in insect communities. This may be an indirect effect of land-use change, i.e. due to decreasing plant species richness. Third, relatively similar insect groups respond differently to the same environmental changes as different developments in Auchenorrhyncha and Heteroptera communities suggest. This is important for future work, because the assessment of single insect groups may not allow predicting the development of whole insect communities.

Acknowledgements

We are grateful to Albert Melber for help with determining tricky heteropteran species. Thanks to Heather Lessig for linguistic corrections and helpful remarks. This is a contribution from the joint project BioChange Germany, which is funded by the State of Lower Saxony (Cluster of Excellency "Functional Biodiversity Research").

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Chapter 2

Minor changes in orthopteran assemblages of Central European protected, dry grasslands during the last 40 years

Journal of Insect Conservation (in press)

Minor changes in orthopteran assemblages of Central European protected dry grasslands during the last 40 years

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Keywords: *Caelifera, Ensifera, insect diversity, long-term, nature reserve*

Abstract

During the past 50 years development of farming practices caused tremendous changes in European agricultural landscapes and many insect species became increasingly restricted to protected areas. Yet little is known about long-term trends of insect diversity and community composition in these often small reserves. We performed a comparative study on changes in orthopteran communities of protected dry grasslands in East Germany, which had been surveyed in the 1960s. Applying the same sampling techniques, we revisited 26 of the original sites in 2008 and 2009. Nearly all sites are controlled by conservation policies and changes in vegetation composition were relatively small, although some sites showed shrub encroachment. Changes in orthopteran diversity were not significant. Community composition exhibited minor changes which were correlated with evidence of woody plant encroachment as derived from historical and recent aerial imagery. The frequency of some Caelifera species decreased from the 1960s to 2008/09 with one species inhabiting bare soils (*Myrmeleotettix maculatus*) showing the strongest decline. Some Ensifera, especially two species inhabiting open woodland and scrub (*Tettigonia viridissima, Phaneroptera falcata*) exhibited positive trends. Nevertheless, three different regions (each belonging to a different German federal state) had shown distinct orthopteran assemblages in the 1960s, and these were equally different 40 years later.

We conclude that we found small changes in species composition of orthopteran fauna of Central European protected dry grasslands, and overall diversity remained rather constant during the past 40 years, which is in accordance with the minor changes in the surrounding landscape. Consequently, the applied conservation management practices - mainly sheep grazing and trimming - are largely effective.

Introduction

The majority of available studies on changes in European arthropod diversity support the assumption of a general decline in insect diversity during the last 50 years (Conrad *et al.* 2004; Thomas *et al.* 2004; Biesmeijer *et al.* 2006). In comparison to vertebrates and plants high decline rates are experienced by butterflies and other insects (Bourn & Thomas 2002; Schaffers *et al.* 2008). This is of special concern to nature conservation, since insects comprise a wide range of functional groups and trophic levels. Their declines are thought to have far-ranging consequences for ecosystem services. However, levels of decline seem to differ among insect taxa. The only available global assessment for any insect order - Odonata - indicated much lower threat levels than for most vertebrates groups (Clausnitzer *et al.* 2009). In Europe, ongoing global warming could even have positive effects on arthropods resulting in increased diversity, especially for thermobiont species (Roy *et al.* 2001; Warren *et al.* 2001; Hickling *et al.* 2006). These developments can best be observed through long-term studies in protected areas where general trends are not masked by land-use practices (cf. Nickel 2002; Gordo & Sanz 2005; González-Megías *et al.* 2008).

Effects of land-use change on local insect faunas are at least as pronounced as those of climate change, and changing agricultural practices strongly affect insect communities (cf. Maas *et al.* 2002; Irmler 2003; Pokivailov 2007; Müller-Motzfeld 2008). Insect conservation in Central Europe has largely been directed towards protecting habitats rather than single species, with a major focus on dry grasslands. Especially calcareous grasslands are one of the most species-rich habitats in central Europe harbouring many specialised plants and insect species (Steffan-Dewenter & Tscharntke 2002). These dry grasslands and their open structures reflect traditional land-use practices (mainly hay-making and grazing by sheep or goat (WallisDeVries *et al.* 2002)), and will be encroached by shrubs and eventually trees if land use ceases entirely. This has led to major concerns on the effectiveness of reserves, which do not always receive proper conservation management (Haarmann & Pretscher 1993).

It is thus of great importance to nature conservation to evaluate the efficacy of conservation measures for maintaining biodiversity.

Before the European Flora Fauna Habitat Directive (FFH) enforced large-scale reserve gazetting in the last decade (Claus & Konermann 2006), Nature Conservation Sites (NSG, "Naturschutzgebiete") were by far the most important type of nature reserves in Germany. NSGs have been at the heart of German nature conservation for almost a century, yet the few studies available suggest that they often lose diversity of rare species in spite of their protected status (Haarmann & Pretscher 1993). This is alarming, because NSGs could serve as source populations for colonization of smaller habitats in their surroundings. In turn, biodiversity losses in reserves may be caused by ongoing changes in the surrounding landscape. Landscape-level effects were repeatedly shown to influence insect community composition on the plot-level (Smart *et al.* 2006; Oliver *et al.* 2010) and may thus also affect the often island-like, mostly small habitat reserves.

However, comprehensive long-term monitoring data are not readily available, because studies on temporal changes in insect communities struggle with a general set of problems: Most publications are based on regionally restricted data sets. Large-scale comparisons are beginning to emerge, yet data quality for different taxa is inconsistent (Thomas *et al.* 2004; Biesmeijer *et al.* 2006). In addition, very few studies on species' change are based on long-term observations or comparisons with historical data sets. Where historical data are available, studies usually do not go back for more than three decades (cf. Irmler 2003; González-Megías *et al.* 2008; Schlicht *et al.* 2009). However, the most severe structural changes in the agricultural landscapes of Central Europe and other industrialised regions occurred from the 1950s to the early 1980s (Bender *et al.* 2005; Baessler & Klotz 2006). These may have affected insect communities that had survived centuries, or perhaps millenia, of extensive human land use (Morris 2000). Climate change has also become more pronounced in the second half of the last century, so long-term studies should ideally include

data from the 1960s or earlier. Few scholars compiled reliable species lists of arthropods at that time, and where these are available the rapidly changing landscapes in Central Europe make it very hard or even impossible to rediscover former sampling sites.

Here, we present a long-term comparison for Orthoptera, which are among the preferred taxonomic groups in environmental impact assessment and conservation monitoring in Central Europe. Published data on long-term trends seem to be sparse for this group (Barker 2004), and only non-representative case studies are available (Heusinger 1980; Köhler *et al.* 1999). Hence, we resampled the orthopteran fauna of grassland reserves in eastern Germany, which had been surveyed by Schiemenz (1969) in the 1960s. Schiemenz provided relatively detailed descriptions of study sites and sampling methods which enabled us to directly compare orthopteran assemblages over a 40-year-period. Most sites have been and still are under some level of protection (usually NSG or equivalent). The study of Schiemenz thus provides the unique opportunity to assess changes in diversity on sites where conservation policies prevented strong alterations due to changing land use over the last five decades. Specifically, we intend to answer the following questions:

(1) Are there long-term changes in orthopteran diversity or community composition of protected Central European dry grassland habitats? (2) Did changes in the surrounding landscape influence orthopteran diversity? (3) Are changes in single species occurrences related to changes in habitat structure? (4) Are current dry grassland conservation practices effective for orthopterans?

Material and methods

Study sites and sampling

We chose 26 dry grassland sites from those where Schiemenz (1969) had compiled species lists between 1963 and 1967 (period 1). These sites are located in an area approximately 250 km x 250 km in eastern Germany (Fig. 1), and comprise three different federal states: Thuringia (Thu, 8 sites, including one plot in Saxony-Anhalt), Saxony (Sax, 8 sites) and Brandenburg (Bra, 10 sites). Schiemenz gave brief descriptions of the plant communities encountered in the 1960s, which we used to rediscover the 26 plots (Table 1).

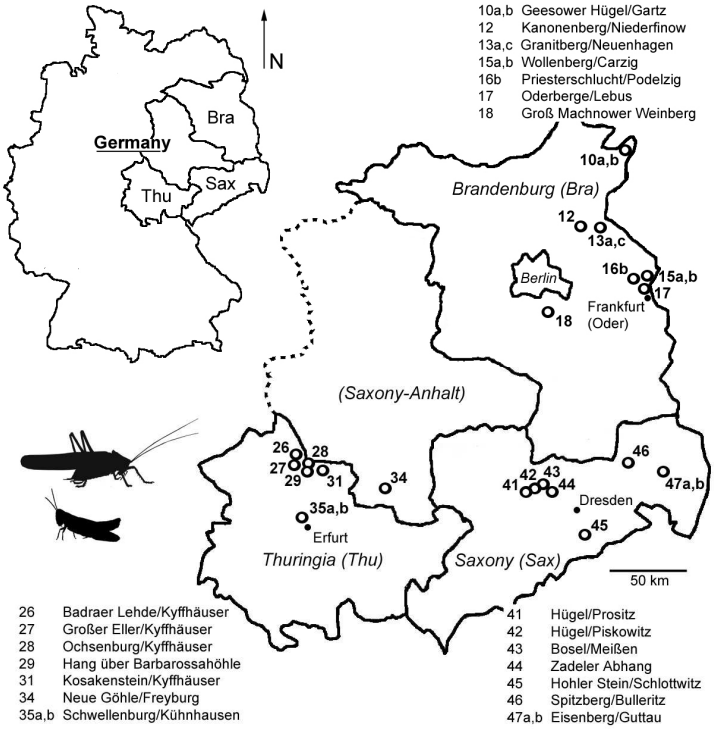

Figure 1 Sampling sites visited in the 1960s and 2008/09 in eastern Germany, modified from a figure by Schiemenz (1969). Sampling sites are distributed over Thuringia (Thu), Saxony (Sax) and Brandenburg (Bra). Names of sampling locations are given in German as translating did not seem reasonable (see Table 1 for exact coordinates).

All plots have southern exposures with an inclination of 0-40° (mean 22°) and have a mean annual precipitation well below 750 mm. They represent subcontinental climatic conditions within the Central European context.

Table 1 Plant communities at the sample sites in the 1960s and 2008/09 (full phytosociological data for 2008/09 available on request), GPS-coordinates for the investigated plots (decimal degrees, WGS 84), surface of the whole nature conservation area ("Naturschutzgebiet"), grassland cover of the whole protected area and surface of dry grasslands sampled.

	Plant community		GPS-coordinates		Surface in ha (10.000 m²)			
Plot #	Plant community according to Schiemenz (1969)	Plant community (own samples 2009)	Latitude	Longitude	Total	Grassland	Plot	
10a	*Stipa capillata* steppe	Dito	53.238218	14.389833	81.90	~ 73.7	0.07	Brandenburg
10b	Subcontinental dry grassland	Dito	53.233788	14.388843	81.90	~ 73.7	0.07	
12	*Stipa capillata* steppe	dito, encroachment of *Prunus spinosa*	52.827051	13.935813	20.40	~ 18.4	0.04	
13a	*Stipa capillata* steppe	dito, encroachment of *Festuca rupicola*	52.823782	14.083996	75.53	~ 45.3	0.14	
13c	*Corynephorus canescens* sandy grassland	Dito	52.823139	14.083082	75.53	~ 45.3	0.075	
15a	*Stipa capillata* steppe	Dito	52.468293	14.470070	305.12	~ 213.6	0.09	
15b	Subcontinental dry grassland	Dito	52.466368	14.471961	305.12	~ 213.6	0.15	
16b	*Corynephorus canescens* sandy grassland	Dito	52.482725	14.542973	5.62	~ 3.9	0.01	
17	*Stipa capillata* steppe	dito, encroachment by *Rosa* spec.	52.412539	14.536262	12.61	~ 12.5	0.15	
18	Sandy grassland *(Festuca* / *Koeleria* / *Corynephorus*)	*C. canescens* / *F. brevipila* sandy grassland	52.267675	13.506271	12.89	< 0.4	0.2	
26	*Stipa capillata* steppe	dito, slightly ruderalised (*Avenochloa pratensis*)	51.407095	11.005656	81.90	~ 69.6	0.12	Thuringia
27	Subcontinental dry grassland with *Stipa capillata*	ruderalised dry grassland with *S. capillata*	51.399356	10.999568	81.90	~ 69.6	0.48	
28	Submediterranean grassland on rocky outcrops	Dito	51.385314	11.036555	831.70	~ 332.7	0.08	
29	Submediterranean grassland on rocky outcrops	Dito	51.376219	11.037205	831.70	~ 332.7	0.1	
31	*Stipa capillata* steppe	Dito	51.365090	11.082112	442.90	~ 88.6	0.05	
34	Subcontinental dry grassland	Dito	51.232742	11.783225	52.90	< 2.7	0.07	
35a	*Stipa capillata* steppe	Dito	51.030429	10.954009	22.10	~ 21.9	0.02	
35b	Submediterranean dry grassland	dito, with *S. capillata*	51.031397	10.958000	22.10	~ 21.9	0.03	
41	Subcontinental dry grassland	ruderalised dry grassland	51.193286	13.357796	4.30	< 1.3	0.06	Saxony
42	Subcontinental dry grassland	dito, encroachment with *Prunus cerasifera*	51.197540	13.377533	10.43	~ 5.2	0.02	
43	Subcontinental dry grassland	*F. rubra* dry grassland	51.195311	13.428338	31.10	~ 9.3	0.08	
44	Subcontinental dry grassland	dito, encroachment with *Prunus mahaleb*	51.137609	13.515559	45.50	~ 13.7	0.01	
45	Submontane grassland (*Festuca rubra* / *Agrostis tenuis*)	*F. rubra* grassland with *Poa angustifolia*, *Rosa* spec.	50.894065	13.803696	0.30	~ 0.3	0.1	
46	Sandy grassland *(Festuca* / *Koeleria* / *Corynephorus*)	ruderalised sandy grassland with *F. ovina*	51.334595	14.019501	0.85	< 0.1	0.01	
47a	*Corynephorus canescens* sandy grassland	Sandy grassland with *Agrostis tenuis*	51.253325	14.570319	1.48	< 0.2	0.12	
47b	Subcontinental dry grassland	Dito	51.253828	14.56988	1.48	< 0.2	0.01	

Table 2 Overview of conservation measures currently taken at the different sampling sites, plus information since when the site has been under governmental protection. Changes in cover of woody plants, arable fields and grassland vegetation from the 1960s to 2008 for the site itself (radius: 0 - 50 m) and the total buffer (radius: 0 - 200 m).

		NSG	Woody plant cover (%)				Arable fields (%)				All types of grassland (%)				
		(protected)	0 - 50 m		0 - 200 m		0 - 50 m		0 - 200 m		0 - 50 m		0 - 200 m		
Plot #	Management practices	since	'60s	'08	'60s	'08	'60s	'08	'60s	'08	'60s	'08	'60s	'08	
10a, b	Grazed (sheep)	1984	0	0	0	4	0	0	15	38	100	100	85	59	Brandenburg
12	Grazed (sheep) / trimmed*	1990	5	10	1	6	0	0	32	8	95	90	64	83	
13a	Grazed (sheep)	2003	5	5	1	10	0	0	0	0	95	95	98	89	
13c	Grazed (sheep)	2003	0	5	0	9	0	0	0	0	100	95	99	90	
15a, b	Grazed (sheep)	2003	10	20	34	39	25	25	22	22	65	55	43	39	
16b	Grazed (sheep)	1967	20	25	7	18	0	0	64	30	80	75	28	52	
17	Grazed (sheep)	1967	5	5	6	7	55	60	41	43	40	35	50	47	
18	Non	1936	5	35	73	91	0	0	4	4	95	65	23	5	
26	Grazed (cattle) / trimmed*	1991	0	5	0	5	0	0	43	24	100	95	56	70	Thuringia
27	Grazed (sheep) / trimmed*	1991	5	5	5	14	0	0	36	12	95	95	58	72	
28	Grazed (sheep) / trimmed*	1961	5	5	4	9	10	10	61	61	85	85	34	30	
29	Grazed (sheep) / trimmed*	1991	5	10	55	72	0	0	0	0	95	90	44	27	
31	Grazed (sheep) / trimmed*	1991	5	15	5	12	0	0	27	12	95	85	67	75	
34	Grazed (sheep) / trimmed*	1961	45	75	65	77	0	0	8	8	55	25	27	15	
35a	Grazed (sheep) / trimmed*	1939	0	0	4	4	0	0	28	28	100	100	67	67	
35b	Grazed (sheep)	1939	0	0	0	4	0	0	23	23	100	100	76	72	
41	Grazed (sheep) / trimmed*	2011/12	5	5	5	6	65	65	74	74	30	30	20	19	Saxony
42	Trimmed*	2011/12	5	25	10	17	20	20	58	56	75	55	31	26	
43	Mown twice a year	2002	5	20	37	41	0	0	0	0	95	80	38	29	
44	Non (probably irregularly mown)	-	70	40	33	31	0	0	19	19	30	60	46	48	
45	Grazed (cattle)	?	40	70	50	63	0	0	8	8	60	30	42	30	
46	Mown twice a year / grazed (horses)	?	45	50	9	10	5	5	77	72	50	45	13	19	
47a	Mown once a year / trimmed*	1983	30	50	23	39	20	5	43	35	50	45	33	25	
47b	Mown once a year / trimmed*	1983	45	80	17	24	5	5	62	58	50	15	20	18	
		Median	5	10	6	13	0	0	28	23	90	78	44	43	

*if necessary and affordable

All sites were located in agricultural landscapes, dominated by (annual) crops, perennial grasslands and forests, while human settlements were negligible and in at least 1 km distance. Truly natural habitats were absent like in most parts of Central Europe.

Each site was revisited during summer and autumn of 2008 and 2009 (period 2). Schiemenz mainly sampled Orthoptera with sweep nets (200 seeps per visit), so we repeated this procedure to ensure comparability. Most of the species were identified in the field and were released after that. Just a few exceptions – including untypical *Stenobothrus nigromaculatus* – were determined in the lab. Individuals were not counted. Schiemenz also identified and recorded grasshopper calls, which was repeated in 2009 as well. Bat detectors did not come in use since they were not available in Schiemenz' time. Thus, we may have missed occurrences of low chirring species such as *Leptophyes albovittata* Kollar 1830 or *Meconema thalassinum* De Geer 1773. *Tetrix* spp. were entirely excluded, because in period 2 mostly larvae were caught, which can not be identified with any certainty. Both Schiemenz' and our data are on the presence/absence level (no abundance), because Schiemenz provided only incomplete data on abundance in his publication, and unfortunately the original survey lists got lost.

Vegetation relevés were taken for each plot in 2008/09. We sampled one plot (10 x 10 m) and recorded all occurring vascular plants and an estimate of their cover, plus supplementary information such as locality (for GPS-coordinates see Table 1), inclination and exposure. No vegetation relevés from the 1960s were available, but comparison with Schiemenz' notes suggested that vegetation changed only slightly during the last 40 years (Table 1). Current management measures are not intensive and usually directed towards maintenance of non-woody vegetation (Table 2).

We compared the surrounding landscape of every plot using aerial photographs of the 1960s (received from Bundesarchiv Berlin) and images from 2008. We estimated cover of arable fields (A), grasslands as well as of shrubs and trees (W) expressed as a percentage (in 5

% intervals) for circular areas around the centre of the single plots using a 50 x 50 m grid as a visual aid. We separately estimated vegetation cover values for three spatial sections: 0 - 50 m, 50 - 100 m and 100 - 200 m (Table 2). The size of the buffer was chosen, because most Central European Orthoptera cover very limited distances during their life-time (averages < 40 m and maxima < 150 m; (Ingrisch & Köhler 1998)). Arable fields plus shrubs and trees cover on average 50 % of the whole surface around each plot in the 1960s as well as in 2008. The rest is mainly grassland of different types (settlements, streets and water account for < 5 %), which can not be distinguished on the historical aerial photographs due to similar shades on the black and white images. Analyses suggested that only changes on the plot and its immediate vicinity had effects on orthopteran communities (see results below), so we refrained from analysing larger buffers.

Data Analysis

We used boxplots (median and interquartile ranges) to summarise data on species richness per plot, and differences were tested with repeated measures ANOVA with period as the within-subject factor and region as between-subject factor. Data were analysed separately for total species richness, and for those species only that are currently red-listed in at least one of the relevant federal states (Binot *et al.* 1998).

An initial DCA (Detrended Correspondence Analysis) indicated that faunistic gradients were rather short (length of gradient = 3.7, equivalent to less than one species turnover). We based our multivariate analysis on linear methods (McCune *et al.* 2002). We used PCA (Principal Components Analysis) to visualise patterns in Orthopteran communities (species centred, not standardised). Available supplementary variables were fitted with *post hoc* correlations on the ordination space. In correspondence to PCA, Euclidean distances were used to quantify changes in grasshopper communities among sample pairs. We used an indicator species analysis (ISA) to test for species that were significantly associated with one

period or the other, and permutations were carried out separately for each region following (Bakker 2008).

Vegetation data were available for period 2 only and were used to calculate weighted (square-root of plant cover) Ellenberg indicator values (Diekmann 2003) for moisture, nutrients and pH for current samples. Correlations between grasshopper and plant communities of period 2 were analysed with a Mantel-Test. Data were analysed using R (R Development Core Team 2009), PC-ORD (McCune & Mefford 2006) and Canoco (ter Braak & Šmilauer 2002).

Results

Species richness

There were 35 different orthopteran species (*Tetrix spp*. excluded) recorded in the 1960s and 2008/09 combined (Table 3). Schiemenz found 29 different species (13 Ensifera and 16 Caelifera) and we detected 32 in 2008/09 (13 Ensifera and 19 Caelifera).

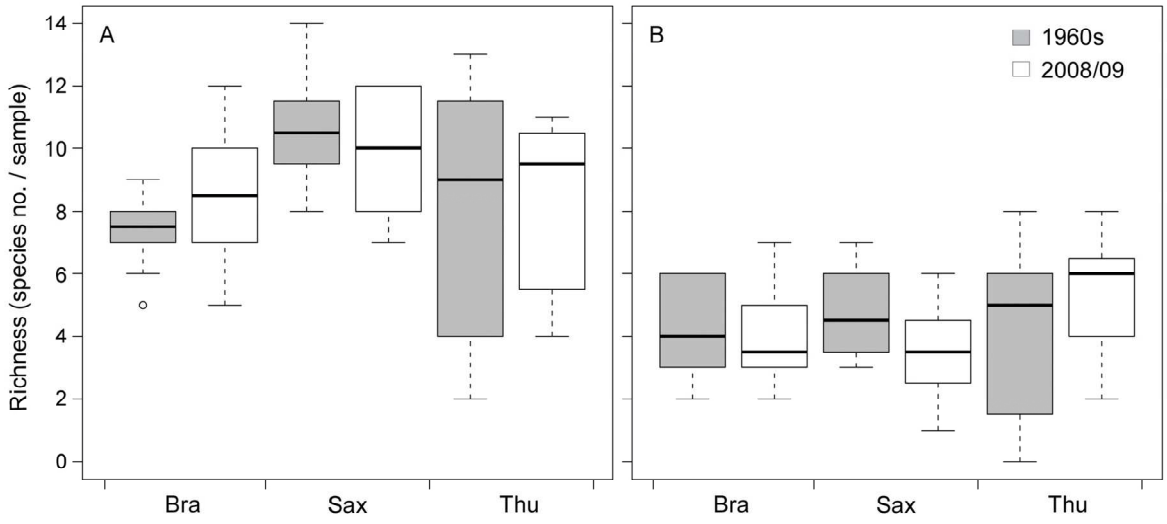

Figure 2 Species richness per site for the two time periods and three regions. A) Total number of species. B) Species red-listed in at least one of the relevant federal states.

The total number of species encountered remained unchanged over time in Thuringia and Saxony at 19 and 21, respectively. The total number of species increased for Brandenburg from 15 in period 1 to 24 in period 2.

Table 3 Complete dataset of all Orthoptera species recorded in the 1960s (■) by Schiemenz (1969) and 2008/09 (□) by the authors (no. of plots = 26). The last two columns refer to the frequency of each species in both periods (in %).

	Plot # (totalling 26 plots; 1960s:■/2009:□)																										Frequency (%)	
Species	10a	10b	12	13a	13c	15a	15b	16b	17	18	26	27	28	29	31	34	35a	35b	41	42	43	44	45	46	47a	47b	1960s	2009
Phaneroptera falcata Poda 1761									□				□	□	□	■□			□								4	23
Leptophyes albovittata Kollar 1833																			■□	■□	■	■□			■	■	23	12
Conocephalus dorsalis Latreille 1804						■	■																				8	0
Tettigonia viridissima Linnaeus 1758		□	□							□				□	■□	□			□					□			4	31
Tettigonia cantans Fuessli 1775		□				□																	■□				4	12
Pholidoptera griseoaptera De Geer 1773										□	□				■□	□			■□	□	□		■□				12	31
Platycleis albopunctata Goeze 1778				■□	■□	■□	■□		■	■	■□	■□	■□	■□	■□	□	□	□	■	■□	■	■		□			58	54
Metrioptera bicolor Philippi 1830	■□	■□	■□	■□	■□	■□	■□	□	■□			□					□	□									31	46
Metrioptera roeselii Hagenbach 1822	□	□				□			□	□									■□	□	■□		■	■□		□	15	38
Decticus verrucivorus Linnaeus 1758	■□	■□		■	■						□	■											■				23	12
Gryllus campestris Linnaeus 1758					□			■□	■□		■□	■□	■□	□	■□	■□			■□	■□	□			■□			38	50
Nemobius sylvestris Bosc 1792											□		□	□	■□	■□			■		■□	■□	□	■□			23	35
Tetrix spec.									■			■		■□	■	■□			■			■□		■		□	31	15
Oedipoda caerulescens Linnaeus 1758				■□	■□	□			■	■□	□		■□	■□	■	□						■□					31	35
Euthystira brachyptera Ocskay 1826													■	■□	■												12	4
Stenobothrus lineatus Panzer 1796			□	■□	■	■□	■	■		□		■□				□						■□	■□	■	■□	■□	42	38
Stenobothrus nigromaculatus H.-Schaffer 1840											■□	■□	■□	■□	■□	■											23	19
Omocestus viridulus Linnaeus 1758																			□		□					□	0	12
Omocestus haemorrhoidalis Charpentier 1825	■□	■□	■□	■□	■□	■□	■	■	■□	□									■	■□	■	■□	■□	■□	■	■□	65	50
Chorthippus apricarius Linnaeus 1758	■□	■□	■□									■	■			■			■	■		■□		■□	■□	■	46	23
Chorthippus vagans Eversmann 1848										□				■	■□												8	8
Chorthippus brunneus Thunberg 1815	■□	■□	■□	■□	■□	■□	■□	□	■□	■□		■	■	■					■□	■□	■□	■□	□	■□	■□	■□	73	69
Chorthippus biguttulus Linnaeus 1758			■□			■□	■□	■□	□	■□	■□	■□	■	■	■	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	81	73
Chorthippus mollis Charpentier 1825	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□	■□		■□	■	■	96	88
Chorthippus albomarginatus De Geer 1773																									■□	■	8	4
Chorthippus parallelus Zetterstedt 1821							□		□			■□							■□	■□	□	■□	■□		■□	■□	27	38
Chorthippus dorsatus Zetterstedt 1821	□	□																	□			□	■	■□	■□	■	15	23
Myrmeleotettix maculatus Thunberg 1815	■	■	■	■	■□					■□	■□	■	■	■	■□												42	15
Gomphocerippus rufus Linnaeus 1758														■□					■								8	4
Calliptamus italicus Linnaeus 1758					□	□																		□			0	12
Recorded once: *Stenobothrus stigmaticus* Rambur 1838 (□18); *Stenobothrus crassipes* Charpentier 1825 (□27); *Conocephalus fuscus* Fabricius 1793																			Median frequency of Ensifera species per plot								12	23
(□13c); *Tettigonia caudata* Charpentier 1845 (□42); *Psophus stridulus* Linnaeus 1758 and *Metrioptera brachyptera* Linnaeus 1761 (both ■45)																			Median frequency of Caelifera species per plot								19	17

Plot-based species richness differed among regions but not between periods (Fig. 2 A). Brandenburg had the lowest species richness, with a median of 7 in period 1 and 8 in period 2. Saxony had the highest richness in the 1960s, with a median of 11 compared to 9 for Thuringia; richness decreased to 10 in Saxony and increased to 10 in Thuringia in 2008/09. Change over time was not significant (RM-ANOVA, $p > 0.3$, period × region interaction $p > 0.2$); differences between regions were also limited ($p = 0.09$). Almost half of the species encountered are currently threatened in at least one region (Fig. 2 B). Numbers of threatened species present did neither differ between regions ($p > 0.6$) nor between periods ($p > 0.9$), but a significant period × region interaction ($p = 0.02$) confirmed that the number of threatened species present decreased in Brandenburg and Saxony but increased slightly in Thuringia.

Species composition

Only one of the species showed a significant change in terms of frequency over time according to ISA, but there were some which showed noticeable trends. The ensiferan *Tettigonia viridissima* occurred in only 4 % of all sites in the 1960s but was present in 31 % of the recent samples ($p = 0.03$). *Phaneroptera falcata* (Ensifera) increased from 4 to 23 %, while the caeliferan *Myrmeleotettix maculatus* decreased from 42 to 15 %. The latter was the only caeliferan species that exhibited a marginally significant change according to ISA ($p < 0.1$). Pooling numbers for major taxonomical groups revealed a similar trend: In the 1960s, grasshopper (Caelifera) species had a median frequency of 19 % (interquartile range 7 - 43), which decreased to 17 % (IQR 8 – 38) in 2008/09. The Ensifera exhibited an opposite trend. In period 1 each species was found at a median of 12 % of all sites (IQR 4 – 23) while it occurred at 23 % (IQR 8 - 37) in period 2. Thus, grasshopper in the strict sense tended to decline, while some cricket species increased. This is particularly true for Thuringia.

A multivariate analysis of species assemblages indicated that regions have distinct orthopteran assemblages. In the PCA, polygons connecting the plots of samples from one

region at any given time period did hardly overlap with those of other regions (Fig. 3 A). The regions preserved their distinct species composition during the last 40 years as seen by the close proximity of historical and current samples for a given region in ordination space, although minor shifts in species composition were apparent. The biplot of species and samples (Fig. 3 B) indicated that *Metrioptera bicolor* (Metr_bic) and *Decticus verrucivorus* (Dect_ver) are typical for Brandenburg, while *Stenobothrus nigromaculatus* (Sten_nig) and *Chorthippus vagans* (Chor_vag) are restricted to Thuringia (see also Table 3). Samples from Saxony are characterised by high incidences of *Chorthippus parallelus* (Chor_par), and *Leptophyes albovittata* (Lept_alb) is also restricted to that region.

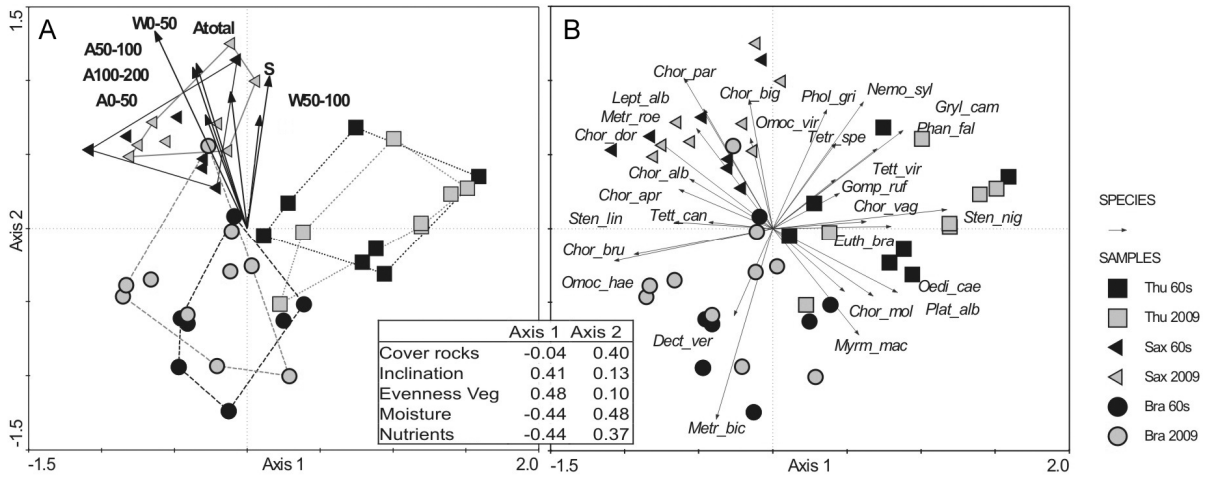

Figure 3 PCA of the Orthoptera data for both study periods (variance / covariance PCA, explained variance axis 1: 19.6%, axis 2: 14.4%, axis 3: 8.2%). A) Samples and supplementary variables: Regions and periods are indicated with different polygons. Supplementary variables were fitted *post hoc* on the sample plot (as vectors, threshold for *post hoc* correlations was $r^2 = 0.11$ with either axis 1 or 2). B) Same PCA, biplot of samples and species (only the 28 best fitting species depicted). Table: *Post hoc* correlations of ordination scores with environmental data available for 2009 only (those that showed $r^2 > 0.10$).

The fitted supplementary variables showed that species richness (S) tended to be higher in Saxony (Fig. 3 A). Cover of shrubs / trees at the plots (W 0 - 50) is also highest in Saxony, while the area of agricultural fields within a radius of 200 m is also largest around Saxonian plots and smaller in Thuringia and Brandenburg.

For period 2, vegetation samples were available allowing to test whether samples with a similar orthopteran community composition also had similar plant communities. The Mantel

test indicated a modest, yet significant correlation ($r_M = 0.32$, $p = 0.0002$, 4999 permutations) between pair-wise orthopteran similarity (Euclidean distance) and vegetation similarity (Sörensen similarity). This justified correlating environmental information inferred from vegetation sampling in 2009 with the ordination (Fig. 3). The second PCA axis was positively associated with the current cover of rocks, indicating that sites in Saxony today have a high cover of rock outcrops. Inclination and evenness of the vegetation were correlated with axis 1 (Fig. 3) and are therefore high in Thuringia. Weighted mean Ellenberg Indicator values for moisture and nutrient availability were negatively correlated with axis 1 and positively correlated with axis 2, and thus pointed to the direction of the current samples from Saxony.

Landscape structure and management

Landscape structure as inferred from aerial images changed over time (Table 2). Woody cover tended to increase in all regions, but changes over time were most pronounced in Saxony, where cover on the plots increased from an already high median of 35 % to 45 %, increases in Brandenburg were small (median 5 % and 8 %) while woody plant cover in Thuringia remained constant (5 %). Cover of agricultural fields remained largely constant in the immediate surroundings of the plots, and changes in the wider buffer were also small (median cover 1960s 28 %, median cover 2008 23 %, t-test for paired samples $p = 0.06$).

Except plots # 18 and # 44, all plots were under some kind of conservation management measures; most of them are grazed by sheep (Table 2) once a year. Management concepts for some sites provide trimming if necessary to prevent plots from shrub and tree encroachment, while Saxony relies on mowing and grazing by cattle. Plots that are only mown or trimmed indicated a strong increase with woody plants gaining from a median of 35 % cover in the 1960s to 50 % cover in 2008/09, while grazed sites remained largely constant.

Euclidean distances between Orthoptera communities of a given sample pair were moderately strongly correlated with changes (expressed in percentage cover) of shrubs / trees

on the plots (r = 0.44, p = 0.025), while woody perennials in the immediate surroundings were less important (r = 0.37, p = 0.06), and cover in the distance class 100 - 200 m had no influence at all (r = 0.07, ns). Changes in the presence of agricultural fields had no effect for any of the three tested distance class.

Discussion

The main aim of this study was to assess long-term diversity and composition changes of orthopteran assemblages in dry grassland reserves, which where under various forms of conservation management. In contrast to our expectations, these assemblages seem to be astonishingly constant, at least with respect to species presence/absence. Overall species richness did not change at all, nor did the number of species red-listed in northern Germany show any consistent change over the past 40 years. Changes in species composition existed but were relatively small, and few species showed any detectable temporal trend. Additionally, changes in composition were related to shrub encroachment on the plots, while effects of the larger landscape context were not detected.

However, trends differed among major taxonomical groups. During the past 40 years frequency decreased for grasshoppers, while it increased for the rest of the sampled orthopteran species (Ensifera). In our data set, the Ensifera comprise more generalist species and those increasing show a preference for at least partly wooded sites. The caeliferan species included a number of specialists of open soil and sparsely vegetated grasslands. One example is *Myrmeleotettix maculatus*, which was the only species that exhibited a marginal significant decline compared to the 1960s. In Germany, *M. maculatus* is tied to open heathland or sandy sites with sparse vegetation cover (Detzel 1998). It is also negatively associated with high shrub cover, high soil moisture and high nutrient availability (Fig. 3), and it is one of the species that underlies the correlation between changes in pair-wise species composition and shrub/tree encroachment. The decline is probably due to a slight increase of shrub/tree cover

at the plots. The shrub encroachment favours another species that showed a frequency change over time, *Tettigonia viridissima*. This ensiferan species is today significantly more common than it used to be in the 1960s, and it indeed prefers the edges of shrubs and hedgerows in warmer habitats (Detzel 1998). Two other species showed conspicuous though not significant increases: *Calliptamus italicus* (Cael.) and *Phaneroptera falcata* (Ens.). The latter occurs in moderately open habitats with dense grass and even shrub cover, and has been spreading northwards in Germany since the 1970s. Our data reflect this general expansion. *Calliptamus italicus* instead is regarded as threatened in Germany (Binot *et al.* 1998), but the species is known for pronounced fluctuations in population size and distribution range (Sergeev & Van'kova 2008). In recent years, it seemed to re-expand on open sandy grasslands in Brandenburg, possibly as a consequence of increasing temperatures (Luthardt *et al.* 2009). No other species showed a clear temporal trend.

Differences between regions were pronounced. Sites in Saxony were characterised by initially high cover of shrubs/trees and agricultural fields in the surroundings, and at least as judged from the present vegetation by relatively high moisture and nutrient availability. The regions have high incidences of species which occur in intensively used grasslands and road margins (*Chorthippus parallelus*, *Metrioptera roeselii*). *Metrioptera bicolor* has one of its two German distribution centres in Brandenburg (Maas *et al.* 2002) and is therefore also common in our samples from that region. Preferred sites there are sandy and share the relatively open structure with the calcareous/gypsum grasslands we visited in Thuringia. Accordingly, both regions are characterised by the presence of *Oedipoda caerulescens*, which also prefers open sites. *Stenobothrus nigromaculatus* is regarded as extremely rare and threatened in Germany, and suffers from cessation of sheep grazing in dry grasslands. The Kyffhäuser region in northern Thuringia is indeed one of the few places in Germany were populations densities are still reasonable large (Maas *et al.* 2002).

The lack of strong changes in species composition is probably also owed in part to the general ecology of Orthoptera. As a polyphageous insect group of low diversity (about 84 species in Germany), Orthoptera may be more resistant to environmental changes than more specialised insect groups. Results of Maas *et al.* (2002) indicate that the percentage of threatened (Red List) orthopteran species slightly declined in Germany during the 1990s, which concurs with our observations.

Within Central Europe, grasshopper diversity is high in regions with warm conditions such as the Rhine and Main valleys, followed by southern and eastern Brandenburg. Thus, temperature constraints certainly play a role and Orthoptera as a group may benefit from increasing temperatures. They are an example of taxa, which are less sensitive to climate change or could even benefit from it (Roy *et al.* 2001). Nevertheless, we found little evidence for the influence of climate change as the most thermophilous species in terms of habitat preferences are Caelifera that tended to decline rather than increase.

Overall grassland cover on the territory of eastern Germany has slightly decreased from 21 % of the agricultural area to 19 % (official statistical yearbooks). Changes in grassland quality have been much more pronounced with intensively managed grasslands replacing other less fertile grassland types (Wesche *et al.* 2009). In Central Europe, dry and especially calcareous grasslands have decreased strongly in spatial extent in the last centuries (WallisDeVries *et al.* 2002). The general decrease of dry grasslands can probably affect population sizes but also gene diversity in species (including grasshoppers) that are dependent on patch size as well as on patch isolation (Appelt & Poethke 1997). Additionally, source populations are on the decline, because habitat quality is apparently changing in spite of conservation, and our data suggest that increasing density of woody perennials may affect even potentially constant taxa such as Orthoptera (declining *M. maculatus* and increasing *T. viridissima* populations). We did, however, not find any evidence for landscape-level effects since only wood cover at the plot itself seems to have affected grasshopper communities, and

even that did not influence total richness. This is in contrast to recent studies that highlight the importance of the larger landscape context for local community composition (Gabriel *et al.* 2010; Oliver *et al.* 2010). These differences may again be related to special aspects of grasshopper biology (limited dispersal capabilities), but also to peculiarities of our analysis. Changes in the surrounding landscape were assessed by analysis of aerial imagery, which had only limited spatial and spectral resolution. This indicated only very small changes in the last 40 years, which did not explain the apparent changes in orthopteran communities.

Trends in grasshoppers are not necessarily representative for other groups (cf. Billeter *et al.* 2008). There are more specialized insect groups which may show faster and/or more drastic responses to slight changes. Currently, a similar study on leafhoppers and planthoppers (Auchenorrhyncha) is in progress, which may shed light on these relationships.

The data suggest that grazing is more effective in controlling woody plants encroachment than trimming or mowing alone. This confirms conservationists preference for grazing as a management tool (Morris 2000) and the general notion that traditional land-use practices are often associated with high biological diversity in grassland habitats (Kruess & Tscharntke 2002). For dry grasslands, we conclude if a consistent and sustainable conservation management is implemented, crickets, and to a somewhat lesser extent, grasshoppers may continue to flourish as they did in the past 40 years.

Acknowledgements

The study benefited from support by Viola and Hans-Joachim Clausnitzer, who offered valuable help in determining critical Orthoptera. Monika Partzsch kindly determined samples of *Festuca ovina* agg. Access to reserves was granted by the responsible conservation agencies. We are grateful to Heather Lessig and Sharon Cooper for linguistic corrections and to both anonymous referees for their valuable comments. This is a contribution from the joint

project BioChange Germany (Cluster of Excellence “Functional Biodiversity Research”), which is funded by the State of Lower Saxony (Ministry of Science and Culture).

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Chapter 3

Long-term decline in abundance of planthoppers and leafhoppers (Auchenorrhyncha) in Central European protected dry grasslands

Long-term decline in the abundance of leafhoppers and planthoppers (Auchenorrhyncha) in Central European protected dry grasslands

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Keywords: *Species richness, species composition, nature reserve,* Zyginidia scutellaris

Abstract

Landscapes in Central Europe have changed considerably during the last five decades, while governmentally protected areas have been less affected. We performed a comparative study of the development of auchenorrhynchan communities of protected dry grasslands in Eastern Germany. The historical surveys were from 1963 to 1967. Between 2008 and 2010 we revisited 26 of the original sites and sampled leafhoppers and planthoppers by applying the same sampling technique as in the 1960s. Thus, we were able to perform a 40-year-comparison for auchenorrhynchan species richness and abundance. Comparisons capturing three years of each period allowed us to assess interannual variability in abundance. Species richness hardly differed between the two periods; however, some new species were found, and therefore species composition changed. In addition, species abundance declined. Mainly species known to be very common dry grassland specialists exhibited strong declines in abundance. On average, only 27 % of auchenorrhynchan population numbers from 1964 to 1966 were recorded for the years 2008 to 2010. We discuss the influence of environmental factors on auchenorrhynchan populations such as climate change, nitrogen availability in plants, increased plant cover, and an altered plant species composition. We suggest that weather conditions and climate change are minor factors leading to the decline in auchenorrhynchan populations in recent years. Air-borne nitrogen deposition, the introduction of modern intense land use practices causing formerly open grassland swards to close, and alterations in plant communities, might have influenced auchenorrhynchan abundance to a much larger extent.

Introduction

The majority of studies on changes in European arthropod diversity support the assumption of a general decline in insect species richness during the last 50 years (Biesmeijer *et al.* 2006; Conrad *et al.* 2004; Thomas *et al.* 2004) In comparison to vertebrates and plants, for example, high decline rates are experienced by butterflies and other insects (Bourn & Thomas 2002; Schaffers *et al.* 2008). Such species losses are most often correlated with changes in land use (Biedermann *et al.* 2005; Watkinson & Ormerod 2001). Other factors such as climate change, forest succession or nitrogen deposition via air pollution are less easy to detect because of the strong overriding influence of modern agriculture. To tease out factors affecting species richness beyond modern agriculture, it is crucial to carry out long-term studies in well protected areas that can provide evidence of more subtle influences (cf. González-Megías *et al.* 2008; Nickel 2002).

One ideal type of ecosystem in which to carry out such studies are calcareous grasslands, which are one of the most species-rich habitats in Central Europe and harbour many rare and specialised plant and insect species (Steffan-Dewenter & Tscharntke 2002). Most of these grasslands owe their open structure to traditional land use practices – such as cutting or grazing – and are thus regarded as semi-natural because they grow on potentially forested sites (Poschlod & WallisDeVries 2002). The special forms of land use that kept these dry grasslands open declined during the twentieth century with the introduction of modern agriculture, creating a conservation need. Before the European Flora Fauna Habitat Directive (FFH) enforced large-scale reserve gazetting in the last decade (Claus & Konermann 2006), Nature Conservation Sites ("Naturschutzgebiete", NSGs) were by far the most important type of nature reserves in Germany. NSGs have been at the heart of German nature conservation for almost a century, yet the few studies available from them suggest that rare species that inhabit them still often go extinct in spite of the protected land status (Haarmann & Pretscher 1993). This is potentially disruptive for local population dynamics, as NSGs could provide

source populations for the colonisation of smaller habitats in the surrounding landscape. This surrounding landscape may also affect what happens within NSGs in terms of species richness or species abundance. Landscape-level effects were repeatedly shown to influence insect community composition on the plot-level (Oliver *et al.* 2010; Smart *et al.* 2006) and may thus also affect the often island-like, mostly small habitat reserves. Despite their high conservation potential, there are only a few surveys about long-term development in protected dry habitats, and these mainly concern vertebrates (Haarmann & Pretscher 1993).

Beyond vertebrates, dry grasslands have long been known to host highly diverse auchenorrhynchan communities. Planthoppers and leafhoppers (Hemiptera: Auchenorrhyncha) are very characteristic insects of temperate grasslands. Most Central European auchenorrhynchan species are relatively small in body size and inconspicuous, but along with Diptera, Hymenoptera and other Hemiptera, they account for a large proportion of the biomass of the above-ground insects in natural and anthropogenic grasslands (Biedermann *et al.* 2005). Their prominent impact on grassland ecosystems as a very abundant phytophagous group is in stark contrast to their marginal representation in ecological research. Although there are difficulties in identifying some species, their interesting ecological characteristics can be very helpful to investigate ecosystem dynamics. For example, auchenorrhynchans are very sensitive to changes in vegetation structure (Andrzejewska 1965), their life cycle is often closely connected to the life cycle of their host plants (Nickel 2003), and they respond quickly to management practices such as cutting (Morris 1971; Morris & Lakhani 1979) or grazing (Brown *et al.* 1992). Planthoppers and leafhoppers are also known to occur in high densities (Waloff & Thompson 1980). This is of special concern for assessing long-term changes in community structure. Unfortunately, long-term development in insect densities is very difficult to predict because abundance of single species can differ strongly between years (Hollier *et al.* 2005). When long-term studies are available, they do not go back for more than two or three decades (cf. González-Megías *et al.*

2008; Irmler 2003). Thus, it is largely unknown the extent to which long-term environmental changes (for example, increased mean annual temperatures or altered precipitation patterns) influence insect communities of dry grasslands, specifically auchenorrhynchan communities (Biedermann *et al.* 2005). Arthropods may even benefit from climate change, especially thermobiont species (Bale *et al.* 2002; Hickling *et al.* 2006). Whittaker & Tribe (1998) found that an increased mean annual temperature by 1 K led to increased Auchenorrhyncha population densities. A similar pattern was found in another study comparing summer rainfall patterns instead of temperature (Masters *et al.* 1998). These are indications that under some circumstances climate change may favour growth of Auchenorrhyncha populations. Unfortunately, long-term studies on insect abundance are generally very rare.

To understand long-term changes in auchenorrhynchan species richness and abundance in dry grassland, we carried out a comparative analysis based on a forty-year-old study conducted in dry grasslands of Eastern Germany (Schiemenz 1969). To our knowledge, such a long-term comparison of the abundance of an insect group in this type of habitat has never been done before. Schiemenz studied the auchenorrhynchan fauna of 48 dry grassland sites in Eastern Germany using standardized sweep netting. The complete original data are still available, and because sampling occurred at well-known sites, it was relatively easy to rediscover them. This allowed us to partially repeat his study in order to analyse long-term development of the planthopper and leafhopper fauna. We focused on the following questions: (1) Does protection status prevent long-term declines in auchenorrhynchan species richness? (2) Is there a long-term change in species abundance not caused by interannual variability? (3) Are there different species composition and abundance patterns between periods that are potentially influenced by long-term environmental changes?

Material and methods

Study sites

The original study sites of Schiemenz (1969) were widespread in Eastern Germany. We chose 26 of these sites (43 % of the original sites; Fig. 1). Nine were located in Brandenburg (Bra), nine were in Thuringia (Thu, one of them in Saxony-Anhalt) and eight were in Saxony (Sax). Except for one site (# 43) they are all located in protected areas (mainly NSGs), representing the range of grasslands on sandy (mainly Brandenburg), loamy (most of Saxony) or calcareous substrates (Thuringia).

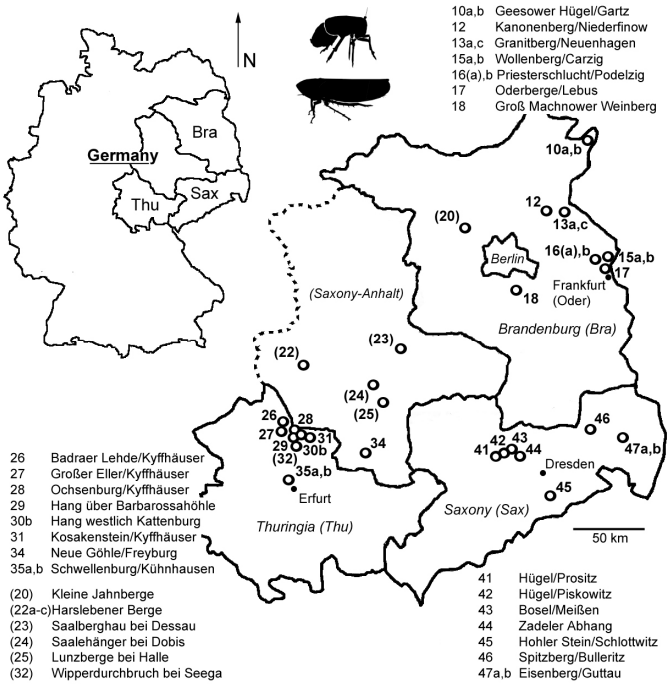

Figure 1 Map of the protected sites in eastern Germany sampled from 1963 to 1967 and re-sampled from 2008 to 2010, modified from a figure by Schiemenz (1969). Sampling sites are distributed over Thuringia (Thu), Saxony (Sax), Saxony-Anhalt and Brandenburg (Bra); (see Table 1 for exact coordinates).

Schiemenz gave brief descriptions of the plant communities encountered in the 1960s (unfortunately no relevés were sampled), which we used to relocate the sites (Table 1). Plant community composition was again recorded in 2008 and 2009, and resembled descriptions from the 1960s in about 80% of all cases.

Table 1 Plant communities at the sample sites in the 1960s and 2008 / 2009 (full phytosociological data for period 2 available on request). GPS-coordinates and substrates are given for the investigated sites (decimal degrees, WGS 84). For sites # 16; 20; 22-25; and 32 see Schiemenz (1969).

	Plant community		GPS-coordinates		
Plot #	Plant community according to Schiemenz (1969)	Plant community (own samples 2009)	Latitude	Longitude	Substrate
10a	*Stipa capillata* steppe	Dito	53.238218	14.389833	Sandy
10b	Subcontinental dry grassland	Dito	53.233788	14.388843	Sandy
12	*Stipa capillata* steppe	Dito, encroachment of *Prunus spinosa*	52.827051	13.935813	Sandy
13a	*Stipa capillata* steppe	Dito, encroachment of *Festuca rupicola*	52.823782	14.083996	Sandy
13c	*Corynephorus canescens* sandy grassland	Dito	52.823139	14.083082	Sandy
15a	*Stipa capillata* steppe	Dito	52.468293	14.470070	Sandy
15b	Subcontinental dry grassland	Dito	52.466368	14.471961	Sandy
17	*Stipa capillata* steppe	Dito, encroachment by *Rosa* spec.	52.412539	14.536262	Sandy
18	Sandy grassland *(Festuca* / *Koeleria* / *Corynephorus*)	*C. canescens* / *F. brevipila* sandy grassland	52.267675	13.506271	Sandy
26	*Stipa capillata* steppe	Dito, slightly ruderalised (*Avenochloa pratensis*)	51.407095	11.005656	Calcareous
27	Subcontinental dry grassland with *Stipa capillata*	Ruderalised dry grassland with *S. capillata*	51.399356	10.999568	Calcareous
28	Submediterranean grassland on rocky outcrops	Dito	51.385314	11.036555	Calcareous
29	Submediterranean grassland on rocky outcrops	Dito	51.376219	11.037205	Calcareous
30a	*Stipa capillata* steppe	Dito	51.370590	11.076412	Calcareous
31	*Stipa capillata* steppe	Dito	51.365090	11.082112	Calcareous
34	Subcontinental dry grassland	Dito	51.232742	11.783225	Sandy
35a	*Stipa capillata* steppe	Dito	51.030429	10.954009	Calcareous
35b	Submediterranean dry grassland	Dito, with *S. capillata*	51.031397	10.958000	Calcareous
41	Subcontinental dry grassland	Ruderalised dry grassland	51.193286	13.357796	Loamy
42	Subcontinental dry grassland	Dito, encroachment with *Prunus cerasifera*	51.197540	13.377533	Sandy
43	Subcontinental dry grassland	*F. rubra* dry grassland	51.195311	13.428338	Loamy
44	Subcontinental dry grassland	Dito, encroachment with *Prunus mahaleb*	51.137609	13.515559	Loamy
45	Submontane grassland (*Festuca rubra* / *Agrostis tenuis*)	*F. rubra* grassland with *Poa angustifolia*, *Rosa* spec.	50.894065	13.803696	Loamy
46	Sandy grassland *(Festuca* / *Koeleria* / *Corynephorus*)	Ruderalised sandy grassland with *F. ovina*	51.334595	14.019501	Loamy
47a	*Corynephorus canescens* sandy grassland	Sandy grassland with *Agrostis tenuis*	51.253325	14.570319	Sandy
47b	Subcontinental dry grassland	Dito	51.253828	14.56988	Loamy
	for plots # 16; 20; 22-25; and 32 see Schiemenz (1969)				

Current management is not intensive and usually directed towards maintenance of non-woody vegetation (see Table 2 in Chapter 2 for detailed description). All sites have southern exposures with an inclination of 0° - 40° (mean 22°) and a mean annual precipitation well below 750 mm. They represent subcontinental conditions within the Central European context. Sites are located in agricultural landscapes, dominated by (annual) crops, perennial grasslands and forests, while human settlements were rare and in at least 1 km distance (Schuch *et al.* 2011). Truly natural habitats were absent, which is the case for most parts of Central Europe.

Sampling

Schiemenz (1969) sampled planthoppers and leafhoppers from 1963 to 1967 (period 1). During this period each site was visited from three up to ten times (hereafter referred to as sampling frequency: f = 3 – 10), but at least once in spring, summer and autumn of the respective year. The 26 focal sites were re-sampled during July and September of 2008, May, July, and September of 2009 (period 2), resulting in five samples each (f = 5; except sites 10a, 10b, 18, and 30b: only three samples each in 2009 or 2010). Five sites in Thuringia (sites 26 – 29, and 31) and four Saxonian sites (sites 41, 42, 46, and 47b) were intensely sampled by Schiemenz and thus additionally sampled in spring, summer and autumn of 2010 (f = 8). The comparisons between period 1 and period 2 are based on a limited number of equivalent samplings per site (f = 3; n = 26) or a limited number of sites with maximum number of samplings (f = 5; n = 13). Finally, we compared summer and autumn samplings of three successive years per period (f = 2; for details see *Data Analysis*).

Schiemenz sampled Auchenorrhyncha with standardized sweep netting (Ø 30 cm; 200 sweeps per visit) and described the sampling technique (Schiemenz 1969). Because of this, we were able to repeat his method with a similar sweep net and a similar amount of sweeps to ensure comparability. Additionally, Schiemenz used pitfall traps to catch ground dwelling

species as a supplementary for qualitative comparisons. Because these species comprised less than 0.1 % of the total species, we did not sample with pitfall traps.

Weather conditions

Weather conditions of growing seasons of the examined years differed strongly among years but showed limited systematic differences among both periods (Table 2; data retrieved from Deutscher Wetterdienst). Mean annual temperature in Germany was 8.0 °C in 1964 – 1966 and 8.8 °C in 2008 – 2010. Spring and summer temperatures increased much more than the mean temperature of autumn. As a result, there are strong differences between monthly mean temperatures; for example, mean temperatures of March and July increased by 2.2 K and 2.6 K, but mean temperatures of September and October hardly changed from period 1 to period 2 (by 0.1 K and -0.3 K, respectively). Mean annual precipitation decreased by 72.5 mm from period 1 to period 2, although mean summer precipitation decreased by only 11.4 mm.

Table 2 Weather conditions of the growing seasons of Germany from 1964 to 1966 and from 2008 to 2010. Mean annual temperature (°C) and mean annual precipitation (mm) for Germany are given for each year and each season of the respective year (except winter), followed by the means of each period (period 1: 1964 to 1966; period 2: 2008 to 2010). All data retrieved from Deutscher Wetterdienst.

	Period 1			Period 2			Mean	
	1964	1965	1966	2008	2009	2010	Period 1	Period 2
Mean annual temperature (C°)	8.1	7.5	8.5	9.5	9.2	7.9	8.0	8.8
Mean springs temperature (C°)	7.6	6.7	8.3	8.8	9.9	7.8	7.5	8.8
Mean summer temperature (C°)	17.0	15.1	16.0	17.4	17.2	17.8	16.0	17.5
Mean autumn temperature (C°)	8.5	7.4	8.8	8.9	10.1	8.4	8.2	9.1
Mean annual precipitation (mm)	631.2	989.4	965.2	778.3	812.7	777.3	861.9	789.4
Mean spring precipation (mm)	164.0	257.8	215.4	197.3	184.0	172.6	212.4	184.6
Mean summer precipitation (mm)	175.2	291.5	327.6	235.3	235.2	289.7	264.8	253.4
Mean autumn precipition (mm)	188.8	177.1	173.1	178.0	214.0	215.0	179.6	202.3

Data Analysis

Although a substantial number of Auchenorrhyncha were collected and identified (approximately 76,000 individuals in both periods combined), the structure of the data set is not homogeneous. Each site was neither sampled every year nor was it always sampled at the

same date in the growing season, especially during period 1. For this reason, we decided to use two approaches. First, we compared as many sites of both periods with equivalent samplings as available per growing season. This results in a maximum of n = 26 sites with f = 3 (one spring, summer, and autumn sampling of one year per site and period) and a minimum of n = 13 with f = 5 (most Brandenburg sites were only sampled three times). To achieve maximum statistical power we focused on sites sampled with f = 3. Results for f = 5 are not mentioned, because they exhibited qualitatively similar patterns (data available in the online appendix). Second, we compared summer and autumn samplings for three single years of each period to capture interannual variability. Auchenorrhyncha populations are known to be very variable (Waloff 1994; Waloff & Thompson 1980) and abundance of single species can differ strongly between the years (Hollier *et al.* 2005). For this reason, we compared several more sites (f = 2; n = 59) than in the first approach for period 1 and period 2 independently. With this approach we were able to examine sites for period 1 (# 16a, 20 – 25 and 32), which had not been sampled in period 2.

We used boxplots (median and interquartile ranges) to summarise the data on the number of individuals per site. Interannual differences were tested with linear mixed models using period as a fixed factor and assuming a Poisson distribution of data. For the model for f = 3 (one value per period), region was used as a random factor. For f = 2, years and region (both random) were nested within periods (fixed). We additionally compared the full model without simplification against one excluding the factor period and tested for significant differences. An initial detrended correspondence analysis (DCA) showed that faunistic gradients were rather short (length of gradient = 3.0, equivalent to less than one species turnover). We thus based our multivariate analysis on linear methods (McCune *et al.* 2002) using principal components analysis (PCA) to visualise patterns in samples and species (species centred, not standardised). We used an indicator species analysis (ISA) to test for species that were significantly associated with one period or the other, and permutations were

carried out separately for each region following Bakker (2008). Data were analysed using R (R Development Core Team 2009, package nlme4), PC-ORD (McCune & Mefford 2006) and Canoco (ter Braak & Šmilauer 2002).

Special case: Excluding Zyginidia scutellaris

The statistical analysis of abundance values was problematic, because of the high impact of *Zyginidia scutellaris* (Typhlocybinae) on the dataset. *Z. scutellaris* occurred as a dominant species in the autumn-samples of nearly all of the sites in period 2 (up to 75 % of all individuals of a single site). According to Morris (1990) *Z. scutellaris* is one of the most abundant Auchenorrhyncha species in grasslands of calcareous soils and also very common in acidic grasslands (Waloff, 1994). This multivoltine species was completely absent from Schiemenz's dry grasslands in the 1960s, but known from dry grasslands in parts of Western Germany. According to Nickel (2003), *Z. scutellaris* is known to migrate easily, and it occurs abundantly in maize fields, where it feeds and reproduces (Huth & Witsack, 2009). Because of the high impact of *Z. scutellaris* on period 2 (about 40 % of individuals caught belonged to this species; Table 3) it seemed necessary to exclude it from most analyses to detect potential differences in the rest of the auchenorrhynchan fauna. *Z. scutellaris* was always excluded from the datasets used for abundance analysis. It was not excluded in comparisons regarding species richness or species composition such as PCA or ISA.

Results

Species richness and species composition (f = 3; n = 26)

From 1963 to 1966 Schiemenz recorded 147 different species in 156 sampling events at 26 sites, while 152 species (*Z. scutellaris* not excluded) in 149 sampling events were recorded at the same sites from 2008 to 2010. Restricting the data to a comparison of equivalent sampling dates per period (f = 3) yielded 125 species in period 1 and 129 species

in period 2. The median species richness per site of each period was 22 (Fig. 2). Brandenburg had the lowest species richness, with a median of 20 for each period. Thuringia showed the highest richness in the 1960s, with a median of 26 compared to 25 in Saxony.

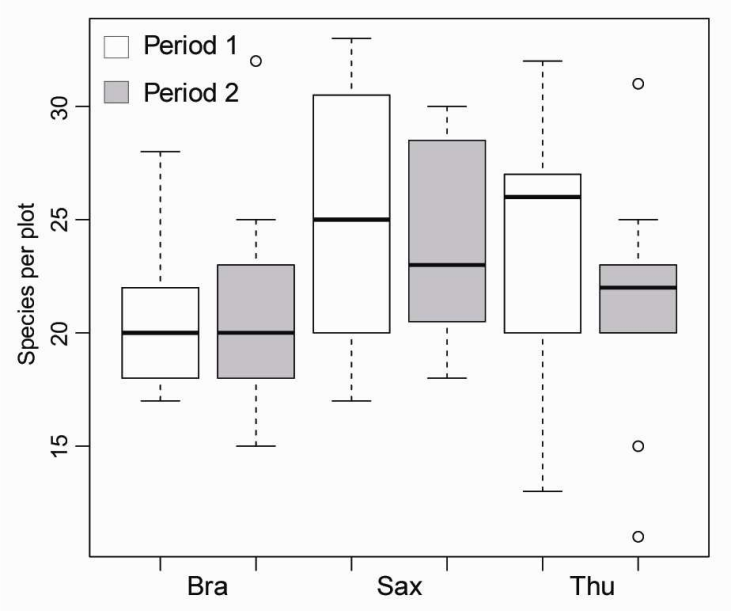

Figure 2 Species richness (dataset used: f = 3; n = 26) of the three regions Brandenburg, Saxony and Thuringia for period 1 (1964 to 1966) and period 2 (2008 to 2010).

Median species richness decreased to 22 in Thuringia and to 23 in Saxony in 2008 and 2009. Differences in species richness between periods were not significant (mixed model analysis, fixed factor period $p = 0.2000$, comparison with null model excluding period $p = 0.2293$).

A multivariate analysis of species assemblages (f = 3) revealed that all three regions had different auchenorrhynchan assemblages (Fig. 3). PCA differentiated polygons connecting the samples of Brandenburg, Thuringia and Saxony along the first axes, while samples from a given region but from different periods were differentiated along the second axis. There was some overlap (periods and regions) in polygons for Brandenburg and Thuringia, while polygons of Saxonian samples differ completely for both periods and hardly overlap with polygons of other regions.

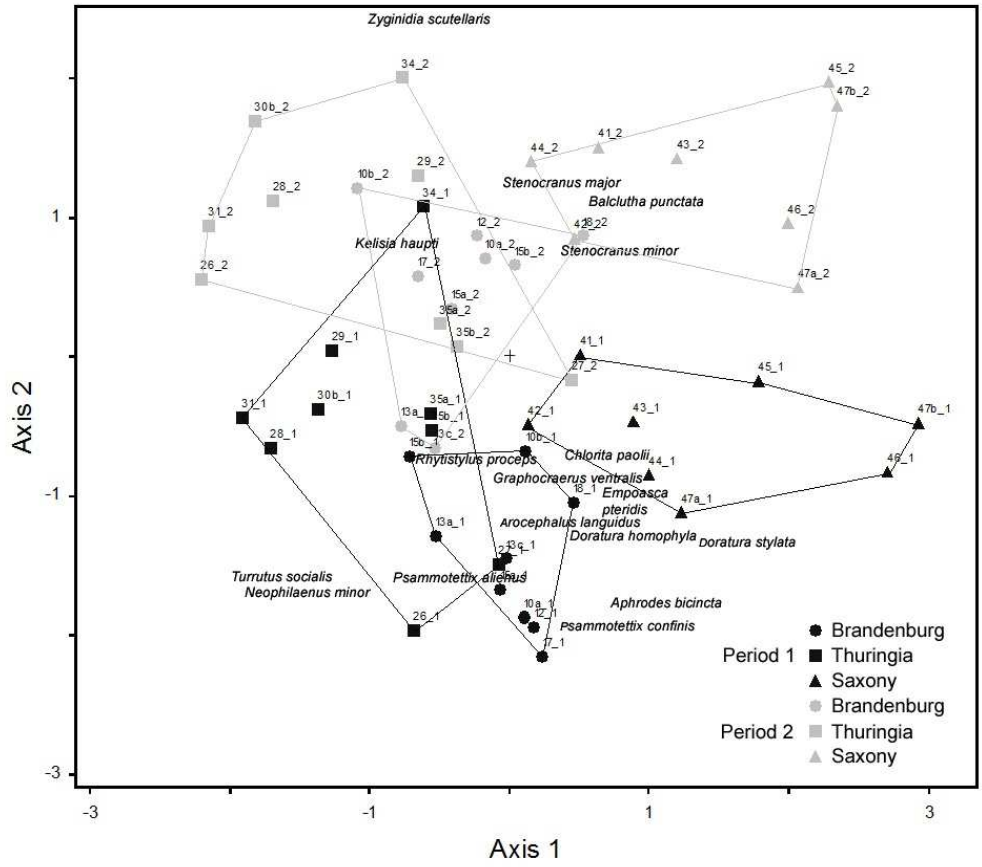

Figure 3 PCA of the Auchenorrhyncha data (presence / absence; dataset used: f = 3; n = 26) for both study periods (variance / covariance PCA, explained variance axis 1: 9.6 % axis 2: 8.0 % axis 3: 6.3 %) and a biplot of species (only the 17 best fitting species depicted). Regions and periods are indicated with different polygons.

Abundance (f = 3; n = 26 and f = 2; n = 59); Z. scutellaris excluded

From 1963 to 1966 Schiemenz sampled a total of 49,744 individuals in 156 samplings events on 26 sites, while 14,466 individuals (if *Z. scutellaris* is not excluded 25,811 individuals) in 149 events were caught at the same sites from 2008 to 2010. For the subset with f = 3, annual means were 24,225 individuals in period 1 and 8,448 individuals in period 2 (Table 3). The median abundance per site for period 1 was 679, for period 2 it was 231. In the samples from Brandenburg, abundances declined from a median of 587 in period 1 to 187 in period 2 (Fig. 4 A). For Thuringia, the corresponding figures were 704 in period 1 and 226 in period 2, and samples in Saxony yielded 858 in period 2 and 303 in period 2. Site-based abundance differed significantly between periods (mixed model analysis, fixed factor period $p < 0.0001$, comparison with null model excluding period $p = 0.0036$).

Table 3 Number of all individuals of the two different datasets used (f = 3; n = 26 and f = 2; n = 59) with a different sampling frequency (f) and number of sites (n) for both periods (period 1: 1964 to 1966; period 2: 2008 to 2010). For period 2 datasets are shown with individuals of *Zyginidia scutellaris* included and excluded.

	Dataset	
	f = 2; n = 59	f = 3; n = 26
Individuals of *Z. scutellaris* total (period 2)	13033	5147
Individuals total (period 2, *Z. scutellaris* excluded*)*	12480	8449
Individuals total (period 2)	25513	13596
Individuals total (period 1)	45415	24225
Period2/period1-ratio (*Z. scutellaris* excluded)	0.27	0.35
Period2/period1-ratio (*Z. scutellaris* included)	0.56	0.56

For f = 2, in period 1 Schiemenz sampled a total of 45,415 individuals, while in period 2 12,480 individuals were recorded (Table 3). Number of individuals caught per site (summer and autumn sampling dates) varied enormously between years (Fig. 4 B). The median abundance per site for 1964, 1965, and 1966 was 629, 534, and 1,697 respectively. In contrast, the median abundance per site for 2008, 2009 and 2010 was 146, 201, and 85 respectively. The maximum number of individuals sampled in period 1 was 2,702 (site #17 in 1966) compared to a maximum of 897 individuals in period 2 (site #35b in 2009). If *Z. scutellaris* is included, the maximum figure was 2,141 individuals (site #42 in 2009).

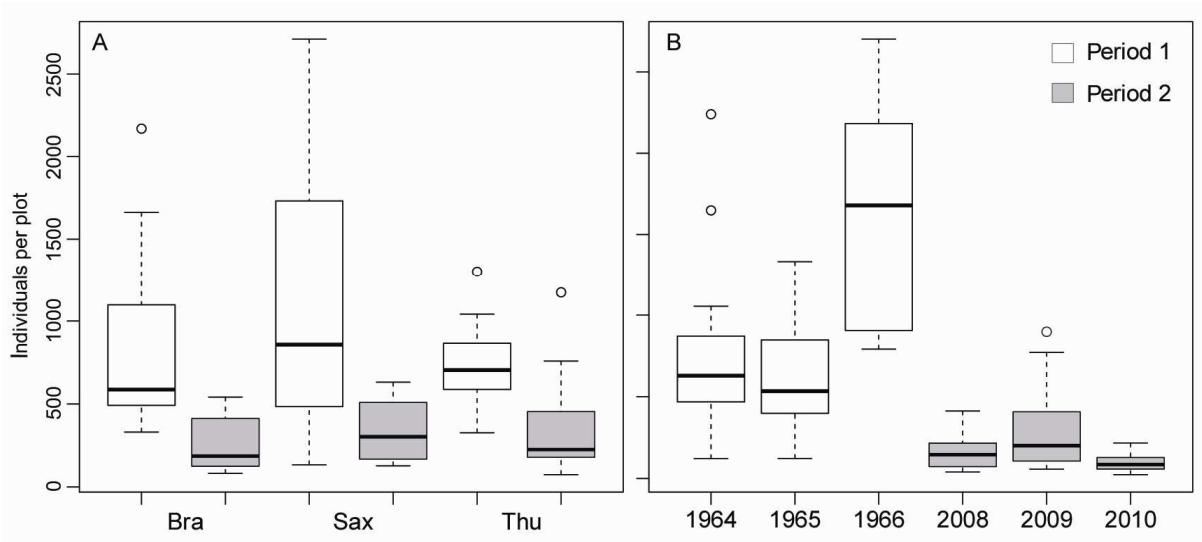

Figure 4 A) Abundance per site for period 1 and period 2 of the three regions Brandenburg (Bra), Thuringia (Thu) and Saxony (Sax) (dataset used: f = 3; n = 26). B) Abundance per site for the years 1964 to 1966 and 2008 to 2010 (dataset used: f = 2; n = 59).

Period had a significant effect on individual numbers as revealed by the significances of the full mixed model ($p < 0.0001$) and by comparison with the null model excluding period

($p < 0.012$). In this dataset, richness was higher in the historical samples (Median = 23) than in the recent samples (Median = 18), the difference was significant at $p < 0.05$ (standard significance from the full model, $p = 0.007$, comparison with null model $p = 0.038$).

Increases and declines of individual species (f = 3; n = 26)

Out of 172 species recorded in period 1 and/or 2, 15 exhibited significant changes, another 9 conspicuous trends ($0.05 < p < 0.10$) according to ISA (Table 4). *Z. scutellaris, Balclutha punctata, Stenocranus major, Megadelphax sordidula* and *Thamnotettix dilutior* hardly occurred in the 1960s (frequency < 1 % of all sites), but were present on 23 – 92 % of the sites in period 2. Furthermore, *Kelisia haupti* was also found much more frequently in period 2. However, this species was solely confined to the Kyffhäuser region (6 sites of the Thuringian region), where it was not present in the 1960s. Increases in *K. haupti* are not representative for other regions (for significances see Table 4).

Seven species declined markedly in abundance from period 1 to period 2. The most severe declines were observed for *Doratura stylata, Psammotettix alienus,* and *Neophilaenus minor*. Another four species also showed significant declines (e.g. *Aphrodes bicincta* and *Empoasca pteridis*). Additionally, five species revealed conspicuously trends of decline, for example *Rhytistylus proceps* and *Arocephalus languides*. Finally, there were some species, which exhibited significant declines in just one region. One example is *Rhopalopyx vitripennis,* for which abundance decreased in Brandenburg, but slightly increased in Saxony.

Table 4 Species with significant population trends according to ISA for the two different datasets (*: $p < 0.05$; (*): $0.1 > p > 0.05$; r: species restricted to this region). For f = 3; n = 26 relative abundance, relative frequencies and total number of individuals are presented. Indications are shown for significances or trends for f = 2; n = 59 and the regions Brandenburg (Bra), Thuringia (Thu) and Saxony (Sax) for f = 3. Grey-shaded rows indicate an increase, non-shaded rows indicate a decline.

	Relative abundances		Relative frequency		Individuals total			Period		Period (f3)		
Species	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	p	f3n26	f2n59	Bra	Thu	Sax
Zyginidia scutellaris	0	100	0	92	0	5147	<0.001	*	*	*	*	*
Doratura stylata	89	11	77	46	743	91	<0.001	*	*	*	(*)	
Aphrodes bicincta	99	1	50	4	77	1	<0.001	*	*			*
Psammotettix alienus	85	15	88	54	1010	181	<0.001	*	*		*	(*)
Balclutha punctata	0	100	0	38	0	106	0.001	*	*	(*) r		* r
Stenocranus major	0	100	0	38	0	49	0.002	*	*	*		
Empoasca pteridis	97	3	42	8	269	8	0.002	*	*	(*)		*
Eupteryx atropunctata	96	4	46	12	103	4	0.002	*	*			(*)
Neophilaenus minor	89	11	62	31	1175	147	0.004	*	*	*		
Psammotettix confinis	80	20	69	31	903	223	0.005	*	*			*
Megadelphax sordidula	0	100	0	27	0	131	0.009	*	*	r		* r
Graphocraerus ventralis	100	0	23	0	28	0	0.023	*	*			
Thamnotettix dilutior	0	100	0	23	0	25	0.026	*	*		r	(*) r
Adarrus multinotatus	93	7	31	12	463	34	0.044	*	*	r	* r	
Kelisia haupti	0	100	0	19	0	47	0.049	*			* r	
Psammotettix nodosus	100	0	19	0	48	0	0.052	(*)	*	(*) r		
Rhytistylus proceps	95	5	23	8	81	4	0.054	(*)	*			
Arocephalus languidus	94	6	58	42	3466	203	0.055	(*)	*		(*)	
Zygina hyperici	21	79	27	46	19	71	0.064	(*)		*		
Stenocranus minutus	18	82	4	23	6	28	0.068	(*)	(*)	r		r
Chlorita paolii	77	23	77	69	1565	466	0.070	(*)	*			
Mocuellus collinus	98	2	23	8	112	2	0.070	(*)	*		r	r
Artianus interstitialis	27	73	19	42	32	85	0.084	(*)		(*)		
Doratura homophyla	91	9	31	12	215	20	0.092	(*)	*			
Cercopis sanguinolenta	94	6	19	8	143	9	0.107				(*) r	
Neophilaenus exclamationis	100	0	15	0	33	0	0.115		*			(*) r
Mocydiopsis longicauda	79	21	27	12	31	8	0.128		*		(*) r	
Rhopalopyx vitripennis	71	29	65	58	684	279	0.175		*	*		
Anaceratagallia ribauti	81	19	27	35	81	19	0.562					(*) r
Psammotettix helvolus	82	18	38	69	1985	446	0.751		*	*	*	

Discussion

Species richness and overall composition

In our study we investigated long-term developments of auchenorrhynchan communities in protected dry grasslands of Eastern Germany. Changes in species richness were limited in magnitude for period 1 to period 2. Total species numbers slightly increased, while losses on the site level were at most 1 to 3 species. A PCA on presence/absence data revealed some changes, especially in the Saxonian sites. In combination with ISA (discussed later), we detected a shift in species composition rather than a species loss. Some species newly occurred in period 2. Thus, there is no evidence for a species loss in protected dry grasslands. This complements the results of a similar study about the orthopteran community of the same grassland sites (Schuch *et al.* 2011). However, in contrast to the results for the Auchenorrhyncha study, the study of Orthoptera revealed only slight species composition shifts. Differences between regions were pronounced, but orthopteran assemblages of each region remained characteristic for about 40 years. In Auchenorrhyncha many species are highly specialised. This insect group is very sensitive to changes in vegetation structure (Andrzejewska 1965), and shifts in an auchenorrhynchan assemblage might reflect environmental changes much earlier than shifts in an orthopteran assemblage.

Abundance

In contrast to slight changes in species richness, the abundance of the auchenorrhynchan fauna strongly declined from period 1 to period 2. Losses were quite high, totalling approximately 70 %; with *Z. scutellaris* included losses still equalled 40 % (Table 3). However, several studies found that planthopper populations, like in many other insect groups, fluctuate strongly within and among seasons in the same patch as well as among spatially distant patches (Denno & Roderick 1990; Hollier *et al.* 2005). Müller (1978) observed that single auchenorrhynchan species severely fluctuated in abundance up to a factor

of 10 from one year to another. Unlike previous studies (Nickel 2002), we had the opportunity to compare 3 years per each period (f = 2; n = 59). Site-based median abundance of Auchenorrhyncha in 1964 – 1966 was at least 2.5 times higher as compared to 2008 – 2010 (1965 compared to 2009), reaching a maximal difference of 20 times (1966 compared to 2010). In comparison, median abundance among years of one period amounted to a maximum of 3 times in period 1 (1965 compared to 1966) and showed hardly any differences in period 2. This indicates that there is much less abundance fluctuation within a period than among both periods, pointing to a general decline in auchenorrhynchan densities during the last 40 years.

We assert that there may be several additional environmental factors increasing auchenorrhynchan populations, including climate change, nitrogen availability in plants, increased plant cover due to succession, and a loss of special host plants due to an altered plant species composition in dry grasslands or in the surrounding landscape. For example, Whittaker & Tribe (1998) found that an increased mean annual temperature by 1 K led to increased populations by more than 50 % on average of the spittlebug *Neophilaenus linneatus* (L.). In our study, mean annual temperature increased by 0.8 K from period 1 to period 2. We also observed the length of the growing season increase by 5 days from 1951 to 1996 (Menzel *et al.* 2001). A prolonged growing season could positively affect auchenorrhynchan populations by promoting extended food availability (Bale *et al.* 2002). Precipitation in both periods reached or exceeded the long-term mean precipitation of 799 mm (1961 to 1990). Except for 1964, all years were wet to very wet (Table 2). Higher summer rainfall may indirectly lead to higher abundance in Auchenorrhyncha populations, while summer drought does not cause a corresponding decrease (Masters *et al.* 1998). Despite the more favourable climatic conditions in the second period of our study with a higher mean annual temperature, prolonged growing seasons and plentiful summer rainfall, auchenorrhynchan population

densities declined. This suggests that weather conditions might be less important than initially thought.

If favourable climatic conditions did not increase population densities, then other factors may be coming into play. Prestidge & McNeill (1983) identified the availability of nitrogen in host plants as an essential factor for the amount of eggs laid per auchenorrhynchan female per day, which is highly species-dependent. For example, *Z. scutellaris* (the most abundant species in period 2) lays up to four times more eggs per day onto *Holcus mollis* which is fertilized with high nitrogen-concentrations compared to *H. mollis* with low concentrations. On the other hand, species such as *Elymana sulphurella* have an optimum at low nitrogen-concentrations. *E. sulphurella* lays about seven times eggs less per day at high nitrogen-level levels compared to low ones (Prestidge & McNeill 1983). Due to air pollution and direct fertilization as an effect of modern agriculture (Vitousek *et al.* 1997), nitrogen input is increasingly responsible for a higher nitrogen-concentration in host plants, even on dry grasslands. This may be a driving factor for abundance declines of species preferring low-productive sites. Presumably, the nitrogen-concentration is no longer optimal for many species. Interestingly, Haddad *et al.* (2000) discovered that increased nitrogen deposition indirectly decreased auchenorrhynchan species diversity. Here, we could not detect any loss in species richness, although there was a species composition change. More generalist species, i.e. nutrient tolerant species not present in period 1 such as *Z. scutellaris, Balclutha punctata,* and *Stenocranus major,* partly compensated losses in species richness of period 2.

Botanical studies imply that the critical nitrogen load for plant communities of calcareous grassland are 42 to 55 kg N ha^{-1} $year^{-1}$ (Wilson *et al.* 1995). Nitrogen-input threatens these grasslands, because species from more nutrient-rich habitats, such as *Arrhenatherum* meadows, have invaded calcareous grasslands (Hagen 1996). Important host plants, which were much more common in the landscape when Schiemenz conducted his research, disappeared during the last decades due to changed agricultural practices (Stevens *et*

al. 2004). Unfortunately, Schiemenz's data about plant composition at our sites are not sufficient to provide evidence for this assumption, but changes in auchenorrhynchan species composition might be related to the presence or absence of plant species. For example, *Doratura stylata* prefers fine-leafed grasses like *Festuca rubra* or *Agrostis capillaris* (Nickel, 2003) in less intensively or non-used dry habitats (Nickel & Achtziger 1999). The same applies to *Aphrodes bicincta*, *Doratura homophyla*, *Neophilaenus minor*, *Adarrus multinotatus, Arocephalus languidus*, *Rhytistylus proceps* and *Rhopalopyx vitripennis*. These eight species alone exhibited a loss of 6,125 individuals from period 1 to period 2. This accounts for 39 % of the total loss of numbers of individuals (from dataset f = 3). None of these species is red-listed today (Nickel & Sander 2001; Walter *et al.* 2003) and none of them has been threatened in the 1960s. Except for *R. proceps* and *D. homophyla,* they are even known to be relatively common in dry grasslands. In the past, these species probably benefited from a higher density of suitable habitats. Today, the reservoir of dry habitats in the landscape has decreased. In Germany the loss of calcareous grassland has been very great locally from the 1960s to 1990 (WallisDeVries *et al.* 2002). Thus, we potentially detected an indirect effect on the dry grassland of our study sites due to nitrogen deposition. Additionally, all species which appear to be much more common today (*Z. scutellaris*, *B. punctata*, *S. major*, *S. minor*, *Thamnotettix dilutior*, *Megadelphax sordidula*, *Artianus interstitialis*) are known to occur also in damper, more shadowy sites. This is an indirect indication for a successional trend in the grassland to denser vegetation and closer swards.

Although the protection status may have helped to prevent a loss in species richness, community composition is different and specialised species of dry grassland occur in much lower densities in recent times. As mentioned above, patterns in weather conditions are not able to explain these developments. A decline in host plant abundance in combination with habitat losses due to nitrogen deposition and succession may be responsible for the decline in auchenorrhynchan abundance in dry grasslands. However, it appears that the development of

auchenorhynchan communities of protected dry grasslands is buffered by the protection status against the influence of modern agriculture.

Acknowledgements

Herbert Nickel directed our attention to the work of Schiemenz and provided invaluable help in determining planthoppers and leafhoppers. We are grateful to Sabine Walter who was so kind to help us to find the Saxonian sites. Thanks to Eckart Fründ for determining some females of the genus *Mocydiopsis,* Henrik von Wehrden for providing advice on mixed model analysis, and Dirk Sanders, Daniela Justa-Schuch, and especially Heather Lessig for linguistic corrections and helpful remarks. Access to reserves was kindly granted by the responsible conservation agencies. This is a contribution from the joint project BioChange Germany (Cluster of Excellence "Functional Biodiversity Research"), which is funded by the State of Lower Saxony (Ministry of Science and Culture).

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Synopsis

General long-term trends in the investigated insect communities

Our results allow three general statements to the investigated insect communities (Table 1). First, we could not detect any decline in species richness. Second, species composition mostly tended to be more homogenous today than in the 1950s. Third, our results indicate that species densities tended to decline during the last decades for two out of three investigated groups. Admittedly, the detected changes in the insect communities on pastures have to be considered with care, because they base on the comparisons of two single years and relatively few plots. However, the development in the dry grassland insect fauna is more representative as a higher number of sites representatives for a larger spatial scale were taken into consideration. Though, with the sites being reserves and thus under conservation management they may not necessarily be representative for more intensively used grasslands.

Table 1 Results of long-term comparisons indicating changes in species richness (on plot-level and landscape-level), species composition and species abundance. The comparisons for the three insect groups Auchenorrhyncha, Heteroptera and Orthoptera (first to third line) are based on the surveys of Marchand (1953) and Schiemenz (1969a, b), and surveys from 2008, 2009, and 2010.

	Mainly pastures (1951 | 2009)			Dry grassland (1964-1966 | 2008-2010)		
	Richness	Composition	Abundance	Richness	Composition	Abundance
	Slight increase	Homogenisation	Decline	Constant	Shift	Decline
	Increase	Homogenisation	Increase	-	-	-
	Constant	Mainly unchanged	Decline	Constant	Mainly unchanged	-

In the following, changes in species richness (1), species composition (2) and species abundance (3) are discussed separately.

(1) Species richness did not decline for any of the investigated insect groups (Auchenorrhyncha, Heteroptera and Orthoptera) neither in pastures nor in dry grasslands. For

Heteroptera of pastures, species richness even significantly increased from 1951 to 2009. These observations are in contrast to previous research on Lepidoptera (Maes & Van Dyck 2001; Thomas *et al.* 2004; Öckinger *et al.* 2006), and Hymenoptera and Diptera (Biesmeijer *et al.* 2006; Kosior *et al.* 2007). For these taxa a decline in species richness during the last few decades on landscape and partly on plot level have been found for various habitat types. There are, however, also local long-term studies on Auchenorrhyncha and Heteroptera from Germany which support our observations as these studies also found a constant or even a slight increase in species richness (Bröring & Niedringhaus 1989; Nickel 2002; Stöckmann & Niedringhaus 2004). The discrepancy between declines in pollinator groups on the one hand and constant species richness in mainly phytophagous groups on the other hand implies that there could be a general difference in the reaction of functional groups to environmental changes. Especially butterflies have high demands for habitat quality (Maes & Van Dyck 2001) and thus may be good indicators for habitat degradation, but probably do not reflect changes in less sensitive insect groups. Unfortunately, there is no study which simultaneously investigated pollinating and phytophagous insects to test this hypothesis. This underlines the need for long-term research for at least the basic, functionally different groups of the insect fauna.

As mentioned above, most of our sites were located in protected dry grasslands and were not representative for other habitat types. Thus, our study mainly indicates that protected dry grasslands maintained their species richness. This is in contrast to some of the mentioned large-scale studies, in which many different grassland types have been investigated. Nevertheless, our results are based on re-sampling at the same sites, not on comparisons of raster data or relatively heterogeneous datasets, and may be more reliable than the large-scale studies with respect to changes on the local level.

(2) Species composition shifted for Auchenorrhyncha and Heteroptera, and remained largely unchanged for Orthoptera. All alterations in species composition suggest a loss of

habitat specialists and an increase in more generalist species. Such homogenisation trends are in line with research on plant communities in agricultural landscapes of different European countries (Treweek *et al.* 1997; Joyce & Wade 1998; Smart *et al.* 2006; Prach 2008; Wesche *et al.* 2009). A more homogeneous landscape due to agricultural intensification was found to host a homogeneous insect fauna (Hendrickx *et al.* 2007; Ekroos *et al.* 2010).

Unfortunately, species identity and species composition of insect communities have received surprisingly limited attention in research, particularly when contrasted with the vast number of studies on diversity on local and landscape scale (Koleff *et al.* 2003). In our study, the patterns of unchanged or even increased species richness as shown in (1) are underlain by losses in species of certain functional groups. Observations from mammals and birds point in a similar direction: losses in functional diversity are bigger than losses in taxanomical diversity (Flynn *et al.* 2009). In related studies on plant communities an increased nutrient input often leads to the dominance of a few nitrogen tolerant species which outperform most of the low-input species (Albrecht & Bachthaler 1990). Such losses in species richness may not be that severe in phytophagous insect communities, because if nitrogen levels increase, highly mobile insect species with little host plant dependence may occur and counteract losses in more specialised species. Thus, comparisons solemnly considering species richness may be appropriate for very sensitive insects but may miss effects in more robust species. This assumption is also supported by observations on butterflies in Flanders that indicated a general loss of species preferring oligotrophic habitats in favour of species preferring eutrophic biotopes (Maes & Van Dyck 2001).

(3) In our study, auchenorrhynchan species declined in abundance in pastures as well as in dry grasslands during the last 40 years. The available long-term surveys on insect abundance covering three up to eight decades found declines for a number of taxa in Britain and The Netherlands (Van Swaay 1990; Benton *et al.* 2002; Conrad *et al.* 2004; Shortall *et al.* 2009). In our study, the abundance data sampled over several years per period (1964 to 1966

and 2008 to 2010) suggest a general decline in auchenorrynchan densities which is apparently independent from short-term interannual variability. The results also indicate that species preferring low-productive sites or having dry habitat requirements exhibited more pronounced losses in numbers than generalist species. This implies that species confined to oligotrophic habitats (i.e. nutrient-poor grasslands) are in general decline. As far as we know, this is the first large-scale assessment on insect abundance in Germany. Since our research sites were mainly located in protected areas, this gives reason for concern. There were also pronounced declines in numbers of Orthoptera on pastures, while Heteroptera increased in abundance on these sites. These opposing trends underline the need for more long-term research on the responses of different insect groups to similar environmental changes.

The influence of the environment

Agricultural practices and climatic conditions have been shown to influence insect communities in both species composition and abundance (Masters *et al.* 1998; Ryszkowsky *et al.* 2009). In particular, landscape degradation, increased fertilizer input (Haddad *et al.* 2000), increased mean annual temperatures, and altered rainfall (Masters *et al.* 1998) are regarded as crucial factors for insect populations. For example, Whittaker and Tribe (1998) found that an increase of the mean annual temperature by 1 K led to increased auchenorrynchan populations. In our case, the mean annual temperature increased by 0.8 K from the 1950s to 2000. Additionally, the growing season lenghtened by 5 days from 1951 to 1996 (Menzel *et al.* 2001). An extended growing season is supposed to have positive effects on phytophagous populations due to extended food availability (Bale *et al.* 2002). Surprisingly, in spite of this potentially positive development of climatic conditions the insect densities in our study declined. Thus, we think weather conditions were less important for the investigated insect communities than suspected.

The increase in frequency and abundance of eurytopic species and the decline of species preffering low-productive habitats hint on a major role of increased nutrient input. The strong decline of Orthoptera in pastures also reflects the influence of land use intensification, while the slight changes in orthopteran assemblages of dry grasslands pointed to an influence of successional development (woody plants encroachment). Taken together this implies that alterations in land use practices are not only reflected in changes in plant communities (cf. Treweek *et al.* 1997; Joyce & Wade 1998; Smart *et al.* 2006; Prach 2008), but also induce long-term changes in at least parts of the insect fauna.

The losses in auchenorrhynchan abundance probably have strong effects on higher trophic levels, like on spiders, ants or even birds (Atkinson *et al.* 2005; Biedermann *et al.* 2005). The same holds true for Orthoptera, which are known to be a crucial food source for many farmland bird species (Barker 2004). Benton *et al.* (2002) found that bird populations respond to declines in insect availability via reduced breeding success or reduced post-breeding and lower over-winter survival. On the other hand, increases in other groups like Heteroptera may buffer such losses of food sources, but probably mainly for relatively generalist predators.

Remarks on some species

This study revealed some remarkable changes in frequency and/or abundance of single species. Some of these might be exemplary for general changes in the insect fauna on pastures and dry grasslands in Germany. In the following seven of these species are briefly discussed.

(1) *Zyginidia scutellaris* (Herrich-Schäffer, 1838). In our study, this is the most prominent example for an auchenorrhynchan species which exhibited a long-term increase. It was completely absent at any of the sites in the 1950s or 1960s, but was sampled at every site between 2008 and 2010. It occurred in very high abundance on dry grasslands (up to 99 % of an autumn-catch) and in a lower extent on pastures. According to Nickel (2003) this species is

mainly found in disturbed dry grassland, ruderal sites, abandoned vineyards, but also maize fields and fertilized meadows. As it feeds on various grasses it is exemplary for a generalist species with non-specific habitat requirements which obviously benefited from general changes in the landscapes of Germany during the past decades.

(2) *Neophilaenus minor* (Kirschbaum, 1868). This species is an example for a relatively common Auchenorrhancha occurring in high numbers on dry to very dry grassland sites with sparse vegetation cover, and it feeds on a few fine-leaved grass species (Nickel 2003). In our study, it significantly declined in frequency and abundance on dry grassland sites during the past 40 years. The decline of this species is representative for a general trend of declining auchenorrhynchan densities on dry grassland, because the main losses in individual numbers occurred in species which resemble *N. minor* in both habitat and host plants preferences.

(3) *Macrosteles sexnotatus* (Fallén, 1806). In the 1950, only very few individuals of *Macrosteles* (1 ‰) were caught on pastures by Marchand, while in 2009 about 12 % of all individuals caught belonged to this genus. As the life history of most of the *Macrosteles*-species of Germany is very similar to *M. sexnotatus*, this species is exemplary for the genus. It occurs commonly as a pioneer species in disturbed and/or fertilized habitats (Nickel 2003) so that the increase of this species reflects the changes in nutrient availability of pastures but probably also of other grassland types.

(4) *Philaenus spumarius* (Linnaeus, 1758). Although this Auchenorrhyncha is known to be extremely eurytopic and very abundant in various types of habitats (Nickel 2003), it severely decreased in abundance on the investigated pasture sites. This is an example for a common species preferring ruderal and low-input sites that is still very frequent but nonetheless less abundant than before. Losses in abundance of such species will remain undetected if just species richness is considered.

(5) *Phaneroptera falcata* (Poda, 1761). This Orthoptera occurs in moderately open habitats with dense grass and even shrub cover, and has been spreading northwards in Germany since the 1970s (Detzel 1998). In our study, *P. falcata* has increased significantly in frequency on dry grassland since the 1960s, especially on sites with denser shrub cover at the edges. This increase indirectly reflects an ongoing cessation, and indicates that the less intensive conservation management on many of today's dry grassland reserves results in a growing shrub cover and potentially associated loss of open vegetation types.

(6) *Myrmeleotettix maculatus* (Thunberg, 1815). This Orthoptera is tied to open heathland or sandy sites with sparse vegetation cover (Detzel 1998). It declined significantly in frequency on the investigated dry grassland sites. With its decline being negatively correlated with shrub and tree cover in the surrounding of the sites, it is exemplary for orthopteran species suffering from shrub and tree encroachment on many of the dry grassland sites.

(7) *Amblytylus nasutus* (Kirschbaum, 1856). This species is an example for increased abundance of Heteroptera on pastures. It was not recorded by Marchand in 1951 but accounted for 14 % of all heteropteran individuals in 2009. It is a common species with no special habitat requirements feeding on various common grasses (*Poa pratensis* and *Agrostis spec.*). Interestingly, all Heteroptera exhibiting an increased abundance in this work are in general very common grassland species and show similar ecological characteristics.

Implications for future work and outlook

One aim of this work was to reveal long-term trends in species richness and species composition of insect communities covering about four to five decades and thus larger time scales than most other long-term studies (cf. Table 1 in the Introduction). Of special concern was to assess changes in insect abundance, because in most previous studies this aspect had not been considered. Our results indicate that there were changes in species abundance which

were independent from effects on the species richness level. This demonstrated how important abundance data are for long-term research, and we recommend including this factor in future studies. In the past, abundance data of insect surveys have often been neglected due to difficulties in distinguishing between interannual fluctuations and real long-term changes. Current zoological research often concentrates on species richness, but in our case focussing just on presence/absence data would have lead to partly opposite conclusions. Abundance data should at least be stored, for example by including them in appendices of publications.

This study gave new insights on long-term developments of the insect fauna of Germany. Especially the changes in the composition of many dry grassland species indicate that plant composition of this habitat type also changed over the past decades. It would be very interesting to compare developments in plant communities to those in the auchenorrhynchan fauna. Fortunately, old relevés are available for some of the investigated dry grassland sites, taken in the Kyffhäuser region and probably also in Brandenburg in the 1960s. Due to time constraints we were not able to retrieve and include these vegetation plant data in our study. However, future work will be to relate plant data to data of auchenorrhynchan communities to get an even more comprehensive understanding of how these more sensitive and protected parts of the landscapes of Germany developed during the last 50 years.

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Zusammenfassung

Die Landschaft Mitteleuropas ist geprägt von der modernen Landwirtschaft. Ihr Einfluss setzte mit der Massenproduktion von Kunstdünger und verbesserten Landmaschinen in den 1950er Jahren ein und führte spätestens ab den 1960ern zu einer fortschreitenden Vereinheitlichung weiter Teile der mitteleuropäischen Landschaft. Heute weiß man, dass viele Tier- und Pflanzenarten im Rückgang begriffen sind und man vermutet, dass dies durch die Weiterentwicklung der Landwirtschaft hervorgerufen wurde und wird. Zu diesem Phänomen gibt es allerdings wenige Forschungsergebnisse, denn oftmals liegen Erkenntnisse zu langfristigen Populationsentwicklungen nur exemplarisch für einzelne Tiergruppen vor. Ein besonders gutes Beispiel hierfür sind Insekten. Obwohl sie den größten Teil der mitteleuropäischen Fauna ausmachen und ganz entscheidende und mannigfaltige Funktionen in allen terrestrischen Ökosystemen einnehmen, ist noch sehr wenig über langfristige Bestandsentwicklungen bei Insekten bekannt. Zwar wurden einige prominente Insektengruppen auf langjährige Veränderungen in der Artenvielfalt hin untersucht (vor allem Schmetterlinge in Großbritannien), aber wie sich Populationsdichten über mehrere Jahrzehnte entwickelt haben, weiß man kaum. In dieser Studie wurden Aufnahmen aus den 1950er und 1960er Jahren von Zikaden-, Wanzen- und Heuschreckenpopulationen verschiedener Graslandtypen mit Erhebungen aus den Jahren 2008 bis 2010 verglichen (gleiche Erfassungsmethode und gleiche Untersuchungsflächen). Mit Hilfe dieses Ansatzes sollten folgende Fragen beantwortet werden:

(i) Gibt es Veränderungen in der Artenvielfalt, der Artzusammensetzung und der Individuendichte verschiedener Insektenordnungen in geschützten und ungeschützten Graslandtypen?

(ii) Lassen Muster in der Artzusammensetzung dieser Gruppen in Kombination mit vergleichenden Luftbild- und Klimadatenanalysen Rückschlüsse auf die Ursachen für etwaige Veränderungen zu?

Hierfür wurden zwei Studien aus den 1950ern und 1960ern herangezogen, deren Originaldatensätze erhalten geblieben sind und die sich darum zur Reproduktion eigneten. In der ersten Studie wurden mittels standardisierten Kescherfängen Zikaden, Wanzen und Heuschrecken verschiedener Feuchtgrünlandhabitate Niedersachsens erfasst. Dies geschah mehrfach während der Vegetationsperiode 1951 und wurde 2009 auf die gleiche Art und Weise wiederholt. Somit umspannt diese Untersuchung etwa sechs Jahrzehnte und ermöglichte zudem Vergleiche für mehrere Insektengruppen.

Die zweite Studie wurde in den 1960er Jahren an Zikaden- und Heuschreckenpopulationen geschützter Trockenrasenflächen Thüringens, Sachsens und Brandenburgs durchgeführt. Hier wurde ebenfalls standardisiert gekeschert, allerdings über mehrere Jahre hinweg (1963 bis 1967). Diese Studie konnte auf 26 der in den 1960ern untersuchten Flächen in den Jahren 2008 bis 2010 wiederholt werden. Somit ließen sich zwei Perioden vergleichen, zwischen denen etwa 40 Jahre liegen.

Die Untersuchungen brachten folgende Ergebnisse:

(i) Die mittleren Artenzahlen pro Fläche gingen für keine der untersuchten Insektenordnungen innerhalb der letzen Jahrzehnte zurück. Sowohl die Zikaden- und Heuschreckenpopulationen der Trockenrasen als auch die des Feuchtgrünlands blieben in ihren Artenzahlen pro Fläche in etwa konstant. Bei den Wanzen des Feuchtgrünlandes gab es 2009 sogar signifikant mehr Arten pro Fläche als 1951. Die Anzahl der insgesamt registrierten Arten ist bei beiden Untersuchungen für alle Gruppen heute leicht erhöht im Vergleich zu den 1950ern und 1960ern.

Außer bei den Heuschrecken der Trockenrasen veränderte sich die Artenzusammensetzung bei allen untersuchten Gruppen. Sowohl die Artengemeinschaften der Wanzen- als auch der

Zikadenpopulationen der einzelnen Feuchtgrünlandflächen sind im Laufe der letzten Jahrzehnte immer einheitlicher geworden. Außerdem hat der Anteil an Generalisten (vor allem Arten, die nährstoffreiche Standorte bevorzugen) zugenommen. Letzteres gilt auch für die Zikadenpopulationen der untersuchten Trockenrasen.

Für die Individuendichten der untersuchten Insektengruppen gilt: viele der häufigen Zikadenarten des Feuchtgrünlands und der Trockenrasen wurden im Wiederholungszeitraum in signifikant geringeren Dichten pro Fläche erfasst als in beiden Vorgängerstudien. Auch die Individuenzahlen der Heuschrecken pro Fläche im Feuchtgrünland waren 2009 signifikant geringer als 1951 (für die Trockenrasen konnten keine Dichtevergleiche angestellt werden, da die Daten aus den 1960ern fehlen). Im Gegensatz dazu wurden 2009 mehr Wanzen pro Fläche gefangen als 1951.

(ii) Vergleichende Luftbildanalyse hat gezeigt, dass sich sowohl die untersuchten Flächen beider Studien als auch deren unmittelbare Umgebung nur leicht verändert hatten. Eine Ausnahme bilden die sächsischen Flächen, die innerhalb der letzten Jahre zusehends verbuschten. Die Jahresdurchschnittstemperatur ist heute etwa ein Grad höher verglichen mit dem Untersuchungszeitraum der Erststudien und in den Jahren der Wiederholungsuntersuchungen gab es im Durchschnitt weniger Jahresniederschlag (hierbei sind vor allem die Wintermonate ausschlaggebend).

Die aufgeführten Veränderungen in der Umwelt sind womöglich für einen Teil der Veränderungen in den untersuchten Insektengesellschaften verantwortlich. So waren unter den Zikadenarten der Trockenrasen vermehrt Ruderalarten und Arten von Gebüschsäumen zu finden. Diese treten sukzessionsbedingt häufiger auf. Der Einfluss des veränderten Klimas lässt sich nur schwer ermitteln, sollte sich aber, betrachtet man die Ergebnisse anderer Studien, eher begünstigend auf die Bestandsentwicklung von Insekten auswirken. Die Zunahme der Wanzendichten im Feuchtgrünland scheint dies zu bestätigen. Im Gegensatz hierzu ist der Rückgang bei den Individuenzahlen von Zikaden sowohl auf Trockenrasen als

auch im Feuchtgrünland jedoch so stark, dass es Faktoren geben muss, die einer möglichen bestandsstärkenden Wirkung durch Klimaänderung entgegenstehen. Hier macht sich womöglich der Einfluss der modernen Landwirtschaft bemerkbar. Die Muster in der Artfrequenz in Kombination mit Änderungen in der Individuendichte legen nahe, dass Trockenrasenspezialisten im Rückgang begriffen sind. Demgegenüber breiten sich die an eine stickstoffreichere Agrarlandschaft angepassten Generalisten in diesem Habitattyp immer weiter aus.

Danksagung

Herrn Prof. Dr. Matthias Schaefer gilt mein Dank, da er stets ein offenes Ohr für mich hatte, wenn ich Rat brauchte.

An dieser Stelle ist auch Prof. Dr. Christoph Leuschner zu nennen, ohne dessen Wirken das Projekt BIOCHANGE nicht zustande gekommen wäre.

Die Mithilfe von PD Karsten Wesche ließ die Arbeit im Gelände wesentlich ergiebiger und doppelt so beschwingt ausfallen. Seine Hilfe bei statistischen Analysen und anderen Problemen hat vieles erleichtert. Vielen Dank, Karsten!

Prof. Dr. Stefan Vidal hat sich freundlicherweise als Korreferent zur Verfügung gestellt.

Mein Dank gilt auch Herrn Prof. Dr. Stefan Scheu, in dessen Abteilung es immer angenehm war zu arbeiten.

Julian Bock war mir eine unersetzliche Hilfe im Gelände und ein stets gutgelaunter und interessierter Gesprächspartner. Sein unermüdlicher Fleiß beim Wanzenbestimmen hat meine Arbeit sehr vorangebracht.

Benjamin Krause und Stefan Meyer waren sowohl bei der Arbeit im Feld als auch am Schreibtisch kompetente und herzliche Kollegen, die mir mit Rat und Tat zu Seite standen.

Die angenehme Arbeitsatmosphäre in der Abteilung Tierökologie hat Freude bereitet. Allen Kollegen sei's gedankt. Gesondert zu erwähnen sind Herbert Nickel, der mir bei der Bestimmung der Zikaden wertvolle Tipps gab, und Dieter Nünchert, dessen handwerklicher Einfallsreichtum die Grundlage für meine erfolgreiche Freilandarbeit schuf.

Danken möchte ich auch Sabine Walter, die maßgeblichen Anteil daran hatte, dass wir die Flächen in Sachsen wieder finden konnten. Eckart Fründ und Reinhard Remane halfen mir bei der Bestimmung einiger schwieriger Zikadenarten.

Die geschützten Gebiete durfte ich betreten, da mir die zuständigen Naturschutzbehörden freundlicherweise den Zugang gewährten. Ich danke hier auch Familie Mehner aus Zadel und Familie Hölzig aus Coswig, die es mir gestatteten auf ihrem Privatbesitz zu arbeiten.

Meine Frau hat mich stets unterstützt und in meinen Bestrebungen bestärkt. Mein Dank gilt hier auch meinen Eltern.

Zuletzt danke ich dem Niedersächsischen Ministerium für Wissenschaft und Kultur dafür, dass es Mittel bereitstellte, die zur Finanzierung meiner Stelle genutzt werden konnten.

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Appendix

The appendix lists all data gathered by Marchand (1953), Schiemenz (1969a, b), and the author. It includes the original species/abundance lists for Auchenorrhyncha, Heteroptera and Orthoptera, and relevés of all sites visited in 2009.

Explanations to Marchand's and Schuch's data

Marchand sampled at twelve sites. He visited them between eight and eleven times in 1951. We visited nine of these sites eight times beginning in May and ending in September 2009, trying to match sampling dates of Marchand as closely as possible. Like Marchand we sampled with a sweep net (Ø 30 cm; 100 sweeps per sampling visit).

All heteropteran individuals were determined by Julian Bock, auchenorrhynchan and orthopteran individuals by the author. Relevés were taken by Benjamin Krause. For comparisons described in chapter 2 the following samples were not considered in the analysis:

- Site II: 11.05.1951, 04.10.1951
- Site III: 11.05.1951, 10.07.1951, 4.10.1951
- Site IV: 12.5.1951, 17.10.1951
- Site V: 04.10.1951
- Site VI: 30.08.1951, 17.10.1951
- Site X: 22.05.1951, 27.06.1951
- Site XI: 11.05.1951, 10.07.1951
- Site XII: 16.08.1951, 4.10.1951

Explanations to Schiemenz's and Schuch's data

Schiemenz (1969b) sampled planthoppers and leafhoppers from 1963 to 1967 on 48 sites (60 plots). During this period each site was sampled from three up to ten times.

We chose 26 focal sites and visited them during July and September of 2008, May, July, and September of 2009, resulting in five samples each sites (except for sites # 10a, 10b, 18, and 30b). Five sites in Thuringia (sites 26 – 29, and 31) and four Saxonian sites (sites # 41, 42, 46, and 47b) were intensely sampled by Schiemenz and thus additionally sampled in spring, summer and autumn of 2010. Schiemenz sampled with sweep nets (Ø 30 cm; 200 sweeps per sampling visit). All species were collected in the field and determined in the lab. Relevés were taken by Karsten Wesche.

Explanations to the species lists: All species marked with positive numbers were exclusively caught with sweep net (200 sweeps per sampling visit). A column marked with ♀ shows the number of females of the given species. It always refers to the column to the left, which shows the total number of individuals per sampling visit. Species marked with negative numbers in period 1 were exclusively caught by pitfall trap. In period 2 such species were exclusively caught with suction sampling. Schiemenz and the author added these species for qualitative reasons. They were not considered in any analysis.

Explanations to remarks in some of the species lists:

'': Just 50 sweeps per sampling visit!

²: 2 x 200 sweeps during the sampling on 19th of September 2009! Second sampling was done immediately after the first one.

³: Total day catch on 19th of August 1966, 6x50 sweeps!

*: 200 sweeps on a dry pasture in the surrounding of the site.

We searched for sites # 11, 14a, 14b, and 48 without success. Sites # 11 and #48 have probably changed severely due to shrub and tree encroachment. All individuals of *Cicadetta montana* listed in period 1 were not caught with sweep net.

Marchand's and Schuch's data

Data listed in the following order: Species/abundance list of Orthoptera, Auchenorrhyncha, Heteroptera, and relevés.

Plot #	Orthoptera	23.05.51	06.06.51	27.06.51	10.07.51	06.08.51	21.08.51	30.08.51	21.09.51	19.05.09	15.06.09	24.06.09	16.07.09	01.08.09	18.08.09	01.09.09	21.09.09
1	*Gomophocerus macalatus*			2		3	8										
1	*Chorthippus mollis*				1	1		4			1		2	2	4		
1	*Omocestus viridulus*				1												
1	*Oedipoda caerulescens*					1											
1	*Chorthippus parallelus*										1	3	5	1	1	2	
1	*Chorthippus biguttulus*													1	1	3	
2	*Gomophocerus macalatus*			37	16	9	2										
2	*Chorthippus mollis*				2	4	6		7				2	8	4	3	3
2	*Myrmeleotettix maculatus*										1	1			6	1	4
2	*Stenobothrus nigromaculatus*												1				
2	*Chorthippus albomarginatus*										1		1	1	1	1	1
3	*Chorthippus parallelus*						4	7									
3	*Chorthippus biguttulus*						1	5	2								
4	*Chorthippus parallelus*						7	10	3			2	5	3		3	
4	*Chorthippus biguttulus*							13	2								
4	*Chorthippus montanus*						1										
4	*Chorthippus mollis*												3	1		1	
4	*Metrioptera roeselii*													1			
4	*Chorthippus albomarginatus*													4			1
4	*Chorthippus dorsatus*												4	1	3	1	1
5	*Chorthippus parallelus*					4		6	4					1			
5	*Chorthippus biguttulus*							1	1				1				
5	*Chorthippus dorsatus*								1								
5	*Chorthippus brunneus*														1		
6	*Chorthippus parallelus*						7	15	9				1				
6	*Chorthippus albomarginatus*													1	1		
10	*Omocestus viridulus*					3											
10	*Chorthippus dorsatus*					2	7	4	1								
10	*Chorthippus montanus*					3	18	7	6								
10	*Metrioptera roeselii*															3	1
11	*Chorthippus dorsatus*					2	4	2	3								
11	*Chorthippus montanus*					1	4	8	5								
11	*Acrydium subulatum*							1									
11	*Chorthippus parallelus*														1		1
11	*Chorthippus albomarginatus*												2			2	
12	*Chorthippus montanus*					3	7	10	12								
12	*Chorthippus dorsatus*						5	4	5								
12	*Omocestus viridulus*						1										
12	*Tetrix subulata*									1							
12	*Chorthippus parallelus*												1				
12	*Chorthippus montanus*													1			
12	*Metrioptera roeselii*													1			
12	*Metrioptera brachyptera*													2		1	
12	*Chorthippus dorsatus*													1			

Plot #	Auchenorrhyncha	12.05.51	27.06.51	02.07.51	19.07.51	06.08.51	21.08.51	21.09.51	04.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
1	*Acanthodelphax spinosa*															1	1	4	1						
1	*Arthaldeus pascuellus*								1			10	8	10	9							2	1	2	1
1	*Athysanus argentarius*											1	1					2	1						
1	*Balclutha punctata*											1	1	1	1	1	1	12	7			2	0	1	0
1	*Cercopis vulnerata*									2	2														
1	*Cicadula* spec., female											5	5	1	1							1	1	1	0
1	*Dicranotropis hamata*									1	0	2	1					1	1						
1	*Dikraneura variata*											1	1												
1	*Doratura exilis*		4	7	48	10	9																		
1	*Doratura stylata*															2	2	6	2						
1	*Errastunus ocellaris*									43	14	3	2	1	1	2	0	5	4	1	1			2	2
1	*Eupteryx notata*						1																		
1	*Eurybregma nigrolineata*									2	1														
1	*Forcipata forcipata*					1																			
1	*Grypotes puncticollis*																	1	0						
1	*Jassargus pseudocellaris*			4			2			25	7	27	7	43	29	3	3	2	0	19	7	14	2	9	6
1	*Javesella pellucida*			1												12	8	55	33						
1	*Macrosteles sexnotatus*			1														1	0						
1	*Macrosteles* spec., female							3																	
1	*Mocydia crocea*									1	1													2	1
1	*Mocydiopsis parvicauda*									1	1													1	0
1	*Neophilaenus minor*		396	257	214	134	224	46	20									1	0						
1	*Psammotettix alienus*																					5	2	2	2
1	*Psammotettix excisus*	36	106	104	36	7	47	27	13																
1	*Psammottetix confinis*							1		1	0	2	1					6	3					2	1
1	*Rhopalopyx preyssleri*																	2	0						
1	*Rhopalopyx vitripennis*											1	1			1	1			1	0	1	0		
1	*Rhytistylus proceps*					1																			
1	*Ribautodelphax albostriata*															1	1	4	0						
1	*Ribautodelphax vinealis*		3	1																					
1	*Stenocranus minutus*																							3	0
1	*Xanthodelphax straminea*									2	2	1	1			1	1	5	4						
1	*Zyginidia scutellaris*													1	0							15	2	18	8

Plot #	Auchenorrhyncha	11.05.51	23.05.51	06.06.51	27.06.51	02.07.51	19.07.51	06.08.51	21.08.51	21.09.51	04.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
2	*Anaceratagallia* spec., female																	2	2							1	1
2	*Anoscopus flavostriatus*																			1	1						
2	*Aphrodes bicincta*															3	0	1	0								
2	*Arocephalus longiceps*																			2	0					1	1
2	*Arocephalus punctum*													1	0	11	0	20	1	51	23	4	2	4	0	1	0
2	*Arthaldeus pascuellus*					1	4			2	3			6	2												
2	*Balclutha punctata*																	1	1					1	1		
2	*Cicadula quadrinotata*																									5	2
2	*Deltocephalus pulicaris*						2																	1	0		
2	*Doratura exilis*				2	2	3	2																			
2	*Doratura homophyla*				7	14	40	20	2	1	1																
2	*Doratura stylata*													3	1	1	0	5	2	4	1						
2	*Eupelix cuspidata*			3	1							1	0														
2	*Eupteryx cyclops*													1	0					1	0						
2	*Eupteryx notata*							1			1																
2	*Euscelis incisus*																	1	1			1	1				
2	*Jassargus pseudocellaris*					2	1	3		3	4	5	1	18	7	22	8	2	1	1	0	3	2	6	0	5	4
2	*Javesella pellucida*		9				1	9	9									3	3			1	1				
2	*Kosswigianella exigua*	4	1	5		24	158	210	21			33	12	1	0	2	2	187	86	53	11	2	1	1	1		
2	*Macrosteles sexnotatus*									1												1	1				
2	*Megadelphax sordidula*					1																					
2	*Megadelphax sordidula*											1	0														
2	*Mocydiopsis spec.,* female										2																
2	*Muellerianella fairmairei*					3																					
2	*Neophilaenus minor*			1	199	121	141	143	178	99	47			5	3	11	6	38	16	31	14	32	17	30	18	30	12
2	*Notus flavipennis*			2																							
2	*Psammotettix albomarginatus*			30	89	84	22	22	48	69	22																
2	*Psammotettix alienus*															2	1										
2	*Psammotettix confinis*							1	1	1	2	1	0			1	0			5	3	5	3	6	1	2	0
2	*Rhopalopyx vitripennis*													6	3	2	2							3	0	9	3
2	*Rhytistylus proceps*						5											3	0								
2	*Ribautodelphax vinealis*				2	1	1	91	27																		
2	*Streptanus aemulans*															1	1										
2	*Streptanus confinis*															2	2										
2	*Zyginidia scutellaris*																	1	1					1	0	9	7

Plot #	Auchenorrhyncha	11.05.51	23.05.51	06.06.51	27.06.51	10.07.51	19.07.51	06.08.51	21.08.51	30.08.51	21.09.51	04.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
3	*Javesella pellucida*	123	21				31	434	53	18			14	1	1	0			123	64	63	31	6	5	7	3		
3	*Euscelis incisus*	4		1		1	9	38	18	16	11	9							2	1	1	1	1	0	1	0		
3	*Megadelphax sordidula*		8		12	2		161	145	32			1	1											2	2		
3	*Graphocraerus ventralis*			4	3	5	1	1																				
3	*Philaenus spumarius*				2	10	2	2		2					1	0							1	0				
3	*Arthaldeus pascuellus*				42	45	39	3	15	35	89	89			13	3	15	3	4	4	3	2	37	12	83	34	26	18
3	*Jassargus pseudocellaris*				28	13	18	7	9	24	77	63											1	0				
3	*Deltocephalus pulicaris*				6	8	2	5		2	33	16			5	2	2	0	7	1	12	3	50	6	56	24	17	8
3	*Errastunus ocellaris*				7	13	2			2	4	6																
3	*Psammotettix confinis*				2	1		2		7	16	4			5	3	1	0	10	6	15	8	25	13	47	17	21	9
3	*Cicadula persimilis*				2	2	6	1	2	1	1	1																
3	*Athysanus argentarius*					10	18	8	20	1																		
3	*Macrosteles* spec., female								3		3	4																
3	*Macrosteles laevis*										1	1			6	3	5	4	11	3	5	3	29	7	62	25	2	1
3	*Eupteryx notata*				1					1																		
3	*Muellerianella fairmairei*				1																							
3	*Megophthalmus scanicus*					1	5												1	0								
3	*Neophilaenus minor*						1																					
3	*Aphrodes bicincta*							3	1																			
3	*Conosanus obsoletus*								1																			
3	*Psammotettix alienus*																		6	3			7	2	7	5	1	0
3	*Macrosteles sexnotatus*												2	1	43	18	5	4	6	2	17	9	25	7	20	9	8	5
3	*Xanthodelphax straminea*																		1	1					2	1		
3	*Javesella dubia*												3	1					3	0	1	0	2	0				
3	*Streptanus sordidus*																1	0										
3	*Macrosteles viridigriseus*														4	2	5	4			2	1	23	6	9	3	2	1
3	*Javesella forcipata*																				2	1						
3	*Conomelus anceps*																				1	1						
3	*Rhopalopyx vitripennis*																						1	0				
3	*Balclutha punctata*												2	2														
3	*Dikraneura variata*																								1	1		
3	*Laodelphax striatella*																								2	1		
3	*Arocephalus longiceps*																								1	0		
3	*Typhlocyba* spec.														2	0									1	1		
3	*Zyginidia scutellaris*														3	1	1	1	2	0	1	0	2	1	9	4		

Plot #	Auchenorrhyncha	12.05.51	23.05.51	06.06.51	27.06.51	10.07.51	19.07.51	16.08.51	30.08.51	21.09.51	17.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
4	*Acanthodelphax spinosa*								1									1	0								
4	*Alebra coryli*															1	1										
4	*Arocephalus longiceps*																			4	1			1	0	2	1
4	*Arthaldeus pascuellus*				5	3	2		9	35	20	2	0	1	1	5	3	6	6	13	4	109	64	85	53	156	123
4	*Athysanus argentarius*				1	1	3	4	3																		
4	*Balclutha punctata*											3	3	1	1			4	4	7	3			2	1		
4	*Cicadula persimilis*				5	2	2	3		6	4			2	1	7	4	2	2					9	3	4	2
4	*Cicadula quadrinotata*													1	0												
4	*Deltocephalus pulicaris*				1	3			2	40	9							2	1	8	0	5	0	2	2	1	0
4	*Doratura stylata*						1		1																		
4	*Elymana sulphurella*							9																			
4	*Errastunus ocellaris*				1				2	9	7											1	0	1	0	1	0
4	*Eupteryx notata*								6	5	2																
4	*Euscelis incisus*	2	8	1	3	6	9	59	95	23	18							1	1					1	1		
4	*Forcipata forcipata*									1																	
4	*Graphocraerus ventralis*				5	3	1																				
4	*Hesium domino*													3	0												
4	*Jassargus pseudocellaris*				28	8	2	2	15	104	35															2	2
4	*Javesella dubia*											1	0					1	0	2	0						
4	*Javesella pellucida*	27	13	1			20	44	14			6	2					47	26	19	16	14	9	5	2		
4	*Macrosteles laevis*									1	1			4	3	1	1	12	7	13	6	7	3			5	5
4	*Macrosteles sexnotatus*													3	2			3	2	24	12	19	10			5	5
4	*Macrosteles* spec., female									4	3																
4	*Macrosteles viridigriseus*															3	2	10	2	5	2	10	7	1	0	4	4
4	*Megadelphax sordidula*	1	180	43	13			323	98	1																	
4	*Neophilaenus minor*				1		2																			1	1
4	*Philaenus spumarius*				4		3			1																	
4	*Psammotettix albomarginatus*						2					1	0														
4	*Psammotettix confinis*									9	2			1	1	1	1	11	4	35	18	24	13	19	9	23	11
4	*Rhopalopyx preyssleri*									3																	
4	*Stenocranus major*																			1	1						
4	*Stenocranus minutus*													1	1											1	1
4	*Turrutus socialis*											1	0														
4	*Xanthodelphax straminea*											1	0					3	0	3	1	9	6	4	4	1	0
4	*Zyginidia scutellaris*											1	0	3	1	7	2	9	5	6	4	15	6	40	15	66	39

Plot #	Auchenorrhyncha	12.05.51	23.05.51	05.06.51	10.07.51	19.07.51	06.08.51	30.08.51	21.09.51	04.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
5	*Acanthodelphax spinosa*	6				56	8	2																		
5	*Agallia brachyptera*																		1	1						
5	*Aphrodes bicincta*						1			1																
5	*Arthaldeus pascuellus*				13	12		2	24	6			2	1	4	4	3	1			3	2	2	1	27	5
5	*Athysanus argentarius*				1	5		2													1	1				
5	*Balclutha punctata*																2	1			1	0				
5	*Cercopis vulnerata*										7	0														
5	*Cicadula persimilis*				1				1	1			1	1	2	2							1	1	2	1
5	*Deltocephalus pulicaris*				32	6		1	23	13																
5	*Dicranotropis hamata*										2	2	2	2	1	1	1	1	18	12	2	1				
5	*Elymana sulphurella*					11	1	1	2																	
5	*Empoasca decipiens*																5	4	2	2	1	0	1	0	1	1
5	*Errastunus ocellaris*												3	1	2	2	1	1			1	0	1	0	5	4
5	*Eupteryx aurata*																1	1	1	1	1	0				
5	*Eupteryx cyclops*												2	2	2	2	1	1			1	1				
5	*Eupteryx notata*								1																	
5	*Euscelis incisus*		2	2	5	6	24	22	26	6																
5	*Evacanthus interruptus*														1	0	8	2	3	3						
5	*Forcipata forcipata*									1																
5	*Graphocraerus ventralis*				2										1	1										
5	*Jassargus pseudocellaris*				30	27	1	7	94	29													1	0		
5	*Javesella pellucida*	130	14	41		9	113	9									9	5	24	13	1	1				
5	*Macrosteles laevis*								1	1							1	0								
5	*Macrosteles sexnotatus*																				4	3	1	0		
5	*Macrosteles spec.,* female				2			2	5	3																
5	*Macrosteles viridigriseus*				1																					
5	*Megadelphax sordidula*		6	21	1		163	34																		
5	*Megamelus notula*							1																		
5	*Megophthalmus scanicus*				1	1																				
5	*Neophilaenus minor*				1																					
5	*Oncopsis tristis*												1	0												
5	*Philaenus spumarius*				5	6	1								2	1	1	0	2	1	1	1	1	0	1	1
5	*Psammotettix confinis*				3	2		1	13	7											1	1				
5	*Ribautodelphax* spec., female																		1	1						
5	*Stenocranus minutus*																								1	0
5	*Zyginidia scutellaris*																1	0			1	0	1	0	4	1

Plot #	Auchenorrhyncha	12.05.51		05.06.51	27.06.51	10.07.51	19.07.51	31.07.51	16.08.51	30.08.51	21.09.51	17.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
6	*Anoscopus serratulae*								1																			
6	*Aphrodes bicincta*								1																			
6	*Arthaldeus pascuellus*					1	2	1		3	32	25			8	3	1	1			6	5	36	19	63	35	21	10
6	*Athysanus argentarius*						12		3																			
6	*Balclutha punctata*																		1	1	1	1						
6	*Cicadula persimilis*					1		1	1		2				3	0	1	0										
6	*Deltocephalus pulicaris*							1	1	16	16	11			4	1					4	0	18	1	26	6	12	5
6	*Dicranotropis hamata*																				1	1						
6	*Doratura stylata*									1																		
6	*Elymana sulphurella*								1																			
6	*Emelyanoviana mollicula*																										1	0
6	*Errastunus ocellaris*				2	9	6	1			86	38			1	0	1	1	1	1	1	0	8	3	5	3	12	6
6	*Eupteryx aurata*																		1	0								
6	*Eupteryx notata*										1																	
6	*Euscelis incisus*												1	1			2	0	12	2	13	4	6	5	3	3	2	1
6	*Florodelphax leptosoma*										1																	
6	*Forcipata forcipata*				1																							
6	*Graphocraerus ventralis*				4	10	3	3																				
6	*Jassargus pseudocellaris*								1																			
6	*Javesella obscurella*																				1	0						
6	*Javesella pellucida*	4		9	4		9	14	47	16			6	3					45	24	55	29	5	4	3	2		
6	*Macrosteles laevis*				1					1									5	1	4	2	6	2	5	3	1	0
6	*Macrosteles sexnotatus*				1								2	0	1	0	2	2	1	0	1	0	1	0			4	2
6	*Macrosteles* spec., female									2	4	9																
6	*Macrosteles viridigriseus*									1																		
6	*Megadelphax sordidula*					1		19	99	26	4																	
6	*Neophilaenus minor*				1																							
6	*Philaenus spumarius*							2																				
6	*Psammotettix albomarginatus*									1																		
6	*Psammotettix alienus*																				2	1					1	0
6	*Psammotettix confinis*									1	1	2			1	0			1	0	12	6	12	5	2	0	21	8
6	*Streptanus aemulans*																										2	0
6	*Streptanus sordidus*											1																
6	*Zyginidia scutellaris*																1	1					1	0	2	2	1	1

Plot #	Auchenorrhyncha	11.05.51	22.05.51	06.06.51	27.06.51	19.07.51	06.08.51	21.08.51	30.08.51	21.09.51	04.10.51	19.05.09 ♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
10	*Acanthodelphax spinosa*	2				8	2	1																		
10	*Agallia brachyptera*									1	1															
10	*Anoscopus flavostriatus*							1																		
10	*Aphrodes bicincta*					1	9	1																		
10	*Arthaldeus pascuellus*				2	279	30	27	25	700	467		69	69	28	25			3	2	45	21	16	4	65	50
10	*Athysanus argentarius*					2		2	1																	
10	*Balclutha punctata*																1	0								
10	*Cicadella viridis*								1		1												2	0	1	0
10	*Cicadula flori*												16	5	3	2									7	2
10	*Cicadula quadrinotata*				8	15	2	6	7	37	20		28	12	3	3	1	1							5	5
10	*Conomelus anceps*					34	7	3		1																
10	*Conosanus obsoletus*					1		6	1	2																
10	*Deltocephalus pulicaris*					79	3	2		175	85				1	1			1	0	1	1			1	0
10	*Elymana sulphurella*					33	37	23	9		1															
10	*Errastunus ocellaris*												6	5	2	1			8	3	5	2	2	0	4	2
10	*Eupteryx vittata*																								2	2
10	*Euscelis incisus*												1	1					4	2			2	2	1	1
10	*Florodelphax leptosoma*					10		1																		
10	*Forcipata forcipata*					24	5	2	39	12																
10	*Graphocraerus ventralis*												1	0												
10	*Jassargus pseudocellaris*				2	94	10	6	14	10	3															
10	*Javesella dubia*												2	2			1	1			4	4				
10	*Javesella pellucida*	28	10	8		25	172	112	23						2	2	65	36	28	13	2	1	1	1	1	1
10	*Kelisia guttula*									1																
10	*Kelisia punctulum*																		1	0						
10	*Laodelphax striatella*																		1	1						
10	*Macrosteles laevis*																				1	0	2	1		
10	*Macrosteles septemnotatus*					1																				
10	*Macrosteles sexnotatus*										1						1	0	1	1	8	3	1	0	15	8
10	*Macrosteles* spec., female									3	3															
10	*Macrosteles viridigriseus*																				1	0				
10	*Megadelphax sordidula*			1									4	4	2	2			20	13			1	0		
10	*Megamelus notula*				1	14	2	6	3	20	12															
10	*Megophthalmus scanicus*					14	1	4			1				1	0	1	0								
10	*Muellerianella fairmairei*					96	10	5	9	298	130										5	3				
10	*Neophilaenus lineatus*						4	5	2																	
10	*Notus flavipennis*								3	1			3	3	1	0			3	2					7	5

Plot #	Auchenorrhyncha	11.05.51	22.05.51	06.06.51	27.06.51		19.07.51	06.08.51	21.08.51	30.08.51	21.09.51	04.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
10	*Philaenus spumarius*				16		71	79	91	45	5	1					1	1			1	1			2	1		
10	*Psammotettix alienus*																		3	2	1	0	1	1			4	2
10	*Psammotettix confinis*											1									1	1						
10	*Ribautodelphax albostriata*																		1	1								
10	*Stenocranus major*																										1	1
10	*Streptanus sordidus*						1				1																1	1
10	*Xanthodelphax straminea*																1	1										
10	*Zyginidia scutellaris*														2	1	1	1			1	0	1	0	5	5	11	4

Plot #	Auchenorrhyncha	11.05.51	22.05.51	06.06.51		10.07.51	19.07.51	06.08.51	16.08.51	30.08.51	21.09.51	04.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
11	*Agallia brachyptera*									1																		
11	*Anoscopus flavostriatus*							1		1																		
11	*Anoscopus flavostriatus*																		1	1	1	1						
11	*Anoscopus serratulae*																				7	7						
11	*Aphrodes bicincta*						1	2		3																		
11	*Arthaldeus pascuellus*					268	113	34	3	11	484	298			205	180	198	181	21	20	2	2	13	8	28	15	61	43
11	*Athysanus argentarius*					3																						
11	*Balclutha punctata*												1	1														
11	*Florodelphax paryphasma*									1																		
11	*Cercopis vulnerata*														1	0												
11	*Cicadella viridis*							2	1																			
11	*Cicadula persimilis*														6	5	1	0							2	1	1	1
11	*Cicadula quadrinotata*					8	7	2	3	1	48	30																
11	*Cixius nervorsus*												1	0														
11	*Conomelus anceps*						1	1	1		2	5																
11	*Deltocephalus pulicaris*					15	8	3			6	20																
11	*Dicranotropis hamata*																		2	1	2	1	1	1	1	1		
11	*Elymana sulphurella*								1	1																		
11	*Errastunus ocellaris*														6	4	20	15	3	3	1	0	11	8	5	4	2	2

Plot #	Auchenorrhyncha	11.05.51	22.05.51	06.06.51	10.07.51	19.07.51	06.08.51	16.08.51	30.08.51	21.09.51	04.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
11	*Eupteryx calcarata*													2	2												
11	*Eupteryx florida*																									1	1
11	*Eupteryx vittata*				1																						
11	*Euscelis incisus*						1	1								3	1			2	0	1	1				
11	*Florodelphax leptosoma*										1																
11	*Forcipata forcipata*									2	5																
11	*Graphocraerus ventralis*													1	1	1	1	4	4								
11	*Jassargus pseudocellaris*									3																	
11	*Javesella pellucida*	30	13	3		59	260	75	10			5	1					21	14	11	10						
11	*Macrosteles laevis*				1																						
11	*Macrosteles sexnotatus*									2																	
11	*Macrosteles* spec., female				1					2								1	1					1	1	4	4
11	*Macrosteles viridigriseus*				1	1																					
11	*Megadelphax sordidula*							1	1			5	3							7	2	3	2				
11	*Megamelus notula*				8	3	2	2	3	46	11																
11	*Megophthalmus scanicus*					1																					
11	*Muellerianella fairmairei*				64	11	9	7	1	24	11																
11	*Neophilaenus lineatus*					1																					
11	*Notus flavipennis*								2		3																
11	*Philaenus spumarius*				184	222	96	65	42	9	3			1	0			1	1	1	1	1	0				
11	*Psammotettix albomarginatus*								1																		
11	*Psammotettix confinis*																					1	1	1	1		
11	*Stenocranus major*																									1	1
11	*Streptanus sordidus*				1																						
11	*Stroggylocephalus agrestis*							1																			
11	*Zyginidia scutellaris*											4	3	3	2	4	1	1	1	1	0			15	6	19	15

Plot #	Auchenorrhyncha	22.05.51	06.06.51	27.06.51	10.07.51	31.07.51	16.08.51	30.08.51	21.09.51	04.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
12	*Acanthodelphax spinosa*	43				172	55	7																		
12	*Agallia brachyptera*								1																	
12	*Anoscopus albostriatus*																				2	2				
12	*Anoscopus flavostriatus*					1	1																			
12	*Aphrodes bicincta*					8	5		1																	
12	*Arthaldeus pascuellus*			2	5	25	8	15	63	28			53	50	88	74	1	1	12	3	47	17	17	14	6	5
12	*Athysanus argentarius*				2	9	2	2																		
12	*Athysanus quadrum*					2	3																			
12	*Balclutha punctata*																1	1								
12	*Cercopis vulnerata*										3	0	2	0												
12	*Chloriona sicula*																		4	3						
12	*Chloriona smaragdula*												3	2												
12	*Cicadella viridis*				5	1	3	2	16	5					1	0	1	0			1	1	1	1		
12	*Cicadula persimilis*																2	1								
12	*Cicadula quadrinotata*			3	6	4	3	5	20	15			3	1	1	1							4	2	14	7
12	*Conomelus anceps*					9	1	3	2	2									1	0					1	0
12	*Conosanus obsoletus*					12	11	4	2	3																
12	*Deltocephalus pulicaris*														5	0	1	1	1	1	4	3	2	1	7	3
12	*Dicranotropis hamata*										2	2														
12	*Doratura stylata*						1	1																		
12	*Elymana sulphurella*					122	53	25	11	4																
12	*Euides basilinea*												1	0					1	0	1	0				
12	*Eupelix cuspidata*														1	1										
12	*Euscelis incisus*																4	1								
12	*Florodelphax leptosoma*	10			1	8	3	3	374	124																
12	*Forcipata forcipata*					1	8	79	13	16																
12	*Jassargus pseudocellaris*			51	20	124	38	111	211	142			1	1												

Plot #	Auchenorrhyncha	22.05.51	06.06.51	27.06.51	10.07.51	31.07.51	16.08.51	30.08.51	21.09.51	04.10.51	19.05.09	♀	15.06.09	♀	24.06.09	♀	16.07.09	♀	01.08.09	♀	18.08.09	♀	01.09.09	♀	21.09.09	♀
12	*Javesella dubia*																1	1	1	0			1	1		
12	*Javesella pellucida*	14	4			126	147	18			1	0					99	67	57	34	5	3	1	0		
12	*Kelisia punctulum*																				2	1				
12	*Kelisia ribauti*				2	1	4		2																	
12	*Macrosteles sexnotatus*					1	2	1					8	2	34	18	20	10	14	5	28	9	16	9	65	24
12	*Macrosteles* spec., female			4			6	4							6	4	5	2	3	1	4	1	5	3	6	4
12	*Macrosteles viridigriseus*							1	3																	
12	*Megadelphax sordidula*														1	1										
12	*Megamelus notula*								1																	
12	*Megophthalmus scanicus*					7	1								1	0										
12	*Muellerianella fairmairei*				4	3	5	21	186	62							3	3					2	2	3	3
12	*Neophilaenus lineatus*					38	29	30	14	8																
12	*Notus flavipennis*							1																		
12	*Paradelphacodes paludosa*							9																		
12	*Philaenus spumarius*			4	16	56	42	45	6	6																
12	*Psammotettix confinis*																		1	0						
12	*Ribautodelphax* spec., female																1	1								
12	*Stenocranus major*												1	1							1	1	2	2		
12	*Streptanus sordidus*								2	1																
12	*Stroggylocephalus agrestis*						1	1																		
12	*Zyginidia scutellaris*														1	0	11	3	6	4	3	2	19	7	2	0

Plot #	Heteroptera	12.05.1951	27.06.1951	02.07.1951	19.07.1951	06.08.1951	21.08.1951	21.09.1951	04.10.1951
1	*Trigonotylus ruficornis*		11	12	1	11	10		
1	*Amblytylus albidus*				40	10	2		
1	*Nysius thymi*				1	3	10	1	
1	*Trigonotylus pulchellus*					58	30		
1	*Nysius ericae*					5	11	6	
1	*Chorosoma schillingii*					7	9	4	1
1	*Lopus decolor*				1				
1	*Raglius quadratus*				1				
1	*Stenodema virens*					4			
1	*Rhopalus parumpunctatus*					1			
1	*Nysius senecionis*					1	1		
1	*Nabis ferus*						1		
1	*Carpocoris fuscispinus*						1		
1	*Lygus rugulipennis*								1
1									
1									
1									
1									
1									
1									
1									

		19.05.2009	♀	15.06.2009	♀	24.06.2009	♀	16.07.2009	♀	01.08.2009	♀	18.08.2009	♀	01.09.2009	♀	21.09.2009	♀
	Aelia acuminata	9	6	2	0	1	1			2	1					2	0
	Capsus ater	1	1			2	0										
	Cymus melanocephalus	1	1														
	Nabis pseudoferus	3	0			4	1			10	8			7	3	4	3
	Notostira elongata	1	1	7	5	20	15	4	4	4	2	10	5	5	3	7	6
	Stenodema calcarata	1	1			2	1			3	2	1	1				
	Stenodema laevigata	3	3			1	1	2	1	5	0	1	1				
	Amplytylus nasutus			46	10	16	6										
	Leptopterna dolobrata			5	2	4	1										
	Leptopterna ferrugata			2	2	2	2										
	Megaloceroea recticornis			12	2	9	2										
	Myrmus miriformis			4	2	3	2	1	1	2	0	3	2	4	2	2	2
	Pithanus maerkelii			2	2	1	1										
	Stenotus binotatus			5	1	5	1										
	Nabis flavomarginata					1	1	1	1	1	1	1	0				
	Neottiglossa pusilla					1	0			2	1						
	Eurygaster maurea							1	0								
	Lygus rugulipennis							1	1								
	Nabis ferus							1	0								
	Acalypta parvula									2	1						
	Syromastus rhombeus									1	1						
	Trigonotylus caelestialium									10	5						
	Nysius ericae															1	1

Plot #	Heteroptera	11.05.1951	23.05.1951	06.06.1951	27.06.1951	02.07.1951	19.07.1951	06.08.1951	21.08.1951	21.09.1951	04.10.1951
2	*Nabis pseudoferus*		1								
2	*Stenodema laevigata*		1								
2	*Acetropis carinata*				14	33					
2	*Leptopterna ferrugata*				16	8	5				
2	*Trigonotylus ruficornis*				33	49	10	1	9		
2	*Notostira elongata*					1				1	1
2	*Lopus decolor*						14	1	1		
2	*Myrmus miriformis*						2	3	2	3	
2	*Chorosoma schillingii*						1	1	4	3	
2	*Trigonatylus pulchellus*							17	14		
2	*Stenodema calcarata*							1	6		
2	*Nysius thymi*								1		
2	*Nabis ferus*								1		1
2	*Dictyonata tricornis*									1	
2	*Lygus pubescens*									3	2
2											
2											
2											
2											
2											
2											
2											

		19.05.2009	♀	15.06.2009	♀	24.06.2009	♀	16.07.2009	♀	01.08.2009	♀	18.08.2009	♀	01.09.2009	♀	21.09.2009	♀
	Dolycoris baccarum	1	0														
	Kleidocerys resedae	2	2														
	Aelia acuminata	4	4							3	1	1	0				
	Aelia klugii	1	0			3	2	1	1	1	1	2	2				
	Nabis pseudoferus	2	1					1	1					2	1		
	Leptopterna dolobrata			2	0												
	Leptopterna ferrugata			2	2	6	6										
	Myrmus miriformis			10	8	1	0	11	6	7	6	7	5	8	3	1	1
	Amblytylus nasutus			2	2												
	Acetropis carinata			1	1												
	Stenodema calcarata					4	2	7	3	1	0	2	1				
	Notostira elongata					1	0									1	1
	Megaloceroea recticornis					1	0										
	Plagiognathus chrysanthemi					1	1	1	1								
	Stenodema laevigata							11	4								
	Chorosoma schillingii							1	1	3	3	3	1	1	1	1	0
	Pterotmetus staphyliniformis							1	1	1	0						
	Lopus decolor							1	1	1	1						
	Lygus gemellatus									1	0						
	Trigonotylus caelestialium									1	0	1	0				
	Nabis ferus													2	1		
	Nysius ericae													1	1	3	3
	Acalypta parvula															1	0

Plot #	Heteroptera	11.05.1951	23.05.1951	06.06.1951	27.06.1951	02.07.1951	19.07.1951	06.08.1951	21.08.1951	30.08.1951	21.09.1951	04.10.1951
3	*Pachybrachius fracticollis*	1										
3	*Notostira elongata*		1		11	17	23	2	4	7	39	14
3	*Pithanus maerkelii*				1							
3	*Nabis ferus*							1	4	3	2	
3	*Orthops kalmii*								1			
3	*Stenodema laevigata*								3	1		
3	*Nabis pseudoferus*								1	1		
3	*Trigonotylus ruficornis*								1	1		
3	*Stygnocoris rusticus*									1		
3												
3												

		19.05.2009	♀	15.06.2009	♀	24.06.2009	♀	16.07.2009	♀	01.08.2009	♀	18.08.2009	♀	01.09.2009	♀	21.09.2009	♀
	Stenodema calcarata	1	0	1	0	2	1	1	0								
	Notostira elongata	1	1	3	0	6	3	5	5			7	5	23	11	3	2
	Dolycoris baccarum	1	0														
	Aelia acuminata	1	0														
	Nabis pseudoferus	2	1			2	1										
	Stenodema laevigata	1	1														
	Nabis ferus							1	0					1	0		
	Trigonotylus caelestialium							3	2	4	2	4	0	7	2		
	Closterotomus norwegicus							1	0								
	Plagiognathus arbustorum							2	1								
	Lygus pratensis											1	1				

Plot #	Heteroptera	12.05.1951	05.06.1951	27.06.1951	10.07.1951	19.07.1951	31.08.1951	16.08.1951	30.08.1951	21.09.1951	17.10.1951
6	*Stenodema calcarata*	2									
6	*Nabis ferus*	1	4								
6	*Nabis pseudoferus*		1								
6	*Notostira elongata*			1	2					1	4
6	*Plagiognathus chrysanthemi*				1	3	14	3			
6	*Orthops campestris*					1	1	2			
6	*Orthocephalus saltator*						1				
6	*Adelphocoris seticornis*						2	6			
6	*Lygus pratensis*						1	1			
6	*Orthops kalmii*						1		1		
6	*Lygus rugulipennis*							2			
6	*Polymerus unifasciatus*							1			
6	*Cymus glandicolor*				1						
6	*Phytocoris varipes*							1			

		19.05.2009	♀	15.06.2009	♀	24.06.2009	♀	16.07.2009	♀	01.08.2009	♀	18.08.2009	♀	01.09.2009	♀	21.09.2009	♀
	Stenodema calcarata	3	3	1	1					3	2						
	Stenodema laevigata	1	1														
	Notostira elongata			1	0	4	2	3	3	4	3	10	2	7	5	2	1
	Amblytylus nasutus			1	1												
	Nabis ferus					1	0										
	Lygus pratensis							1	0								
	Trigonotylus caelestialium							8	7	19	9	1	1				
	Nabis pseudoferus											1	1				

Plot #	Heteroptera	12.05.1951	23.05.1951	06.06.1951	27.06.1951	10.07.1951	19.07.1951	16.08.1951	30.08.1951	21.09.1951	17.10.1951
4	*Notostira elongata*	2			17	30	10		11	40	40
4	*Nabis ferus*		1								
4	*Catoplatus fabricii*		2		1						
4	*Peritrechus geniculatus*			1							
4	*Chlamydatus pulicarius*				2						
4	*Plagiognathus chrysanthemi*					12	16	3		2	
4	*Lygus rugulipennis*					2					1
4	*Adelphocoris lineolatus*							1			
4	*Stenodema calcarata*							2			
4	*Nabis pseudoferus*							1			
4	*Orthops kalmii*										1
4	*Cymus glandicolor*				1						
4	*Nabis flavomarginatus*						1				
4	*Trigonotylus ruficornis*							1			
4	*Acetropis carinata*									1	
4											
4											
4											
4											
4											
4											
4											
4											
4											
4											
4											
4											

Plot #	Heteroptera	19.05.2009	♀	15.06.2009	♀	24.06.2009	♀	16.07.2009	♀	01.08.2009	♀	18.08.2009	♀	01.09.2009	♀	21.09.2009	♀
4	*Eurygaster testudinaria*	1	1	1	1					1	0						
4	*Stenodema leavigata*	7	7	1	1			12	6	16	8						
4	*Amblytylus nasutus*			6	3	4	2										
4	*Capsus ater*			1	1	3	2	1	1								
4	*Leptopterna dolobrata*			2	2												
4	*Liorhyssus hyalinus*			1	0												
4	*Lygus pratensis*			1	0			10	0	5	0	1	1	6	4	5	3
4	*Notostira elongata*			4	0	3	2	3	1	6	4	38	22	21	14	49	37
4	*Stenodema calcarata*			8	3	6	4	1	0	11	5	2	0	1	0		
4	*Trigonotylus caelestialium*			2	0	1	1	3	0	6	1						
4	*Megaloceroea recticornis*					1	0										
4	*Dolycoris baccarum*							1	1								
4	*Himacerus mirmicoides*							1		2							
4	*Nabis ferus*							2	0					2	2		
4	*Nabis pseudoferus*							4	0	6	1			2	2	7	5
4	*Eurygaster maura*									1	0						
4	*Aelia acuminata*									2	1	1	0				
4	*Carpocoris fuscispinus*											1	0				
4	*Coreus marginatus*							1				1	0	1	1		
4	*Stictopleurus punctatonervosus*							1	1	1	0	2	0	2	1	4	2
4	*Chlamydatus pullus*							1	0								
4	*Compsidolon salicellum*							1	1								
4	*Plagiognathus chrysanthemi*							3	0	1	1						
4	*Lygus rugulipennis*							1	0	1	0	11	5	3	3	9	4
4	*Lygus gemellatus*							3	3	1	0						
4	*Rhopalus parumpunctatus*									2	0	1	0				

Plot #	Heteroptera	12.05.1951	23.05.1951	06.06.1951	27.06.1951	10.07.1951	19.07.1951	06.08.1951	30.08.1951	21.09.1951	04.10.1951		19.05.2009	♀	15.06.2009	♀	24.06.2009	♀	16.07.2009	♀	01.08.2009	♀	18.08.2009	♀	01.09.2009	♀	21.09.2009	♀
5	*Notistira erratica*	2				14	36	6	21	51	45	*Drymus sylvaticus*	1	0														
5	*Catoplatus fabricii*			6								*Tingis ampliata*	1	0														
5	*Plagiognathus chrysanthemii*					87	101	51	3			*Apolygus lucorum*			1	0	1	0	4	3								
5	*Lygus rugulipennis*					1	1	2	1			*Capsus ater*			8	6	3	1										
5	*Stenodema calcarata*						1		1			*Coreus marginatus*			1	1									1	1		
5	*Orthocephalus saltator*							1	1			*Eurygaster testudinaria*			1	1												
5	*Adelphocoris seticornis*							1	5			*Leptopterna dolobrata*			2	1	1	0										
5	*Nabis ferus*							1	2			*Notostira elongata*			2	1	5	4			3	2	2	2			5	4
5	*Nabis pseudoferus*							1	1			*Oncotylus punctipes*			4	1			2	1	2	1						
5	*Lygus pratensis*								1			*Polymerus holosericeus*			1	0												
5	*Monalocoris filicis*					1						*Nabis limbatus*					1	0	5	2	5	3					1	1
5	*Orius majusculus*							1				*Stenodema calcarata*					1	1			1	0						
5												*Lygocoris contaminatus*					1	1										
5												*Adelphocoris quadripunctatus*							6	0	4	3						
5												*Aelia acuminata*							1	1			3	2				
5												*Lygus pratensis*							7	6					3	0		
5												*Himacerus mirmicoides*							5		2							
5												*Megaloceroea recticornis*							1	1								
5												*Stenodema laevigata*							4	3	1	0	1	1				
5												*Stenotus binotatus*							2	2								
5												*Trigonotylus caelestialium*							1	1								
5												*Adelphocoris seticornis*									1	0						
5												*Nabis flavomarginatus*									2	0						
5												*Nabis pseudoferus*	1	1							1	0			1	0	1	1
5												*Dolycoris baccarum*											1	0				
5												*Picromerus bidens*											2	0	1	0		
5												*Lygus rugulipennis*													3	1		
5												*Holcostethus vernalis*															1	1
5												*Kleidocerys resedae*															1	0
5												*Stictopleurus punctatonervosus*															2	0
5												*Charagochilus gyllenhallii*							2	1	2	2	4	3	4	3		
5												*Criocoris crassicornis*							2	2	2	2						
5												*Plagiognathus arbustorum*							2	1								
5												*Plagiognathus chrysanthemi*							7	5	3	2						
5												*Megalocoleus tanaceti*							8	3	9	9						
5												*Phytocoris varipes*							1	0								
5												*Stynocoris rusticus*									1	1						

Plot #	Heteroptera	11.05.1951	22.05.1951	06.06.1951	27.06.1951	19.07.1951	06.08.1951	21.08.1951	30.08.1951	21.09.1951	04.10.1951
10	*Acompus rufipes*	2		1							
10	*Nabis flavomarginatus*					1	1	4	6		
10	*Stenodema laevigata*							6	3		
10	*Stenodema calcarata*							2	2		
10	*Nabis ferus*							4	13		
10	*Nabis pseudoferus*								3		
10	*Notostira elongata*									2	
10											
10											
10											
10											
10											
10											
10											
10											
10											

Plot #	Heteroptera	19.05.2009	♀	15.06.2009	♀	24.06.2009	♀	16.07.2009	♀	01.08.2009	♀	18.08.2009	♀	01.09.2009	♀	21.09.2009	♀
10	*Amblytylus nasutus*			27	12	29	14										
10	*Capsus ater*			4	0	7	1										
10	*Leptopterna dolobrata*			7	5	4	3										
10	*Megaloceroea recticornis*			17	10	12	9										
10	*Nabis flavomarginatus*					2	0										
10	*Notostira elongata*			7	6	14	9	2	2	3	1	7	3	17	6	24	13
10	*Stenodema calcarata*			5	3	24	18					1	0				
10	*Stenotus binotatus*			51	32	30	27										
10	*Stenodema laevigata*			1	1							1	1				
10	*Trigonotylus caelestialium*			1	0			5	0	9	6	4	2	5	2	1	0
10	*Nabis ferus*							1	0			2	0			6	3
10	*Lygus pratensis*							1	0	1	0					1	0
10	*Dolycoris baccarum*											1	1				
10	*Nabis pseudoferus*													1	1	4	2
10	*Teratocoris paludum*			1	0												
10	*Plagiognathus chrysanthemi*					2	2										

Plot #	Heteroptera	11.05.1951	22.05.1951	06.06.1951	10.07.1951	19.07.1951	06.08.1951	16.08.1951	30.08.1951	21.09.1951	04.10.1951
11	*Stenodema laevigata*		1								
11	*Stenodema calcarata*		1			1	1	1			
11	*Nabis flavomarginatus*						7	2	8		
11	*Trigonotylus ruficornis*							2			
11	*Nabis ferus*							1	4	1	
11	*Nabis pseudoferus*								6		1
11											
11											
11											
11											
11											
11											
11											
11											
11											
11											
11											
11											
11											
11											

Plot #	Heteroptera	19.05.2009	♀	15.06.2009	♀	24.06.2009	♀	16.07.2009	♀	01.08.2009	♀	18.08.2009	♀	01.09.2009	♀	21.09.2009	♀
11	*Nabis ferus*	1	0					1	1								
11	*Stenodema calcarata*	2	2	10	5	24	11										
11	*Stenodema laevigata*	3	3					16	7	5	2						
11	*Amblytylus nasutus*			37	12	50	29										
11	*Capsus ater*			2	0	1	1										
11	*Drymus sylvaticus*			1	0												
11	*Leptopterna dolobrata*			24	7	18	8	1	1								
11	*Megaloceroea recticornis*			3	0	12	4	2	2								
11	*Nabis flavomarginatus*			1		2	1			2	0						
11	*Notostira elongata*			2	2	7	4	5	2			2	0			2	1
11	*Stenotus binotatus*			2	0	6	0										
11	*Tingis ampliata*			1	0												
11	*Adelphocoris quadripunctatus*									1	1						
11	*Aelia acuminata*									1	0						
11	*Dictyla humuli*									3	1						
11	*Nabis pseudoferus*									1	0	1	0				
11	*Plagiognathus arbustorum*					1	0										
11	*Criocoris crassicornis*									1	0						
11	*Charagochilus gyllenhallii*									1	1						

Plot #	Heteroptera	23.05.1951	06.06.1951	27.06.1951	10.07.1951	19.07.1951	06.08.1951	16.08.1951	30.08.1951	21.09.1951	04.10.1951
12	*Serenthia laeta*	4	2	5			22	9	10	1	1
12	*Pachybrachius luridus*		5								
12	*Cymus glandicolor*		4				1	4			
12	*Leptopterna ferrugata*			1							
12	*Leptopterna dolobrata*			1	1						
12	*Notostira elongata*			1	5	1			1	3	
12	*Stenotus binotatus*				4						
12	*Capsus ater*				2						
12	*Polymerus palustris*				1						
12	*Megaloceroea recticornis*				2						
12	*Plagiognathus chrysanthemi*				2	1					
12	*Nabis flavomarginatus*				2				2		
12	*Stenodema calcarata*					1			1	1	
12	*Nabis ferus*								3		
12	*Nabis pseudoferus*								4	1	
12	*Piesma capitatum*						1				
12	*Anthocoris confusus*	1									
12	*Acalypta parvula*						1				
12	*Nabis ericetorum*								1		
12	*Nysius ericae*								1		
12	*Orthops kalmii*								1		
12	*Lygus pratensis*									1	
12	*Thyreocoris scarabaeoides*										1

Plot #	Heteroptera	19.05.2009	♀	15.06.2009	♀	24.06.2009	♀	16.07.2009	♀	01.08.2009	♀	18.08.2009	♀	01.09.2009	♀	21.09.2009	♀
12	*Eurygaster testudinaria*	1	0														
12	*Amblytylus nasutus*			19	10	24	9										
12	*Capsus ater*			3	0	3	0										
12	*Leptopterna dolobrata*			6	3												
12	*Megaloceroea recticornis*			1	0												
12	*Stenodema calcarata*			5	4	2	0	2	1	1	1			4	1		
12	*Stenotus binotatus*			3	1	4	1										
12	*Nabis ferus*							1	0	2	1			11	3	1	0
12	*Stenodema laevigata*							2	2	16	8	8	5				
12	*Trigonotylus caelestialium*							5	1	5	4	1	1	1	1		
12	*Lygus pratensis*									1	0						
12	*Nabis pseudoferus*									2	1			2	1		
12	*Myrmus miriformis*									1	0						
12	*Notostira elongata*											1	1	4	3		
12	*Nabis rugosus*	1	1									6	4				
12	*Lygus rugulipennis*													1	0		

Site #	XII	XI	X	IV	V	VI	I	II	III
Mean Ellenberg IV reaction	6.7	6.5	6.2	6.7	7.2	6.5	5.3	4.6	6.2
Mean Ellenberg IV nutrients	6.1	6.7	5.8	7.0	6.6	6.5	5.2	3.5	6.2
Mean Ellenberg IV moisture	7.9	6.0	6.8	5.7	5.6	5.6	4.6	3.5	5.6
Date	14.9.2009	19.5.2009	14.9.2009	19.5.2009	14.9.2009	19.5.2009	19.5.2009	19.5.2009	19.5.2009
RelevÚ area (m²)	16	16	16	16	16	16	16	16	16
Cover herb layer (%)	100	100	100	75	100	100	98	60	100
Cover moss layer (%)	0	0	0	0	0	0	0	10	0
Cover litter layer (%)	0	0	0	0	0	0	0	0	0
Aver. height (high) herbs (cm)	90	120	50	40	70	90	45	30	80
Aver. height lowest herbs (cm)	0	0	0	0	0	0	0	0	0
Maximum height herbs (cm)	130	160	80	90	140	140	70	60	140
Longitude	9.1045064	9.1180730	9.1041684	9.0761769	9.0794116	9.1048336	9.1238880	9.1098547	9.0715528
Latitude	52.4845803	52.5237089	52.4905679	52.5213262	52.5078598	52.5456498	52.5399731	52.4924166	52.5021554
Phragmites australis	68.0		0.1						
Glyceria fluitans	1.0		1.0						
Deschampsia cespitosa	0.1		0.1						
Agrostis stolonifera	0.1		0.1						
Phalaris arundinacea	8.0		8.0	1.0					
Filipendula ulmaria		0.1	1.0						
Ranunculus repens			8.0	2.0		0.1			
Equisetum palustre	0.1	1.0	0.1						
Taraxacum Sec. Alpina; Hamata et Ruderalia						0.1	0.1		0.1
Lolium perenne			1.0	0.1					8.0
Vicia cracca	1.0				0.1	1.0	1.0		
Stellaria media				1.0		1.0			
Plantago major				1.0					1.0
Urtica dioica	0.1	0.1		1.0	1.0	1.0			
Galium mollugo		18.0	1.0		8.0	0.1			
Alopecurus pratensis		38.0	18.0	18.0		38.0			38.0
Holcus lanatus	8.0	0.1	8.0			0.1	8.0		0.1
Glechoma hederacea	1.0	1.0			8.0	0.1			
Elymus repens			0.1	18.0	18.0		18.0	0.1	
Dactylis glomerata		1.0		1.0	0.1	0.1	0.1		0.1
Poa trivialis		0.1	8.0	8.0	0.1	38.0			18.0
Arrhenatherum elatius		18.0			8.0	8.0	0.1	1.0	
Bellis perennis				1.0		1.0			
Cirsium arvense		1.0			18.0				
Veronica serpyllifolia						0.1			0.1
Potentilla reptans					0.1	0.1			
Trifolium repens				0.1		0.1			8.0
Anthriscus sylvestris					1.0	1.0			
Rumex acetosa									1.0
Rumex crispus		1.0			0.1				
Cerastium holosteoides			0.1	0.1		1.0	0.1		0.1
Plantago lanceolata				1.0			0.1		
Bromus hordeaceus							8.0		0.1
Poa pratensis				0.1			8.0		0.1

Site #	XII	XI	X	IV	V	VI	I	II	III
Capsella bursa-pastoris							0.1		
Agrostis capillaris							8.0	0.1	
Festuca rubra							18.0	1.0	
Achillea millefolium					0.1	0.1	0.1	1.0	
Quercus robur					0.1			1.0	
Corynephorus canescens							1.0	8.0	
Festuca ovina							0.1	18.0	
Carex acutiformis									
Lolium multiflorum									
Scirpus sylvaticus									
Festuca pratensis			1.0						
Juncus conglomeratus			8.0						
Lathyrus pratensis			1.0						
Galium aparine		0.1							
Vicia sepium		1.0							
Symphytum officinale		1.0							
Alliaria petiolata				1.0					
Carduus crispus				1.0					
Matricaria discoidea				0.1					
Polygonum aviculare				0.1					
Prunus avium				0.1					
Rumex obtusifolius				1.0					
Senecio erraticus				0.1					
Geranium dissectum						1.0			
Heracleum sphondylium						1.0			
Lamium album						1.0			
Trifolium campestre						0.1			
Convolvulus arvensis									1.0
Anthriscus sylvestris									0.1
Triticum aestivum									0.1
Artemisia vulgaris					1.0				
Sanguisorba officinalis					8.0				
Tanacetum vulgare					0.1				
Crepis biennis									
Veronica verna									
Bromus sterilis							1.0		
Cerastium semidecandrum							0.1		
Stellaria holostea							1.0		
Verbascum thapsus							0.1		
Calluna vulgaris								1.0	
Campanula rotundifolia								1.0	
Hieracium pilosella								8.0	
Hypericum perforatum								1.0	
Jasione montana								0.1	
Leontodon autumnalis								0.1	
Poa compressa								0.1	
Erophila verna								1.0	
Rumex acetosella								8.0	
Gemarkung	-	LEESE	-	STOLZENAU	STOLZENAU	LANDESBERGEN	LANDESBERGEN	LEESE	STOLZENAU
Flur	-	010	-	003	007	016	014	002	008
Flurstücknummer	-	00054/002	-	00010/003	00004/008	00035/004	00007/004	00265/001	00082/003

Schiemenz's and Schuch's data

Data listed in the following order: Species/abundance list of Auchenorrhyncha, and relevés.

#10a, Geesower Hügel bei Gartz/Oder	11.09.1963	14.06.1964	31.07.1964	03.10.1964	15.05.2009	♀	27.07.2009	♀	18.09.2009	♀
Anaceratagallia ribauti				-1					2	1
Anoscopus albifrons				-1						
Aphrodes bicincta			2							
Arocephalus languidus	2	101	11	14	40	10	10	9	3	2
Artianus interstitialis							8	5	1	1
Athysanus argentarius				-1						
Chlorita paolii	10	16	111	101	1	0	3	1	7	7
Dikraneura variata	1	6	2	13						
Doratura homophyla	4	125	17							
Doratura stylata	1	2	37				2	0		
Elymana sulphurella							1	1		
Emelyanoviana mollicula		5		2					5	5
Empoasca pteridis				28						
Eupteryx atropunctata				26						
Eupteryx melissae									1	1
Euscelis incisus			1							
Graphocraerus ventralis		4								
Javesella pellucida							5	2		
Kosswigianella exigua			4							
Laburrus impictifrons	8		89	2			6	2	5	5
Macrosteles spec., female	4		2							
Megadelphax sordidula					2	2	2	2		
Mocydia crocea				1					1	0
Muirodelphax aubei			50							
Neophilaenus campestris		19	12	2					1	1
Neophilaenus minor	12	65	64	3						
Psammotettix alienus			1	15	3	2	1	1		
Psammotettix confinis	47	6		52	1	0				
Psammotettix helvolus					9	5				
Rhopalopyx vitripennis	21	79		25						
Stenocranus major									1	1
Turrutus socialis	21	89	10	15	49	12	14	5	2	2
Zygina hyperici					1	0				
Zyginidia scutellaris									33	9

#10b, Geesower Hügel bei Gartz/Oder	11.09.1963	14.06.1964	31.07.1964	03.10.1964	15.05.2009	♀	29.07.2009	♀	17.09.2009	♀
Adarrus multinotatus	101	27	2	21	3	2			7	3
Agallia brachyptera									1	1
Allygidius commutatus			1							
Anoscopus albifrons			-1							
Arocephalus languidus	2									
Athysanus argentarius	5		2							
Balclutha punctata							1	1		
Chlorita paolii				6	2	1	1	1	1	1
Cicadula flori		3								
Doratura homophyla				2						
Doratura stylata			83	4						
Elymana sulphurella	2									
Emelyanoviana mollicula	13	10	6		12	5	1	0	22	9
Empoasca pteridis			1	85						
Errastunus ocellaris	1									
Erythria aureola	12									
Eupteryx atropunctata		1		63						
Eupteryx thoulessi									1	1
Euscelis incisus	1									
Gargara genistae			7							
Graphocraerus ventralis		2								
Macrosteles laevis		2								
Mocydia crocea	85	2	23	30					2	1
Muirodelphax aubei			4							
Neoaliturus fenestratus									10	2
Neophilaenus campestris	4	17	16				4	3	1	0
Oncopsis carpini					1	1				
Philaenus spumarius	2		1							
Psammotettix alienus	7			3						
Psammotettix spec., female					1	1				
Rhopalopyx vitripennis					1	0				
Ribautodelphax albostriata			2							
Ribautodelphax pungens			37							
Ribautodelphax spec.							1	1		
Stenocranus major									3	1
Stenocranus minutus	6			2						
Turrutus socialis		2			6	2				
Zygina schneideri									1	1
Zyginidia scutellaris									21	12

#12, Kanonenberg bei Niederfinow	12.09.1963	15.06.1964	31.07.1964	04.10.1964	11.07.2008	♀	11.09.2008	♀	15.05.2009	♀	29.07.2009	♀	16.09.2009	♀
Adarrus multinotatus	4				1	1	3	1					20	13
Anaceratagallia ribauti									1	1				
Aphrodes bicincta			2				1	1						
Arocephalus languidus	65	97	10	31	14	8			2	0	9	2	15	10
Artianus interstitialis			2		4	3	2	2			4	3	1	1
Chlorita paolii	2		117	25										
Cicadula persimilis													1	0
Cicadula quadrinotata	5													
Dictyophara europaea													1	0
Doratura homophyla				2										
Doratura stylata			3		6	3	2	2			6	4	1	1
Elymana sulphurella											1	1		
Empoasca pteridis				8										
Errastunus ocellaris									2	0	2	0	5	4
Eupteryx atropunctata				3							1	1		
Eurysula lurida							-1							
Euscelis incisus	1		45											
Fiebierella spec., female											-1			
Jassargus pseudocellaris	3						26	14						
Jassidaeus lugubris							-1							
Javesella pellucida											3	2		
Kosswigianella exigua									1	1				
Laburrus impictifrons	2													
Lepyrona coleoptrata					1	1								
Macropsidius sahlbergi			1											
Macrosteles laevis	11			10										
Mirabella albifrons					3	3								
Mocydia crocea							1	0	1	1	2	0		
Muirodelphax aubei		2	9											
Neoaliturus fenestratus				2			6	1					1	0
Neophilaenus campestris	4			6			1	1						
Neophilaenus minor			2	2										
Philaenus spumarius	1				1	1								
Pinumius areatus	219	310	35	73										
Psammotettix alienus	19		5	27			6	6					4	1
Psammotettix confinis	37	4	21	171										
Psammotettix helvolus													2	1
Psammotettix nodosus				20										
Rhopalopyx adumbrata							-1							
Rhopalopyx vitripennis		6		6			25	12			2	1	6	4
Ribautodelphax pungens					1	1					7	7		
Stenocranus major													1	1
Stenocranus minutus													10	6
Turrutus socialis	31	14	4	6	5	1	25	22	3	0	6	2	30	26
Xanthodelphax flaveola			4											
Zygina hyperici													1	1
Zygina schneideri					1	1								
Zyginidia scutellaris							83	35					124	37

#13a, Granitberg bei Neuenhagen	11.09.1963	15.06.1964	31.07.1964	04.10.1964	11.07.2008	♀	11.09.2008	♀	15.05.2009	♀	29.07.2009	♀	17.09.2009	♀
Anaceratagallia frisia			4	2										
Anaceratagallia venosa							1	0			1	1	1	0
Arocephalus languidus	16	6	29	51			3	3	5	2	10	2	17	5
Artianus interstitialis							1	1						
Chlorita paolii	10			8	5	4	43	21	14	6	40	33	29	17
Doratura stylata	4		61	4	1	1								
Elymana sulphurella											1	1		
Empoasca decipiens				1										
Empoasca pteridis				80										
Eupteryx atropunctata				2										
Euscelis incisus			3											
Jassidaeus lugubris				1										
Javesella pellucida					2	2					3	3		
Kosswigianella exigua											2	0		
Laburrus impictifrons	4		2		3	1	2	2			6	4	2	1
Macrosteles laevis	42						1	1						
Micantulina stigmatipennis					1	1					1	0		
Mocuellus collinus							1	1						
Mocydia crocea	7													
Muirodelphax aubei					23	14	1	1	5	3	126	58		
Neoaliturus fenestratus	20						2	2						
Neophilaenus campestris				2									2	1
Neophilaenus minor	25	2	16	21	2	1	8	6			2	1	13	7
Psammotettix alienus	17		1	3			16	7			1	0	45	34
Psammotettix confinis	87	2		27			15	8			1	0		
Psammotettix excisus							1	1			1	0		
Psammotettix helvolus											2	1	6	5
Psammotettix kolosvarensis									2	1	1	0		
Psammotettix nodosus	34			4										
Psammotettix pallidinervis	12													
Rhopalopyx vitripennis	17	8		61			2	1					5	1
Rhytistylus proceps			6	2										
Turrutus socialis	113	15		47	4	4	16	13	11	3	35	7	31	21
Zygina hyperici									2	2			2	2
Zyginidia scutellaris							388	135					1097	395

#13c, Granitberg bei Neuenhagen	15.06.1964	08.06.1966	25.07.1966	11.09.1966	11.07.2008	♀	11.09.2008	♀	15.05.2009	♀	29.07.2009	♀	17.09.2009	♀
Artianus interstitialis											1	1		
Balclutha punctata							1	0						
Chlorita paolii			6	6			18	8	2	2	17	17	75	60
Doratura exilis							6	5			2	1		
Doratura homophyla							2	2			8	3		
Doratura stylata	46		59	34										
Empoasca pteridis													3	2
Errastunus ocellaris		1												
Eupelix cuspidata		2												
Eupteryx notata			2	8										
Eurysa lineata									1	0				
Javesella pellucida			3		1	1								
Kosswigianella exigua		69	213	16							4	0		
Laburrus impictifrons				2	1	1	1	0			3	1	3	3
Laodelphax striatella											2	2	1	1
Macrosteles laevis	1			79	1	1	36	27	2	1	4	4	47	26
Macrosteles quadripunctatulus									2	1	1	1		
Muirodelphax aubei			6		2	1			2	2	29	15		
Neoaliturus fenestratus			2	4			4	2	1	1			2	0
Neophilaenus campestris							1	0					1	1
Neophilaenus minor	291	4	148	65	9	2	11	4			11	8	21	10
Ophiola decumana									1	0	3	1	1	1
Psammotettix alienus				21			34	18			3	2	98	60
Psammotettix cephalotes											1	0		
Psammotettix confinis	2			15			68	32	21	6	57	23	59	40
Psammotettix excisus	86	506		671			27	14	35	12	101	15	41	28
Psammotettix helvolus									5	3	1	0	13	8
Psammotettix nodosus		6												
Psammotettix pallidinervis	37	77	13	41										
Rhopalopyx vitripennis	53	2		50			4	3					5	4
Rhytistylus proceps			29	7	1	0								
Turrutus socialis	41	2									5	0	2	1
Zygina hyperici									4	2			7	4
Zyginidia scutellaris							80	32			1	1	168	84

#15a, Wollenberg bei Carzig	06.06.1965	25.07.1965	03.10.1965	10.07.2008	♀	10.09.2008	♀	14.05.2009	♀	30.07.2009	♀	16.09.2009	♀
Arboridia parvula				-1		-1							
Arocephalus languidus			6			2	0	2	1	18	5	4	1
Arocephalus longiceps								1	1				
Artinanus interstitialis				1	1								
Chlorita paolii	9	37	115					2	0	5	4	50	25
Cicadula spec., female												1	1
Dictyophara europeae				1	0								
Dikraneura variata			1										
Doratura stylata		9	4	1	0								
Emelyanoviana mollicula								1	1				
Empoasca pteridis			8										
Eupteryx atropunctata	2		21										
Eupteryx notata			2										
Jassidaeus lugubris			1										
Javesella pellucida		7								2	1		
Kosswigianella exigua		2								8	3		
Laburrus impictifrons		4								7	7	5	5
Macresteles laevis			6			1	0					3	1
Mocydia crocea				1	0								
Muirodelphax aubei		137		2	2			15	10	92	37		
Neoaliturus fenestratus			5										
Neophilaenus campestris			4									2	2
Neophilaenus minor		4											
Pinumius areatus	3		13										
Psammotettix alienus		1	61			26	12	2	1	2	2	33	20
Psammotettix confinis			37			12	6						
Psammotettix helvolus						5	2	42	12	4	3	34	16
Psammotettix nodosus		2											
Rhopalopyx vitripennis			6			4	1					10	3
Stenocranus fuscovittatus			1										
Stenocranus major												4	4
Stenocranus minutus												1	0
Tettigometra virescens				1	0								
Turrutus socialis	2	7	76	2	2	25	16	19	7	24	6	8	6
Zygina hyperici								11	7	2	1		
Zyginidia scutellaris						84	22					896	479

#15b, Wollenberg bei Carzig	06.06.1965	25.07.1965	03.10.1965	10.07.2008	♀	10.09.2008	♀	14.05.2009	♀	30.07.2009	♀	16.09.2009	♀
Adarrus multinotatus		4	23										
Anaceratagallia ribauti		-1											
Aphrodes bicincta				-1									
Arocephalus languidus						1	0			2	0	2	0
Arthaldeus pascuellus		1											
Arthaldeus striifrons												1	0
Artianus interstitialis				12	5	2	1			10	8	2	2
Athysanus argentarius						1	1						
Chlorita paolii	4	5	171									4	3
Cicadella viridis												3	0
Cicadula persimilis												2	1
Deltocephalus pulicaris												1	0
Ditropsis flavipes										1	0		
Doratura stylata			2	12	4	1	1			5	5		
Elymana sulphurella										1	0		
Emelyanoviana mollicula	2	2	6					2	2	1	0	3	1
Empoasca pteridis			16							4	4	2	1
Eupteryx atropunctata			9										
Eupteryx tenella			6										
Euscelis incisus										3	1	1	0
Hardya tenuis										1	1		
Javesella pellucida										12	9		
Macrosteles laevis			8									7	1
Megadelphax sordidula										2	2		
Mocydia crocea	3		63	1	0	3	1	1	1	1	1	1	1
Muirodelphax aubei		23		7	5			4	3	4	3		
Neoaliturus fenestratus			4			4	2					1	0
Neophilaenus minor			2										
Psammotettix alienus		1	14			13	7			1	1	10	6
Psammotettix cephalotes												1	0
Psammotettix confinis						3	1						
Psammotettix excisus								1	0				
Psammotettix helvolus				2	2	39	19	9	2	5	3	6	5
Rhopalopyx vitripennis			2			6	5					1	0
Ribautodelphax pungens		49		2	1					3	2		
Stenocranus major												2	0
Stenocranus minutus												1	1
Streptanus aemulans												2	0
Turrutus socialis	4		17	16	12	119	73	5	1	68	31	50	23
Zygina hyperici								1	1			1	0
Zyginidia scutellaris						126	30					327	135

#16b, Priesterschlucht bei Podelzig	25.07.1966"	11.09.1966"	10.07.2008	♀	10.09.2008	♀	14.05.2009	♀	29.07.2009	♀	16.09.2009	♀
Anaceratagallia venosa		4	1	1			1	1			2	1
Arocephalus languidus		29			1	0	1	0	4	2	19	8
Arocephalus longiceps									3	0	4	2
Artianus interstitialis			4	2					4	3	2	2
Balcanocerus larvatus			1	1								
Balclutha punctata											2	0
Chlorita paolii	6	22	8	5	22	8	29	18	29	18	183	86
Cicadula persemilis			1	1								
Deltocephalus pulicarus											1	0
Doratura stylata	2	2	3	2								
Elymana sulphurella											1	1
Emelyanoviana mollicula		25										
Empoasca pteridis		1									2	1
Eupelix cuspidata							1	0				
Euscelidius schenckii			1	1								
Euscelis incisus			1	0	1	1						
Javesella pellucida	8								15	11		
Kosswigianella exigua							2	1	9	6		
Laburrus impictifrons	14	12	9	2	3	3			9	8	2	2
Laodelphax striatella									5	3		
Macrosteles laevis		9									2	1
Macrosteles sexnotatus									2	1		
Megadelphax sordidula							5	3	1	1		
Muirodelphax aubei	55		3	3					9	8		
Neoaliturus fenestratus									1	0	29	8
Neophilaenus minor	21	13	97	42	22	11			41	21	56	22
Psammotettix alienus		9			8	3	1	1	3	2	23	13
Psammotettix confinis		20			15	10	2	0	12	7	57	42
Psammotettix excisus		36									4	2
Psammotettix helvolus							10	2	18	8	18	13
Rhopalopyx vitripennis		24			6	2	1	0			59	23
Ribautodelphax albostriatus			1	1			1	1	1	0		
Turrutus socialis		41			2	1	28	5	43	18	23	17
Zygina hyperici											1	1
Zygina schneideri											1	1
Zyginidia scutellaris					104	38	1	1	1	1	1600	805

#17, Oderberge bei Lebus	06.06.1965	25.07.1965	03.10.1965	08.06.1966	25.07.1966	11.09.1966	10.07.2008	♀	10.09.2008	♀	14.05.2009	♀	30.07.2009	♀	16.09.2009	♀	16.09.2009[2]	♀
Allygidius atomarius		4		2														
Anaceratagallia venosa		4	2	11		22			1	1								
Aphrodes bicincta		18	2		4													
Arboridia parvula					1	2												
Arocephalus languidus		30	29	16	6	209	1	1					1	0				
Arocephalus punctum		2																
Artianus interstitialis							5	3	1	1			3	3	1	1		
Balclutha punctata											1	0						
Chlorita dumosa					4	2												
Chlorita paolii	351	102	75	59	131	260			2	2	2	2	13	9	26	19	42	26
Dicranotropis divergens				1														
Dictyophara europaea					4								4	0				
Dikraneura variata						1												
Doratura homophyla		2																
Doratura stylata		16			7													
Elymana sulphurella					1													
Emelyanoviana mollicula	53	1	13	85	37	143												
Empoasca pteridis			4			2									1	0		
Erythria aureola	9	19	111	152	6	435												
Eupelix cuspidata	4																	
Eupteryx atropunctata		1	2			1												
Eupteryx notata	2																	
Euscelis incisus		1			2	2	2	0										
Graphocraerus ventralis				2														
Hardya tenuis									1	1								
Jassidaeus lugubris						2												
Javesella pellucida		1			117		1	1					4	2				
Kosswigianella exigua		17			35	2												
Laburrus impictifrons		77	8		62	15												
Macrosteles laevis			4	5	3	49							1	1				
Macrosteles quadripunctulatus						1												
Mocydia crocea							1	0	1	1							4	2
Muirodelphax aubei	8	157		18	181	20							2	2				
Neoaliturus fenestratus		2	2		6	9	5	4	4	0					1	0	1	0
Neophilaenus campestris	2					2												
Neophilaenus exclamationis						7												
Neophilaenus minor		137	4		35	2												
Philaenus spumarius		11	4		2								1	0				
Psammotettix alienus			3		2	17			11	5			2	1	4	3	4	2
Psammotettix confinis			4	5	2	161												
Psammotettix excisus						4												
Psammotettix helvolus									3	1	4	2			4	2	3	2
Psammotettix kolosvarensis									1	1								
Rhopalopyx vitripennis		7	79	9		71											1	1
Turrutus socialis	2	121	155	152	45	568	11	11	15	9	27	8	10	2	27	14	29	16
Zygina hyperici											1	1			1	1	1	1
Zygina schneideri															1	1		
Zyginidia scutellaris									140	47					97	34	93	47

#18, Groß Machnower Weinberg	12.06.1964	27.07.1964	29.09.1964	22.07.1965	12.07.2009	♀	28.07.2009	♀	15.09.2009	♀
Arocephalus punctum				1						
Balclutha punctata							47	18	15	6
Chlorita paolii									1	0
Doratura homophyla		7	1							
Doratura impudica		3								
Doratura stylata	20	8	4	2			1	1		
Elymana sulphurella							1	0		
Empoasca affinis			14							
Empoasca decipiens			2							
Empoasca pteridis		6	52							
Errastunus ocellaris									1	1
Hardya tenuis									6	3
Hyledelphax elegantula							1	1	1	1
Jassargus allobrogicus							7	9		
Jassargus flori	4	15	4				8	4	2	0
Javesella pellucida					1	0				
Macrosteles laevis	1		3							
Macrosteles laevis									1	0
Neoaliturus fenestratus									1	0
Neophilaenus minor	29	11	25	17						
Psammotettix alienus			21	2			2	1	5	5
Psammotettix angulatus	2	1								
Psammotettix confinis		13	85							
Psammotettix excisus			13		12	8	7	7	5	3
Psammotettix nodosus			1	4						
Rhopalopyx vitripennis	2		4	2						
Rhytistylus proceps				4						
Zyginidia scutellaris									4	2
Zyginidia viaduensis	21		6							

#26, Badraer Lehde	15.07.1964	25.08.1964	16.07.1965	13.08.1965	09.10.1965	30.05.1966	13.07.2008	♀	02.09.2008	♀	20.05.2009	♀	21.07.2009	♀	25.09.2009	♀	05.06.2010	♀	01.08.2010	♀	22.09.2010	♀
Anaceratagallia ribauti					2																	
Anaceratagallia venosa	12		4	33	2								3	0					2	1		
Aphrodes bicincta		1			1																	
Arboridia parvula	1								62	41			6	1	13	7			19	12	32	21
Arboridia simillima													7	1								
Arocephalus languidus	26		2	10	8																	
Artianus interstitialis							1	0														
Batracomorphus irroratus																			1	1		
Cercopis sanguinolenta			3			39											3	2				
Chlorita paolii	17	5		12		6									1	0	1	0			1	0
Cixus cambricus		1																				
Dictyophara europaea		1			1																	
Dikraneura variata									2	1					1	1					1	1
Doratura horvathi																			2	1		
Doratura stylata	2	4	14	9																		
Emelyanoviana mollicula	1			6	11	55					2	1	1	1	1	1	3	0				
Empoasca pteridis					4																	
Eupelix cuspidata		1			2	1									2	0						
Eupteryx atropunctata						2																
Eupteryx notata						2																
Euscelis incisus	6	5	1		2																	
Graphocraerus ventralis						2																
Hardyia signifer	6	5		6	7		1	0	11	4	5	5	12	4	12	3	4	4			4	1
Jassargus obtusivalvis		2		3													1	1	2	2		
Jassargus pseudocellaris	1		3	3																		
Javesella pellucida				2																		
Kelisia haupti				12	4		2	0	1	1			14	6	4	4			2	2	8	2
Kosswigianella exigua			2										2	1								
Laburrus impictifrons		4		5	1																	
Macropsis megerli													1	1					3	0		
Mendrausus pauxillus	9	10	4	7																		
Mocydia crocea									1	1									2	0	1	0
Mocydiopsis longicauda	3	4	2	3																		
Muirodelphax aubei	2		4	1		9																
Neoaliturus fenestratus	2				2		3	2	5	2			1	0	2	0	3	3	5	3	1	0
Neophilaenus campestris							12	6	2	1			1	1								
Neophilaenus infumatus	41	8											2	2					1	1	1	1
Neophilaenus minor	178	129	125	75	13		14	7	12	5			49	25	7	2			7	3	9	5
Philaenus spumarius		2																				
Platymetopius major			1																			
Psammotettix alienus		6		2					1	1					2	0			2	1	4	3
Psammotettix cephalotes							1	1	2	2	1	0			2	1	6	3			3	1
Psammotettix confinis		17			4																	
Psammotettix helvolus		295	2	7	15	11			8	7	2	1	1	1	2	2			2	1	12	9
Rhopalopyx vitripennis	9		2	2	19										1	1						
Rhytistylus proceps	2	3	1	2									2	0								
Ribautodelphax collina							1	0														
Thamnotettix dilutior																			1	1		
Turrutus socialis	75	8	41	8	18	17	1	1	3	2	2	1	2	2			3	3				
Zyginidia scutellaris									2	0					12	9					26	13

#27, Großer Eller bei Badra	15.07.1964	26.08.1964	08.06.1965	16.07.1965	13.08.1965	09.10.1965	13.07.2008	♀	02.09.2008	♀	20.05.2009	♀	21.07.2009	♀	25.09.2009	♀	05.06.2010	♀	01.08.2010	♀	22.09.2010	♀
Acanthodelphax spinosa													5	2			1	0	5	4		
Adarrus multinotatus															1	1						
Alebra albostriella				1																		
Allygus communis																					1	1
Anaceratagallia ribauti					2	21	2	2	1	0			2	2	5	2			5	5	5	0
Anaceratagallia venosa	6			2																		
Aphrodes bicincta		2		1	11		3	1					1	0					3	1		
Aphrophora alni									1	1									1	1		
Arboridia parvula									2	2			1	0	4	1			1	0		
Arocephalus languidus	2	27		113	37	4			25	11			1	0	2	0			2	0	1	0
Arthaldeus striifrons									1	1												
Artianus interstitialis		2		2	1		2	2					2	1							1	1
Cercopis sanguinolenta			45	2													2	1				
Chlorita paolii	2			4	179	45					2	1	6	4	4	2	2	2	4	4	11	5
Cicadula persimilis									1	1												
Dikraneura variata																	1	0				
Doratura homophyla				4	13								6	2					5	0		
Doratura stylata	171	35		48	60	7	1	0	1	0									1	0	1	1
Emelyanoviana mollicula									1	1												
Empoasca pteridis						3																
Errastunus ocellaris		1							6	1												
Eupelix cuspidata			4			2					1	0									1	0
Eupteryx atropunctata						2																
Eupteryx notata																	1	0				
Euscelis incisus	11	14	1	25	70	8	5	3	3	3			4	3	1	0	1	1	5	3		
Euscelis ohausi													1	0								
Graphocraerus ventralis	2			17	2																	
Jassargus obtusivalvis	1														1	0						
Jassargus pseudocellaris		2																				
Jassidaeus lugubris						3									1	1					4	1
Javesella pellucida		3			34		9	7					5	4					2	2		

#27, Großer Eller bei Badra (continued)	15.07.1964	26.08.1964	08.06.1965	16.07.1965	13.08.1965	09.10.1965	13.07.2008	♀	02.09.2008	♀	20.05.2009	♀	21.07.2009	♀	25.09.2009	♀	05.06.2010	♀	01.08.2010	♀	22.09.2010	♀
Kosswigianella exigua					4		4	4			4	4	12	8								
Macropsis megerlei													1	0			1?	0	1	0		
Macrsoteles laevis																			2	1		
Megophthalmus scanicus													1	0								
Mocuellus collinus	9	26		22	9	4																
Mocydia crocea					2														3	1		
Mocydiopsis longicauda		1			1				1	1									1	0		
Neoaliturus fenestratus		8		2		1	2	1	6	1					14	5			3	1		
Neophilaenus campestris					2		1	0	3	1			1	1					1	0	1	1
Neophilaenus infumatus	37	36		251	115	12							4	3					3	2	1	1
Neophilaenus minor		6		15																		
Oncopsis avellanae																	1	1				
Philaenus spumarius	2	3		12	5																	
Psammotettix alienus		25				1			6	5							3	2	8	3	2	2
Psammotettix confinis		16																				
Psammotettix helvolus		125	26	25	57	33			58	32	121	54	13	4	25	20	6	4	11	8	2	2
Psammotettix kolosvarensis		2																				
Rhopalopyx vitripennis				38		77			29	3			2	1	98	41	8	1	1	0	22	7
Rhytistylus proceps					2																	
Ribautodelphax albostriatus					2																	
Ribautodelphax pungens													1	1								
Ribautodelphax pungens																			2	1		
Stenocranus major									3	2												
Stenocranus minutus																					2	2
Turrutus socialis	51	20	2	285	85	63	15	8	29	10	71	12	9	6	52	45	96	40	15	10	6	5
Zygina hyperici					5	2																
Zyginidia scutellaris																					1	1

#28, Ochsenburg/Kyffhäuser	18.09.1963	12.05.1964	14.07.1964	25.08.1964	08.06.1965	15.07.1965	13.08.1965	09.10.1965	13.07.2008	♀	02.09.2008	♀	20.05.2009	♀	21.07.2009	♀	28.09.2009	♀	05.06.2010	♀	01.08.2010	♀	22.09.2010	♀
Adarrus multinotatus						2																		
Anaceratagallia frisia	25			8	1	15	6	112			6	3					1	1	3	3				
Anaceratagallia venosa			89	7		10	25						5	4	2	1	2	2	3	3			1	0
Arboridia simillima				3		1			1	0					1	0	1	0					1	1
Arboridia velata								1									2	1					1	1
Arocephalus languidus			4			5	4														1	1		
Arocephalus longiceps											1	1					1	1						
Batracomorphus irroratus			2			2																		
Cercopis sanguinolenta													4	0					11	8				
Chlorita dumosa	4		2	1	8	4		4																
Chlorita paolii					2				4	3	1	0	1	0	1	1			2	2				
Cicadetta montana					+																			
Cicadula spec., female																	1	1						
Doratura exilis															2	2								
Doratura horvathi				5																				
Doratura stylata	1		65	2		47	21		3	1														
Emelyanoviana mollicula	11			2			8	21							1	0			2	1				
Empoasca affinis								4			1	0												
Eupelix cuspidata	2		3		2	2			-1		-1													
Eupteryx atropunctata					2																			
Euscelis incisus			1																					
Hardyia signifer	2		8	10	2	11	23	82	3	2	6	2			1	0	7	2	2	2			1	1
Hephathus nanus						2																		
Jassargus flori									-1		-1													
Jassargus obtusivalvis											1	1	15	7			11	9	43	9	1	0		
Javesella Pellucida									8	6					2	1					1	1		
Kelisia haupti							17				2	2			9	0	3	2			1	0	1	1
Kosswigianella exigua		37	6			17	63																	
Laburrus impictifrons			11			8	4		10	4	7	7			26	13	3	3			4	3		
Laburrus pellax															2	1							1	1
Macropsis fuscula							1																	
Macropsis megerlei			1																					
Macrosteles spec., female																							1	1
Micantulina stigmatipennis																			1	0				
Neoaliturus fenestratus	25		5		2	18	42	55			5	2			1	1	1	0	2	2			2	0
Neophilaenus campestris							2				1	0												
Neophilaenus infumatus			2			6																		
Neophilaenus minor	2		6	2		13	10	2	7	2	2	1			9	5					2	1	2	0
Philaenus spumarius															1	1								
Planaphrodes trifasciata			1				2																	
Psammotettix alienus			2	6				8									1	0			1	0	1	0
Psammotettix cephalotes				5		2																		
Psammotettix confinis	14		2	95	5		13	21																
Psammotettix helvolus	33		4	188	6			10			1	1	1	0			2	2	6	5			1	0
Psammotettix pallidinervis			13		9	11	12	13																
Rhopalopyx vitripennis	5		4					8			1	1												
Rhytistylus proceps							1																	
Ribautodelphax pungens						2																		
Turrutus socialis	2																							
Zygina flammigera								2																
Zyginidia mocsaryi			1	23	1	13																		
Zyginidia scutellaris											2	0			1	0	47	33					20	11

#29, Hang über Barbarossahöhle/Kyffhäuser	18.09.1963	14.07.1964	25.08.1964	16.07.1965	13.08.1965	09.10.1965	30.05.1966	13.07.2008	♀	02.09.2008	♀	20.05.2009	♀	21.07.2009	♀	25.09.2009	♀	05.06.2010	♀	01.08.2010	♀	22.09.2010	♀
Adarrus multinotatus	47	4	15	8	11	71	13																
Anaceratagallia venosa		12	13	6	37	2								2	0					1	1	2	2
Anakelisia perspicillata			5																				
Aphrodes bicincta			2																				
Aphrophora alni														1	1					1	1		
Arboridia simillima				1	5	6										2	2					2	2
Arboridia velata																						5	4
Arocephalus languidus	4	33	25	149	47	6																	
Arocephalus longiceps		1	2															1	0				
Cercopis sanguinolenta							15																
Chlorita paolii	2			6	5													1	1	1	0	1	1
Cicadetta montana							+																
Ditropsis flavipes										-1													
Doratura horvathi	2	31	8	27	80																		
Doratura stylata		2																					
Edwardsiana rosae						1																	
Emelyanoviana mollicula	4	1	2		81	17	42					3	0										
Empoasca affinis	2				2	6																	
Empoasca decipiens																						1	0
Empoasca pteridis																						1	0
Eupelix cuspidata						5						1	0									1	0
Fieberiella spec., female														-1									
Gargara genistae								2	1					11	5					3	3	1	1
Goniagnathus brevis																1	0						
Hardyia signifer			1		2	13		4	1	4	2	1	1	5	0	40	21	1	1	2	1	4	1
Jassargus obtusivalvis	1		2			4	6					29	13	1	1	4	3	34	9			7	4
Jassidaeus lugubris						2																	
Javesella pellucida					1			18	8					3	1								

#29, Hang über Barbarossahöhle/Kyffhäuser	18.09.1963	14.07.1964	25.08.1964	16.07.1965	13.08.1965	09.10.1965	30.05.1966	13.07.2008	♀	02.09.2008	♀	20.05.2009	♀	21.07.2009	♀	25.09.2009	♀	05.06.2010	♀	01.08.2010	♀	22.09.2010	♀
Kelisia haupti			11		106	9								2	1								
Kosswigianella exigua				4																			
Macrosteles spec., female										1	1												
Mocydia crocea			2			10	2			1	1					1	0						
Mocydiopsis longicauda	10	2	5		13	2																	
Mocydiopsis parvicauda			1																				
Mocydiopsis spec., female																1	1					1	1
Neophilaenus albipennis				1	9																		
Neophilaenus campestris					2																		
Neophilaenus infumatus																		1	0	1	0		
Neophilaenus minor								3	1	4	2			4	3	6	5			5	3	4	2
Platymetopius major					4																		
Psammotettix alienus	91		3					1	1											4	4	1	1
Psammotettix cephalotes					2		8																
Psammotettix confinis			10					1	1			1	0							1	1		
Psammotettix helvolus			198		5											6	5	1	1				
Rhopalopyx vitripennis	25	2			6	4										8	7	32	9			7	4
Rhytistylus proceps		2			4																		
Ribautodelphax pungens				2	2																		
Thamnotettix confinis																		1	1				
Turrutus socialis	44	9	28	5	20	21	20																
Zygina hyperici										1	1												
Zygina schneideri												1	1							1	1		
Zyginidia mocsaryi							2																
Zyginidia scutellaris								1	1	1	0					37	27					59	34

#30b, Hang westlich Kattenburg	19.09.1963	14.07.1964	26.08.1964	08.06.1965	16.07.1965	13.08.1965	10.10.1965	05.06.2010	♀	01.08.2010	♀	22.09.2010	♀
Adarrus multinotatus	115	75	42	19	65	25	231						
Anaceratagallia venosa		23	4			5	-9	4	4	1	1	1	1
Anoscopus albifrons						-3							
Aphrophora alni					1					1	1		
Arboridia parvula		11	2		6		18						
Arboridia pusilla										5	1	16	12
Arboridia simillima								1	1	9	2	8	6
Arboridia velata										7	2	75	56
Arocephalus languidus		4			3	4		1	0				
Arocephalus longiceps		3						1	0				
Arocephalus punctum						2							
Cercopis sanguinolenta		1		2									
Chlorionidea flava								1	0				
Chlorita paolii						2				1	1		
Dictyophara europaea										1	0		
Diplocolenus bohemani		4			5			1	1				
Doratura horvathi	2	85	8		7	15							
Doratura stylata		12				2							
Elymana sulphurella						3							
Emelyanoviana mollicula	11		5	11	4	83	33	7	5				
Empoasca affinis							6						
Empoasca decipiens										3	2	6	4
Eupelix cuspidata				2			4						
Euscelis distinguendus					1								
Goniagnathus brevis							-1						
Hardyia signifer								2	2	2	0	8	2
Hephathus nanus		3			2	4							
Jassargus obtusivalvis	26	22	33	31	53	10	112						
Jassargus pseudocellaris					1								
Jassidaeus lugubris	2						17						
Javesella pellucida						5				1	1		

#30b, Hang westlich Kattenburg	19.09.1963	14.07.1964	26.08.1964	08.06.1965	16.07.1965	13.08.1965	10.10.1965	05.06.2010	♀	01.08.2010	♀	22.09.2010	♀
Kelisia haupti										3	2	5	3
Laburrus impictifrons										8	5	2	2
Laburrus pellax										2	2	1	1
Macrosteles laevis			2				2						
Mendrausus pauxillus		17	6		2	1							
Mocydia crocea	13	2	6				4						
Mocydiopsis longicauda	5	3	4			4	2						
Mocydiopsis longicauda													
Neoaliturus fenestratus										5	2	3	0
Neophilaenus albipennis		10				3							
Neophilaenus infumatus		12			6	2						4	1
Neophilaenus minor		2	1		2					13	10	4	4
Planaphrodes spec., female								1	0				
Platymetopius major					2								
Platymetopius major													
Psammotettix alienus	8	1	23										
Psammotettix confinis	13		60										
Psammotettix helvolus	12		95	2			2	1	0				
Psammotettix inexpectatus							3						
Rhopalopyx preyssleri		2				1							
Rhopalopyx vitripennis	160	47	2		39	4	54						
Rhopalopyx vitripennis													
Rhytistylus proceps		10	3			2							
Ribautodelphax pungens		55		2	15	9							
Thamnotettix dilutior												1	1
Turrutus socialis	2				2		1						
Zyginidia moksaryi												21	15
Zyginidia scutellaris												47	32

#31, Kosakenstein/Kyffhäuser	19.09.1963	12.05.1964	14.07.1964	26.08.1964	15.07.1965	13.08.1965	10.10.1965	30.05.1966	13.07.2008	♀	02.09.2008	♀	20.05.2009	♀	21.07.2009	♀	25.09.2009	♀	05.06.2010	♀	01.08.2010	♀	22.09.2010	♀
Allygus mixtus							1																	
Anaceratagallia frisia	21	17	33	63	77	23	210	4	3	3	3	2	7	7	5	5	8	5	4	4			3	2
Anaceratagallia venosa			39	4	4	2							1	1	2	2	2	1	2	2			2	1
Aphrophora alni	2																							
Arboridia parvula				1			2				5	2			1	0	1	1			3	2		
Arboridia simillima				1	2								2	1			1	1					3	2
Arboridia velata				2	1		17				2	1											2	1
Arocephalus languidus			4																					
Arocephalus longiceps																	1	1						
Arocephalus punctum						2																		
Artianus interstitialis											1	1												
Balcanocerus larvatus											-1													
Cercopis sanguinolenta								37					5	2					18	12				
Chlorita paolii	123		28	6	45	37	14	45	1	1			4	1	2	1	1	1	2	2	4	3	9	4
Cicadetta montana								+																
Delphacinus mesomelas		2																						
Dictyophara europaea						2															1	0		
Ditropsis flavipes																					1	1		
Doratura stylata			65	14	43	68																		
Edwardsiana rosae								2																
Emelyanoviana mollicula	2					8	11	17					8	2			1	1	2	2				
Empoasca affinis							42																	
Empoasca decipiens							5																	
Empoasca pteridis							18																	
Enantiocephalus cornutus									-1															
Eupelix cuspidata							5		-1		-1													
Eupteryx atropunctata								1																
Eurysa lurida					1																			
Eurysula lineata																			1	1				
Euscelis incisus									1	0					1	0								
Fieberiella macchiae							3																	
Goniagnathus brevis				3			2																	

#31, Kosakenstein/Kyffhäuser	19.09.1963	12.05.1964	14.07.1964	26.08.1964	15.07.1965	13.08.1965	10.10.1965	30.05.1966	13.07.2008	♀	02.09.2008	♀	20.05.2009	♀	21.07.2009	♀	25.09.2009	♀	05.06.2010	♀	01.08.2010	♀	22.09.2010	♀
Hardyia signifer	4		2	3	16	15	71				3	2	7	7	2	1	8	2	2	2	1	0	6	3
Issus coleoptratus																							1	0
Jassargus obtusivalvis	11		24		14	4	57	22			3	0	14	4	2	2	26	13	131	17	3	0	4	2
Jassidaeus lugubris							4																	
Javesella pellucida						2			8	7					1	1								
Kelisia haupti						7	6										5	3			2	1		
Kosswigianella exigua			1						1	1														
Laburrus impictifrons	25		35	36	28	62			6	5	14	11			50	38	4	2			13	9	11	4
Laburrus pellax									2	0	1	1			2	1	1	1			14	2	2	2
Mocydia crocea													1	1			3	2	1	1	3	2	1	1
Mocydiopsis longicauda					1	4	2						2	2	1	1	1	1	1?	1			4?	4
Muirodelphax aubei		1	18		17			2																
Neoaliturus fenestratus					6		28				2	1	1	1			3	1			1	0	3	1
Neophilaenus albipennis			2																					
Neophilaenus exclamationis			1			2																		
Neophilaenus infumatus															1	1								
Neophilaenus minor	13		26	21	54	42	4	1	1	0	2	1			10	7	6	1			9	6	8	3
Planaphrodes trifasciata				2																				
Platymetopius major			3																					
Psammotettix alienus																	1	1			1	0		
Psammotettix excisus				4	3	4	4																	
Psammotettix helvolus	38			93	4	8	4				5	3	3	2	1	0	6	3	3	3	2	0	3	2
Psammotettix nodosus				1																				
Psammotettix pallidinervis								3																
Rhopalopyx vitripennis	4						6												10	1				
Rhytistylus proceps			4		12	3																		
Stenocranus minutus																	1	1						
Turrutus socialis	18		69	18	49	50	33	21					2	0			1	1	25	7	3	2	2	0
Zygina hyperici								2																
Zygina ordinaria							4		1	1														
Zyginidia scutellaris									2	1	8	2					113	76	2	0			375	219

#34, Neue Göhle bei Freyburg/Unstrut	14.09.1963	05.06.1964	22.07.1964	15.09.1964	14.07.2008	♀	03.09.2008	♀	27.05.2009	♀	27.07.2009	♀	19.09.2009	♀
Adarrus multinotatus	12	6	7	18					2	1			2	2
Anaceratagallia venosa					-1									
Aphrophora alni									5	5	4	3	1	1
Arboridia parvula					7	3	42	24						
Arboridia pusilla	19	20	81	43	14	6	116	71	6	5	348	175	269	139
Arocephalus longiceps	8	11	4											
Asiraca clavicornis		4												
Balcanoceros larvatus					7	7	2	2						
Cixius cambricus											1	0		
Dictyophara europaea			2	1										
Diplocolenus bohemani		5	2											
Elymana sulphurella			1											
Emelyanoviana mollicula	9	4		2	1	1	4	1			5	3	31	28
Empoasca affinis	2	1		60										
Empoasca decipiens					1	1					2	1	7	4
Erythria aureola	2													
Eupelix cuspidata							-1							
Eupteryx atropunctata	2			1									2	0
Euscelis incisus			2		1	0								
Fieberiella septentrionalis							2	1			1	0		
Issus coleoptratus					1	0								
Jassargus obtusivalvis	15	33	12	18			3	1	5	2	3	2	21	12
Jassargus sursumflexus				1										
Javesella pellucida											13	9		
Kelisia haupti											3	2	8	3
Kelisia monoceros													1	0
Macrosteles spec., female	2			1										
Mocydia crocea			4	4									1	0
Neoaliturus fenestratus			4	8	1	0	2	0			1	0	5	4
Neophilaenus campestris					1	0	3	0	1	1				
Philaenus spumarius							1	1			3	3		
Psammotettix alienus	35			13										
Psammotettix helvolus	16	4		7										
Ribautiana debilis													1	1
Ribautodelphax pungens											1	0		
Stenocranus major							1	1					1	0
Thamnotettix dilutior							1	1	2	1	2	2	1	1
Utecha trivia				11										
Zyginidia scutellaris					1	0	53	32			1	1	728	524

#35a, Schwellenburg bei Kühnhausen	15.09.1963	11.05.1964	19.06.1964	16.08.1964	31.10.1964	14.07.2008	♀	03.09.2008	♀	27.05.2009	♀	17.07.2009	♀	25.09.2009	♀
Aphrodes bicincta				1											
Arocephalus longiceps	2														
Chlorita paolii								-1							
Doratura stylata												1	1		
Eupelix cuspidata										1	1				
Euscelis incisus				1											
Javesella pellucida						2	1								
Kosswigianella exigua												1	1		
Mocydia crocea				2											
Mocydiopsis longicauda	6			1											
Muirodelphax aubei		16				100	42					53	27		
Neophilaenus campestris						21	13	2	0	6	1	18	6	2	1
Neophilaenus infumatus			4	2		12	4	1	1	1	0	9	5	6	3
Philaenus spumarius			2	2								8	3		
Praganus hofferi	36					44	41	6	1	7	5	1	1	19	18
Psammotettix alienus	2			71											
Psammotettix confinis										2	1				
Psammotettix helvolus	89		2	728	21			3	2	1	1	4	2	6	5
Rhopalopyx vitripennis	71		10		8	1	0			1	0	2	2	25	9
Turrutus socialis	11		33			1	0			1	0			1	0
Zygina hyperici								-1							
Zyginidia scutellaris								3	3					14	8

#35b, Schwellenburg bei Kühnhausen	15.09.1963	19.06.1964	16.08.1964	31.10.1964	14.07.2008	♀	03.09.2008	♀	27.05.2009	♀	17.07.2009	♀	25.09.2009	♀
Adarrus multinotatus			8	1										
Anaceratagallia ribauti				4							1	0		
Arocephalus languidus	2													
Artinaus interstitialis					2	1					28	21	4	4
Chlorita paolii	6													
Dictyophara europaea			2		2	0	2	0			1	0		
Ditropsis flavipes											1	0		
Doratura homophyla			5											
Doratura stylata	4	11	27		27	9	2	2			43	17		
Elymana sulphurella			13											
Emelyanoviana mollicula	2													
Empoasca pteridis				4										
Empoasca pteridis													2	1
Eupelix cuspidata		1							1	1				
Eupteryx atropunctata													1	1
Euscelis incisus	1													
Fiebierella spec., female							-1							
Jassidaeus lugubris													2	1
Javesella pellucida					1	0					1	0		
Kosswigianella exigua					2	1					1	0		
Lepyrona coleoptrata											1	1		
Mocuellus collinus			1											
Mocydia crocea	2		10	2	2	1	1	0			2	2	3	1
Mocydiopsis longicauda			1	1	4	2					3	1	1	1
Muirodelphax aubei					109	54					53	28		
Neophilaenus campestris			2		3	2	9	8	8	2	23	8	3	1
Neophilaenus infumatus		4	4		109	61	35	33	152	69	271	162	41	33
Philaenus spumarius		21	16		13	7	9	9	26	10	156	91	16	12
Psammotettix alienus	3		151											
Psammotettix helvolus	93	6	169	6	2	1	1	0			9	3	4	3
Rhopalopyx vitripennis	25								12	5	13	12	127	72
Turrutus socialis	15	65	34		28	7	7	2	77	44	20	7	66	74
Zyginidia scutellaris							16	5					31	16

#41, Hügel bei Prositz	07.07.1963	17.05.1964	26.06.1964	06.08.1964	19.09.1964	16.06.1965	17.07.1965	28.08.1965	12.10.1965	22.07.2008	♀	09.09.2008	♀	08.06.2009	♀	27.07.2009	♀	19.09.2009	♀	08.06.2010	♀	10.08.2010	♀	21.09.2010	♀
Anaceratagallia ribauti	6	2	6	25	5		15	2	23					1	1			1	0						
Aphrodes bicincta	4			2			1	2																	
Aphrophora alni																				1	0				
Arocephalus languidus																1	0								
Arocephalus longiceps					6				10			1	1												
Arocephalus punctum	2																								
Artianus interstitialis	12		107	62	4		2	2	4	38	20	1	0			10	7	4	3			5	3		
Asiraca clavicornis																				1	0	1	0		
Austroasca vittata										4	1	3	3	1	1	54	28	13	11	2	2	6	4	2	2
Chlorita paolii	15	43	2		11	31	11	15	23									2	2					1	0
Cicadula spec., female								1																	
Dicranotropis hamata												1	1			3	2								
Dictyophara europaea				7	8					3	0	3	0			4	0					4	3		
Doratura stylata			2	6						1	0					5	2								
Edwardsiana rosae	7				15		2																		
Emelyanoviana mollicula									2	9	2	3	3	6	6	59	31	16	11			2	2	1	0
Empoasca pteridis		2			93			3	2															3	3
Eupteryx adspersa																10	7	36	9	1	1				
Eupteryx artemisiae									1																
Eupteryx atropunctata					48													12	12			2	1	4	3
Eupteryx florida																		1	1						
Eupteryx notata									2																
Eurhadina pulchella	8																								
Eurysa lineata						2																			
Euscelis incisus	1	2		35				2		2	1	2	2			1	1	3	3						
Fiebierella florii																						1	0		
Iassus lanio	3																								
Jassargus obtusivalvis	7		25	2	127	8	15	12	203	3	3	17	10	14	6	4	3	58	9	19	9	8	4	6	3
Javesella pellucida	1									7	4					34	22					21	11		
Macropsidius sahlbergi							6																		
Macrosteles laevis					15																	1	0	1	0
Megadelphax sordidula										3	1					15	9			1	1	2	1		
Megophthalmus scanicus										-1															
Mocuellus collinus	3		15		2				8																
Mocydia crocea					4			2	2									1	1						
Mocydiopsis parvicauda																		1	1						
Neoaliturus fenestratus							10	4	45																
Neophilaenus campestris						2		2				2	2	2	1										
Philaenus spumarius																				1	0				
Psammotettix alienus				13	46													5	4						
Psammotettix confinis				6	43	6	11	1	6																
Psammotettix helvolus												10	5	4	3	7	3	59	40	3	1	1	1	2	1
Psammotettix kolosvarensis									2																
Rhopalopyx vitripennis										5	3	5	3	6	2			15	7						
Ribautodelphax albostriata																1	0	3	3						
Stenocranus minutus																		3	2					1	1
Turrutus socialis										1	1														
Zygina angusta					1																				
Zygina hyperici						3		1	2							8	4	7	7						
Zyginidia scutellaris												219	78			7	2	802	501			1	1	345	263

#42, Hügel bei Piskowitz	07.07.1963	17.05.1964	26.06.1964	06.08.1964	26.09.1964	16.06.1965	14.07.1965	28.08.1965	12.10.1965	30.03.1967	22.07.2008	♀	09.09.2008	♀	08.06.2009	♀	27.07.2009	♀	19.09.2009	♀	08.06.2010	♀	10.08.2010	♀	21.09.2010	♀
Anaceratagallia ribauti	17				1		41		3		1	1							2	1						
Aphrodes bicincta	8				4		14																			
Aphrophora alni																							1	1		
Arocephalus languidus	4		1																							
Arocephalus longiceps					18				4												1	1				
Artianus interstitialis	1		2	4	14			15	2		8	8											1	1		
Asiraca clavicornis																							1	0		
Balclutha punctata											2	0			2	1	5	2								
Chlorita paolii		27	6	13	115	53	25	35	18		12	10	7	4	7	3	28	16	47	29	10	5	12	8	9	5
Dicranotropis hamata	1																									
Dictyophara europaea								1									2	1								
Dikraneura variata													2	2												
Doratura stylata	18						5																			
Edwardsiana rosae									1																	
Emelyanoviana mollicula					5			24	23										3	3	1	1			1	0
Empoasca affinis					13				26																	
Empoasca decipiens					5				8																	
Empoasca pteridis					52	2		4	45																	
Eupteryx adspersa																			1	1						
Eupteryx artemisiae					2				5																	
Eupteryx atropunctata					3			5	12																	
Eupteryx tenella								1																		
Eurhadina pulchella																			1	1						
Euscelis incisus	6			57	3		12	5		2	7	6					4	2	1	1						
Fieberiella florii									1																	
Hephathus nanus							1																			
Jassargus obtusivalvis	11		4	2	153	24	11	24	37		5	2	3	1	7	7	1	1	10	5	33	18	2	0	2	0
Javesella pellucida											4	2					28	21					1	1		
Kelisia monoceros													1	1			1	1								
Kosswigianella exigua													1	1												
Macropsis fuscula																	1	1								

#42, Hügel bei Piskowitz	07.07.1963	17.05.1964	26.06.1964	06.08.1964	26.09.1964	16.06.1965	14.07.1965	28.08.1965	12.10.1965	30.03.1967	22.07.2008	♀	09.09.2008	♀	08.06.2009	♀	27.07.2009	♀	19.09.2009	♀	08.06.2010	♀	10.08.2010	♀	21.09.2010	♀
Macrosteles laevis	2				9								2	2			1	1					1	0		
Macrosteles sexnotatus					2																					
Micantulina stigmatipennis											1	0														
Mocuellus collinus	22				26		4	25	2																	
Mocydia crocea		2		1	10			14																		
Mocydiopsis parvicauda					1					7															1	0
Neoaliturus fenestratus	6	1			5		21		20		2	2	1	1	4	3	2	1	7	1	1	1	6	2	3	2
Neophilaenus campestris					2	2	2	7	2		3	2	3	3			1	1			1	0			3	0
Neophilaenus minor	21		24	21	14	6	61	56	4																	
Philaenus spumarius																					4	4				
Psammotettix alienus			2	10	265		2								2	2			7	6					1	1
Psammotettix confinis	1		3	2	66	9	14		3		2	2			13	7	16	8	31	22	19	12	7	5		
Psammotettix helvolus					45			18													5	3				
Rhopalopyx vitripennis	11		4		4			1	18						2	1			9	4	10	6				
Ribautodelphax spec., female																	2	2								
Tettigometra atra																			1	0	1	0				
Thamnotettix dilutior											2	1					1	1								
Turrutus socialis	23				2																1	0			2	2
Zygina hyperici			7			2	1								1	0	10	2	3	3	1	1				
Zygina schneideri											1	0														
Zyginidia scutellaris											1	0	486	219	2	2	6	3	1909	1242	4	3	44	17	407	261

#43, Zadeler Abhang	07.07.1963	17.05.1964	26.06.1964	06.08.1964	19.09.1964	16.06.1965	14.07.1965	28.08.1965	12.10.1965	23.07.2008	♀	09.09.2008	♀	27.05.2009	♀	27.07.2009	♀	18.09.2009	♀
Acanthodelphax spinosa	4									1	0					5	4		
Anaceratagallia ribauti	3		3	15	4	1	4	2	3			5	3					11	7
Anoscopus serratulae																1	1	1	1
Aphrodes bicincta					1														
Aphrodes makarovi										1	0					2	2		
Arocephalus languidus	4											9	3	2	1	2	1	10	2
Arocephalus longiceps			2				2											3	1
Arthaldeus pascuellus												15	3	6	3	1	1	29	15
Artianus interstitialis	10		65	32	4		2	31	6	32	12					6	3	1	1
Asiraca clavicornis																			
Cercopis vulnerata						1												6	3
Chlorita paolii					2				1			1	1	6	2			43	21
Cicadula persimilis																		6	3
Cicadula quadrinotata												1	0						
Cixius cambricus					1														
Deltocephalus pulicaris												9	2	8	4	31	3	13	8
Dicranotropis hamata								4		5	4					1	1		
Doratura stylata	107		110	145			10	27	4	20	7					5	1		
Edwardsiana rosae					3				2										
Emelyanoviana mollicula									2	2	0	1	0					4	3
Empoasca affinis									2										
Empoasca decipiens									1										
Empoasca pteridis					4	2	11	16	72										
Empoasca spec., female										1	1								
Errastunus ocellaris			1						2	6	5	56	14	73	28	79	16	144	52
Eupelix cuspidata		2																	
Eupteryx atropunctata								2	10									9	3
Eupteryx notata																		2	1

#43, Zadeler Abhang	07.07.1963	17.05.1964	26.06.1964	06.08.1964	19.09.1964	16.06.1965	14.07.1965	28.08.1965	12.10.1965	23.07.2008	♀	09.09.2008	♀	27.05.2009	♀	27.07.2009	♀	18.09.2009	♀
Eupteryx tenella																		1	1
Euscelis incisus	1		9	17				8		41	15	1	1	3	2	35	7	11	10
Fiebierella spec., female										-1									
Graphocraerus ventralis							1												
Jassargus obtusivalvis	25		32	18	57	22	87	100	478	1	1	4	2	15	7	2	1	34	14
Javesella pellucida								5		83	41	1	0			64	22		
Macrosteles spec., female				2	7			2											
Megadelphax sordidula										7	3					2	1		
Micantulina stigmatipennis							1												
Mocuellus collinus	198		115	17	26		4	42	31										
Mocydia crocea				1					28										
Neoaliturus fenestratus																		3	3
Neophilaenus campestris							2	2										1	0
Neophilaenus exclamationis						1													
Philaenus spumarius							1												
Psammotettix alienus			15	16	85													6	2
Psammotettix confinis					25			9				13	9	6	3	4	2	18	7
Psammotettix helvolus	62	65	40	42	8	29	9	129	72	2	1	10	7	6	0	30	11	56	26
Psammotettix kolosvarensis												27	13	4	2	5	2	15	9
Rhopalopyx vitripennis		2	10		2		1		9			39	10	3	2			27	12
Ribautodelphax albostriata										6	4			1	0	16	7	3	2
Ribautodelphax pungens	4																		
Stenocranus major												10	3					2	0
Stenocranus minutus												3	3						
Turrutus socialis																		4	1
Xanthodelphax straminea																2	1		
Zygina hyperici							2	1										15	9
Zyginidia scutellaris												139	58	10	8	1	0	585	264

#44, Bosel bei Meißen	10.09.1962	07.07.1963	17.05.1964	26.06.1964	06.08.1964	19.09.1964	23.07.2008	♀	09.09.2008	♀	08.06.2009	♀	27.07.2009	♀	18.09.2009	♀
Allygidius atomarius				1												
Anaceratagallia ribauti					2										1	0
Anoscopus albifrons					1	1										
Aphrodes bicincta				2												
Aphrodes makarovi													2	0	1	1
Aphrophora alni	1										1	0	1	1	2	2
Arocephalus longiceps									1	0						
Arthaldeus pascuellus											2	2			1	1
Balclutha punctata	1								2	2	1	1	1	0	1	1
Chlorita paolii		17			15	8										
Doratura homophyla				2												
Edwardsiana spec., female									1	1						
Elymana sulphurella	2															
Emelyanoviana mollicula	11						1	0	4	3	3	0	1	0	6	1
Empoasca affinis	12				4	6	7	4	1	1	1	0	3	2	6	3
Errastunus ocellaris					1										1	1
Eupelix cuspidata											1	0				
Eupteryx stachydearum	1															
Euscelis distinguendus	1				2											
Euscelis incisus	3	3	2		2	2										
Fieberiella septentrionalis					1										1	1
Graphocraerus ventralis				2												
Iassus lanio	1															
Issus spec., Larve											-1					
Jassargus obtusivalvis	4			1		1	3	2	10	4	32	9	2	2	16	6
Jassargus pseudocellaris	43			3	4		5	4	1	0	7	5	1	1	8	5
Javesella pellucida							2	0					4	1		
Kosswigianella exigua													3	0		
Laodelphax striatella							1	1								
Macrosteles spec. female	1			2	2	1										
Mirabella albifrons													2	1		
Neoaliturus fenestratus									1	0						
Neophilaenus campestris	2			2												
Neophilaenus minor					2				1	0						
Philaenus spumarius	2	10		7	14	4										
Psammotettix alienus					2	1			1	1	2	2			1	1
Psammotettix confinis	13	2		22	10	33										
Psammotettix helvolus						2										
Rhopalopyx vitripennis									2	2	5	2	1	1	6	3
Rhytistylus proceps							2	1					2	1		
Stenocranus major									22	11					6	4
Stenocranus minutus															1	0
Thamnotettix dilutior							1	0								
Zygina hyperici							1	0	3	3	1	1				
Zyginidia scutellaris									124	41	2	1	1	1	2	2

#45, Hohler Stein bei Schlottwitz	26.09.1963	27.05.1964	07.07.1964	15.08.1964	12.10.1964	14.07.1965	25.09.1965	18.06.1967	21.07.2008	♀	12.09.2008	♀	13.05.2009	♀	28.07.2009	♀	18.09.2009	♀	13.05.2009*	♀
Acanthodelphax spinosa													13	7	1	0				
Agallia brachyptera									-1											
Alnetoidia alneti					1															
Anaceratagallia ribauti									2	2	1	0			1	1	6	3	4	4
Anoscopus albifrons				2																
Anoscopus flavostriatus															1	0				
Anoscopus serratulae									-1											
Aphrodes makarovi									2	1										
Aphropdes diminuta															4	2				
Aphrophora alni	8		6	5			10	4	1	1	3	3			4	3	1	1		
Arocephalus longiceps	2		2	10	13		8	3							1	1				
Arocephalus punctum			11	31	2		6								4	4				
Arthaldeus pascuellus									1	1										
Balclutha calamagrostis									1	1										
Balclutha punctata											1	0					1	0	2	2
Cercopis vulnerata								2												
Chlorita paolii			2					1			4	4	5	2	5	4	47	22	4	1
Cicadula persimilis			19														1	1		
Criomorphus albomarginatus													1	1						
Deltocephalus pullicaris															1	0				
Dictyophara europaea				1																
Doratura stylata			73	19		2	6		17	11					4	2				
Elymana sulphurella							1		3	2					1	1				
Emelyanoviana mollicula		2			1		3				1	0							1	0
Empoasca affinis	10			2	145						2	2								
Empoasca pteridis					13												2	0		
Eupelix cuspidata		10				2		1	2	0					1	0				
Eupteryx atropunctata					8															
Eupteryx notata	4	2							1	1			72	16	10	4	21	11	50	22
Euscelis incisus	3			4	2			1	31	14	3	3	7	5	5	2			1	1
Evacanthus interruptus			15						2	1										

#45, Hohler Stein bei Schlottwitz	26.09.1963	27.05.1964	07.07.1964	15.08.1964	12.10.1964	14.07.1965	25.09.1965	18.06.1967	21.07.2008	♀	12.09.2008	♀	13.05.2009	♀	28.07.2009	♀	18.09.2009	♀	13.05.2009*	♀
Hesium domino			10			7					1	1								
Hyledelphax elegantula		1											2	1						
Jassargus flori				4					8	8										
Jassargus pseudocellaris	18		30	9	85	21	167	473	8	1	27	14			6	2	64	35	3	0
Javesella pellucida								6							2	2			1	1
Kosswigianella exigua															15	7				
Macrosteles cristatus											1	1					3	3		
Megadelphax sordidula									1	0	2	1	26	12						
Megophthalmus scanicus									-1											
Mocydiopsis attenuata					2															
Mocydiopsis parvicauda	9			17	38		131		-1											
Neoaliturus fenestratus																			1	1
Neophilaenus exclamationis	2		26	8		23	28	23												
Philaenus spumarius	11		25	12		11		3	1	0										
Platymetopius major			4																	
Psammotettix alienus				2	1															
Psammotettix cephalotes			2		8			16												
Psammotettix confinis				4	2	2		3											14	2
Ribautodelphax collina		1	4				2	7	23	15			32	15	24	12			12	3
Ribautodelphax pungens		2						2											46	12
Stenocranus diminutus											10	6	1	1					2	2
Tachycixius pilosus													2	2						
Thamnotettix dilutior									2	1					1	1				
Zygina hyperici	9				2		19	2									1	1	4	0
Zygina rubrovittata					3															
Zyginida scutellaris											58	18	2	2			127	64		

#46, Spitzberg bei Bulleritz	13.07.1965	30.08.1965	13.10.1965	11.06.1966	24.07.1966	04.09.1966	16.10.1966	29.04.1967	22.07.2008	♀	12.09.2008	♀	13.05.2009	♀	27.07.2009	♀	18.09.2009	♀	08.06.2010	♀	10.08.2010	♀	21.09.2010	♀
Alebra albostriella		2																						
Anaceratagallia ribauti		2	5	3			15																	
Anaceratagallia ribauti																								
Anakelisia perspicillata		5	1		1	2	1																	
Anoscopus albifrons					2																			
Aphrodes bicincta		1				2			4	4														
Aphrophora alni					1																			
Arocephalus languidus		2																					1	1
Arocephalus punctum	8	15			14	2	1				8	5	44	21	7	2			8	2			3	0
Arthaldeus pascuellus																	1	1						
Artianus interstitialis									5	5					2	2					2	2	1	1
Asiraca clavicornis																							1	0
Athysanus argentarius															2	2								
Balclutha punctata									2	1	1	0	1	1	2	0			1	1	2	2		
Cercopis vulnerata													2	1										
Chlorita paolii			17	8			25		1	1	11	8	31	17	2	1	28	20	87	50	16	7	36	12
Cixius cunicularius		1							2	2														
Deltocephalus pulicaris																	1	0						
Dikraneura variata											4	4	2	2	1	0	1	0						
Doratura homophyla	14	16	2	3	25	21	4																	
Doratura stylata	2				15				1	1					1	0			1	0				
Emelyanoviana mollicula									1	1														
Empoasca affinis		1	26			2	1				1	1			4	3	1	1			1	1		
Errastunus ocellaris		2			1	2							153	64	5	2	3	2	15	9	1	1		
Eupelix cuspidata													1	0										
Eupteryx atropunctata			3				5																	
Eupteryx notata		4	1	5	1	1																		
Eurysa lineata													7	7			3	1	1	1				
Euscelis distinguendus	12				17																			
Euscelis incisus	1	5			3			5	4	2	1	1	1	1	1	0					3	2		
Forcipata citrinella		4		5		6	1																	

#46, Spitzberg bei Bulleritz	13.07.1965	30.08.1965	13.10.1965	11.06.1966	24.07.1966	04.09.1966	16.10.1966	29.04.1967	22.07.2008	♀	12.09.2008	♀	13.05.2009	♀	27.07.2009	♀	18.09.2009	♀	08.06.2010	♀	10.08.2010	♀	21.09.2010	♀
Hyledelphax elegantula													5	4							1	1		
Jassargus obtusivalvis											1	0	1	0										
Jassargus pseudocellaris	29	178	155	178	41	165	229				4	1	37	14	11	5	9	3	4	0			2	1
Javesella pellucida					285	3		11	4	2					2	2								
Kosswigianella exigua	25	4		12	34	2		25	1	1			8	7										
Kybos ludus						1																		
Laodelphax striatella													1	1										
Macrosteles laevis	5					2									19	12	20	14	5	5	3	3	1	0
Macrosteles sexnotatus							1																	
Megadelphax sordidula											2	1	75	48	1	1			1	1				
Megophthalmus scanicus					1																			
Mocuellus collinus									1	1			1	0										
Mocydiopsis longicauda													3	2										
Mocydiopsis parvicauda		12	63			9	107																	
Muirodelphax aubei	3				3	1																		
Neoaliturus fenestratus									1	1											4	0		
Neophilaenus exclamationis	4				2																			
Psammotettix alienus							4				6	3			3	3	7	6			2	1		
Psammotettix confinis	11	135	83	24	3	161	128				6	4	11	3	3	2	16	8	71	40			3	2
Psammotettix helvolus													13	4	1	0			9	3	5	2	6	3
Psammotettix kolosvarensis													1	0	1	1								
Recilia coronifer															1	1								
Rhopalopyx vitripennis	12	6	9	20	8	4	10												3	2			1	0
Rhytistylus proceps	11	3			16	4																		
Ribautodelphax albostriatus	32	11		5	21	3		2																
Ribautodelphax collina	20	7		5	16			15																
Ribautodelphax spec., female															1	1								
Stenocranus major			2																					
Thamnotettix dilutior																								
Zygina hyperici		5				2			1	1	1	1	15	5	5	3	10	9	2	1				
Zyginidia scutellaris											109	39					40	19	1	0			30	9

#47a, Eisenberg bei Guttau	24.05.1964	11.07.1964	23.08.1964	11.10.1964	21.07.2008	♀	12.09.2008	♀	13.05.2009	♀	28.07.2009	♀	18.09.2009	♀
Anaceratagallia ribauti		2					2	0			2	2	1	0
Anakelisia perspicillata											1	0		
Aphrodes bicincta			1				1	1						
Aphrophora alni							1	1						
Arocephalus languidus		260	1699	2245	1	0	40	18			2	0	20	5
Balclutha punctata					3	1	7	2			4	3	6	3
Chlorita paolii					1	0	22	13	14	10	27	22	66	48
Cicadella viridis													3	3
Conomelus anceps											1	1		
Dikraneura variata									1	1			1	1
Doratura homophyla			4	3							1	1	3	2
Doratura impudica			1											
Doratura stylata		17	2	4	1	0					1	1		
Empoasca affinis				2										
Empoasca pteridis	2			27										
Empoasca spec., female											1	1		
Eupelix cuspidata									2	0				
Eupteryx atropunctata				2										
Eupteryx notata											1	1	9	3
Eupteryx vittata							1	0						
Eurysa lineata	1								1	1				
Euscelis incisus			2						1	1	1	1		
Hyledelphax elegantula									7	6	4	3		
Jassargus obtusivalvis	17	26	21	67	9	5	164	95	30	9	11	3	220	119
Javesella pellucida					3	3					26	18		
Macrosteles laevis		2	11								1	0	2	2
Mocuellus collinus			1										1	0
Muirodelphax aubei	2	6		2										
Neophilaenus minor		79	42	2										
Oncopsis spec., female									1	1	1	1		
Psammotettix alienus			37								1	1		
Psammotettix confinis		1	26	3										
Rhopalopyx vitripennis													1	0
Stenocranus major							3	3						
Thamnotettix dilutior					11	4	1	1	4	2	8	8		
Zygina hyperici	2													
Zyginidia scutellaris							105	53			1	0	433	251

#47b, Eisenberg bei Guttau	23.08.1964	13.07.1965	30.08.1965	13.10.1965	11.06.1966	24.07.1966	19.08.1966[3]	04.09.1966	16.10.1966	29.04.1967	21.07.2008	♀	12.09.2008	♀	13.05.2009	♀	28.07.2009	♀	18.09.2009	♀	08.06.2010	♀	10.08.2010	♀	21.09.2010	♀
Acanthodelphax spinosa						9																	1	0		
Adarrus multinotatus	1																									
Allygus maculatus											1	1														
Allygus mixtus			1														1	1	1	1						
Anaceratagallia ribauti	2			2	1		1		8						1	1			1	0			1	0	3	1
Anakelisia perspicillata	2		17	4		2	13	6	2								2	1					1	0		
Aphrodes bicincta			3			21	13	2																		
Aphrodes makarovi																	1	0								
Aphrophora alni													1	1			1	1					1	0		
Arocephalus languidus	181	48	167	182	387	242	716	249	570																	
Arocephalus punctum			14			100	41	10																		
Arthaldeus pascuellus																			1	1						
Athysanus argentarius																									1	1
Balclutha punctata											3	1	15	4							1	1				
Cercopis vulnerata															1	1										
Chlorita paolii				2	1			2	2		1	1			20	11			1	1	15	12			2	0
Cicadella viridis											1						1	1	3	3					1	0
Delphacinus mesomelas					59		1																			
Dicranotropis hamata																							3	3		
Dikraneura variata						1			4																	
Doratura stylata	33		8			35	26	13			3	1	1	0			15	8					2	1		
Empoasca affinis								4	10																	
Empoasca pteridis			1	51		2	2	11	33		1?	1											2	1	8	6
Eupelix cuspidata					7																					
Eupteryx atropunctata	1		1	26				4	2																	
Eupteryx notata			6	2	8	1	1	2							2	0										
Eurysa lineata															2	2										
Eurysula lurida					1																					
Euscelidius schenckii						1																				
Euscelis incisus	8		2	7		6		2	2	1	2	0			5	4	6	4	1	1			2	2		
Forcipata citrinella			4		6		3	4	3																	

#47b, Eisenberg bei Guttau	23.08.1964	13.07.1965	30.08.1965	13.10.1965	11.06.1966	24.07.1966	19.08.1966[3]	04.09.1966	16.10.1966	29.04.1967	21.07.2008	♀	12.09.2008	♀	13.05.2009	♀	28.07.2009	♀	18.09.2009	♀	08.06.2010	♀	10.08.2010	♀	21.09.2010	♀
Graphocraerus ventralis																					3	1				
Grypotes puncticollis											1	0														
Hesium domino			2																							
Hyledelphax elegantula		1	2		35	8	11								32	30	12	8			1	0	2	0		
Jassargus obtusivalvis	98	57	62	775	294	113	83	78	165		8	7	33	19	3	0	1	1	37	21	9	1	1	0	8	4
Jassargus pseudocellaris					1																					
Javesella dubia															2	0										
Javesella pellucida					2	594	70	7		9	4	3			1	0	8	4			1	1	2	1		
Kosswigianella exigua			13		46	57	10	2		10																
Macrosteles laevis	3				2		1	2															4	3	4	4
Megadelphax sordidula																	2	1							1	1
Megophthalmus scanicus		1				2											1	0								
Muellerianella fairmairei																							1	1		
Muirodelphax aubei						8		2		2																
Neophilaenus exclamationis			2			2	1																			
Neophilaenus minor		2																								
Platymetopius henriribauti		4																								
Platymetopius undatus		1																								
Psammotettix alienus	5			2															2	1						
Psammotettix cephalotes	29	8	2		135	6	18	67	1																	
Psammotettix confinis	12																									
Recilia coronifer																							2	1		
Rhopalopyx preyssleri	5		8	2		89	26	6			-1															
Ribautodelphax albostriatus			21		10	76	57	7		68					1	1	2	1	1	1			1	0		
Ribautodelphax collina							1																			
Stenocranus major				3					4				2	1					3	2					3	0
Stenocranus minutus													2	2											2	1
Streptanus marginatus					6			1																		
Tettigometra leucophaea				1																						
Thamnotettix confinis																					2	2				
Thamnotettix dilutior											19	8			4	0	1	1					3	3		
Typhlocyba spec., female		1						3																		
Zygina flammigera								2																		
Zyginidia scutellaris																			58	41			1	0	11	3

#1, Hang bei Lietzow/Rügen	29.07.1964	01.10.1964	14.06.1966
Anaceratagallia venosa		-2	
Aphrodes bicincta	1		
Aphrophora alni		1	
Athysanus argentarius		-1	
Chlorita paolii		2	17
Doratura homophyla	2		
Doratura stylata	3		
Elymana sulphurella	27		
Empoasca pteridis		101	2
Euscelis incisus	21		
Graphocraerus ventralis			15
Jassargus flori	2	15	2
Javesella pellucida			1
Kelisia sabulicola		4	
Kosswigianella exigua	2		21
Neophilaenus minor	55	11	
Philaenus spumarius	2		
Psammotettix confinis		3	
Psammotettix poecilus			1

#2, Zicker'sche Höft/Rügen	29.07.1964	01.10.1964	14.06.1966
Anaceratagallia venosa	17	4	
Arocephalus languidus	11	65	18
Chlorita paolii	10	21	14
Delphacinus mesomelas			3
Doratura homophyla	8		5
Emelyanoviana mollicula		4	249
Empoasca pteridis		376	
Eupteryx atropunctata		2	
Eupteryx notata			57
Euscelis incisus	14	2	
Graphocraerus ventralis	2		9
Javesella pellucida	7		
Kelisia sabulicola	2	2	
Kosswigianella exigua			2
Laburrus impictifrons	15	9	
Muirodelphax aubei	2		
Neophilaenus minor	377	182	
Ophiola transversa	1		
Philaenus spumarius	25		
Psammotettix cephalotes		8	145
Psammotettix confinis	2	8	1
Psammotettix excisus	9	19	3
Psammotettix nodosus		21	75
Rhopalopyx vitripennis		4	1
Ribautodelphax pungens			9
Verdanus abdominalis			25
Zygina hyperici			2

#3, Presendorfer Hügel bei Rostock	13.06.1964	28.07.1964	30.09.1964
Anaceratagallia ribauti			2
Anaceratagallia venosa		33	
Anoscopus albifrons			-1
Anoscopus serratulae		-4	-4
Aphrodes bicincta		23	
Arthaldeus pascuellus			7
Cicadula spec., female		2	3
Cixius nervosus		1	
Conosanus obsoletus		1	
Delphacinus mesomelas	5		
Deltocephalus pulicaris			-1
Doratura homophyla		53	5
Doratura stylata		38	
Elymana sulphurella			2
Empoasca pteridis			11
Errastunus ocellaris	1		
Eupelix cuspidata	6		
Eupteryx notata	2	2	
Euscelis incisus	11	225	9
Graphocraerus ventralis	13	2	
Javesella pellucida		1	
Kosswigianella exigua		39	
Megophthalmus scanicus		-28	-1
Muirodelphax aubei	2		
Neophilaenus exclamationis	1		
Psammotettix confinis	9		57
Psammotettix nodosus	4		5
Turrutus socialis	133	59	56

#4, Weinberg bei Perleberg	07.06.1965	24.07.1965	29.09.1965	30.08.1966
Anaceratagallia venosa		2	8	4
Aphrodes bicincta		1		
Arocephalus punctum		21	11	15
Chlorita paolii	19	6	17	6
Chlorita pusilla	2	5	6	4
Delphacinus mesomelas		1		
Deltocephalus pulicaris			1	
Dikraneura variata			1	2
Doratura homophyla		2		4
Doratura stylata		21		7
Empoasca pteridis			2	
Forcipata forcipata				5
Jassargus flori			3	4
Jassargus pseudocellaris	4		2	17
Kosswigianella exigua	55	22		23
Laburrus impictifrons			2	4
Macrosteles laevis				1
Neophilaenus exclamationis	6		4	2
Neophilaenus minor		9		
Philaenus spumarius		2		
Psammotettix confinis	21		2	
Psammotettix nodosus	50		15	11
Rhopalopyx vitripennis	7	4	303	367
Rhytistylus proceps		2	1	2
Streptanus marginatus	11			
Zygina hyperici				17

#5, Datzeberg bei Neubrandenburg	12.06.1964	28.07.1964	30.09.1964
Anaceratagallia ribauti			14
Anaceratagallia venosa		11	
Aphrodes bicincta		8	2
Arocephalus languidus	15	22	25
Chlorita paolii	14	251	61
Cicadula spec., female	1		
Doratura stylata		21	
Emelyanoviana mollicula	2		1
Empoasca pteridis			145
Errastunus ocellaris			10
Eupteryx atropunctata			7
Euscelis incisus		33	7
Graphocraerus ventralis	2		
Macrosteles laevis			10
Neophilaenus campestris	127	141	57
Ophiola transversa		1	
Psammotettix alienus			4
Psammotettix confinis	22	8	250
Psammotettix nodosus	26		27
Ribautodelphax albostriata		35	
Turrutus socialis	501	85	291
Verdanus abdominalis	7		

#6, Hang bei Klein Nemerow	12.06.1964	27.07.1964	29.09.1964
Eurysa lineata	1		
Kosswigianella exigua		18	
Neophilaenus campestris	177	41	24
Aphrodes bicincta		6	
Doratura homophyla	14	7	
Doratura stylata	12	215	
Anaceratagallia ribauti		4	7
Chlorita paolii	15	121	107
Empoasca pteridis	4		73
Deltocephalus pulicaris	17		
Psammotettix confinis	121	6	368
Psammotettix nodosus	28	17	33
Mocuellus collinus	5	2	4
Rhopalopyx vitripennis	109		117
Euscelis incisus		85	
Laburrus impictifrons		26	11
Macrosteles laevis	2		10

#7, Hauptmannsberg bei Carwitz	16.08.1963	14.06.1964	30.07.1964	02.10.1964
Anaoscopus albifrons			-4	-1
Aphrodes bicincta	5		5	
Athysanus argentarius	4		14	4
Balclutha punctata			1	
Chlorita paolii			5	2
Delphacinus mesomelas		4		
Deltocephalus pulicaris	8		2	9
Doratura homophyla	51	7	41	
Doratura stylata	4		21	
Elymana sulphurella	199		211	13
Empoasca pteridis		2	2	17
Eupelix cuspidata	2		2	
Eupteryx notata		10	2	7
Euscelis distinguendus	15		35	7
Euscelis incisus			3	
Graphocraerus ventralis		4		
Grypotes puncticollis	1			
Hyledelphax elegantula	1			
Jassargus flori		1		2
Jassargus pseudocellaris				4
Javesella pellucida	8		1	2
Laburrus impictifrons	2		2	
Macrosteles spec., female				1
Megophthalmus scanicus			-5	
Neophilaenus minor				2
Planaphrodes trifasciata	2			
Psammotettix confinis	65	10	9	37
Psammotettix nodosus	231	65		92
Ribautodelphax collina	22	10	13	
Turrutus socialis		2	2	21
Xanthodelphax flaveola		9		

#8, Schanzberge bei Brietzig	06.08.1963	14.06.1964	30.07.1964	02.10.1964
Anaceratagallia ribauti		2	6	8
Anaceratagallia venosa			4	
Aphrodes bicincta	8			
Arocephalus languidus	2	253	22	111
Chlorita paolii	2	49	91	445
Cicadula persimilis				2
Delphacinus mesomelas		1		
Doratura homophyla		2	1	2
Doratura stylata	2	87	98	6
Elymana sulphurella			2	
Emelyanoviana mollicula				1
Empoasca pteridis				54
Erythria aureola		40		11
Eupteryx atropunctata				6
Euscelis incisus	7			2
Graphocraerus ventralis		2		
Javesella pellucida	5			
Kosswigianella exigua	2	2	4	
Laburrus impictifrons	41		91	13
Macropsidius sahlbergi		1		
Macrosteles laevis			2	5
Mocuellus collinus				1
Neophilaenus minor	8	17	27	
Philaenus spumarius	13		19	6
Psammotettix alienus				4
Psammotettix confinis			2	180
Psammotettix nodosus				13
Rhopalopyx vitripennis		114	4	179
Rhytistylus proceps				4
Turrutus socialis		157	14	162

#9, Hang an der Köhntop bei Bandelow	06.08.1963	14.06.1964	31.07.1964	02.10.1964
Adarrus multinotatus	132	36	15	115
Allygidius commutatus		2		
Anaceratagallia ribauti		1	2	9
Aphrodes bicincta	6		6	
Aphrophora alni			3	
Arocephalus languidus	6	33	57	22
Arocephalus longiceps		4		11
Chlorita paolii	4	4	43	36
Cicadula persimilis				10
Dicranotropis hamata	2		2	
Dictyophara europaea			2	2
Doratura stylata			15	
Elymana sulphurella			2	
Empoasca pteridis			4	57
Errastunus ocellaris			5	2
Eupteryx atropunctata				7
Euscelis incisus	51		14	2
Graphocraerus ventralis		8	2	
Javesella pellucida	32		11	
Macrosteles spec., female	1			
Megophthalmus scanicus			-2	
Mocydia crocea	26		58	31
Neophilaenus minor				2
Philaenus spumarius	7		12	2
Psammotettix alienus				4
Psammotettix confinis				2
Rhopalopyx vitripennis				8
Ribautodelphax pungens	113		36	
Stenocranus minutus		1		2
Streptanus aemulans			1	
Turrutus socialis	31	73	13	172

#11, Pimpinellenberg bei Oderberg	12.09.1963	15.06.1964	01.08.1964	03.10.1964
Anaceratagallia frisia	2	2		7
Anaceratagallia ribauti			-1	
Aphrodes bicincta				2
Aphrophora alni	3		5	2
Arocephalus languidus	4	2	4	1
Arocephalus longiceps	2			
Artianus interstitialis				2
Chlorita paolii	57	11	37	55
Doratura stylata		2	6	
Elymana sulphurella	1		4	
Empoasca affinis				56
Empoasca pteridis		1	2	73
Eupteryx atropunctata				9
Eupteryx tenella				1
Graphocraerus ventralis		2		
Jassargus pseudocellaris	1			
Laburrus impictifrons	17		39	5
Macrosteles laevis	6	8	2	
Mocydia crocea	3		11	33
Neoaliturus fenestratus			-1	
Neophilaenus campestris	6	4		
Neophilaenus minor	4	15	22	14
Philaenus spumarius	2		1	
Psammotettix alienus				7
Psammotettix confinis	23	2		
Psammotettix nodosus	6			
Psammotettix pallidinervis		4		
Rhopalopyx vitripennis	6	31		10
Turrutus socialis	41	65	13	32
Zyginidia viaduensis		4		2

#14a, Moräne bei Dolgelin	13.09.1963	15.06.1964	01.08.1964	04.10.1964
Adarrus multinotatus	2	2	1	
Anaceratagallia ribauti			2	
Chlorita paolii		4	15	4
Dictyophara europaea	3		2	
Emelyanoviana mollicula	6		4	
Empoasca affinis				62
Empoasca pteridis				15
Eupteryx atropunctata				4
Jassargus pseudocellaris	3			
Macrosteles laevis	2			2
Mocydia crocea	4		6	2
Muirodelphax aubei			5	
Neoaliturus fenestratus	1	4	1	2
Philaenus spumarius	1			
Psammotettix alienus	2		6	5
Psammotettix confinis	6	2		6
Tettigometra leucophaea				1
Turrutus socialis	37	31	11	23

#14b, Moräne bei Dolgelin	13.09.1963	15.06.1964	01.08.1964	04.10.1964
Adarrus multinotatus	13	21	2	20
Aphrodes bicincta	2			2
Aphrophora alni	8	9	13	
Chlorita paolii	2			2
Dictyophara europaea			6	
Elymana sulphurella		1		
Emelyanoviana mollicula	7	4		18
Empoasca pteridis	2	2	13	55
Eupteryx atropunctata			2	4
Euscelis incisus			2	
Jassargus pseudocellaris		1	1	
Macrosteles spec., female			4	
Mocydia crocea	10		1	4
Neoaliturus fenestratus				2
Philaenus spumarius	4		6	
Planaphrodes bifasciata			-1	-1
Psammotettix alienus			4	17
Psammotettix confinis	9	2		1
Ribautodelphax collina			2	
Streptanus marginatus	1			
Tettigometra leucophaea			5	
Turrutus socialis	2	17	1	3

#16a, Priesterschlucht bei Podelzig	06.06.1965	25.07.1965	07.10.1965	08.06.1966	25.07.1966	11.09.1966
Anaceratagallia ribauti			4		2	
Anaceratagallia venosa		2		21		4
Aphrodes bicincta		2			4	
Arboridia parvula			5			2
Arocephalus languidus	2	85	122	187	179	225
Artianus interstitialis		17			5	
Balclutha punctata					1	
Chlorita paolii	251	41	79	65	69	75
Doratura stylata		32	2		69	2
Emelyanoviana mollicula	35		31	2	25	21
Empoasca pteridis			53		1	
Eupelix cuspidata				2		
Eupteryx atropunctata	2		6			
Euscelis incisus		1	2		8	
Graphocraerus ventralis	6			43	2	
Javesella pellucida					381	1
Laburrus impictifrons		6			47	4
Laodelphax striatella					3	
Macrosteles laevis			4		4	21
Micantulina stigmatipennis	14					
Mocydia crocea			2			
Muirodelphax aubei	18	225		30	502	6
Neoaliturus fenestratus		2	25		10	24
Neophilaenus campestris			4	2		
Neophilaenus minor		13			12	
Philaenus spumarius					2	
Pinumius areatus		16		10	6	
Planaphrodes bifasciata					-2	
Psammotettix alienus	2		13	1		35
Psammotettix confinis			2			15
Rhopalopyx vitripennis		4	34	70	2	25
Tettigometra leucophaea			2			
Turrutus socialis	17	28	121	329	100	289
Zygina hyperici	5		2			

#33, Steinklöbe bei Wangen	27.06.1965	05.08.1965	01.10.1965	30.05.1966
Adarrus multinotatus	50	4	85	2
Anoscopus albifrons		3		
Aphrodes bicincta		1		
Aphrophora alni			1	2
Arboridia parvula	6	2	12	2
Arboridia pusilla			4	
Arboridia simillima		6	9	
Arboridia spec., female		13	33	
Arocephalus longiceps		4		
Arocephalus punctum		1		
Balcanocerus larvatus		3		
Centrotus cornutus				1
Cercopis sanguinolenta				15
Cercopis vulnerata				10
Chlorita paolii		6	2	
Cicadetta montana				1
Dictyophara europaea			2	
Elymana sulphurella		2		
Emelyanoviana mollicula		27	161	37
Empoasca affinis	2		35	
Empoasca decipiens		2		
Eurysa lineata				14
Jassargus flori		2		
Jassargus obtusivalvis	198	41	315	31
Jassidaeus lugubris			9	
Javesella pellucida		2		
Kelisia haupti		11	6	
Mocydia crocea			2	
Mocydiopsis longicauda		5	33	
Neophilaenus albipennis		3		
Platymetopius undatus	2			
Psammotettix alienus			4	
Psammotettix helvolus	1	2		
Rhopalopyx vitripennis	6		4	
Ribautodelphax pungens		3		
Stenocranus minutus			6	
Thamnotettix dilutior	1			1

#19a, Kuppe des Königsberges bei Deetz	07.06.1965	24.07.1965	26.09.1965
Aphrodes bicincta		2	
Arocephalus languidus	4	7	21
Arocephalus punctum			-1
Chlorita paolii	23	17	17
Cixius nervosus		1	
Doratura homophyla		5	
Doratura stylata		3	
Emelyanoviana mollicula			2
Empoasca pteridis			11
Eupteryx atropunctata			4
Eurysa lineata	14		
Graphocraerus ventralis	6		
Jassargus flori	2	1	14
Javesella pellucida		2	
Kosswigianella exigua		4	
Laburrus impictifrons		27	8
Laodelphax striatella	1		
Macrosteles spec., female			1
Muirodelphax aubei	2	7	2
Neophilaenus exclamationis		2	
Neophilaenus minor		13	
Philaenus spumarius		3	
Psammotettix alienus	1		
Psammotettix confinis			5
Rhopalopyx vitripennis			20
Turrutus socialis	5	4	23
Verdanus abdominalis	8	2	

#19b, Kuppe des Königsberges bei Deetz	07.06.1965	24.07.1965	26.09.1965
Anaceratagallia ribauti		-5	
Arocephalus languidus		4	1
Chlorita paolii	15	2	17
Doratura homophyla		11	6
Doratura stylata		-1	
Eurysa lineata	2		
Graphocraerus ventralis	14		
Jassargus flori			2
Laburrus impictifrons		1	
Mocuellus collinus			6
Neophilaenus campestris	2		
Neophilaenus minor		48	33
Psammotettix alienus			9
Psammotettix confinis	4		26
Psammotettix excisus	11		29
Rhopalopyx vitripennis			2

#20, Kleine Jahnberge bei Paulinenaue	24.07.1965	26.09.1965	06.06.1966	30.08.1966
Agallia brachyptera		-1		2
Anaceratagallia venosa	6	2		7
Arocephalus languidus	33	98	7	22
Chlorita paolii	4	17	14	6
Cicadula persimilis				2
Dicranotropis hamata			1	
Doratura homophyla		2		
Doratura stylata	29	3		6
Emelyanoviana mollicula		1		
Empoasca pteridis		2		
Errastunus ocellaris		7	2	
Eupelix cuspidata			4	
Euscelis incisus	5			
Forcipata citrinella				17
Graphocraerus ventralis	6		4	
Kelisia sabulicola	5	9		2
Kosswigianella exigua	8	2	113	2
Macrosteles sexnotatus				1
Mocuellus collinus		21		10
Neophilaenus minor	15	8		23
Philaenus spumarius	12	2		8
Planaphrodes nigrita	2			
Psammotettix alienus				11
Psammotettix confinis	1	11		13
Rhopalopyx vitripennis	6	145	33	103
Ribautodelphax albostriata				2
Turrutus socialis	71	465	109	267
Zygina hyperici		3		

#21, Rüsterberg bei Berbertal	04.06.1964	16.07.1964	27.08.1964
Anaceratagallia venosa		18	15
Anoscopus albifrons		2	
Arocephalus languidus		2	
Arocephalus punctum		6	
Chlorita paolii	2	13	24
Doratura homophyla		2	1
Doratura stylata		162	8
Eupelix cuspidata	2		
Eurysula lurida	1		
Euscelis incisus		6	5
Kosswigianella exigua		67	
Macrosteles laevis			3
Mocydiopsis longicauda			4
Mocydiopsis parvicauda		3	
Neophilaenus campestris	4		
Neophilaenus minor			2
Philaenus spumarius		1	
Psammotettix alienus	5		6
Psammotettix confinis	84	8	191
Psammotettix helvolus	185	17	430
Psammotettix nodosus	5		
Rhopalopyx vitripennis	317	19	41
Ribautodelphax collina		2	
Zygina hyperici	31		4

#24, Saalehänge bei Dobis	05.06.1964	23.07.1964	19.09.1964	20.07.1965	23.09.1965	31.05.1966
Adarrus multinotatus	1		4			3
Anaceratagallia ribauti		-2				
Anaceratagallia venosa		4	-3	4	4	
Aphrodes bicincta			-1			
Aphrophora alni				1		
Arocephalus punctum		25	2	7	2	
Athysanus argentarius		-1				
Chlorita paolii	12	9	19	28	15	7
Cixius nervosus		1				
Dictyophara europaea			2			
Doratura stylata		17	-6	6	13	
Emelyanoviana mollicula					4	2
Empoasca decipiens			9			
Empoasca pteridis	1		30	3	11	
Eupelix cuspidata		-1				1
Eupteryx atropunctata			2			1
Euscelis incisus		51	8	4		
Laburrus impictifrons		16	6	2	2	
Macrosteles spec., female			5		1	
Mendrausus pauxillus				2		
Mocydiopsis longicauda					9	
Neophilaenus albipennis				5		
Neophilaenus infumatus	2	40	6	267	38	2
Philaenus spumarius		12	3	58	3	2
Psammotettix alienus			55			
Psammotettix helvolus	29	21	263		26	47
Rhopalopyx preyssleri					2	
Rhopalopyx vitripennis	2		19		23	
Turrutus socialis	6	4	4	30	71	28
Zygina hyperici	4					

#25, Lunzberge bei Halle	05.06.1964	22.07.1964	16.09.1964	20.07.1965	23.09.1965	31.05.1966
Anaceratagallia ribauti				2	6	
Aphrodes bicincta				6		
Arocephalus punctum		4				
Artianus interstitialis		2				
Chlorita paolii	30	11	23	95	15	8
Dictyophara europaea					1	
Doratura horvathi		4				
Doratura stylata		31		5		
Elymana sulphurella		1				
Emelyanoviana mollicula					2	
Empoasca pteridis		1	2	1	2	
Eupelix cuspidata	2			2		
Eupteryx atropunctata			8			1
Euscelis incisus		9	2		1	
Macrosteles spec., female		2		2		
Mocydiopsis longicauda		6			3	
Muirodelphax aubei		2				
Neophilaenus campestris				2		
Neophilaenus infumatus		10		9	2	
Neophilaenus minor				4		
Philaenus spumarius		9	2	3		
Psammotettix alienus		1	75		1	
Psammotettix confinis	2		5		12	2
Psammotettix helvolus	101	29	216	6	159	141
Rhopalopyx vitripennis	33		13	8	26	6
Rhytistylus proceps		6		4		
Zygina hyperici		2			1	

#22a, Harslebener Berge	13.05.1964	16.07.1964	27.08.1964	10.08.1965	11.10.1965	31.05.1966
Adarrus multinotatus		41	30	12	65	11
Anoscopus albifrons			-1			
Aphrodes bicincta				4	2	
Arocephalus languidus		4	2	15	8	
Arocephalus punctum		8	3	2	3	
Chlorita paolii		23	6	4	1	
Doratura homophyla				2		
Doratura horvathi		81	24	11		
Doratura stylata		64	41	10		
Elymana sulphurella		4	2	9	2	
Emelyanoviana mollicula					2	19
Euscelis incisus		6	11			
Graphocraerus ventralis		1				
Jassargus pseudocellaris		1				
Jassidaeus lugubris					15	
Javesella pellucida				29		4
Kelisia haupti			1	2		
Kosswigianella exigua				1		
Mocydia crocea			4		34	6
Mocydiopsis attenuata					3	
Mocydiopsis longicauda	2	7	20	18	5	
Neophilaenus albipennis		6	11	37	15	
Neophilaenus campestris			1	1	2	
Neophilaenus infumatus		2	2	1		
Neophilaenus minor		5	19	18	24	
Oncopsis subangulata						1
Psammotettix alienus			45			
Psammotettix confinis			2			
Psammotettix helvolus		2	198		1	
Rhopalopyx preyssleri		2	1			
Rhopalopyx vitripennis		7			14	
Rhytistylus proceps		6		15	2	
Ribautodelphax pungens		2		6		
Stenocranus minutus					4	
Streptanus marginatus						1

#22b, Harslebener Berge	16.07.1964	27.08.1964	09.05.1965	10.08.1965	11.10.1965	31.05.1966
Anoscopus albifrons		-2		-1		
Aphrodes bicincta				2		
Arocephalus punctum	35	61		191	16	
Artianus interstitialis	6	4		18		
Chlorita paolii	33	16		73	28	45
Cixius cambricus				2		
Delphacinus mesomelas				4		25
Doratura homophyla	24	37		23		
Doratura stylata	161	95		50		
Elymana sulphurella	1					
Emelyanoviana mollicula					2	6
Empoasca decipiens					3	
Eupelix cuspidata		2				
Eupteryx notata		2				
Euscelis incisus	4	2				
Goniagnathus brevis		1				
Graphocraerus ventralis	2			1		
Jassargus pseudocellaris		2		5	3	2
Jassidaeus lugubris					241	
Javesella pellucida				23		
Kelisia haupti		2		65	34	
Kosswigianella exigua	8	2		62		17
Mocuellus collinus	16	92		2	1	4
Mocydiopsis attenuata					10	
Mocydiopsis longicauda				1		
Mocydiopsis parvicauda		1		1	3	
Neophilaenus campestris		1		16		
Neophilaenus minor	17	109		282	80	
Planaphrodes trifasciata				-1		
Psammotettix albomarginatus	3	55			18	6
Psammotettix alienus		31				
Psammotettix confinis	1	121			1	1
Psammotettix helvolus		670		6		
Rhopalopyx preyssleri				2		
Rhopalopyx vitripennis	6	2		4	32	
Rhytistylus proceps	10	10		26	1	
Streptanus marginatus	2					16
Ulopa reticulata			-1			
Zygina rubrovittata		1				

#22c, Harslebener Berge	16.07.1964	27.08.1964	10.08.1965	11.10.1965	31.05.1966
Acanthodelphax spinosa			8		
Adarrus multinotatus		6			
Anoscopus albifrons		-2	9		
Anoscopus serratulae				-1	
Aphrodes bicincta		2	2		
Arocephalus languidus	17	5	2		
Arocephalus punctum	38	25	215	6	
Arthaldeus pascuellus	1				
Artianus interstitialis	7		6		
Athysanus argentarius	6	1			
Chlorita paolii		17	6	2	
Delphacinus mesomelas	-1		4		4
Dikraneura variata	3				
Doratura homophyla	16	6	13		
Doratura horvathi	8				
Doratura stylata	49	25	31		
Elymana sulphurella	21	20	21	2	
Emelyanoviana mollicula		2			
Empoasca decipiens				5	
Enantiocephalus cornutus	2	4			
Errastunus ocellaris		5			
Eupelix cuspidata	6	4	8		
Eupteryx atropunctata				2	
Eupteryx notata			11		
Eupteryx tenella		1			
Euscelis incisus	2	5			
Graphocraerus ventralis	4		2		
Jassargus pseudocellaris	4	6	20	1	
Jassidaeus lugubris				12	
Javesella pellucida			19		10
Kosswigianella exigua	4		39		13
Mocuellus collinus	3	22	13		
Mocydia crocea		6			
Mocydiopsis attenuata		3			
Mocydiopsis longicauda		6			
Mocydiopsis parvicauda			8	2	
Neophilaenus campestris			11		
Neophilaenus infumatus			4		
Neophilaenus minor	21	27	258	25	
Psammotettix alienus		26		21	
Psammotettix confinis		16			
Psammotettix helvolus	2	55	2		
Psammotettix nodosus		2			
Rhopalopyx preyssleri	4	2	12		
Rhytistylus proceps	14	2	40		
Stenocranus minutus		2		4	
Streptanus marginatus	4		1		18
Ulopa reticulata	-2		-1		

#23, Saalberghau bei Dessau	04.06.1964	23.07.1964	23.09.1964	20.07.1965	23.09.1965
Anaceratagallia venosa			-1	2	
Anoscopus albifrons		2			
Aphrodes bicincta			2		
Aphrophora alni					2
Arocephalus punctum		20		6	
Cercopis vulnerata	2				
Chlorita paolii	31	30	18	11	9
Cicadula spec., female			1		
Dictyophara europaea		2			
Doratura stylata		115	3	12	
Elymana sulphurella		1		2	
Empoasca affinis			31		
Empoasca pteridis				4	8
Errastunus ocellaris	2	1	15		10
Eupelix cuspidata	15	2			
Eupteryx atropunctata			8		
Euscelis incisus		5	2		
Jassargus flori					3
Jassidaeus lugubris					11
Javesella pellucida		3			
Kosswigianella exigua		2			
Laburrus impictifrons		10			
Lepyronia celeoptrata		6	4	2	
Macrosteles spec., female			1		23
Micantulina stigmatipennis	8		11		
Mocydiopsis longicauda			1		
Neoaliturus fenestratus			1		
Neophilaenus campestris			2		
Neophilaenus exclamationis		1	2	4	6
Neophilaenus lineatus				1	
Neophilaenus minor		25		13	4
Psammotettix alienus		1	38		2
Psammotettix confinis	5		41		8
Psammotettix helvolus	17	2	379	4	35
Psammotettix nodosus	1		22		
Rhopalopyx preyssleri		2			
Rhopalopyx vitripennis			21		4
Turrutus socialis	29	33	56	7	21
Verdanus abdominalis	2				

#30a, Hang westlich Kattenburg/Kyffhäuser	19.09.1963	14.07.1964	26.08.1964	08.06.1965	16.07.1965	13.08.1965	10.10.1965
Adarrus multinotatus		1					4
Anaceratagallia venosa		27	6			11	-7
Aphrodes bicincta						1	
Arboridia parvula		3	4		4		16
Arocephalus punctum		4			1	4	
Chlorita paolii						4	6
Doratura horvathi		65	10		11	4	1
Doratura stylata		10	1				
Emelyanoviana mollicula			4	17	2	295	310
Empoasca affinis							13
Eupelix cuspidata							2
Euscelis distinguendus						4	
Hardyia signifer		1					2
Hephathus nanus		2	1		1		
Jassargus obtusivalvis	4	4	8	7	19	18	27
Jassidaeus lugubris				-1			12
Javesella pellucida						7	
Macrosteles quadripunctulatus			1				
Mendrausus pauxillus		67	31		70	51	4
Mocydiopsis longicauda	2	1	3				
Mocydiopsis parvicauda							2
Neophilaenus albipennis		2					
Neophilaenus campestris						2	
Neophilaenus infumatus		25	2		13	10	
Neophilaenus minor		2	5	2	8	15	
Psammotettix confinis	4		34			2	1
Psammotettix helvolus	19	6	713	8	2	13	2
Rhopalopyx vitripennis	7	2	-1		6		21
Rhytistylus proceps		4	2				
Ribautodelphax pungens		4					
Tettigometra leucophaea							3
Zygina hyperici						3	

#48, Strohmberg bei Weißenberg	24.05.1964	11.07.1964	23.08.1964	11.10.1964
Anaceratagallia venosa		4	55	
Aphrodes bicincta			3	
Arocephalus longiceps			4	6
Balclutha punctata			1	
Doratura stylata			25	
Edwardsiana rosae				3
Empoasca pteridis	10		1	75
Euscelis incisus	11	1	12	
Jassargus allobrogicus		1		
Jassargus flori			2	15
Jassargus pseudocellaris			2	
Macrosteles laevis		2	25	
Neophilaenus minor		2		
Philaenus spumarius			2	
Psammotettix alienus			9	18
Psammotettix confinis		2	151	4

#32, Wipperdurchbruch bei Seega	12.05.1964	15.07.1964	26.08.1964	15.07.1965	14.08.1965	10.10.1965	30.05.1966
Adarrus multinotatus		14	150	57	7	45	2
Allygidius commutatus						-1	
Anaceratagallia venosa		65	8	1	31		
Anoscopus albifrons						-1	
Aphrodes bicincta		2		2	2		
Aphrophora alni						2	
Arocephalus longiceps		1	6	4	2		
Batracomorphus irroratus		2		6			
Chlorita dumosa			2		2		20
Chlorita paolii		2				2	
Dictyophara europaea			9				
Diplocolenus bohemani		4		15			
Doratura horvathi		29	4		21		
Doratura stylata		62	13	18	32		
Elymana sulphurella						1	
Emelyanoviana mollicula			17		6	11	75
Empoasca affinis						21	
Empoasca pteridis			4			22	
Eupelix cuspidata						2	
Eupteryx atropunctata					1		2
Eupteryx notata					4	8	175
Eupteryx tenella							1
Hephathus nanus					2		
Jassargus flori		2		4			
Jassargus obtusivalvis		9	21	26	2	4	2
Jassidaeus lugubris						2	
Javesella pellucida		2			1		
Kosswigianella exigua				2			
Macrosteles spec., female			2				
Mendrausus pauxillus		2					
Mocydia crocea						19	4
Mocydiopsis intermedia						3	
Mocydiopsis longicauda		2	19		16	6	
Neophilaenus albipennis			2	4	2		
Philaenus spumarius				1	2		
Platymetopius major				2			
Psammotettix alienus						1	
Psammotettix cephalotes				6	2	4	
Psammotettix helvolus			505		4	4	
Rhopalopyx preyssleri		5			2		
Ribautodelphax pungens	2	6		30		-1	2
Stenocranus fuscovittatus						3	
Stenocranus minutus						2	
Tachycixius pilosus				-1			2
Turrutus socialis			2	1	3		

#36, Steppenheide am großen Seeberg bei Gotha	11.05.1964	20.06.1964	16.08.1964	31.10.1964
Adarrus multinotatus		33	8	4
Anaceratagallia venosa				-1
Batracomorphus irroratus			5	
Chlorita dumosa			2	
Chlorita paolii		2		
Dikraneura variata	1			1
Diplocolenus bohemani		46	2	
Doratura stylata				-1
Emelyanoviana mollicula			2	
Empoasca affinis				73
Empoasca decipiens				41
Empoasca pteridis				17
Eupelix cuspidata				-1
Javesella pellucida			1	
Macropsis scutellata		1		
Mocydia crocea	2		39	7
Mocydiopsis longicauda			1	1
Neophilaenus campestris		4	47	
Psammotettix alienus			10	
Psammotettix cephalotes		85	11	
Psammotettix helvolus		2	31	
Stenocranus minutus	2			
Turrutus socialis		26	15	
Utecha trivia			5	
Zygina flammigera				2

#37, Jonastal bei Arnstadt	31.05.1964	20.06.1964	17.08.1964	01.11.1964
Adarrus multinotatus			3	
Anaceratagallia venosa			2	
Aphrophora alni			1	
Chlorita dumosa		-3		
Diplocolenus bohemani	85	141	2	
Doratura impudica			-1	
Doratura stylata			2	
Elymana sulphurella			3	
Emelyanoviana mollicula	35		1	4
Empoasca affinis				13
Erythria aureola		17		2
Goniagnathus brevis			2	
Idiodonus cruentatus			1	
Jassargus obtusivalvis		36	8	15
Kelisia guttula			1	
Macrosteles laevis			2	
Mocydia crocea			2	
Mocydiopsis longicauda				1
Neophilaenus campestris			2	
Psammotettix alienus			23	
Psammotettix helvolus	2		715	62
Rhopalopyx vitripennis		4		2
Turrutus socialis			-1	
Verdanus abdominalis			2	

#38, Hang bei Leutersdorf	20.06.1964	17.08.1964	01.11.1964
Adarrus multinotatus	68	17	7
Anoscopus albifrons		-4	
Aphrodes bicincta			2
Arocephalus longiceps		6	
Cicadetta montana	1		
Diplocolenus bohemani	71		
Doratura stylata	4	4	
Euscelis incisus		2	
Goniagnathus brevis			-1
Jassargus obtusivalvis	72	25	14
Macrosteles spec., female		1	
Mocydiopsis longicauda		2	
Neophilaenus albipennis		6	
Neophilaenus campestris		59	
Neophilaenus minor		6	
Philaenus spumarius		5	
Psammotettix alienus			4
Psammotettix cephalotes		4	
Psammotettix confinis		5	
Psammotettix helvolus		495	73
Rhopalopyx vitripennis	15		2
Ribautodelphax pungens		4	
Zygina hyperici		1	

#39, Leutratal	15.09.1963	11.05.1964	18.06.1964	16.08.1964	31.10.1964
Adarrus multinotatus	2				
Anaceratagallia ribauti	10				95
Anaceratagallia venosa				4	
Aphrodes bicincta	4			2	2
Aphrophora alni			7		
Diplocolenus bohemani			22		
Doratura stylata	2		2	63	
Emelyanoviana mollicula	7	2	2		
Empoasca affinis					18
Erythria aureola			17		2
Eupelix cuspidata					4
Euscelis incisus				2	
Jassargus obtusivalvis	96		129	185	24
Kelisia haupti				1	
Lepyronia coleoptrata			8	10	
Macrosteles laevis				4	
Mocydia crocea	4	4			-1
Mocydiopsis longicauda		1			
Neoaliturus fenestratus	2				
Neophilaenus campestris				2	
Neophilaenus minor				4	2
Philaenus spumarius	11			165	21
Psammotettix alienus				2	1
Psammotettix helvolus	259			1053	79
Turrutus socialis	21		2	64	41

#40, Buntsandsteinaufschluss bei Wogau	15.09.1963	11.05.1964	18.06.1964	16.08.1964	31.10.1964
Adarrus multinotatus	75			29	2
Anaceratagallia ribauti				-5	2
Aphrodes bicincta	2				
Arboridia parvula				3	
Arocephalus longiceps	8		4	2	
Chlorita paolii	6			6	
Dictyophara europaea	41			85	
Doratura stylata	2			2	
Edwardsiana rosae					1
Elymana sulphurella				3	
Emelyanoviana mollicula	57		1	6	
Empoasca pteridis				1	2
Errastunus ocellaris	4				
Erzaleus metrius				1	
Eupteryx atropunctata	6				
Eupteryx notata	2				
Euscelis incisus				8	
Fieberiella septentrionalis				1	
Gargara genistae				2	
Graphocraerus ventralis			2		
Jassargus obtusivalvis	197		46	195	7
Lepyronia coleoptrata			2	19	
Mocydia crocea	35	4		35	4
Neoaliturus fenestratus				2	
Neophilaenus albipennis	6		2	16	2
Philaenus spumarius	2		3	9	
Psammotettix alienus	3			9	
Psammotettix helvolus	52			22	1
Ribautodelphax pungens				4	
Turrutus socialis	14			2	

Plot #	10a	10b	12	13b	13a	13c	15a	15b	16b	17	18	26	27	28	29	31	34	35a	35b	41	42	43	44	45	46	47a	47b
Date	15.5.2009	15.5.2009	11.7.2008	11.7.2008	11.7.2008	11.7.2008	10.7.2008	10.7.2008	11.7.2008	10.7.2008	12.7.2009	25.9.2009	25.9.2009	25.9.2009	25.9.2009	25.9.2009	25.9.2009	25.9.2009	25.9.2009	22.7.2008	22.7.2008	22.7.2008	22.7.2008	21.7.2008	22.7.2008	21.7.2008	21.7.2008
Exposition	180	203	158	135	158	158	180	180	180	180	135	180	180	160	180	180	225	180	180	248	180	225	180	180	135	180	180
Inclination	10	15	15	25	5	5	20	20	20	30	20	15	55	25	15	40	45	20	8	25	35	15	3	25	5	1	8
Cover Shrubs (%)	1	20	0	0	0	0	0	0	2	2	1	2	1	2	7	2	0	1	2	5	5	0	5	0	1	0	0
Cover Herbs (%)	90	80	60	60	4	4	60	60	60	75	20	70	95	55	75	85	60	80	95	90	60	8	75	95	70	90	90
Cover Mosses (%)	1	0	2	1	9	9	5	5	8	1	0	1	1	3	1	0	85	1	1	1	20	0	12	2	0	5	1
Cover Lichen (%)	1	1	3	0	10	10	0	1	1	0	25	1	0	15	1	1	1	1	2	0	10	0	8	0	20	0	0
Cover Litter (%)	3	10	2	20	10	10	10	10	2	10	1	5	10	3	5	10	5	5	5	5	5	12	3	10	5	5	5
Cover Rocks (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Mean Hight Herbs (%)	0	0	0	20	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0	0	30	0	0
Max. Height Herbs (%)	0	0	0	0	0	0	6	50	0	70	0	0	0	0	0	0	0	0	0	90	70	0	0	70	70	0	70
Stotal	32	34	32	24	22	22	24	22	18	21	9	24	31	30	32	30	28	14	27	26	17	26	30	36	22	26	29
Htotal	2.9	2.9	2.6	2.4	2.5	2.5	2.5	2.3	2.4	2.2	1.4	2.8	2.9	2.9	3.1	3	2.8	2.1	2.6	2.3	2.3	2.7	2.9	3	2.5	2.6	2.8
Jtotal	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.7	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Mean R	7	7.7	7.3	7.8	4.6	4.6	7.6	7.4	5.4	7.6	2	7.8	7.9	7.5	7.7	7.5	7.8	7.5	7.8	7.1	5.8	6.2	7	5.3	4.8	5.3	5.4
Mean N	3.1	3	2.6	3.1	2.5	2.5	2.9	2.4	3.1	2.9	2.1	2.1	2.7	2.2	2.3	2.3	2.4	2.4	2.6	3.2	3.1	5.2	2.5	3.9	2.7	3.5	3
Mean F	2.9	2.9	2.6	2.9	2.8	2.8	3.3	2.6	2.5	3	3	2.4	3	2.7	2.4	2.7	2.7	2.7	3	3.1	3.3	4.7	3.1	4.2	3	3.6	3.7
A 0-50	0	0	0	0	0	.	25	0	0	60	0	0	0	10	0	0	0	0	0	65	20	0	0	0	5	5	5
A 50-100	0	0	0	0	0	.	50	5	20	50	0	30	5	60	0	5	0	10	5	75	50	0	20	0	60	25	25
A 100-200	50	0	10	0	0	.	15	35	35	40	5	25	15	65	0	15	10	35	30	75	60	0	20	10	80	40	70
A total	38	0	7.5	0	0	.	22	27	30	43	3.8	24	12	61	0	12	7.5	28	23	74	56	0	19	7.5	72	35	58
W 0-50	0	0	10	5	5	.	20	0	25	5	35	5	5	5	10	15	75	0	0	5	25	20	40	70	50	50	80
W 50-100	0	0	10	10	5	.	40	10	25	15	95	5	15	5	60	20	65	0	0	10	20	30	30	90	15	30	40
W 100-200	5	10	5	10	10	.	40	15	15	5	95	5	15	10	80	10	80	5	5	5	15	45	30	55	5	40	15
W total	3.8	7.5	6.3	9.7	8.8	.	39	13	18	6.9	91	5	14	8.8	72	12	77	3.8	3.8	5.9	17	41	31	63	9.7	39	24
Euphorbia cyparissias	.	.	4	1	1	1	4	1	.	2	.	4	2	10	4	4	2	10	10	2	1	.	1	1	.	.	.
Festuca brevipila	20	2	.	1	2	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.
Stipa capillata	20	4	20	30	10	.	.	30	.	40	.	20	2	4	10	10	.	40	20	.	.	.	.	.	.	.	.
Arrhenatherum elatius	10	.	1	2	4	.	.	.	2	.	.	.	.	.	.	.	.	.	.	4	1	4	.	20	10	.	10
Phleum phleoides	10	.	10	4	4	.	10	4	.	2	.	.	.	10	.	10	.	.	.	.	.	.	.	.	.	10	.
Artemisia campestris	4	.	.	2	.	2	.	2	2	.	.	.	.	2	.	10	.	.	.	.	1	.	.	.	.	.	.
Helichrysum arenarium	4	.	.	2	.	2	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa angustifolia	4	.	.	.	1	.	.	.	.	.	.	.	20	.	.	2	.	.	10	2	.	.	.	.	.	1	.
Galium mollugo	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	4	.	1	1	.	4
Centaurea scabiosa	2	2	.	.	.	.	.	.	.	.	.	2	.	.	4	.	.	.	.	2	.	.	.	2	.	.	.
Sedum sexangulare	2	.	.	2	.	.	.	.	2	.	.	.	.	.	4	2	.	.	.	.	.	.	4	.	.	.	.

Plot #	10a	10b	12	13b	13a	13c	15a	15b	16b	17	18	26	27	28	29	31	34	35a	35b	41	42	43	44	45	46	47a	47b
Agrostis capillaris	2	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.
Arenaria serpyllifolia	2	.	.	.	.	.	.	.	.	.	.	.	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.
Falcaria vulgaris	1	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	2	.	.	.	.	.	.	.
Silene dioica	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Dactylis glomerata	1	.	4	.	1	.	4	.	.	.	.	.	4	.	.	.	.	4	1	2	.	2	.	.	2	.	.
Aster linosyris	1	.	.	.	.	.	.	.	.	.	.	2	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.
Scabiosa canescens	1	.	.	.	.	.	.	.	.	.	.	2	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.
Asparagus officinalis	1	.	.	.	.	.	.	.	.	.	.	2	.	.	1	.	.	.	2	.	.	.	.	.	.	.	.
Arabis hirsuta	.	1	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	1	.	.	.	.	.	.	.	.
Pimpinella saxifraga	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	2	.	.	.
Thymus pulegioides	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	10	1	4	.
Origanum vulgare	.	2	4	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	10	.	.	.	.	.	.	.
Rosa spec.	.	2	.	.	.	.	.	.	.	.	.	2	2	.	.	2	.	.	4	.	.	.	.	.	.	.	.
Asperula cynanchica	.	2	.	.	.	.	.	.	.	.	.	2	.	4	4	.	.	.	.	.	.	.	.	.	.	.	.
Carex caryophyllea	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	4	.	10	2
Potentilla incana	.	4	.	10	4	.	.	4	.	.	.	.	.	2	10	10	.	.	.	.	.	.	.	.	.	.	.
Thesium linophyllon	.	4	.	.	.	.	.	.	.	.	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Peucedanum oreoselinum	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	4	10
Salvia pratensis	.	10	2	.	2	.	1	1	.	1	.	.	4	.	4	2	2	4	2	.	.	.	.	.	.	.	.
Sanguisorba minor	.	10	2	.	.	.	.	.	.	.	.	10	.	.	4	.	1	1	.	1	.	.	1	1	.	.	.
Anthericum liliago	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	.	.
Brachypodium pinnatum	.	20	10	.	30	.	2	1	.	10	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	30
Allium oleraceum	.	.	1	1	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
Agrimonia eupatoria	.	.	1	.	1	.	.	.	.	.	.	.	2	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Achillea setacea	.	.	1	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	4	4	.	.	.	1	2	.
Vicia sepium	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Lotus corniculatus	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	2	.	.	.
Dianthus carthusianorum	.	.	2	1	1	.	1	.	.	1	.	.	1	.	.	2	.	1	2	.	1	.	1	.	.	.	.
Stachys recta	.	.	2	1	1	.	.	.	.	4	.	.	.	.	1	2	1	.	4	10	.	.	.	.	.	.	.
Centaurea stoebe	.	.	2	2	2	.	2	1	2	4	.	2	.	2	4	4	1	.	.	.	.	.	1	.	1	.	.
Medicago falcata	.	.	2	.	2	.	.	.	.	.	.	.	4	.	.	1	.	.	2	.	.	.	.	.	.	.	.
Knautia arvensis	.	.	2	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.
Silene vulgaris	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.
Galium verum	.	.	4	1	2	.	2	1	.	.	.	.	2	.	1	1	.	4	2	.	.	10	.	.	.	.	.
Calamagrostis epigejos	.	.	4	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Securigera varia	.	.	4	.	1	.	10	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
Festuca valesiaca	.	.	20	.	.	.	.	2	.	.	.	10	.	10	10	.	.	.	.	.	.	.	.	.	.	1	.
Chondrilla juncea	.	.	.	1	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.

Plot #	10a	10b	12	13b	13a	13c	15a	15b	16b	17	18	26	27	28	29	31	34	35a	35b	41	42	43	44	45	46	47a	47b
Cerastium spec.	.	.	.	1	.	.	.	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Rumex acetosella	.	.	.	2	.	2	.	.	4	.	.	.	.	.	.	.	.	.	.	.	4	.	.	1	.	2	.
Verbascum lychnitis	.	.	.	2	.	.	.	.	.	2	.	.	.	.	.	2	.	.	.	.	2	.	.	.	.	2	.
Hieracium pilosella	.	.	.	.	1	2	.	.	.	.	.	1	2	20	.	.	.	.	.	.	4	.	.	.	4	10	.
Echium vulgare	.	.	.	.	.	.	1	.	.	.	.	.	2	.	.	2	.	.	1	2	2	.	1	.	.	.	.
Linum austriacum	.	.	.	.	.	.	2	10	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Festuca ovina ag.	.	.	.	.	.	.	2	.	.	2	.	.	10	.	20	.	.	.	20	50	.	.	.	.	20	.	.
Plantago lanceolata	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	4	1	.	.
Bromus erectus	.	.	.	.	.	.	30	2	.	.	.	.	1	.	.	10	.	10	20	.	.	.	.	.	.	.	.
Alyssum montanum	.	.	.	.	.	.	.	1	.	2	.	4	.	1	.	2	.	.	.	.	.	.	.	.	.	.	.
Hypericum perforatum	.	.	.	.	.	.	.	1	.	2	.	.	2	.	.	.	.	.	2	.	.	1	1	2	2	.	1
Anthericum ramosum	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	4	.	.	.	10	.	2	.	.	.	.
Silene otites	.	.	.	.	.	1	.	.	1	.	.	2	1	1	.	2	.	.	.	.	.	.	.	.	.	.	.
Carex humilis	.	.	.	.	.	.	.	.	1	.	.	4	10	10	10	10	20	.	.	.	.	.	.	.	.	.	.
Jasione montana	.	.	.	.	.	2	.	.	2	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	4	.
Agrostis capillaris	.	.	.	.	.	4	.	.	10	.	.	.	.	.	.	.	.	.	.	4	10	2	.	20	10	30	20
Vicia cracca	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	2	.	.	.
Thymus praecox	.	.	.	.	.	.	.	.	.	.	.	1	2	1	.	4	2	.	.	.	.	.	.	.	.	.	.
Gypsophila fastigiata	.	.	.	.	.	.	.	.	.	.	.	1	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.
Briza media	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
Helianthemum nummularium	.	.	.	.	.	.	.	.	.	.	.	2	.	2	4	10	2	.	.	.	.	.	.	.	.	.	.
Potentilla tabernaemontani	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	2	.	1	.	.	.	.	.	.	.	.
Helictotrichon pratense	.	.	.	.	.	.	.	.	.	.	.	4	20	.	.	20	.	10	10	.	.	.	.	.	.	.	.
Teucrium montanum	.	.	.	.	.	.	.	.	.	.	.	4	.	1	.	.	10	.	.	.	.	.	.	.	.	.	.
Acinos arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	2	.	.	.	.	.	.	1	.	.	.	.
Campanula rotundifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2	.	.	2
Hippocrepis comosa	.	.	.	.	.	.	.	.	.	.	.	.	.	4	2	.	2	.	.	.	.	.	.	.	.	.	.
Eryngium campestre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	4	4	4	.	4	2	.	.	.	.	.
Rosa spec.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	4	.	.	.	1	1	.	1
Quercus robur	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	1	1
Anthoxanthum odoratum	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	1	4
Potentilla argentea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	1	.	1	.
Veronica chamaedrys	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2	.	.	2
Silene viscaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	2	1
Festuca rubra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30	.	4	.	4	.
Dianthus deltoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	2
Sedum maximum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	1
Convolvulus arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	2	.	.	.	.	.

Plot #	10a	10b	12	13b	13a	13c	15a	15b	16b	17	18	26	27	28	29	31	34	35a	35b	41	42	43	44	45	46	47a	47b
Gentiana cruciata	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crataegus monogyna	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Allium vineale	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Medicago minima	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus spec.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium echioides	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rosa spec.	2	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium semidecandrum	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Erophila verna	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cynoglossum officinale	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia esula	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melampyrum arvense	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Origanum vulgare ag.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pimpinella major	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Buellia alboatra	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campanula rapunculoides	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carlina vulgaris	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Genista germanica	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypochaeris maculata	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygala amara	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium murorum	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Medicago lupulina	.	2	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lotus corniculatus ag.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Stipa borysthenica	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prunus spinosa ag.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helictotrichon pubescens	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Geranium sanguineum	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.
Filipendula vulgaris	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erigeron annuus	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Anthemis tinctoria	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ajuga genevensis	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum telephium	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chaenorhinum minus	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prunus spinosa	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Verbascum thapsus	.	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Conyza canadensis	.	.	.	1	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lithospermum arvense s. sibthorpianum	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anchusa officinalis	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Plot #	10a	10b	12	13b	13a	13c	15a	15b	16b	17	18	26	27	28	29	31	34	35a	35b	41	42	43	44	45	46	47a	47b
Carex ligerica	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex supina	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Diplotaxis muralis	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Salsola kali s. tragus	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria glauca	.	.	.	2	.	1	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.
*Festuca pallens * glaucina*	.	.	.	2	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Bromus inermis	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca rupicola	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon pratensis s. orientalis	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea jacea	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Senecio jacobaea	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crataegus monogyna	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia hirsuta	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fragaria viridis	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium sabaudum	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Adonis vernalis	.	.	.	.	.	.	10	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum catharticum	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Capsella bursa-pastoris	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus nutans	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria macrantha	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.
Bromus hordeaceus	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chenopodium album	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Setaria viridis	.	.	.	.	.	1	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromus tectorum	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca psammophila	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Corynephorus canescens	.	.	.	.	.	20	.	.	20	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myosotis arvensis	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa pratensis	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Linaria vulgaris	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Deschampsia flexuosa	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pinus sylvestris	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prunus serotina	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercus petraea	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Spergula morisonii	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.
Teesdalia nudicaulis	.	.	.	.	.	1	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.
Pulsatilla pratensis	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cirsium acaule	.	.	.	.	.	.	.	.	.	.	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphrasia stricta	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Plot #	10a	10b	12	13b	13a	13c	15a	15b	16b	17	18	26	27	28	29	31	34	35a	35b	41	42	43	44	45	46	47a	47b
Rhinanthus minor	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium campestre	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Achillea pannonica	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Picris hieracioides	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Seseli annuum	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea stoebe s. stoebe	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Odontites luteus	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	4	.	.	.	.	.	.	.	.	.	.	.
Allium senescens s. montanum	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Rosa spec.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.
Vincetoxicum hirundinaria	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	1	.	.	.	.
Pseudolysimachion spicatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Crataegus laevigata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Teucrium botrys	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Viburnum lantana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Onobrychis viciifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.
Prunus spinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.
Bromus erectus ag.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.
Pyrus pyraster	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.
Rosa micrantha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium piliferum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Bupleurum falcatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.
Cornus sanguinea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Iris aphylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Polygonatum odoratum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Seseli hippomarathrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Thalictrum minus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Viola hirta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Asperula cynanchica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Dictamnus albus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.
Inula hirta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.
Teucrium chamaedrys	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.
Alyssum alyssoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.
Festuca pallens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.
Camelina microcarpa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Erodium cicutarium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Papaver dubium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Rubus spec.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.	.	.	.

Plot #	10a	10b	12	13b	13a	13c	15a	15b	16b	17	18	26	27	28	29	31	34	35a	35b	41	42	43	44	45	46	47a	47b
Scabiosa ochroleuca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1	.	.	.	.
Hieracium laevigatum	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Campanula patula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Leontodon hispidus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.
Astragalus glycyphyllos	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.
Fraxinus excelsior	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Polygala vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Quercus petraea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Trifolium medium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
Veronica officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Viola canina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
Achillea millefolium ag.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Anthriscus sylvestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Trifolium alpestre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Clinopodium vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Tanacetum vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.
Vicia tetrasperma	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Hieracium spec.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Ononis repens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Poa bulbosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.
Ballota nigra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.
Bromus sterilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.
Campanula rapunculus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Silene latifolia s. alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Veronica teucrium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Carex flacca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.
Danthonia decumbens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Achillea millefolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	4	.	.	.
Leucanthemum vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1
Silene nutans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
Holcus mollis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.
Luzula campestris ag.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	4	.
Prunus cerasifera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2	.	.	.
Betula pendula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
Melampyrum nemorosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	10
Trifolium arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	2
Euonymus europaea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Koeleria pyramidata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.

Plot #	10a	10b	12	13b	13a	13c	15a	15b	16b	17	18	26	27	28	29	31	34	35a	35b	41	42	43	44	45	46	47a	47b
Peucedanum cervaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.
Poa compressa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Potentilla tabernaemontani	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.
Prunus mahaleb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
Prunus mahaleb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
Robinia pseudoacacia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
Sedum album	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
Allium senescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
Achillea collina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Calystegia sepium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Crepis capillaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Daucus carota	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Lolium perenne	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.
Ranunculus repens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Trifolium repens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.
Urtica dioica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Taraxacum Sec. Alpina; Hamata et Ruderalia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.
Cerastium holosteoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Elymus repens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.