QUANTITATIVE AND QUALITATIVE INVESTIGATION OF THE SALTATORIA ON THE TIHANY PENINSULA

BY

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The present paper is intended to be a modest continuation of the biocenotic studies which are slowly gaining ground in this country; in it I offer a part of the results formulated from quantitative and qualitative collections made during the summer of 1947 on the Tihany peninsula (Lake Balaton, Western Hungary). My investigations are concerned only with a group of insects of agrobiological and biocenotical significance, with the Saltatoria sub-order of Orthoptera. I published a complete list of the Orthoptera observed on the peninsula in Volume 18 of this periodical (NAGY, 1948). As the Saltatoria form only a small part of the animal associations here it was endeavoured — pursuing the aim of PALMGREN (1928) — to make the methods and the results in such a way that they could some day be related and compared with investigations bearing on other groups of the association and, finally, that a synthesis could be made of the detailed results relating to the different groups.

Of the 50 species of Saltatoria observed on the peninsula (I included the *Mantis religiosa)* 46 figure in the surveys, belonging almost entirely to the Acrididae family, and therefore herbivorous. The partially predaceous Tettigoniidae and the mixed-feeding Gryllidae families, though in nutrition, ecology and other respects belonging to other groups, are also given with the Acrididae family which form the great majority, more significant agrobiologically, in order to give a united and comprehensive picture of the rôle of the Saltatoria.

The starting point for my investigations — as in my research along similar lines in the Hortobágy puszta (NAGY, 1944, 1947) — was the vegetation, which is one of the most important factors in the habitat of the animal community. The vegetation — which itself is of course an organic part of the biocenosis — served as a basis in ecological and biocenotical investigations of a much more motile group of animals, the birds (PALMGREN, 1930, UDVARDY, 1947), but we also find it in the studies of several authors dealing with Orthoptera (VESTAL, 1933, KOZMINSKI, 1925, NEFEDOV, 1933, BALOGH and LOKSA, 1948, etc.). In survey work demarcation of the habitats can most easily and practically be made on the basis of plant societies (associations, sub-assciations, facies). This work was facilitated by the floristic and plant sociological literature on the

Tihany peninsula (Soó, 1930, 1931, 1932 I, 1934) and plant geographical maps (Soó, 1932, II; UDVARDY, 1947), besides which the kind cooperation of dr. LAJOS FELFÖLDY on several occasions helped in identifying the plant communities.

Determination of the abundancy (=density in individuals), which causes so much difficulty in animal associations, was made with the quadrate method I had already employed, following F. OKLAND (1929), in the Hortobágy (NAGY, 1944), and which BALOGH, (1947) applied successfully in establishing the abundance of Saltatoria insects.

The field work schedule was as follows: in places which seemed uniform as to vegetation, without disturbing the animals, I placed the 10×1 m ($= 10$ m^2) squares of yarn, and counted the Saltatoria seen in them. In one survey area 3—6 squares ($= 30$—60 m^2), at an average distance of 10—30 m from one another, generally seemed enough to establish the abundance, in fact, it can be said in general that the density value never varied to any decisive extent after counting 1—2 squares. In some of the less extensive habitats I had to be satisfied with the count from two squares, or even one.

Because of the great motility of most of the Saltatoria, the count of the animals found in the squares cannot be combined with their immediate collection. To obtain the species composition of the Saltatoria populations (German, B e s t a n d) as well as the numerical relations of the species to one another, I made collections with an insect net. Finally I prepared more detailed notes, with numbers which corresponded to those on the formaline bottles, of the habitat and district (see appendix, p. 116.).

The 43 surveys and collections (of which only 6 were qualitative) made from July 22nd to August 21st, 1947, produced 4625 animals, which means an average of 107 per survey.

The Tihany peninsula proved especially suitable for carrying out comparative investigations, as its $\pm$ 12 km^2 area I could examine all the habitats which are important from the standpoint of Saltatoria, such as wheatfields (already in stubble), pastures, slopes with „steppe“[1]! park forests, mesophile and hygrophile meadows.

In evaluating the collected and identified material the following characteristics were observed:

A b u n d a n c y (*A*) means the number of specimens of Saltatoria falling to a unit of area (in this paper 1 hectare = 10,000 m^2 = 2,471 acres), data which I obtained by calculating the average density of the survey squares in terms of hectares (T a b l e VI).

P r o d u c t i o n (*P*) means the live weight of the animals per unit of area (likeweise calculated in hectares). It is to be noted that I obtained the data on the weight of the different species as well as the Saltatoria population per hectare by laboratory measurements and calculations. The animals were taken home in a fresh, living state and weighed according to species and sex on analytical balances. The average weight of several animals of the same species and sex served for the later establishment of the weight of the Saltatoria population surveyed, and from that the weight per hectare (T a b l e VII). The larvae figured separately, and as far as possible according to species or sex (per genus) in the weight calculations, divided into two groups in respect to average weight (Development phases I—III and IV—V); in the absence of measurements (or only 1—2 measurements) the weight of some larvae is given by estimation in parenthesis in T a b l e II. I believe that the above method is suitable both practically and in respect to accuracy.

Besides the *A* and *P* data, which have absolute values, and from the standpoint of production are very important, the following characteristics of relative value throw light on the species constituents of the Saltatoria population, distribution of the species, their connections with different types of habitats, and on the ecological conditions and requirements of the Saltatoria populations and species in general.

[1] steppe = (Hungarian „sztyep“) xerothermous plant association of the S and SE slopes of the Magyarközéphegység mountains. (See Soó, 1940 p. 24).

Dominancy means the species distribution of the Saltatoria populations, expressed in %. The dominance based on the number of individuals (*DI*), is obtained from net-collected material (Table III). Weight dominance (*DG*) means the share of the weight of specimens belonging to one species in the Saltatoria population in question, likewise expressed in % (Table IV). The *DG* values, though they differ significantly from those of *DI*, chiefly only in the Saltatoria populations containing many small larvae, throw light on the comparative ecological significance of the Saltatoria species in the different biotopes.

The Constancy (K) value answers the question of the regularity of the occurrence of any species, the constance in the Saltatoria group in question. Thus all, or at least nearly all the species occurring in the survey, which belong to the type investigated (I distinguished altogether 6 types) were constant, whereas those occurring in only 1—2 surveys were accessary (accidental). This interpretation of constancy corresponds to the idea of „local constancy". The degree of constancy was expressed as in plant sociology (FELFÖLDY, 1943, p. 79—80): The species in question is present in 80—100 % (= *K* Grade 5); in 60—80 % (= Grade 4); in 40—60 % (= Grade 3); in 20—40 % (= Grade 2); in 0—20 % (= Grade 1) of the surveys belonging to the population group.

Fidelity (*F*) expresses the close or lax connection of the species in the Saltatoria population groups to the biotope-types, that is, in reality it gives the degree of ecological plasticity („eurytope" and „stenotope" species). I indicate the *F* in the same way as the degree of constancy: If the surveys of the Saltatoria population group investigated total occurrence of the species in question is 80—100 % (= *F* Grade 5); 60—80 % (= Grade 4); 40—60 % (= Grade 3); 20—40 % (= Grade 2); 0—20 % (= Grade 1).

The percentual distribution of *K* and *F* degrees of the Saltatoria population group is illustrated in Figure 1 diagrams K and F respectively.

For better evaluation of the relation between the population and the vegetation and of the characteristics noted above, and for calculating the *K* and *F* values, it is expedient to range the results of the different surveys in groups. The DI and DG data proved to the most suitable as basis for the grouping, but in addition to the Saltatoria, I took into consideration the vegetation, as the most important constituent of the biocenosis, which for the Saltatoria — and certainly for all the animal populations as well — is the most essential part of the habitat. In classifying I naturally took into consideration the qualitative (species) differences among the Saltatoria. In one Saltatoria population group (SPG) as a result of the classification carried out in this way, were included the surveys made in localities with more or less similar vegetation in which, besides general qualitative (species) agreement, the dominant species (the *DI* or *DG* value above 10 %) were the same. The *SPG* thus established (see below) served thereafter for various comparisons and for calculating the K and F values.

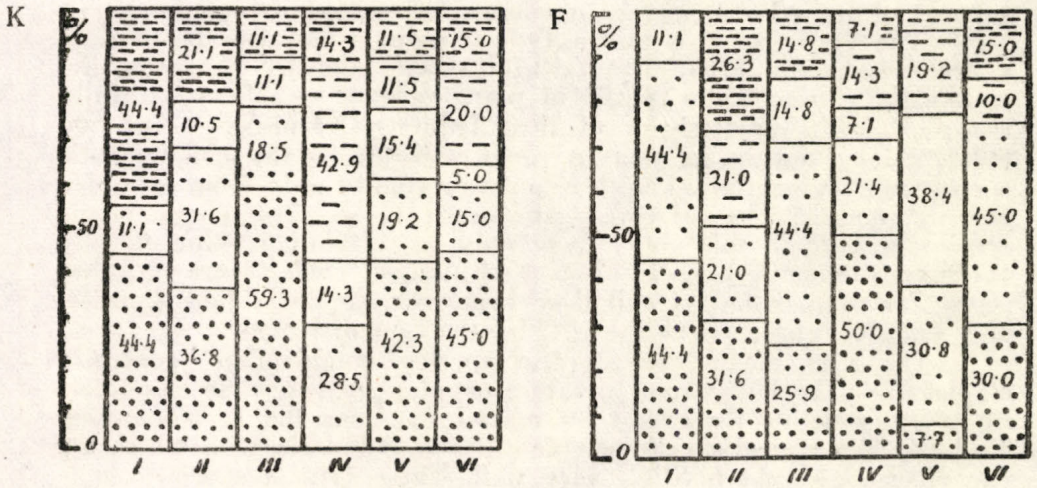

Fig. 1. Diagram showing degrees (1—5) and percentual values of Constancy (left) and Fidelity (right) of Saltatoria Population Groups I—VI.

QUALITATIVE AND RELATIVE QUANTITATIVE (DOMINANCY) CONDITIONS IN THE SALTATORIA POPULATIONS, IN RELATION TO THEIR HABITATS

The *SPG*s established on the basis of the principles given above and named from their most important species are the following:

I. *Stauroderus bicolor — mollis* population group (on stubble).

II. *Stauroderus bicolor — mollis — Omocestus petraeus* population group (on slopes with steppe and pastures formed on such places).

III. *Stauroderus bicolor — mollis — Stenobothrus crassipes* population group (in habitats of transitional type).

IV. *Stauroderus bicolor — mollis — Gomphocerus rufus* population group (in park forests).

V. *Chortippus* population group (in mesophile meadows).

VI. *Mecosthetus* population group (in hygrophile meadows).

The habitats of the first four belong to xeroleimon areas (dry hilly belt), the last two to hygroleimon (flat land meadows).

Looking through the surveys (Tables III—VIII), which were made in the most diverse habitats, we can see that the Saltatoria *PG* therein consist in general of 8—10 species. Many species occur in habitats which are often quite different ecologically, others again are restricted to a few surveys, some form an overwhelming majority of the populations (dominants), others occur with only one or two specimens (recedents). If we take under more minute examination the *SPG*s in which are included populations of kindred type, we can see that, besides the dominant species — which are naturally present in all the surveys appertaining to the group, i. e. constants — other, less or not at all dominant species can be more or less constant. Therefore besides the low *DI* and *DG%*, some other species can still occur regularly in the *SPG*s, i. e. as constants, while we may also see examples where a species showing a high *DI* and *DG%* in one or two surveys of the *SPG* is merely a chance (accessory) occurrence.

The degree of *F* is also a typical value which can be used in characterising the *SPG*. The faithful species (locally characteristic) — like the characteristic species of plant societies — reflect faithfully the ecological characteristics of their habitats. Naturally — as Soó (1945) pointed out in relation to plant societies — the characteristic species can be determined with complete certainty only from extensive and thorough sociological investigations; so the so-called characteristic species as used in this study have only local, relative value (locally characteristic species), — in absence of data of such nature on other areas, for comparison — still they bring out the individual (species) and ecological character of the *SPG* for the type of biotope.

Using as model the „typical species combination" generally employed in the Hungarian literature on plant sociology, to characterise plant societies, there can be assembled from the accompanying Tables the typical species-combinations of Saltatoria with which we can characterise the 6 *SPG*s very well. These typical species-combinations thus contain those important and characteristic species of the *SPG*s which appear with high *DI* and *DG* values (above 10%, in

large type), or *K* (5.4 values spaced-out type), or *F* (5.4 values, species marked with*).

In the following we turn to the characterisation of the 6 *SPG*s.

I. Stauroderus bicolor-mollis population group (in stubble).

Even from the few surveys at our disposal, the exceptional poverty of species of the Saltatoria populations can be seen, the great constancy of the majority of the species and the enormous dominance of *Stauroderus bicolor- mollis* (average *DI:* 87.4%), such as we never found anywhere else among the dominant species. All these circumstances contribute to the great monotony and homogeneity of this *SPG*. There are no locally characteristic species: the Saltatoria of which the population is comprised can therefore be found in the other *SPG*s, too, so that the character of this *SPG* is in reality of negative nature, in contrast to the others. It is to be noted that, due to the presence of species of large size *(Calliptamus, Oedipoda)* the *DG%* is here the most essentially modified as compared with the *DI%*, so that owing to their considerable weight they count as dominant, though their *DI%* is relatively small. Typical species combination of this *SPG* is:

STAURODERUS BICOLOR-MOLLIS
CALLIPTAMUS ITALICUS
OEDIPODA COERULESCENS
Gryllus desertus.

This *SPG* occurs in the stubble of harvested wheatfields. These biotopes spread over variously exposed and inclined slopes, have very sparse vegetation, for the most part *Polygonum aviculare — Stachys annua* or *Setaria glauca* — with *Stachys annua* communities (from the sociological survey of L. FELFÖLDY). The average height of the vegetation was 5—15—20 cm, cover 60—90%, sparse in nature; its condition was generally good, in some localities getting a little dry.

The self-dependent, autochthonous nature of this *SPG* is questionable, a thing we had already suspected in the absence of locally characteristic species. It is probably formed after the harvest in the combination we have mentioned, of Saltatoria individuals from grassy spaces along the neighbouring paths, from pastures, slopes with steppe assn., meadows, in consequence of immigration, as I was also able to show in the Ohat-puszta (in the middle of the Nagy-Alföld Plain) in localities of similar type (NAGY, 1943 II).

II. Stauroderus bicolor-mollis — Omocestus petraeus population group (on slopes with steppe assn. and pastures formed on such places).

Saltatoria populations of fairly varied composition as to species belonging in this group, most of them xerophile forms, as to quantity *Stauroderus bicolor-mollis* and *Omocestus petraeus* provide the most (combined $DI = 73\%$), the other species figuring with uniformly low

* The *Stauroderus bicolor* and *mollis* species, difficult to distinguish and connected by their transitional forms, are everywhere treated together.

dominance. On dwarf grass pasture the tiny *Gomphocerus maculatus* gets a still significant dominance.

The *Metrioptera affinis* was exceptionally remarkable in the 31st survey, *DI:* present in 11.1%, — unusually large for a predaceous species — which, in view of its large size is 24.3% in *DG.* These animals are very fond of habitats with tall grass — but not moist nor vaporous — and of small undergrowths, and in the present case 10—30 (—40) cm vegetation was actually the highest in these surveys. The attraction exercised by relatively high vegetation on the large predaceous Orthoptera is also seen in survey 31, from the presence of the praying mantis, *Decticus verrucivorus* and *Metrioptera grisea.* Thus the total for predaceous Orthoptera in this survey was *DI:* 17.9%, *DG:* 57.4%, which is an uniquely high value for the peninsula. Considering the very low individual density (Table VI.) in this locality and the low percentage of larvae (Figure 2) as compared with other similar localities, the chief cause must be sought in the exceptionally high dominace of predaceous Orthoptera. We see similar conditions in the second survey.

The less constant and numerous accessory species (Figure 1) also show the variability of the *SPG*s which again means the ecological variety of the habitats dealt with here. The multitude of locally characteristic species for conditions on the peninsula throws a sharp light on the comparatively closed nature, sociologically, of the *SPG*s and of the habitats located on slopes with steppe assn. of the peninsula. The following are typical species combinations for this *SPG:*

STAURODERUS BICOLOR-MOLLIS
* OMOCESTUS PETRAEUS
OEDIPODA COERULESCENS
* Stenobothrus nigromaculatus
* Gomphocerus maculatus
* Dociostaurus crucigerus brevicollis
* Oedaleus nigrofasciatus
* Acrida turrita
* Metrioptera affinis
* Metrioptera grisea
* Oecanthus pellucens

The occurrence of the *Stauroderus bicolor-mollis — Omocestus petraeus* population group is linked the slopes with steppe assn. on the Tihany peninsula, but not only in places covered with the original plant societies *(Festuca sulcata — Stipa joannis — Carex humilis* association complex) which are now limited to fairly small and fragmentary growths, but everywhere in meadows, *(Cynodon — Lolium — Andropogon assn.)* forming in consequence of anthropogenic-zoogenic influences. Besides these, many transitional types can be found between places with their original and those with secondary vegetation, all of them excellent habitats for the *SPG*s under discussion. The height of the vegetation on the *Festuca* meadows (— *Cynodon, Andropogon* or — *Carex)* is 3—5—7 cm: in the more undisturbed localities *(Festuca — Stipa — Carex, Festuca-Stipa* assns.) 5—7—15 (—30—40) cm, the cover being 60—95%; inclined to be dense at the

lower turf level and of a more sparse nature in the upper; in July it was already half dried. These habitats are on exposed slopes, hilltops (generally at a height of 130—200 m above sea level).

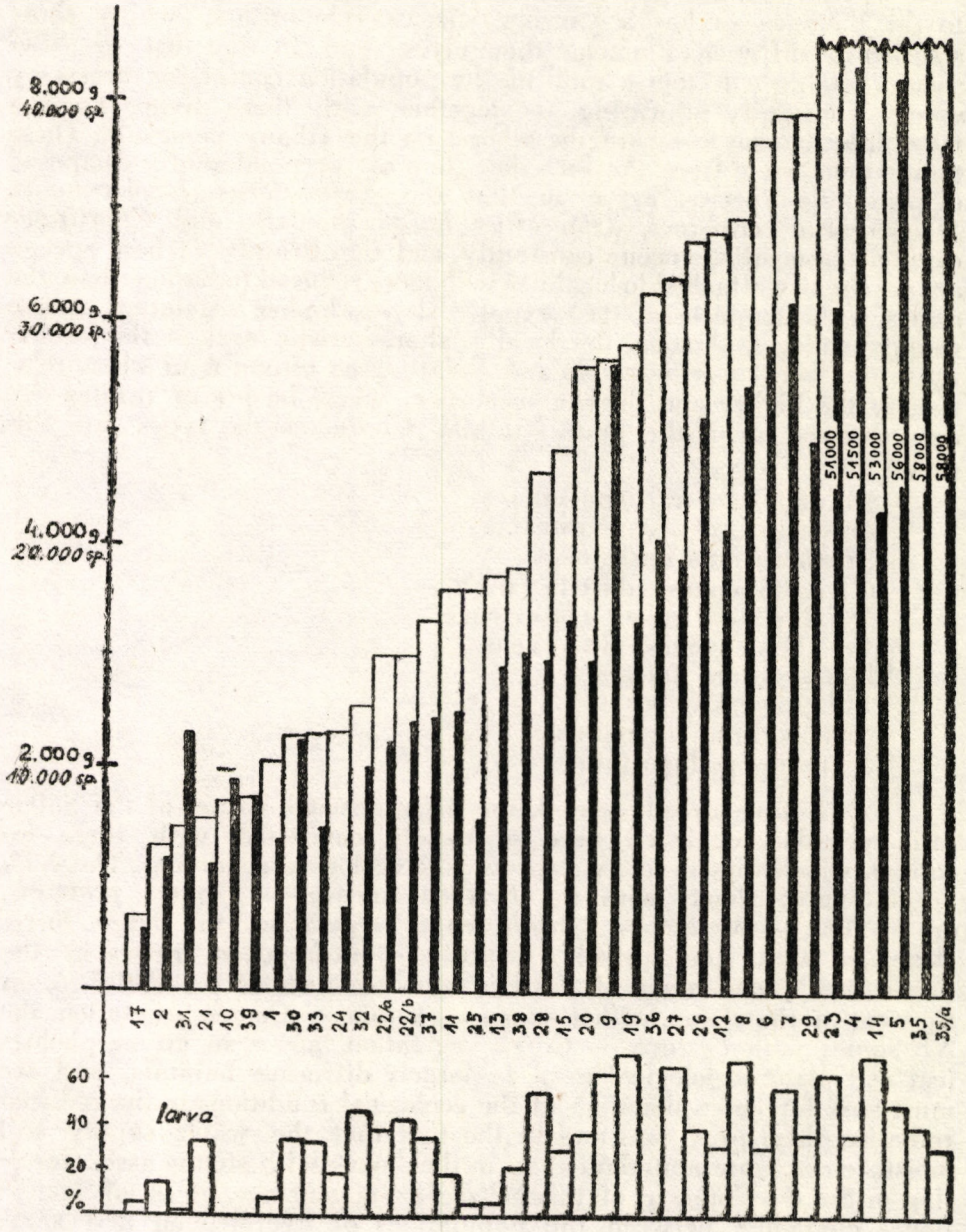

Fig. 2. Above: Values for Abundancy ☐ and Production ■ per hectare in surveys Nos. 1—39. — Below: Percentage of Larvae in the Saltatoria Population in habitats Nos. 1—39. — Abscissa: Nos. of surveys (see Appendix on p. 116) ordinate: Numbers of individuals and fresh weights of Saltatoria per hectare and percentage of Larvae, respectively.

III. *Stauroderus bicolor-mollis — Stenobothrus crassipes* population group (in localities of transitional type).

The Saltatoria population which belongs here — corresponding to the biotopes — has a varying species composition, which show significant differences among themselves, and in the list of *SPG* species established from a total of the population containing accessory species constantly appearing — together with those living on the mesophile meadows — are the richest on the Tihany peninsula. These populations aside from the fact that they are preponderantly composed of xerophile species, agree in that the *Stauroderus bicolor-mollis, Stenobothrus crassipes, Omocestus haemorrhoidalis* and *Chortippus declivus* associations occur constantly and significantly . These species are apparently attached to localities with more reduced radiation than the slopes with steppe assn. (less exposed slopes, higher vegetation, sparse canopy foliage). Among the locally characteristic species the occurrence of *Phaneroptera falcata* and *Ephippigera vitium* is in close relation to the higher and thicker vegetation, where bushes of various size are scattered about the grass stratum. Characteristic types for this group are:

STAURODERUS BICOLOR-MOLLIS
OMOCESTUS HAEMORRHOIDALIS
STENOBOTHRUS CRASSIPES
Chortippus declivus
Oedipoda coerulescens
Calliptamus italicus
* Phaneroptera falcata
* Ephippigera vitium
* Stenobothrus stigmaticus
* Stauroderus biguttulus

As I have already stated, the heterogeneous nature of the Saltatoria populations listed here is closely connected with these localities, which vary in many respects as to ecological conditions. The thick vegetations of slopes with the *Festuca sulcata — Festuca pratensis,* or. *Festuca — Melica — Agrostis tenuis* vegetation, the large forest clearings with undisturbed *Festuca — Andropogon* grasses in the *Festucetum pseudovinae* of the flat land meadows of the Külső-tó, on the foot of the slopes with *Festuca — Salvia — Ononis* vegetation, the *NE* slopes with *Festuca — Carex* vegetation, mean, in geomorphological and plant sociological respects, largely differing habitats, and we must seek for an explanation of the ecological conditions in the reduced radiation (heat provision) and in the fact that the water supply and moisture are more abundant than in the slopes with steppe assn., resulting in the development of this *SPG.* In its stucture, it is of transitional character, between the populations of hygroleimon and xeroleimon areas, though the latter predominantly leaves its mark on the species composition.

IV. *Stauroderus bicolor-mollis — Gomphocerus rufus* population group (in park forests).

Relatively poor in species — somewhat more abundant than in stubble — though it is to be expected that further investigations will

raise the number of species. With regard to the species components and dominance, the *Pezotettix giornae, Omocestus rufipes* and, more particularly, *Gomphocerus rufus* are the most typical; the shadow-loving nature of the two latter appears clearly from the Table. The presence of foliage in the structure of the biotope is of the greatest significance to the association in general and thus to the Saltatoria populations here, and quite certainly the reduced radiation is the chief cause for the absence of several xerophile species.

I consider it probable that in localities of this type the Saltatoria can make fullest use of the radiation. The sunny patches — as I found elsewhere in respect to *Stauroderus* and *Chortippus* species — can be sought in 1—2 minutes from the shady parts, at a distance of 5—10 m. It can thus be supposed that most of the animals can follow the sunny parts at pleasure, constantly wandering with the sun but can retire into the shade or half-shade of the sparse foliage when there is excessive and therefore injurious radiation. It is hence comprehensible that in these biotopes species with high thermal needs *(Oedipoda coerulescens, Stenobothrus crassipes, Chortippus declivus, Mantis religiosa)* occur indeed in quantities, while at the same time the half-shadow-loving species *(Gomphecerus rufus, Omocestus rufipes)* are also considerable in number. The reduced significance of the *K* and *F* values given is due to the small number of surveys, but even so the great homogeneity of the *SPG*s is apparent (many constants); the number of euryoecic species is very large, that of the locally characteristic species, however, only a fifth of all the species (Figure 1). Typical species combination:

STAURODERUS BICOLOR-MOLLIS
*GOMPHOCERUS RUFUS
Pezotettix giornae
Chortippus declivus
Stenobothrus crassipes
*Rhacocleis germanica
Mantis religiosa
*Omocestus rufipes

This *SPG* occurs in park forest *(Quercetum stepposum)* on slopes gently inclining towards NE and NW situated on the SW borders of the Tihany peninsula. The small continuous clearings and the lack of shrubbery stratum make possible the development of this *SPG* fairly poor in species (but the most abundant in the whole peninsula in individual numbers.) The grass level is 3—5 (—8—15) cm high, 100% covered, half dried. The cover of foliage canopy is 30—50%. This *SPG* is practically speaking of no consequence, as there are so few habitats of this kind on the peninsula.

V. *Chortippus* population group (mesophile meadows).

This *SPG* is the most abundant in species, the most varied in composition. The appearance of four *Chortippus* species gives its character, one or another of them predominating according to the ecological condition of the habitats and the „environmental resistance" in general. The populations of the survey can naturally be classified ecologically within the group; in the Saltatoria populations of localities with higher and denser vegetation, generally more moist, the more and more

constant presence of *Acrydium subulatum, Conocephalus fuscus, Mecosthetus grossus* species takes us on to the next group to be discussed, the *Mecosthetus* population group.

In investigating the dominance whether we consider the populations of the different surveys or all the *SPG*s combinated, it can be seen that in general 2—3 or even 4 species jointly have a predominant rôle. We seldom find this trait in the *SPG*s treated so far. This as well as the K data, show that this *SPG* — together with the *Mecosthetus* population group — is more balanced than the others; the percentual participation of the species grows gradually towards the classes of lower constancy, which to a certain extent means a *SPG* of varied composition, but having at the same time homogeneity — though to a smaller extent. The percentage of stenoecic and euryoecic species is equally low, though it assures a still considerable amount of locally characteristic species for the *SPG*, corresponding to the abundance of species. The characteristic type of composition is:

* Chortippus dorsatus
Chortippus elegans
Chortippus parallelus
Chortippus declivus
* Aeolopus thalassinus
Stauroderus bicolor-mollis
* Chrysochraon dispar
* Homocoryphus nitidulus
* Conocephalus dorsalis
* Metrioptera vittata

This *SPG* is to be found, widely distributed in different types of mesophile — in some cases hygrophile — meadows with medium high grass, primarily in localities covered with stands of *Agrostis alba — (Deschampsia caespitosa) — Carex distans* vegetation complex (Soó, 1932 I, 1934), and in moist alkali meadows *(Agrostis alba — Aster pannonicus* assn.). At the time of the investigation the beight of the vegetation was about 7—10—15 (—30—40) cm, cover (90—) 95—100%, of a dense bladed foliated nature, in a good green condition. These localities are utilized agriculturally, as they are mown.

As can be seen from Tables III and IV, the distribution of the Saltatoria species in these biotopes is modified, not so much by plant sociological conditions as through them, by the height of the vegetation, its cover, density, and by local topographical conditions (contact with various habitats). As these localities are very extensive (marshy meadows and mown meadows on the Külső-tó, the Ujlaki rét, Rátai csáva, Diósi rét), the *Chortippus* population group comes into more considerable account, not only in agrobiological respects but also in respect to the effect exercised on the other Saltatoria populations through territorial contact.

VI. *Mecosthetus* population group (in hygrophile meadows).

Populations of medium species abundance, composed almost exclusively of hydrophile species — mostly phytophilous, indeed phytocolous, in which the *Mecosthetus grossus* predominates, the *Chortippus* species also having a considerable rôle. The accessory species figure as

in the *Chortippus* population group, but the rôle of the constant ones is more important; this circumstance with the relatively low number of species means a more homogeneous population group than in the foregoing *SPG*. The percentage ratio of the euryoecic is very high, coming after the stubble habitats.

In characterising the type of this *SPG* I also included as dominant the three species of *Chortippus (Ch. dorsatus, parallelus* and *longicornis)* the *DI* and *DG* values of which did not quite reach 10%. But as in these populations there were very many *Chortippus* larvae which are difficult to identify as to species *(DI:* 13.2%, *DG:* 8.5%), these species can in practice all be treated as dominants, though certainly their larvae do not occur in equal proportions. So the typical species combination is:

* Mecosthetus grossus
* Chortippus longicornis
Chortippus dorsatus
Chortippus parallelus
Conocephalus fuscus
Chortippus elegans
Acrydium subulatum
* Parapleurus alliaceus
* Metrioptera roeselii
* Pteronemobius heydeni

This SPG is linked in its dispersal to the most moist meadows of the peninsula, partly to the moister points of localities covered with an *Agrostic alba — Deschampsia caespitosa) — Carex distans* complex, to Magnocaricetum. Just as in the Chortippus population group, the formation of the Saltatoria population here is regulated not so much by the composition of the association as by the physiognomical aspects of the locality, chiefly the structure of the vegetation. Thus, for example, in localities covered with typical communities of *Schoenoplectus* and *Phragmites,* except for one or two stray specimens, Saltatoria populations do not form, but none the less the *Mecosthetus* population group can be found in the habitat of the 10th survey which is covered with a mixed *Schoenoplectus — Phragmites — Agrostis — Juncus* community formed as a consequence of reclamation) though with low individual density and a dominance which contrasts to the others, for in the otherwise relatively high (up to 120 cm) grass stratum there are parts here and there which are only 20—60 cm. high.

The vegetation of the habitats of the *Mescosthetus* population group is in general 7—25—40 (—60) cm. in height, 100% covered, of a dense bladed type, and due to the damp soil was still a lush green in the middle of August.

ABSOLUTE QUANTITATIVE CONDITIONS

Abundance

No matter how slight the reproductive force of a species may be, it will increase to a considerable extent under favourable circumstances. But unrestricted reproduction has biotic and abiotic limits, which come forward as environmental resistance. It can be seen from Table VI that the Saltatoria species inhabit the different localities in widely differing densities (abundancy). It is evident that for any species, the greatest density will occur in the most favourable localities, and that in unfavourable biotopes they will occur in small numbers per unit of area.

The many different factors acting on the habitat have the closest reciprocal effect on one another (THIENEMANN, 1941). Factors offering optimum conditions can be spoilt by other, unfavourable ones, and the existence of any species in the habitat is determined by the factor which most closley approximates the pessimum (HESSE, 1924, compare LIEBIG „Gesetz vom Minimum!!). Thus, for example, it is of no avail for the habitat to be favourable for a species from an auto-ecological standpoint, if at the same time the structure of the biocenisis is not propitius to it large number of enemies, parasites, competitors).

But the different factors of the habitat act in their entirety (FRIEDERICHS: „lokaler Einheitsfaktor"); the effect of one single factor can be analysed only by thorough laboratory and field observation or experiments, and the extent of the environmental resistance of a species can in practice be expressed by the density, by its *A*. We may therefore say that the environmental resistance diminishes parallel with the *A*. Naturally we can be content with these data only until we can replace them with others, more nearly corresponding to reality. Detailed and fundamental elucidation of the biotic potential, that is of the reproductive force of the species — in connection with which there is still much to be investigated, in respect to the Saltatoria — can serve with further modifications to estimate better the environmental resistance.

The following species appear with greatest density: *Staurodcrus bicolor-mollis, Chortippus elegans, Ch. parallelus, Omocestus haemorrhoidalis, O. petraeus, Gomphocerus rufus, Mecosthetus grossus,* occurring in the territory of several of the surveys with more than 5000 specimens per hectare, among them the *Staurodcrus bicolor-mollis, Omocestus haemorrhoidalis, Chortippus parallelus* and *Mecosthetus grossus* species exceeding in places 20,000 specimens per hectare. The species of such great abundance are all herbivorous; the predaceous species are present in low *A*, in general well below 1000 specimens per hectare. Surveys relatively rich in predaceous *Metrioptera* specimens (e. g. Surveys 31 and 2) have a low total density and the percentage of larvae is small — due certainly to their predaceous activities.

Study of the abundance of the *SPG*s (Table VIII) — the averages calculated from the *A* of the surveys — does not help us much in clearing up the *A* values. Within the same *SPG*, and therefore with the same qualitative and relative quantitative composition, significant differences in *A* can be observed (Table VI). But deducting the relatively few extreme values, the *A* of two-thirds of the surveys mo-

ved around 10,000—40,000/ha at the time of the investigation. The number of specimens per hectare calculated in the average of the *SPGs* is 28,875. The two chief habitat types xeroleimon and hygroleimon stand fairly close to one another. In the xeroleimon the *A* value is 32,046/ha, or 23,395 if we omit the exeptionally high *A* data (58,000/ha) for the *Stauroderus bicolor-mollis — Gomphocerus rufus* population group which is territorially of limited significance, and on hygroleimon areas 25,705/ha. But we must also take into consideration here that on xeroleimon areas the surveys were generally made about 1—2 weeks later, and we must credit the decrease to the xeroleimon territories.

With the advance of the vegetative period the decrease in *A* is significant. In sandy localities near Budapest Saltatoria *A* was 90,000 and 20,000/ha in July and August respectively (BALOGH and LOKSA, 1948), hence in the course of one month it diminished to less than one-fourth. Here, however, we must remember that BALOGH and LOKSA, restricted their investigations, though they were periodic, exclusively to a single biotope type and from them we get no information about the seasonal wanderings taking place during the vegetation period, or about the possible changes of biotope. In order to demonstrate temporal changes in *A,* periodical investigations extending over all the local biotope types are needed. I myself found a 63% reduction in *A* in the course of three weeks in the Külső-tó meadow (surveys 4 and 38). Such a significant decrease warns us that *A* data taken at remote dates, can be compared only with reservations.

Though I have no numerical data on the other animals there, the above data themselves prove the uniformly significant rôle of the Saltatoria in the types of habitat investigated. The *A* data for July and August in the sandy localities mentioned above *(Fumana vulgaris — Festuca vaginata — Cladonia foliacea — magyarica* phytosociation) denote 13.6 and 5.3 *DI%* respectively of the Saltatoria inhabitants in the whole Arthropoda population (BALOGH and LOKSA. 1948), which again means 62.4 and 72.8 *DG%* respectively, i. e. in weight more than two thirds of the whole Arthropod population.

More investigations are needed to clear up the connection between *A* and the number of species in the surveys. But on the basis of those existing up to now, it can be said that a relatively high number of species is not necessarily coupled with great *A,* though in surveys with great *A* the number of species was generally large.

On the basis of the 37 quantitative surveys of the relationship between *A* and the amount (covering, height) and condition of the vegetation the following can be stated: in stubble i. e. in habitat type with the least vegetative yield — brought about by secondary artificial conditions — A increases with the amount of vegetation. From this we cannot conclude without going any further, that the green substances serving for food are present as a minimum factor. In any case, this can also play a part, but a sparse stand of vegetation with a low degree of covering, still offers sufficient food for 1—3 Saltatoria individuals per m^2. With higher and thicker vegetation on the stubble field, other ecological factors besides food conditions very likely improve too, to a considerable extent (microclimate, protection). To some extent this is also true of the *A* of the Saltatoria on the most xerophile steppe assn., especially in respect to the covering the vegetation offers.

In habitat types of less exposed slopes, mesophile and hygrophile meadows where the vegetative covering is nearly everywhere above 90—95%, the height of the vegetation is significant in the development of *A*. From the Tables and a list of the localities of the surveys, it can be said that at the time of the investigation the greatest *A* was found in those habitats, the physiognomically (analysis of the substrata) and floristically various plant covering of which was 3—5—7 (—15—20) cm on the xeroleimon areas and 7—15—20 (—40) cm on the hygroleimon, with a covering of 90—95 and 95—100% respectively (e. g. surveys 23, 14, 35, 4, 5, 29, 26, 7). The greater, higher vegetation on the mesophile, and still more on the hygrophile meadows restricts the *A* of the Saltatoria populations (e. g. surveys 17, 10, 33 and 2). The data from surveys 8 and 9 are interesting in this connection. They were made in the same plant association, except that one of them was on a part which had been mown, i. e. on area with vegetation artificially lowered. In localities with mown grass (survey 8) with approximately the same maximum height of vegetation as mentioned above the *A* is naturally greater than in biotopes which are less favourable, because of their high and dense vegetation (survey 9), though in a floristic-sociological sense the vegetation was the same in both places. The difference is also apparent in the percentage of undeveloped animals, which generally increases with the *A*.

As I have already stated (p 105), in closed stands of *Schoenoplectus* and *Phragmites* there are no Saltatoria except a few stray and scattered specimens. The Saltatoria populations which may appear on the borders of localities with such vegetation are certainly of only secondary significance and are be explained as migrators from neighbouring biotopes with more considerable *A*.

On xeroleimon areas, aside from the quantitative and qualitative conditions the general state of the vegetation — which in reality decisively influences the *A* — the direction of the slope, i. e., its exposition, comes in for consideration. An unfavourable exposure acts unfavourably on the *A* (e. g. survey 24), evidently because there is less radiation.

There is also less sun at the turf level of the sparse park forest *(Quercetum stepposum)* (surveys 35 and 35a) — as I have pointed out on p. 103 — but this is due not to the exposition but to the presence of a canopy of foliage and therefore the motile Saltatoria can counterbalance it. The highest A on this type of biotope (58.00/ha) is kept at a high level by the probably retarded development which occurs in consequence of reduced radiation and hence later hatching of the egg, aside from the possible concurrence of species with different ecological requirements. The higher *A* of the earlier months falls rapidly with the advance of the vegetation period (Balogh and Loksa, 1948). Therefore in park forest habitats, as compared with other types at the same period an early, lagging stadium may be present, though this view is not supported, more particularly by the only fairly large percentage of larvae (31.9 and 40.7%).

The presence of more predaceous Saltatoria also pushed the *A* to a low level (surveys 2 and 31); in these surveys the small percentage of animals in an early stage of development shows that larvae are an easier and more convenient prey for them

Production

The P values given here indicate the live-weight of the Saltatoria per hectare, expressed in gs.

As in the *A,* we find large extremes in the per-hectare weight values of the surveys. In the localities investigated production moved between values of 555—8344 g/ha. But in the majority of habitats the live weight of the animals amounted to 2000—6000 g/ha and was less than 2000 g/ha in only 9 surveys, exceeding 6000 g/ha in 6 survey areas. *P* per hectare of the average *SPGs* was 4083 g. The average for the xeroleimon types of habitat was 4113 g/ha, or if we omit the *Stauroderus bicolor-mollis — Gomphocerus rufus* population group which gives a large yield (7561 g/ha) but is of limited significance territorially: 2964 g/ha. Average *P* for the hygroleimon type of locality, was 4052 g/ha, 27% more than the xeroleimon which has no park forest. This difference is not a true value, for the surveys in the xeroleimon areas were made a week or two later than in the hygroleimon, and the difference may be attributed at least partially to that — as we know the *A* falls rapidly with the advance of the vegetation period. It should be noted, however, as is apparent from the Tables appended to the paper by BALOGH and LOKSA (1948) that decreased *P* follows reduced *O* only towards the end of the vegetation period. This can evidently be attributed to the growth of the small larvae; their increasing weight replaces the loss in numbers.

Considering particularly the approximately uniform weight of the dominant species the differences in production of the localities largely agree with changes in *A.* Therefore what has been said in respect to *A* is mostly true for *P* as well. But must note that both in the heavy (e. g. *Decticus, Oedipoda, Calliptamus,* etc.) and in the species of small weight (*Omocestus petraeus, Gomophocerus maculatus, Acrydium subulatum,* etc.) shifts between *A* and *P* values occur, to their advantage or disadvantage. The hygroleimon (types V, VI) species occurring in more considerable numbers *(Chortippus, Mecosthetus)* are on the average heavier and largea than the xeroleimon (types I, II, III and IV) Saltatoria which occur in the same proportions *(Omocestus, Stauroderus, Stenobothrus;* Table II). Leaving type IV (park forest) out of consideration, the 23,395 specimens per hectare on xeroleimon areas mean a *P* of only 2964 g/ha, as against average data of 25,705 specimens/ha=4052 g/ha in the hygroleimon.

In surveys 35 and 35/a with identical *A* the *P* values are 7476 and 7646 g/ha respectively, corresponding with 40.7 and 31.9% larvae. It is evident, that with identical *A* — and Saltatoria populations — the habitat with the smaller percentage of larvae has greater *P,* but on the other hand it can also be said that generally within the same SPG the greatest *P* (and *A*) are found in those Saltatoria populations, or habitats, which have the greatest percentage of undeveloped animals.

In viewing the *P* values of the averages for the *SPGs* (Table VIII) it is seen that the average *P* of the *SPG* is parallel with the height of the vegetation — and what usually accompanies it — the yield in plant material. To this, to a certain extent, the *Stauroderus bicolor-mollis* population group of the stubble — doubtful in any case in re-

spect to its origin and self-dependence — is an exception. At the end of July and beginning of August on the shortest stubble (having the least yield) and on the slopes with steppe assn *(Stauroderus bicolor-mollis,* and *Stauroderus bicolor-mollis — Omocestus petraeus* population group respectively) the Saltatoria population has a live weight of 2839 and 2538 g/ha respectively. On less exposed slopes with slightly taller grass, in localities of transitional type *(Stauroderus bicolor-mollis — Stenobothrus crassipes* population group) and on mesophile meadows with vegetation of about the same height and quantity *(Chortippus* population group) the *P* is also about uniform: 3494 and 3446 g/ha respectively, nearly 1 kg. more than in the preceding. In the highest grass relatively, of the hygrophile meadows *(Mecosthetus* population group) *P* is 4658 g/ha, in park forest habitats *(Stauroderus bicolor-mollis — Gomphocerus rufus* population group) 7561 g/ha. In the latter type of locality, as there is a foliage canopy here too, the vegetation is the highest and the yield the greatest, though the grass level to which the Saltatoria are completely bound, is scarcely higher or more voluminous than that of the grass of slopes with steppe assn.

Whether the Saltatoria *P* rising parallel with the height and quantity of the vegetation, is a phenomenon of regular occurrence, or merely a coincidence, must be decided by more detailed research, extending to other regions and types of biotope, where the degree of vegetative yield (production) would also be considered.

NOTES ON OCCURENCE AND ABSOLUTE QUANTITATIVE CONDITIONS OF SOME OF THE MORE IMPORTANT SPECIES

Disregarding the dependence of the sexes on one another and the connection of predatory — prey in relation to the other Saltatoria of the few and only rarely important predaceous forms, with the density found on the peninsula the individuals of the Saltatoria population are fairly independent of one another. The species populate different types of habitat according to their ecological requirements. This relative independence ceases in exceptional cases — when some species multiplies in consequence of favourable ecological conditions: its density — for the animals stimulate one another by their activity, due to the great *A* and induce to still greater activity (compare UVAROV's migratory-phase theory: KLINGSTEDT, 1939) which, as experimental results have also shown (FAURE, 1932) results in considerable morphological and physiological changes in individuals of the population („gregaria"=migratory phase). The Saltatoria populations are composed of the total populations of the species in the habitats, the qualitative, as well as the relative and absolute quantitative conditions of which we have already surveyed in the foregoing. It can be seen that 1—2—3 species which comprise 70—90% of the population always take the leading rôles. It is therefore necessary in what follows to refer separately to the species which are the most numerous and the most important in respect to production-biology and agrobiology.

Omocestus petraeus. Stenoecic. An animal of slopes (and summits) exposed to much sunlight. In localities with dwarf grass of

Festuca sulcata — Carex — Stipa (Andropogon — Cynodon) vegetation, where the sparse upper-level of the grass never exceeds 30 cm. Otherwise there is a correlation between its needs as to height and density of grass. Namely, lower grass and greater coverage have the same value for this species, as the higher grass offering less cover. The vegetation of these biotopes was half dried out. I. did not observe them in stubble fields. In higher grass offering more cover they were to be found sporadically (Survey 23) only where this was wedged in between the favourable biotopes noted above (territorial radiating effect). In the area of optimal biotopes the *A* can rise to 8000—14.000 ind./ha, but owing to their small size the *P is* scarcely to be taken into account.

Oedipoda coerulescens. A typical xeroleimon animal. Beginning with stubble fields (here sporadically) on meadows with dwarf grass, on slopes with steppe assn. and peaks, on through to park oak forests, it occurs constantly everywhere. It is a geophile species therefore primarily bound to dwarf grass biotopes, but it also occurs in small numbers (203—547 ind./ha) in xeroleimon places having higher vegetation (surveys 23 and 30). In general, with its small A, its importance can be attributed to its large size and eurycoeic nature.

Calliptamus italicus. In its eurycoeic nature it follows Stauroderus bicolor-mollis. It is primarily a xeroleimon animal; it occurs with great constancy but always in small numbers (between 100 and 600 ind. ha), on stubble fields, meadows and slopes with steppe assn. It can also be found, still more sporadically and with less constancy, in some drier types of flat land meadows, chiefly where these localities adjoin xeroleimon areas (surveys 13, 15). Due particularly to the great weight of the female, the P is important (average 100—360 g/ha in the *SPGs).*

Stauroderus bicolor-mollis. The two species can be separated with difficulty for there are many transitional forms between them. Here and there, and principally in the moister biotopes, specimens of the *bicolor* type are found. They are xerophile animals, with great ecological plasticity. At the time of the investigations together they were the most frequent and the most numerous of Saltatoria, in some localities exceeding 30,000—40,000 ind. ha. In xeroleimon areas their constantly great abundance (averaging in the different biotopes 9473-15, 549-19504-30.873 specimens per hectare is interrupted in three surveys — Nos. 24, 25 and 31 — at which time the *Omocestus petraeus* predominates. Corresponding to the great *A* on xeroleimon areas the Saltatoria gives a 50% *P;* in stubble as much as 73%. With a value of 1200—3860 g/ha, it is from the point of view of production the most important Saltatoria on the peninsula.

Omocestus haemorrhoidalis. A species of habitat of transitional character between xeroleimon and hygroleimon; its *P* is only here more significant (391 g/ha). Irregularly dispersed. It seems to avoid areas with scanty sunlight (surveys 19, 35, 35/a), as well as those with very short grass and scanty coverage (surveys 21 and 31); it was also absent in stubble fields.

Stenobothrus crassipes. In its ecological pretensions it is about the same as the *Omocestus haemorrhoidalis* species. It appears in

transitional areas between xeroleimon and hygroleimon, therefore in the more enclosed and higher grass xeroleimon habitats (surveys 26, 22/b, 36, etc.) and in the drier types of cultivated meadows (surveys 1, 13, 12, etc.) with great constancy and considerable *A* (2800/ha). In spite of its ecological relationship to the *Omocestus haemorrhoidalis*, there is one important difference, that *Stenobothrus crassipes* can put up with a good deal of shade (surveys 35, 35 a).

Gomphocerus rufus. A species fond of half-shady places, therefore very numerous in oak park-forest localities (surveys 35 and 35/a), (9213 specimens/ha = 850 g/ha average), but here too they reach greater *A* in the shadier parts of the borders of the woods. A stenoecic species, does not occur elsewhere than in the types of habitats mentioned.

Pezotettix giornae. Particular in respect to vegetation. Absent in stubble slopes with steppe, at best occurs in grasses containing more luxuriant, higher plants (surveys 23, 14) and above all in *Salvia*. *Salvia* and lavender are its favourite foods. Equally considerable in the more open and the shadier parts of the oak park-forest (on an average of 3587 specimens/ha, or 361 g/ha). It reaches its greatest density (in some places above 5000 specimens/ha) in 10—30 cm high grasses affording complete cover.

Chortippus species. The combined *Chortippus* species are nearly always the most important in the Saltatoria populations of mesophile meadows, as I have already pointed out on another occasion (NAGY, 1943 II). They figure in the hygrophile meadows of the peninsula with an average of 14.000 specimens and on mesophile meodows with 15,000 per hectare, which — though there were great numbers of young larvae — represents a considerable amount of weight (1730 and 2080 g/ha respectively). The *Chortippus* species are therefore present in the Saltatoria populations of the meadows — as *A* and *P* values — in more than 50%. Exact evaluation according to species is difficult and uncertain, on account of the many small larvae.

Chortippus declivus. The most xerophile *Chortippus* species; very large, ecological plasticity nearly approximating that of *Stauroderus bicolor-mollis.* On slopes with steppe assn. and hygrophile meadows it is scarce, but considerable in areas of transitional type, as well as in the drier types of mesophile meadows.

Chortippus dorsatus. Stenoecic, constant meadow species. It was the least important of the *Chortippus* species.

Chortippus parallelus. A species constant to the hygroleimon with slightly greater plasticity than the preceding, manifested chiefly in that it also occurs in the drier types of mesophile meadows (surveys 14, 1, 2 and 13), though not regularly, in large numbers. In *P* it proved the most important of the *Chortippus:* 659 g/ha in mesophile meadows, 551 g/ha in hygrophile.

Chortippus elegans. A species important principally in mesophile meadows, with almost the same ecological plasticity as the preceding. It is found particularly in localities overgrown with alkali vegetation *(Agrostis alba — Aster pannonicus).*

Chortippus longicornis. Stenoecic grasshopper, typical of enclosed habitats with fairly high (20—40 cm) grass, with great and

constant moisture (land which even in August is watery, swampy, marshy). Surveys 8 and 9 are good examples of the effect of the height of the vegetation in creating *A*. In 7—25—30 cm grass of a biotope with this kind of vegetation mown previously there were 3994 specimens per hectare; in unmown 35—40 (—50) cm grass there were 1946. In hygrophile meadows (type VI) the average was 2558 specimens/ha = 377 g/ha.

Mecosthetus grossus. Stenoecic, constant grasshopper in hygrophile meadows—though showing large variations in density according to locality. The most important species of Saltatoria in the hygrophile meadows, owing to its great average *A* (10,226/ha) and considerable *P* (2326 g/ha).

In the following Table are given the ecological plasticity and average *A*, also for species not described above:

TABLE I.

The Saltatoria species of the Tihany peninsula grouped according to their ecological plasticity and average A for 1947.

Degree of plasticity	Great *A*, above 5000 ind./ha	Medium *A*, 1000—5000 ind./ha	Small *A* below 1000 ind./ha
stenoecic species	Omoc. pert., Gomph. rufus, Mecosth.	Gomph. macul., Doc. cr. brev., St. stigm., Ch. dors., longic., Omoc. rufip., Rhacocleis	Acrida, Oedaleus, Sta. bigutt., St. nigrom., Parapleurus, Chrysochraon, Leptophyes, Phaneroptera, Metr. grisea, affinis, vittata, roeselii, Con. dors., Homocoryphus, Oecanthus, Pteronemobius, Ephippigera
species with fair ecol. plasticity.	Omoc. haemorrh.	Oedipoda, Con. fuscus	Acryd. bipunct., St. lineatus, Liogryllus, Mantis
euryoecic species	Ch. parall., eleg., Sta. bicolor-mollis	Acryd. subul., St. crassip., Aeolop. thalass., Pezotettix, Ch. decl.	Calliptamus, Decticus, Gryll. desertus

CIRITICAL SUMMARY OF THE RESULTS

In habitats of different type and extent on the Tihany peninsula I made 43 surveys, 6 of them qualitative, lasting over one month, to discover the quantitative and qualitative distribution of Saltatoria insects. The vegetation served as basis for demarcating the habitats. To ascertain quantities I used the square band method covering 10×1 m^2 at a time; the data on qualitative distribution were obtained by identifying 4625 specimens collected with a net.

The data on density of individuals per survey is presumably somewhat lower than in nature, for some of the animals which remain motionless escape attention. The values for relative quantitative conditions (dominancy) — Tables III and IV — are based on the quantities of Saltatoria which got into the net in the habitat in question

and it is probable that individuals of geophile species (e. g. *Gryllus, Liogryllus)* and of the most active motile-flying forms get into the sample only in a reduced percentage differing from their true distribution. This occurred noticeably and significantly in the *Aelopus thalassinus* species when the temperature rose above 30° C.

I combined the surveys, taking into consideration the dominant species and the biotope (primarily the vegetation), and in the 6 Saltatoria groups thus obtained it became possible to establish the species more or less faithful to the different population groups (types of biotope) and those regularly occurring in them (constant), then on this basis I could combine the typical combinations of species too showing the characteristic structure of the Saltatoria population groups.

Leaving out of consideration the interspecific relations, the Saltatora populations established depend strictly on time and place too. Periodical investigations are needed to demonstrate the reciprocal effect of biotopes and their Saltatoria populations in relation to time and place. My own investigations offer something like a static cross-section of the quantitative and qualitative distribution of the Saltatoria in the middle of the vegetation period (end of July, beginning of August) in localites which are the most essential, or to a certain extent important, from the standpoint of the Saltatoria.

From my work in the summer of 1943 — fragments of which only have survived the war — I can state that the species and relative quantitative conditions (and certainly those of abundance and production too) under normal conditions scarcely vary essentially; the dominant species and the qualitative distribution of the species were similar in corresponding localites, for the two years.

I refer to the Tables (III andIV) concerning qualitative and relative quantitative conditions (dominancy), and in order to recapitulate I mention only the fellowing: in xeroleimon areas (stubble fields, dwarf-grass pastures, slopes with steppe assn., oak park-forests) the *Stauroderus bicolor-mollis* generally dominates, sharing dominancy with other species according to the type of biotope. Thus on slopes with steppe assn. and exposed pastures with *Omocestus petraeus* and *Oedipoda coerulescens;* on less exposed slopes and in other habitats of transitional type with *Omocestus haemorhhoidalis* and *Stenobothrus crassipes;* in the oak park-forest (Quercetum stepposum) with the *Gomphocerus rufus* species, whereas in stubble fields *(Setaria-Polygonum-Stachys* assn.) it appears almost as monarch in relation to the *Calliptamus* and *Oedipoda.* Dominance of the *Chortippus* species and *Mecosthetus grossus* is typical in hygroleimon areas (mesophile and hygrophile meadows). Besides the dominant species mentioned here the Saltatoria population groups of xeroleimon areas (types I—IV) as well as hygroleimon (types V—VI) have their own characteristic species — of local type — as can be seen from Table V and from typical combination of species.

The data on density obtained with the square-band method (see appendix), measurement of the live weight of the species (Table II) and the relative quantitative data obtained by collecting with a net (Tables III and IV) make it possible to obtain absolute quantitative data per species and per Saltatoria population, then from their total

we establish the absolute quantitative data per Saltatoria population group, i. e. the number of specimens per hectare (Table VI) and the weight quantities at the time of the investigation (Table VII) — that is in the midst of the vegetation period. The abundance and production data belonging to the identical Saltatoria population group, as they are based on the results of surveys made at the same, or nearly the same time, can be compared directly: the data obtained from surveys at greater intervals — the original numbering of the surveys also refers to their chronological order — may now be compared with precaution, for the abundance can decline to a considerable extent in 2—3 weeks — poduction somewhat less — as I have more fully reported.

We find fairly sharp differences in the types of habitat of the Saltatoria population groups in regard to species and relative quantitative relations, less so in abundance and production. Extreme values are found the Saltatoria population group within the type of habitat, but the average abundance and production data for most groups (types) are fairly near to one another and the existing 10—30—60% differences shown — particularly in respect to abundance — are in all probability less than the quantitative changes occuring during the vegetation period.

The abundance values established during the period of the investigation were the highest in the sparse oak park forest without undergrowth: 58,000 specimes/ha; in localities of transitional character and in hygrophile meadow the averages were 30,552 and 28,375/ha respectively, and in stubble fields, slopes with steppe assn. and mesophile meadows the average density was uniformly low: 21,145 .— — 18,489, — 23,036 ind./ha). It is to be noted that these abundancy values mean only a smaller proportion of the populations considerably diminishing in numbers during the vegetation period. The production values — as the data of Balogh and Loksa (1948) have shown — reach their maximum at about the same period (July 17 — August 13), for besides their still considerable abundance, the Saltatoria have for the most part developed already. The production value corresponding to the greatest abundance is also greatest in the *Stauroderus bicolor-mollis — Gomphocerus rufus* population group *(Quercetum stepposum):* 7561 g/ha; in hygrophile meadows (type VI) 4658 g/ha. In habitats of other types (slopes with steppe, stubble fields, mesophile meadows, transitional types) the live weight was between 2558—3494 g/ha.

In the surveys with great abundance and production the percentage of larvae was always large too (above 30—40%). Development as connected with this, as well as the possibility of there being two generations a year, demand further periodic study.

Production rises parallel with the height (quantity) of the vegetation in habitats favourable to Saltatoria.

The Saltatoria populations generally achieve the greatest abundance and production it those habitats with physiognomically and floristically varying vegetation, which was 3—5—7 (—15—20) cm in xeroleimon areas and 7—15—20 (—40) cm in hygroleimon areas, with 90—95 and 95—100% coverage respectively.

APPENDIX

Notes on the places surveyed

All the surveys were made on the Tihany peninsula, which projects into Lake Balaton (western Hungary). For lack of space I can give no account of geomorphological nor general climatic and vegetative, etc. conditions. A great many studies on them can be found in earlier volumes of this publication and elsewhere.

Omitting particulars on place and time of the surveys, I give some brief data on the vegetation: in parentheis ( ) the plants found in greatest quantities in the societies; the height of the vegetation in cm — with the height of the taller sublevels with less cover in ( ) — and the degree of cover in %. I give the original data from the squares (per 10 m²) used to establish abundance (*A*), the number of specimens of animals taken by insect net and serving as a basis for data on species components and relative quantities, and, finally, the percentage of larvae.

The numbers of the surveys remain as given in the field, so that they correspond to the numbers of the material of the collection conserved separately for each survey, preserved in the Zoological Institute of the University of Debrecen.

1. Külső-tó, July 25, 1947 (10 hrs.) *Festucetum pseudovinae* (*Cynodon*); 5—7 cm, 95—100%, scarcely drying thick grass. In the vicinity: *Agrostis-Aster* assn., *Pastinaca* facies of mesophile meadow (survey 2). *A*: 9, 18, 9, 8, 7 = 10.2 average. Collected: 80 specimens (8.8% larvae).

2. Northern border of Külső-tó, July 25, 1947 (11 hrs.). *Pastinaca* facies of mesophile meadow (*Daucus, Trifolia, Lotus corniculatus*); 7—10 (—50—60) cm, 100% — 40% green grass. In vicinity: *Festucetum pseudovinae* (survey 1) ploughed fields. *A*: 6, 9, 6, 5 = 6.5 average. Collected: 48 specimens. (14.5% larvae).

4. E border of Külső-tó, July 26, 1947 (11 hours) Marshy meadow [roughly *Agrostis alba* — (*Deschampsia caespitosa*) — *Carex distans* complex], covered with coloured, variegated grasses (*Cirsium canum, brachycephalum, Cichorium, Trifolium pratense, Ononis, Centaurea pannonica, Lotus, Leontodon autumnalis, Achillea*, etc.), in very good green condition: 7—10—15 (—25) cm. 100%. In vicinity: fallow land, *Agrotis-Aster* assn. *A*: 57, 44, 48 = 51.5 average. Collected: 106 specimens (37.7% larvae).

5. SE border of Külső-tó, July 26, 1947 (12 hrs.) Marshy meadow; like the preceding, only more moist, with lumpy soil; (more *Carex*), 10—15—20 (—35) cm, 100%; in exceptionally good green condition. In the vicinity: drier types of marshy meadow. *A*: 56. Collected: 157 specimens. (51.6% larvae).

6 SE part of Külső-tó, July 26, 1947 (13 hrs.). *Plantago maritima* facies of *Agrostis alba-Aster pannonicus* assn. (*Cirsium, Lotus, Carex*), 3—10 cm, 90—95%, drying grass, an area of about 6000 m²; in the vicinity: *Agrostis-Aster* assn. *A*: 54, 34, 33, 32 = 38.2 average. Collected: 123 specimens (32.2% larvae).

7. S part of Külső-tó, July 29, 2947 (11 hrs.). Very wet type of marshy meadow (*Equisetum, Angelica, Mentha, Epilobium, Cirsium, Trifolium, Achillea*), 7—20 (—40) cm, 100%, lush green grass, wet swampy soil. In the vicinity: drier type of marshy meadow, ploughed fields. *A*: 33, 46, 39, 40 = 39.5 average. Collected: 244 specimens (57.4% larvae).

8. SW part of Külső-tó, July 29, 1947 (13 hrs.). Sedgy facies of marshy meadow *Mentha, Inula, Juncus*). The same as survey 9, except with shorter grass (had been mown long before). 7—25—30 cm, 100%, good green condition. Ground somewhat uneven, very wet. In the vicinity: the same, but not mown (survey 9), and ploughed fields. *A*: 41, 22, 41 = 34.7 average. Collected: 217 specimens (70.5% larvae).

9. SW part of Külső-tó, July 29, 1947 (14 hrs.). Sedgy facies of marshy meadow (*Juncus, Mentha, Ranunculus, Lythrum, Orchis*). Same as preceding but not mown. 35—40 (—50) cm, 100%, thick, fibrous grass. *A*: 28, 30, 27 = 28.3 average. Collected: 131 specimens (64.1% larvae).

10. Újlaki-rét, July 30, 1947 (12 hrs.). Marsh-marsh meadow complex (*Schoenoplectus Tabernaemontani, Typha, Phragmites, Agrostis, Juncus*). A wet strip of ground about 30 m wide, 20—60, 80—120 cm high mosaic of vegetation, in good green condition. In the vicinity: area of following survey (11) and a highway. A: 7, 10 = 8.5 average. Collected: 16 specimens.

11. Újlaki rét, July 40. 1947 (12 hrs.). A small marsh meadow area with homogeneous mown grass (about 200 m²), 20 cm, 100%, in good green condition. A narrow strip wedged in between the areas of surveys 10 and 12. A: 18. Collected: 51 specimens (18.8% larvae).

12. Újlaki-rét, July 30, 1947 (13 hrs.). Mown meadow, homogeneous, fibrous Graminea grass (*Trifolium*), 7—10 (—15), 95—100%, in fairly good condition, somewhat

trampled. Ground 50 cm higher than the preceding (reclaimed) areas (surveys 10, 11). In the vicinity: drier (survey 13) and damper types of meadow (Surveys 10, 11). *A*: 33, 33 = 34 average. Collected: 240 specimens (31.7% larvae).

13. Újlaki-rét, July 30, 1947 (13 hrs.). Mown meadow, a somewhat drier part and with more varied vegetation (*Agropyrum, Cynodon, Trifolium, Achillea, Daucus, Pastinaca*), 5—7—10 cm, 80—90%, a drying, narrow-bladed stand. In the vicinity: damper meadow habitats. *A*: 22, 14, 20 = 18.7 average. Collected: 114 specimens (6.1% larvae).

14. Diósi-rétek (neck of peninsula), August 1, 1947 (10 hrs.). Variegated mown meadow (*Festuca, Salvia pratensis, Ononis, Scabiosa*); 15—25—40 cm, 100%, thick green grass. In the vicinity: ploughed fields (on the slopes of Diós-tető hill), meadow (survey 15). *A*: 56, 50 = 53 average. Collected: 294 specimens (72.1% larvae).

15. Diósi-rétek, August 1, 1947 (11 hrs.). Mesophile meadow *Daucus-Pastinaca-Cirsium* aspect (*Achillea, Centaurea, Lotus*, Graminea, *Ranunculus, Centaurium, Euphrasia*); 20—30 (—40—60) cm, 100%, thick, variegated herbage, in very good condition. In the vicinity: the areas of surveys 14 and 16. *A:* 28, 14, 31 = 24.3 average. Collected: 153 specimens (30.0% larvae).

16. Diósi-rétek (meadows), August 1, 1947 (12 hrs.). Homogeneous sedgy grass, a small hollow (about 100 m²) in the preceding (15) habitat. 30—40 (—50) cm, 100%, fibrous good green. (Only qualitative collection.) Collected: 63 specimens (14.3% larvae).

17. Diósi-rétek, August 1, 1947 (13 hrs.). Marshy meadow (*Agrostis alba-Carex distans* complex), on lumpy, watery soil here and there with „zsombék"* (*Carex, Juncus, Typha, Caltha, Alisma*). 40—50—70 cm, 100%, fibrous, homogeneous, green grass. In the vicinity: drier types of meadow (surveys 15 and 16). *A:* 3, 0, 7, 3 = 3.2 average. Collected: 32 specimens (6.2% larvae).

18. On the E slope of Echo Hill (Viszhang-domb), 140 m above sea level, August 3, 1947 (9 hrs.). Small clearing (about 30 m²) among tall *Acer-Robinia-Sambucus* bushes (*Lamium, Leonurus, Agropyrum, Rosa, Clematis*) 30—50 (—70) cm, 100%, bladed-foliated texture. In the vicinity: a wood planted with Robinia-Acer-Pinus. (Only qualitative collection.) Collected: 19 specimens (36.8% larvae).

19. On the E slope of Viszhang-domb, 190 m above sea level. August 3, 1949 (9 hrs.) 3—5 m fruit trees with *Festuca sulcata* grass level, 5—10 cm, 80—90% (cover at foliage level: 20%), somewhat dry grass. 10—15° slope. *A:* 29. Collected: 90 specimens (73.3% larvae).

20. Summit of Óvár, 200 m above sea level, August 3, 1947 (10 hrs.). *Festuca sulcata-Carex humilis* grass (*Scabiosa, Salvia, Medicago, Thymus*), 4—7 (—15 cm, 95—100%, a bladed, drying stand with much moss. About 100 m². In the vicinity: vineyards with hedges of fruit trees. **O**: 28. Collected: 71 specimens (36.6% larvae).

21. SW 20° slope of Óvár, 160—180 m above sea level, August 3, 1947 (11 hrs.). *Festuca-Cynodon* pasture (*Achillea, Andropogon, Teucrium*) 3—4 cm, 75—80—90%, half dried, fibrous grass, slightly uneven ground, with scattered stones. An extensive habitat. *A:* 11, 8, 3, 4, 5 = 7.7 average. Collected: 50 specimens (32% larvae).

22/a. Summit of Óvár, August 3, 1947 (12 hrs.). *Festuca sulcata-Stipa* grass on a 25° S slope (*Xeranthemum, Artemisia*); 200 m above sea level, 5—10—15 cm, 60—70%, drying, bunchy grass. In the vicinity: fruit trees, vineyards, as well as other slopes with steppe assn. (surveys 23, 22/b). *A:* 11, 20, 14 = 15 average; Collected: 36 specimens (38.9% lavae).

22/b. Summit of Óvár, August 3, 1947 (12 hrs.). Same as preceding, except that incline is steeper (5°); 7—15 (—40) cm, 90%, drying grass. In the vicinity: areas of surveys 21, 22/a and 23. *A:* see preceding. Collected: 49 specimens (42.8% larvae).

23. Summit of Óvár, August 3, 1947 (13 hrs.). *Festuca sulcata* grass, with much *Salvia*, 7—20 (—40) cm, 95—100%, bladed-foliated, grass in good green condition, wedged in between the two previous habitats. All three of small extent (50—200 m²). The last a slope of 3—7°. *A:* 51. Collected: 241 specimens (62.6% larvae).

24. Kiserdő, a hill 150 m above sea level. August 6, 1947 (9 hrs.). *Festuca sulcata* (-*Stipa*) grass (*Andropogon, Euphorbia, Thymus, Scilla autumnalis, Xeranthemum, Eryngium*), 2—5 (7—10) cm, 85—90%, fibrous, bunchy, half dry grass. On a small subsidiary NW 7° slope of the principal SE slope. In the vicinity: bushes and orchards. A: 6, 17 = 11.5 average. Collected: 62 specimens (19.3% larvae). The collection was made in a strong N wind.

25. Kiserdő. E 5° slope, 150 m above sea level. August 6, 1047 (10 hrs.). *Festuca-Andropogon* pasture grass (*Artemisia, Thymus, Scilla autumnalis*); 2—4 (—7) cm,

* „Zsombék" (Hung.) = Bunch of plants forming a hillock on swampy etc. ground.

80—90%, three-quarters dry, bushy grass. Ground surface somewhat disturbed (grubbed up.) About 400 m², in the neighbourhood fruit trees, kitchen gardens. **A**: 18. Collected: 107 specimens 5.6% larvae).

26. SE slope of Kiserdő, 150—180 above sea level. August 6, 1947 (11 hrs.) — *Festuca (-Stipa) — Andropogon* grass in an orchard (almond), *(Eryngium, Euphorbia, Xeranthemum, Teucrium, Linum; Scabiosa)*; 3—5 m almond tree foliage-level cover: 20%, 2—4—10 (—20—30) cm 90—100%, fibrous, half dry grass, uneven, stony ground. In the vicinity: vineyards. A: 32, 37, 32 = 34.7 average. Collected: 200 specimens (40.0% larvae).

27. Apáti-hegy hill, foot of SE slope, August 10, 1947 (10 hrs.), Stubble (after oats-vetch: *Rubus, Convolvulus, Stachys*); 15—25 cm. 80—95%, homogeneous, loosely foliated herbage in fairly good condition. In the vicinity: pastures and ploughed fields. *A*: 38, 42, 31, 28, 21 = 32 average. Collected: 227 specimens (67.8% larvae).

28. Apáti-hegy, SE slope, 140 m above sea level, August 10, 1947 (11 hrs.) *Setaria-Rubus* stubble (*Convolvulus, Consolida, Cirsium, Melilotus, Chenopodium*); 10—20 (—30) cm, 70—80%, very sparse, fibrous-foliated drying grass. In the vicinity: stubble of preceding (27.) survey and pasture (survey 29). *A*: 18, 21, 22, 38, 22, 18 = 23.2 average. Collected: 110 specimens (55.5% larvae).

28/a. Kiserdő, foot of S slope, August 10, 1947 (8 hrs.). *Setaria-Erigeron-Chenopodium* stubble (*Convolvulus, Stachys, Consolida*); 5—10—30—40 cm, 60—50%, fibrous-foliated grass in fairly good condition. In the vicinity: a path (bordered by abundant *Festuca*), ploughed fields. (Only qualitative collection.) Collected: 36 specimens (13.4% larvae).

28/b. Kiserdő, foot of S slope, August 10, 1947 (8 hrs.). Stubble vith *Consolida-Erigeron-Stachys-Sideritis* vegetation (*Nigella, Convolvulus, Rubus*), 5—10 cm, 60—75%, sparse grass. (Only qualitative collection.) Collected: 46 specimens (34.8% larvae).

29. Apáti-hegy hill, about 160 m above sea level, August 10, 1947 (12 hrs.). *Festuca sulcata* pasture grass (*Prunus spinosa, Crataegus* and *Rose* bushes, *Thymus. Scabiosa, Stipa, Eryngium, Scilla autumnalis, Andropogon, Sedum, Teucrium*), 5—7 (—10) cm, 90—95%, fibrous-bunchy, drying vegetation. A very extensive habitat. *A*: 43, 40, 36 = 39.6 average. Collected: 167 specimens (38.3% larvae).

30. Nyereg-hegy hill, N slope, 190 m above sea level, August 10, 1947 (13 hrs.). (*Festuca sulcata, Agrostis tenuis, Melica ciliata, Agropyrum* vegetation (*Eryngium; Galium, Convolvulus, Sedum, Hipericum, Euphorbia; Phleum*); with here and there bushes; 15—30 (—50—60) cm, 95—100%, bladed, shrubby, half dried herbage, on disturbed (by planting) stony ground. 10° slope. In the vicinity bushy, woody slopes. *A*: 14, 9, 11 = 11.3 average. Collected: 56 specimens (33.9% larvae).

31. Summit of Nyereg-hegy hill, 225 m above sea level, August 10, 1947 (15 hrs.). *Festuca sulcata-Carex humilis-Stipa* grass (*Andropogon, Eryngium, Euphorbia, Scilla autumnalis, Iris, Artemisia, Thymus, Sedum*, lichens); 10—30 (—40) cm, 80—85% bladed-shrubby, half dried vegetation, on a S 5° slope; the ground stony-rocky. About 1000 m² in extent. In the neighbourhood shurbby-woody slopes. **A**: 9, 7, 6 = 7.3 average. Collected: 45 specimens (2.2% larvae).

32. Kiserdő. Foot of SW slope, August 13, 1947 (10 hrs.). Wheat stubble with *Polygonum aviculare-Stachys annua* plant society *(Convolvulus, Chenopodium album, Rubus)*; 3—15 (—20) cm, 80—90%, fibrous-foliated herbage in fairly good condition. About 1 ha in area. In the vicinity the Külső-tó meadow and ploughed fields. *A*: 12, 13, 19, 7 = 12.7 average. Collected: 53 specimens (47.2% larvae).

33. Rátai csáva (a small patch of meadow in the W part of the peninsula), August 13, 1947 (11 hrs.). Small marshy meadow (about 100 m²). *Carex* p. p. *Bolboschoenus*?) — *Potentilla reptans* society *(Vicia, Cirsium, Rorippa, Heleocharis)*; 15—20—30 (—40) cm, 100—95%, below a foliated, above a fibrous stand, in good green condition. In the vicinity: ploughed fields. *A*: 12, 4, 20, 10, 11 = 11.4 average. Collected: 155 specimens (32.2% larvae).

34. Gurbicsa-tető summit, August 13, 1947 (13 hrs.). *Quercetum stepposum (Festuca, Andropogon, Plantago, Thymus)*, 3—5 cm, 100%; fibrous-bushy half dry grass level, with very scattered small bushes. 5—7° N, NE slope. Only qualitative collection. Collected: 70 specimens (25.7% larvae).

34/a. Hosszúhegy, a hill 140 m above sea level, August 13, 1947 (15 hrs.). Mixed broad leafed forest (chiefly *Quercus sessilis*), with scattered trees, small bushes. Grass level in variegated, good condition. Only qualitative collection. Collected: 44 specimens (11.4 larvae).

35. Gurbicsa-tető, 150 m above sea level, August 13, 1947 (14 hrs.). *Quercetum stepposum* (at grass level: *Festuca, Poa, Plantago*, moss); 3—5 (—7—15) cm, 100%

fibrous, half dry, trampled grass, No shurb level. Oak and elm trees at 5—8 m distance: foliage crown cover 30—50%. About 4 ha in extent, with slight NE slope. In the vicinity forest with shrub stratum. *A*: 58, 65, 51 = 58 average. Collected (principally in the more open, less shady parts): 113 specimens (40.7% larvae).

35/a. The same as the preceding. Collected in scattered bushes near a shady enclosed forest with shrub stratum: 144 specimens (31.9% larvae).

36. Gurbicsa-tető, 160 m above sea level, August 13, 1947 (15 hrs.). *Festuca-Andropogon* summit clearing surrounded by shrubs and planted pines. (*Euphorbia, Thymus, Verbascum, Nigella, Scabiosa Cynodon, Achillea, Potentilla)* 3—6 (—10—40) cm, 95—100%, fibrous, here and there foliated, half dry grass, on flat land, about 1000 m². *A*: 28, 28, 38 = 31.3 average (16.4% larvae).

37. Kiserdő foot-slope, August 17, 1947 (8 hrs.). Barley stubble with *Setaria glauca-Stachys annua* society *(Convolvulus, Medicago, Reseda, Cirsium, Rubus).* 10—15 cm, 80%, grass in fairly good condition. Area of about 1 ha on 3° W slope. In the vicinity: shrubby Kiserdő slope, fallow land, and meadow of Külső-tó. *A*: 15, 19, 16 = 16.7 average. Collected: 58 specimens (36.2% larvae).

38. Külső-tó, E border, August 17, 1947 (10 hrs.). In the vicinity of area of survey 4. Marshy meadow (roughly *Agrostis alba-(Deschampsia caespitosa)-Carex distans* complex), with variegated colourful herbage (*Centaurea pannonica, Trifolium pratense, Cichorium, Cirsium, Achillea, Ranunculus, Lotus, Inula, Plantago, Festuca pseudovina, Dactylis glomerata, Carex*, etc.) about 1 ha in extent. 7—10—15 (—30) cm, 100%, fibrous, somewhat foliated, good green herbage. In the vicinity: ploughed fields, alkali meadow. *A*: 16, 20, 21 = 10 average. Collected: 161 specimens (21.7% larvae).

39. Middle of Külső-tó, August 17, 1947 (11 hrs.). Alkali marshy meadow with *Agrostis alba-Aster pannonicus* plant society *(Agropyrum, Lotus, Inula, Cirsium, Phragmites)*; 3—5—10 (—15—20) cm, 90—100%, three-fourths dry grass. In the vicinity: marshy meadow of better quality. *A*: 23 (a patch of *Agrostis-Agropyron* vegetation), 7, 6, 5, 8, 8 = 8.7 average. Collected: 18 specimens (no larvae).

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КАЧЕСТВЕННЫЙ И КОЛИЧЕСТВЕННЫЙ АНАЛИЗ СОСТАВА САЛТАТОРИЙ НА ПОЛУОСТРОВЕ ТИХАНЬ

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КРАТКОЕ ИЗЛОЖЕНИЕ

В течении одного месяца мне удалось сделать 43 снимка (из них только 6 штук количественного характера) на различных по характеру и размеру культурах полуострова Тихань. Снимки сделаны с целью выяснить количественное и качественное распределение насекомого Салтатория. За основу в разграничении культур служит растительность. Для определения количественных связей я применял квадрат сита покрывающего сразу 10 квадр. метров; к данным количественного распределения я добился путем анализа 4625 экземпляров собранных мною сеткой употребляемой на лугах. (конусная сетка.)

Должны предполагать, что данные о сущенности особей на снимках немного нисшие чем в действительности, потому что часть насекомых, которые по всей вероятности оставались неподвижными, остались вне моего наблюдения. Экземпляры установленные при релятивно-количественных условиях (deminancialis 3 и 4 таблицы) из состава культур Салтатории попавших в сетку, основаны на количестве попавших в сетку, и по всей вероятности это геофильные породы (напр. Gryllus, Liogryllus) и особи самых деятельных — движущих — летающих пород, но процентный состав их среди попавших в сеткунизок, не отвечающий действительным условиям. Заметно и значительно повышается % породы Aeolopus thalassinus, если мы температуру повысим до 30° С.

Господствующие (dominánS) породы, а также приняв во внимание биотоп (в первую очередь растительность), я сравнил снимки, сконцентрировал все и в полученных мною 6-ти группах состава Салтатория мог установить породы более или менее связанные (fidelis) к некоторым группам состава Салтатория (к типу биотоп) и породы постоянно находящиеся (konstana) в них, потом на этой основе я мог составить и типичные комбинации пород показывающих характерность групп состава Салтатории.

Не принимая во внимание внутреннюю специфическую реляцию установленных составов Салтатории, предполагаем, что они находятся в сильной зависимости от пространства и времени. Для того, чтобы показать условия пространственных и временных взаимодействий биотоп, вернее составов Салтатории, нужны периодические анализы.

Мои собственные анализы, все до одного показывают картину статистического профиля в средней части периода вегетативного размножения. (конец июля, начало августа) в количественном и качественном распределении Салтаторий в тех культурах, которые с точки зрения Салтаторий являются самыми существенными вернее хотя бы до некоторой степени являлись бы существенными.

То, что связь между породами состава в Салтаторий и количественной релятивизацией (можно предполагать, что и абундационная связь и связи внутренней продукции) среди нормальных условий вряд ли изменяется существенно, я мог установить на основе результатов анализа проведенного мною летом в 1943 году, к сожалению от них осталась только незначительная часть по причине военных действий; распределение доминирующих и количественных пород в соответственных для них культурах было одинаково в течении двух лет.

Насчет качественных, а также количественных релятивных (dominanciális) отношений я ссылаюсь на таблицы (3—4 таблицы), под'итоживая здесь могу подчеркнуть следующее: в ксеромон-грунте (жнивья, пастбища с карликовой травой, склоны степей, дубовые парки всеобще господствующей породой является stauroderus bicolor-mollis, которая как тип биотопа объединяется каждый раз с другими породами в доминанте. Так на степных склонах, на экспонированых пастбищах преобладает Omocestus petraens, Oedipoda coerulescens, в меннее экспонированных и в других переходного типа культурах мы находим Omocestus haemorrhoidalis, stenobothrus crassipes, в дубовых парках — Quercetum stepposum вместе с породой gomphocerus rufus преобладает, тогда как на жнивьях господствует Setaria-Polygonum-atachis assz. наравне с Calliptanus и Oedipoda. На грунте Гидролеймок мезефиль и гидрофиль-лугах) характерны доминанты пород — Chortippus и Mecosthethus. Кроме упомянутых здесь доминирующих пород как в ксеролеймон грунте (I—IV тип.), так и в гидролеймон-грунте (V—VI.) групп состава Салтаторий имеются еще свои-местного характера типичные породы, которые мы можем увидеть на 5-ой таблице, а также в типичных комбинированных породах.

Данные о сгущенности полученные при помощи применения квадратного сита (смотри приложения) примененного для измерения живого веса пород (2 таблица), а также те данные которые были собраны на основе собранного луговой сеткой и установленные таким образом количественные данные (3 и 4 таблицы) дали возможность установить по породам составам Салтаторий, а после подведения итогов групп составов Салтаторий и абсолютно-количественные данные или же число экземпляров приходящихся на один гектар (6 таблица), а также вес (7 таблица) во время анализа, значит в середине периода вегетативного размножения.

Между тождественными данными продукций и абундаций групп ситава Салтатория учитывая, что они основываются на результатах тождественно проведенных снимков в недалеких друг от друга сроках, можно непосредственно произвести сравнение, но между данными полученными по снимкам проведенным в более далеких друг от друга сроках надо проводить сравнения с соответственной осторожностью, потому, что абундация и продукция могла в течении 2—3 недель в значительной мере уменьшится, на что я и ссылался подробнее. Оставшаяся еще подлинная порядковая нумерация показывает на хронологическую очередность. Замечаемые нами разницы довольно резко проявляющиеся в отношении количественной релятивизации и породистости типов культур групп состава Салтатории мы находим в абундации и продукции гораздо в меньшем количестве.

В группах состава Салтаторий внутри типов культур мы находим ценные экстремы, но в среднем в большей части групп — (типов) данные абундации и продукции относительно, довольно близко стоят друг к другу; имеются 10—30—60% разницы, это особенно относится к абундациям, по всей вероятности являются меньшими чем количественные перемены происходящие во время периода вегетативного размножения.

Установленная во время анализа ценность абундации была самой высокой в безкустарном, дубовом парке (Quercetum steposum 58 000 шт.) на г. в культурах переходного характера и в биотопах гидрофильных лугов в среднем: 30 552, точнее — 28 375 шт/г., тогда как на жнивьях, склонах степей и на мезофильных лугах одинаково низкая, там средняя единица сгущенности особей — 21 145, 18 489,23 036 шт/г.

Надо заметить, что значимость (оценка) абундации в период вегетативного размножения значительно уменьшенного по количеству состава составляют только меньший процент, ценности продукции как это показывают данные И. Балога и Локса (1948) приблизительно в период (VII. 17 — VIII. 13) дистигают до их максимальной величины, потому что Салтатории при все еще значительной абундации в своей большей части являются зрелыми. Соответственно самой большой абундации и ценность продукции тоже самая большая в группах состава Gomphocerus rufus-Stauroderus bicolor — mollis — Quercetum stepposum (7561 на) г.; на гидрофильных лугах (VI-тип): 4658 на/г. На других типовых культурах (склоны степей, жнивья, мезофильные луга), и в культурах переходного характера ценность была между 2558—3494 на/г.

Продукция Салтатории в благоприятных для нее культурах параллельно повышалась с количественным ростом растительности.

Состав Салтатория достиг самой высокой абундации и продукции в таких культурах, которые были богаты видовым и флористическим разнообразием растительности в которых высота растительности на грунте ксеролеймон 3—5—7 (15—20) на грунте гидролеймон 7—15—20 (40) см. при 90—95, точнее — 95—100% покрытии.

TABLE II.

Fresh weight (in gs) of Saltatoria species according to sex and stadium of development (Roman numbers). n = number of individuals weighed; in ( ) estimated values.

Species	imago				larva	
	♂	n	♀	n	♂	♀
Acrida turrita			0,8600	2		
Acrydium subulatum	(0,0400)	—	(0,0700)	—	(0,0300)	(0,0600)
„ bipunctatum	(0,0400)	—	(0,0700)	—	(0,0300)	(0,0600)
Parapleurus alliaceus	0,1165	2	0,4188	2		
Chrysochraon dispar	0,1277	3	0,4800	1		
Stenobothrus lineatus	(0,1500)	—	0,4137	2		
„ crassipes	0,0518	6	0,1149	11		
„ stigmaticus	0,0575	4	0,1127	6		
„ nigromaculatus	0,1100	5	0,2829	10		
Omocestus rufipes	0,0481	7	0,2055	3		
„ haemorrhoidalis	0,0700	2	0,1569	4	(0,0300)	(0,1000)
„ petraeus	0,0455	7	0,0831	8		
Stauroderus biguttulus	(0,0869)	—				
„ bicolor-(mollis)	0,0869	59	0,1638	30	II—III. stad.:	
Chortippus dorsatus	0,0938	46	0,2400	36	(0,0300)	(0,0800)
„ parallelus	0,0993	59	0,2116	40		
„ longicornis	0,0926	46	0,2144	39	IV—V. stad.:	
„ elegans	0,0648	19	0,1660	33	(0,0600)	(0,1600)
„ declivus	0,0724	26	0,2100	27		
Gomphocerus maculatus	0,0600	1	0,0575	6		
„ rufus	0,0883	3	0,2515	7	(0,0600)	(0,1600)
Dociostaurus cr. brevicollis	0,0931	13	0,1859	9		
Mecosthetus grossus	0,1971	17	0,6248	10	(0,08-0,15)	(0,20-0.40)
Aeolopus thalassinus	0,1188	18	0,4244	11	(0,0800)	(0,3000)
Oedipoda coerulescens	0,1780	2	0,5545	5		
Oedaleus nigrofasciatus	0,2850	1	0,6297	3		
Calliptamus italicus	0,1654	2	0,9838	15		
Pezotettix giornai	0,0773	20	0,1319	16	(0,0600)	(0,1000)
Leptophyes albovittata	(0,1500)	—				
Conocephalus fuscus	0,1586	8	0,1853	7	(0,07-0,14)	(0,08-0,15)
„ dorsalis	0,1772	6	0,1870	4	(0,07-0,14)	(0,08-0,15)
Homocoryphus nitidulus	(0,3000)	—	0,3855	2		
Rhacocleis germanica	(0,3500)	—	(0,4000)	—		
Metrioptera grisea	(0,6000)	—	0,6847	3		
„ affinis	0,6312	5	0,7211	3		
„ vittata	(0,2500)	—	(0,3500)	—		
„ roeselii	(0,4000)	—	0,4500	1		
Decticus verrucivorus	1,7314	3	2,4862	4		
Oecanthus pellucens					(0,0600)	
Pteronemobius heydeni					(0,0100)	(0,0150)
Liogryllus campestris					(0,2000)	(0,2000)
Gryllus desertus					0,1252	0,2170
Mantis religiosa	(0,4000)	—	1,4975	4		

TABLE III.

Relative quantitative occurrence (= DI value, in %) of Saltatoria species in the different populations of surveys Nos 1—39 (abscissa), as figured from net collected material.

Species		28/a	28/b	27	32	37	24	25	21	31	22/a	29	26	22/b	23	19	30	1	14	36	34	20	35	35/a	34/a	18	39	13	12	11	2	15	38	33	16	6	4	17	10	5	7	8	9
Acrida turrita									2·0																																		
Acrydium subulatum																		3·7					0·8		2·3					5·9			4·3	21·9	1·6	4·8	5·6		6·2	2·5	3·7	7·8	
„ bipunctatum																			1·7												0·6							3·1					
Parapleurus alliaceus																																	3·2				12·5	6·2	1·3			
Chrysochraon dispar																															0·7		0·7	1·6						0·8		
Stenobothrus lineatus										2·2			0·5		1·3		12·5		+				7·1							2·1					0·8							
„ crassipes												5·4	1·0	4·1	2·5	6·7	5·3	8·8	5·4	11·7	32·9	31·0		2·7	4·5						4·1	0·6										
„ stigmaticus																				13·3																						
„ nigromaculatus							+	2·8		4·4	2·8	0·6	4·0	2·1	0·4					0·8																						
Omocestus rufipes																					5·7		5·3	12·5	11·4				0·4												
„ haemorrhoidalis												14·4		4·1	3·3		5·3	66·3	39·5	9·4		1·4						1·7	0·4		31·3										
„ petraeus							75·8	77·6	24·0	56·5	22·2	7·8	4·0	2·0	0·4	1·1																										
Staurodera biguttulus																																										
„ bicolor-mollis	94·5	72·2	82·6	91·2	94·3	89·7	3·2	2·8	32·0	8·9	55·6	70·1	82·0	59·2	86·3	81·1	66·1		6·1	42·2	55·7	62·0	65·5	41·0	45·5	26·3		0·9	1·2		8·3	9·8	8·7	9·0	1·6		0·9		9·2			
Chortippus dorsatus																													1·3	1·9		55·6	8·7	2·6	61·8		5·6	31·3		5·1	0·4	0·4	
„ parallelus				1·8														8·8	3·7									47·4	15·4		31·3	3·3	27·3	12·3	9·5	4·9	33·1		44·6	5·7	1·4	0·8
„ longicornis																																			3·2		?	15·7		3·2	18·0	11·5	6·9
„ elegans									2·0									3·7									77·8	19·3	12·1	23·5	2·1		16·8	38·1		38·2	13·3	9·4		11·3	3·3	1·4	1·5
„ declivus										2·2	5·5		0·5	2·0	2·1	7·8	1·8	1·2	8·8	7·0	2·9	1·4	2·7	3·5	6·8		5·6	22·8	33·0	66·7	4·1	12·4	1·9		12·7	1·6	1·9	3·1	6·2				
Gomphocerus maculatus							11·3	6·5	22·0											0·8																						
„ rufus								6·5															8·9	22·9	15·9	42·1							3·7	1·9		3·2	14·2	6·2	12·6	17·8	30·0	51·2	72·5
Dociostaurus cr. brevicollis																																										
Mecosthetus grossus																																										
Aeolopus thalassinus				4·4														6·3									+			2·0	4·1	0·7	0·7	+		15·4	1·9		18·8			
Oedipoda coerulescens		25·0	10·9	+	+	5·2	3·2	1·0	+	2·2	8·3	1·2	6·5	12·2	1·6	1·1	1·8			5·4	1·4	2·8	0·9		4·5																
Oedaleus nigrofasciatus									8·0																						0·7		0·7									
Calliptamus italicus	5·5	2·8		1·8	1·9	1·7		1·0	2·0	4·4	2·8		1·5		0·5	1·1	1·8			0·8	1·4		2·7	9·7		26·3	5·6	1·8	15·4			15·0	12·4		4·8	8·1	10·4	3·1		3·2		
Pezotettix giornai															1·2				3·1																						
Stenobothrus s. lat. larva							6·5	0·9	8·0	2·2		0·5		12·2					31·3			1·4	2·6	2·1															1·9			
Gomph. mac. seu Omoc. petr. l.								0·9												8·6								4·4	2·4		2·1										
Omoc. haem. seu rufip. larva																												1·7	17·9				0·6	7·7					36·1	24·9	18·3
Staurod. seu Omoc. larva																																										
Chortippus larva adeterm.																																										
Leptophyes albovittata															0·4											5·3																
Phaneroptera falcata															+																											+
Conocephalus fuscus																			0·4							+	5·5						1·9	1·3	1·6	20·3	5·6	9·4	43·8	7·0			
„ dorsalis																																			1·6	0·8							
Homocoryphus nitidulus																																	+						1·6			
Rhacocleis germanica																							2·7	4·9	4·5																	
Metrioptera grisea										2·2		+	+				+																									
„ affinis										11·1		+		2·1			3·6										5·5				10·5					0·9					
„ vittata				+																																1·9						
„ roeselii																																					6·2		1·3			
Decticus verrucivorus				+	1·9					2·3						+													0·4			+	+						+		
Ephippigera vitium																																										
Oecanthus pellucens											2·8																															
Pteronemobius heydeni																																								+	1·4	
Liogryllus campestris																		0·3					0·8		2·3		+					0·6				1·9			0·6			
Gryllus desertus	+		6·5	0·4	1·9	3·4																									0·6	12·4	0·6		1·6				0·4		
Liogr. seu Gryll. larva																																				2·8					
Mantis religiosa				0·4						2·3					+	1·1	1·8						+	0·7	2·3																

TABLE IV.

Relative quantitative weight conditions (= DG value, in %) of Saltatoria species in the different populations in surveys 1—39 (abscissa).

Species	28	28/a	28/b	27	32	37	24	25	21	31	22/a	29	26	22/b	23	19	30	1	14	36	34	20	35	35/a	34/a	18	39	13	12	11	2	15	38	33	16	6	4	17	10	5	7	8	9
Acrida turrita									6·8																																		
Acrydium subulatum																		1·4					0·5		0.6					2·5			1·7	9·6	0·4	1·7	1·8		2·0	0·8	1·2	3 2	
„ bipunctatum																			1·0												0·3					1·1					
Parapleurus alliaceus																																	8·9			14·0	3·3	3·6			
Chrysochraon dispar																															0·6		0·6	1·4					1·3		
Stenobothrus lineatus										2·9			0·5		1·5		21·5		+											1·7					0·8						
„ crassipes												2·8	0·7	2·9	1·7	5·1	3·1	7·0	5·7	7·7	22·2	19·5	4·1	1·7	2·5					1·2	0·6									
„ stigmaticus																				8·2																					
„ nigromaculatus							+	9·2		4·0	5.3	1·4	6·8	3·6	1·0					1·7																					
Omocestus rufipes																					4·5																				
„ haemorrhoidalis												16·9		2.3	3·1		1·9	65·5	29·7	7·7		0·7	6·4	9·7	8·5			1·3	0·1												
„ petraeus							63·3	58·8	11·5	12·3	9·7	4·5	1·6	0·6	0·3														0·2		14·8											
Stauroderus biguttulus																0·9																									
„ bicolor-mollis	75·6	41·7	53·0	74·0	61·1	74·6	7·1	2·5	32·1	3·6	43·0	70·8	67·0	45·3	83.3	72·0	40·8		7·6	40·3	53·4	71·5	63·7	38·6	31·2	24·3		0·9	1·4		4·8	7·5	7·2	10·4	1·8		0·5		4·6			
Chortippus dorsatus																													1·0	3·4		56·8	11·4	3·6	64·5		5·8	27·7		3·6	0·3	0·7	
„ parallelus				1·4														11·9	7·0									47·2	19·4		32·1	4·5	30·6	13·8	6·7	4·3	29·9		35·4	4·8	0·9	0·8
„ longicornis																																			3·4		?	12·9		3·1	17·3	11·1	4·6
„ elegans									2·2									4·7									59·2	14·8	11·9	18·8	1·9		13·5	36·3		34·3	11·2	7·2		10·2	2·2	1·2	1·3
„ declivus										1·5	5·3		0·2	2·7	2·2	8·9	1·9	2·0	12·4	7·2	1·7	0·7	3·4	4·1	5·2		2·0	19·9	29·0	73·6	3·2	12·6	1·4		12·4	1·5	0·8	3·8	5·9				
Gomphocerus maculatus							7·1	3·4	7·0											0·4																					
„ rufus																							5·9	16·5	16·9	41·3															
Dociostaurus cr. brevicollis								12·1																																	
Mecosthetus grossus																																	11·3	3·0		8.5	24·9	6·3	23·0	29 4	46·5	65·7	81·9
Aeolopus thalassinus				11·1														5·6									+			1·7	2·7	0·4	1·7	+		18·7	4·1		27·1				
Oedipoda coerulescens		44·3	38·4	+	+	19·5	16·4	1·9	+	3·9	17·1	3·5	16·2	32·7	5·0	1·7	6·6			14·3	6·6	7·3	3·8		16·3																
Oedaleus nigrofasciatus									24·8																																
Calliptamus italicus	24·4	14·0		11·2	11·7	1·9		10·7	13·3	13·9	18·5		7·0		0·6	9·5	8·9			5·9	11·6						27·4	11·1				4·7		5·0							
Pezotettix giornai															0·8				3·1				1·9	7·6		25·4			11·7			11·0	7·5		3·7	5·3	4·9	2·4		2·0		
Stenobothrus s. lat. larva							6·1	1·1	2·3	0·6		0·1		1.9					32·7			0·3	1·0	2·0															0·3		
Gomph. mac. seu Omoc. petr. l.								0·3																																	
Omoc. haem. seu rufip. larva																				6·6																					
Staurod. seu Omoc. larva																												3·9	2·3		0·9										
Chortippus larva adeterm.																												0·9	14·5				0·6	6·1					22·6	17·1	11·4
Leptophyes albovittata															0·5											9·0															
Phaneroptera falcata															+																										
Conocephalus fuscus																			0·8							+	4·4						1·9	1·6	1·5	22·1	5·4	10·1	34·1	7·3			+
„ dorsalis																																				1·0						
Homocoryphus nitidulus																																	+		4·2				3·3		
Rhacocleis germanica																							7·2	14·5	11·8																
Metrioptera grisea										4·9		+	+				+																								
„ affinis										24·2		+		8·0			11·7																			3·7					
„ vittata				+																							7·0				36·7					2·9					
„ roeselii																																						14·5		3·4			
Decticus verrucivorus				+	20·6					17.6																			8·5				+	+						+		
Ephippigera vitium																+																									
Oecanthus pellucens											1·1																														
Pteronemobius heydeni																																									
Liogryllus campestris																		1·9					2·1										1·2				2·3		0·9	+	0·1	
Gryllus desertus	+		8·6	0·8	2·6	4·0																			2·9		+				1·0	10·0	1·1		1·8				0·5		
Liogr. seu Gryll. larva																																				1·8					
Mantis religiosa				1·5						10·6					+	1·9	3·6						+	5·3	4·4																

TABLE V.

Average values of individual and weight dominancy (DI and DG [in fat type], in %) and grades of Constancy (K) and Fidelity (F in fat type) of the species in the Saltatoria Population Groups I—VI (see text, p. 99—105).

Species	I.				II.				III.				IV.				V.				VI.			
	Di	Dg	K	F	Di	Dg	K	F	Di	Dg	K	F	Di	Dg	K	F	Di	Dg	K	F	Di	Dg	K	F
Acrida turrita					0·25	0·85	1	5																
Acrydium subulatum									0·46	0·18	1	1	0·77	0·27	3	1	4·96	1·98	3	3	3·37	1·19	4	2
„ bipunctatum									0·21	0·13	1	2					0·04	0·02	1	2	0·52	0·18	1	2
Parapleurus alliaceus																	0·40	1·10	1	2	3·33	3·48	3	4
Chrysochraon dispar																	0·33	0·30	2	4	0·13	0·22	1	2
Stenobothrus lineatus					0·34	0·43	2	2	1·72	2·88	2	3					0·25	0·22	1	2				
„ crassipes					1·31	0·81	2	1	13·04	9·01	5	3	4·15	2·09	4	1	0·33	0·12	1	1				
„ stigmaticus									1·66	1·02	1	5												
„ nigromaculatus					2·09	3·79	5	4	0·15	0·33	2	2												
Omocestus rufipes									0·71	0·56	1	2	7·30	6·07	4	4	0·03	0·08	1	2				
„ haemorrhoidalis					2·31	2·41	2	1	15·65	13·57	4	3					2·38	1·16	2	2				
„ petraeus					33·74	20·27	5	5	0·05	0·04	1	1												
Stauroderus biguttulus									0·14	0·10	1	5												
„ bicolor-mollis	87·42	63·99	5	1	39·22	33·92	5	2	49·94	46·12	5	2	44·57	39·48	5	1	3·50	3·12	4	2	1·03	0·76	1	1
Chortippus dorsatus																	13·57	14·42	4	4	6·15	5·38	4	2
„ parallelus	0·30	0·24	1	1					1·56	2·36	2	1					16·38	16·39	5	3	8·75	6·98	4	2
„ longicornis																	0·40	0·42	1	1	9·22	8·16	5	5
„ elegans					0·25	0·28	1	1	0·46	0·59	1	1					20·03	18·81	5	3	4·48	3·68	5	2
„ declivus					1·27	1·21	3	1	4·12	4·63	5	2	3·25	3·17	4	1	12·49	11·95	5	2	1·55	1·62	2	1
Gomphocerus maculatus					4·97	2·18	2	4	0·10	0·04	1	2												
„ rufus													22·45	20·14	5	5								
Dociostaurus cr. brevicollis					0·81	1·51	1	5																
Mecosthetus grossus																	2·67	5·35	2	3	31·72	42·16	5	4
Aeolopus thalassinus	0·73	1·85	1	1					0·80	0·70	1	1					2·69	3·30	4	4	3·13	4·52	1	1
Oedipoda coerulescens	6·85	17·04	5	2	4·32	11·45	5	2	1·76	5·19	4	2	1·35	5·03	3	1								
Oedaleus nigrofasciatus					1·00	3·10	1	5																
Calliptamus italicus	2·28	10·54	5	2	1·46	7·92	3	2	0·70	4·56	4	2					0·67	3·70	2	2				
Pezotettix giornai									0·54	0·48	2	1	9·67	8·71	4	2	5·96	3·90	3	3	1·05	0·73	2	1
Stenobothrus s. lat. larva					3·79	1·50			4·09	5·20			1·17	0·74							0·32	0·04		
Gomph. mac. seu Omoc. petr. l.					0·11	0·04																		
Omoc. haem. seu rufip. larva									1·06	0·83														
Staurod. seu Omoc. larva																	0·63	0·50						
Chortippus larva adeterm.																	2·40	1·90			13·22	8·51		
Leptophyes albovittata									0·05	0·06	1	3	1·32	2·26	2	3								
Phaneroptera falcata									+	+	1	5												
Conocephalus fuscus									0·05	0·10	1	1	+	+	2	1	4·13	4·28	3	3	10·03	8·59	4	2
„ dorsalis																	0·10	0·12	1	5				
Homocoryphus nitidulus																	0·20	0·53	1	4	0·27	0·55	1	2
Rhacocleis germanica									+	+	1	2	3·02	8·29	4	4								
Metrioptera grisea					0·27	0·61	2	4	0·46	1·45	1	2												
„ affinis					1.65	4·03	2	4									0·88	3·08	1	3				
„ vittata	+	+	1	2													0·62	0·86	1	4				
„ roeselii																					1·25	3·00	1	5
Decticus verrucivorus	0·32	3·44	2	2	0·29	2·20	1	1									0·03	0·60	2	3	+	+	1	1
Ephippigera vitium									+	+	1	5												
Oecanthus pellucens					0·35	0·14	1	5																
Pteronemobius heydeni																					0·23	0·02	2	5
Liogryllus campestris									0·04	0·24	1	2	0·20	0·51	2	2	0·27	0·37	1	3	0·10	0·14	1	2
Gryllus desertus	2·03	2·66	5	3									0·57	0·73	2	1	1·20	1·15	3	3	0·07	0·09	1	1
Liogr. seu Gryll. larva																	0·35	0·22						
Mantis religiosa	0·07	0·24	1	1	0·29	1·32	1	1	0·36	0·69	2	2	0·75	2·42	4	2								

TABLE VI.

Number of individuals of each Saltatoria species per hectare (A value) in the different habitats (surveys 1—39) grouped according to the type of population (SPG).

Species	I				II								III							IV		V										VI					
	28	27	32	37	24	25	21	31	22/a	29	26	22/b	23	19	30	1	14	36	20	35	35/a	39	13	12	11	2	15	38	33	6	4	17	10	5	7	8	9
Acrida turrita							155									382				510					1058		158	827	2501	1851	2915		527	1428	1458	2714	
Acrydium subulatum																	901															101					
„ bipunctatum																													368			406	527	711			
Parapleurus alliaceus																											158		74						324		
Chrysochraon dispar																																					
Stenobothrus lineatus								163			168		632		1417										135				310							
„ crassipes										2138	337	612	1270	1934	607	892	2883	3672	8677	4106	1612				271	158										
„ stigmaticus																		4161																		
„ nigromaculatus						504		326	416	238	1357	306	209					244																		
Omocestus rufipes																				3080	7250			143												
„ haemorrhoidalis										5700		612	1693		607	6757	20914	2939	395				327	143		2031										
„ petraeus					8718	13963	1860	4073	3333	3086	1347	306	209																								
Staurodorus biguttulus														322																						
„ bicolor-mollis	21901	29178	12028	14941	371	504	2480	652	8334	27790	27606	8877	44018	23522	7488		3244	13219	17352	37984	23763		164	425		541	2385	1653	1029		484		527			
Chortippus dorsatus																								425	353		13519	1653	294		2915	1016		2850	162	159	
„ parallelus		563														892	1982						8842	5243		2031	796	5193	1398	2161	17005			24970	2267	478	215
„ longicornis																																508		1781	7122	3994	1946
„ elegans							155									382						6777	3603	4107	4235	135		3186	4339	14497	6803	305		6418	1296	478	433
„ declivus								163	834		168	306	1056	2256	203	127	4685	2203	395	1537	2013	484	4258	11193	12001	271	3022	353		616	973	101	527				
Gomphocerus maculatus					1298	1117	1705											244																		
„ rufus																				5133	13294															
Dociostaurus cr. brevicollis						1177																														
Mecosthetus grossus																												709	220	1232	7287	203	1071	9985	11818	17732	20547
Aeolopus thalassinus		1408														637									353	271	158	118		5860	973		1598				
Oedipoda coerulescens				862	371	167		163	1250	476	2188	1836	847	322	203			1714	790	510																
Oedaleus nigrofasciatus							620						209														158		74							
Calliptamus italicus	1263	563	241	287		167	155	326	416		505		632	322	203		1622	244		1537	5638	484	327	5243			3657	2360		3083	5346	101		1781			
Pezotettix giornai																																					
Stenobothrus s. lat. larva					742	167	620	163		238		1836					16584		395	1537	1206													1070			
Gomph. mac. seu Omoc. petr. l.						167												2692					819	850		135										
Omoc. haem. seu rufip. larva																							327	6093				118	882					14248	8625	5191
Staurod. seu Omoc. larva																																					
Chortippus larva adeterm.																																					
Leptophyes albovittata													209																								
Concephalus fuscus																	180					484						353	147	7711	2915	305	3723	3926			
„ dorsalis																														310					648		
Homocoryphus nitidulus																																					
Rhacocleis germanica																				1537	2819															
Metrioptera grisea								163							404																					
„ elegans								815				306														677					484					
„ vittata																						484									973					
„ roeselii																																203		711			
Decticus verrucivorus			241					163																143												
Oecanthus pellucens									416																												
Pteronemobius heydeni																																			478		
Liogryllus campestris																127				510								118			973			358			
Gryllus desertus		141	241	573																							158	2360	73	616					162		
Liogr. seu Gryll. larva																															1457						
Mantis religiosa		141						163						322	203						400																
Total	23164	31994	12751	16663	11500	17993	7750	7333	14999	39666	33666	14997	50984	29000	11335	10196	52995	31332	28004	57951	57995	8713	18667	34008	18000	6489	24327	19001	11399	38247	51500	3249	8500	55989	39505	34658	28332

TABLE VII.

Total weight of Saltatoria per hectare according to species in the different habitats (surveys 1—39) grouped according to the type of populations (SPG).

Species	I				II								III							IV		V										VI					
	28	27	32	37	24	25	21	31	22/a	29	26	22/b	23	19	30	1	14	36	20	35	35/a	39	13	12	11	2	15	38	33	6	4	17	10	5	7	8	9
Acrida turrita							77																														
Acrydium subulatum																19				36					63			53	140	99	146		37	64	71	176	
„ bipunctatum																	47										10					6					
Parapleurus alliaceus																													129			78	62	298			
Chrysochraon dispar																											20		9						81		
Stenobothrus lineatus								67			25		95		479											20				46						
„ crassipes										141	39	70	106	170	70	95	246	314	578	309	135					14	18									
„ stigmaticus																		334																		
„ nigromaculatus						143		92	118	67	352	87	60					69																		
Omocestus rufipes																				478	742			7												
„ haemorrhoidalis										838		57	192		42	883	1286	312	21				37	10		177									
„ petraeus					461	914	131	283	214	221	80	14	18																							
Staurodera biguttulus														28																						
„ bicolor-mollis	2255	2892	1313	1828	52	39	367	82	954	3505	3453	1093	5138	2402	911		328	1644	2120	4768	2955		27	59		57	252	218	153		43		87				
Chortippus dorsatus																								40	85		1897	345	53		486	155		298	15	39	
„ parallelus		56														160	304						1372	807		384	150	926	201	251	2495			2917	298	48	46
„ longicornis																																72		252	1073	603	259
„ elegans							26									64						1027	432	495	467	22		409	531	1990	932	40		845	133	64	72
„ declivus								34	118		12	64	135	296	42	27	538	294	21	253	312	35	579	1204	1831	38	422	42		87	70	21	112				
Gomphocerus maculatus					51	53	80											15																		
„ rufus																				440	1261															
Dociostaurus cr. brevicollis						188																														
Mecosthetus grossus																												341	43	492	2078	35	437	2423	2882	3572	4608
Aeolopus thalassinus		434														76									42	32	13	50		1083	340		514				
Oedipoda coerulescens				478	119	30		90	379	174	833	788	310	57	148			582	216	285																
Oedaleus nigrofasciatus							284																													
Calliptamus italicus	726	439	237	48		166	153	321	410		359		35	317	199			241				476	322				156		72							
Pezotettix giornai													46				134			143	579			488			368	228		307	411	13		166			
Stenobothrus s. lat. larva					44	17	26	13		7		46					1417			72	153													21			
Gomph. mac. seu Omoc. petr. l.						5																														
Omoc. haem. seu rufip. larva																		269																		
Staurod. seu Omoc. larva																							115	94		11										
Chortippus larva adeterm.																							26	601				19	89						1402	928	638
Leptophyes albovittata													31									77														
Conocephalus fuscus																	33											56	23	1281	454	56	647	602			
„ dorsalis																														57						
Homocoryphus nitidulus																																			266		
Rhacocleis germanica																				539	1108															
Metrioptera grisea								112							260																					
„ affinis								558				193														440					306					
„ vittata																						121									243					
„ roeselii																																81		285			
Decticus verrucivorus			416					405																352												
Oecanthus pellucens									25																											
Pteronemobius heydeni																																			7	
Liogryllus campestris																25				154								35		194				72		
Gryllus desertus		30	52	98																							34	302	16	106					32	
Liogr. seu Gryll. larva																															146					
Mantis religiosa		56						244						64	81						403															
Total weight	2981	3908	2019	2452	728	1553	1144	2302	2218	4953	5153	2413	6167	3336	2233	1348	4333	4073	2965	7476	7646	1736	2910	4157	2488	1197	3341	3026	1459	5799	8344	559	1895	8243	6194	5435	5623

TABLE VIII.

Average value of Abundancy (ind/ha) and Production (g/ha) of Saltatoria found in types of SPG I—VI. established according to habitat types.

Species	I.		II.		III.		IV.		V.		VI.	
	A	P	A	P	A	P	A	P	A	P	A	P
Acrida turrita			19	10								
Acrydium subulatum					55	3	255	18	915	50	1021	58
„ bipunctatum					129	7			16	1	17	1
Parapleurus alliaceus									37	13	274	73
Chrysochraon dispar									23	3	54	14
Stenobothrus lineatus			41	12	293	82			44	7		
„ crassipes			486	32	2848	225	2859	222	43	3		
„ stigmaticus					594	48						
„ nigromaculatus			392	107	65	18						
Omocestus rufipes							5165	610	14	1		
„ haemorrhoidalis			789	112	4758	391			250	23		
„ petraeus			4586	290	30	3						
Stauroderus biguttulus					46	4						
„ bicolor-mollis	19504	2072	9573	1193	15549	1792	30873	3861	668	81	88	15
Chortippus dorsatus									1916	291	698	84
„ parallelus	141	14			411	66			4267	659	4655	551
„ longicornis											2558	377
„ elegans			19	3	55	9			4768	631	1488	192
„ declivus			184	29	1561	193	1775	282	3317	431	105	22
Gomphocerus maculatus			522	23	35	2						
„ rufus							9213	850				
Dociostaurus cr. brevicollis			147	24								
Mecosthetus grossus									945	296	10226	2326
Aeolopus thalassinus	352	108			91	11			773	156	266	86
Oedipoda coerulescens	216	120	806	302	554	188	255	142				
Oedaleus nigrofasciatus			77	35								
Calliptamus italicus	588	362	196	176	142	113			104	103		
Pezotettix giornai					322	26	3587	361	1969	180	314	30
Stenobothrus s. lat. larva			471	19	2425	204	1371	112			178	4
Gomph. mac. seu Omoc. petr. l.			21	1								
Omoc. haem. seu rufip. larva					385	39						
Staurod. seu Omoc. larva									180	22		
Chortippus larva adeterm.									742	74	4677	495
Leptophyes albovittata					30	5						
Conocephalus fuscus					26	5			1161	189	1326	217
„ dorsalis									31	6		
Homocoryphus nitidulus											108	34
Rhacocleis germanica							2178	823				
Metrioptera grisea			20	14	58	37						
„ affinis			140	94					116	75		
„ vittata									146	36		
„ roeselii											152	61
Decticus verrucivorus	60	104	20	51					14	35		
Oecanthus pellucens			52	3								
Pteronemobius heydeni											80	1
Liogryllus campestris					18	4	255	77	109	23	59	12
Gryllus desertus	239	45							321	46	27	5
Liogr. seu Gryll. larva									146	15		
Mantis religiosa	35	14	20	31	75	21	200	202				
Total	21145	2839	18489	2558	30552	3494	58000	7561	23036	3446	28375	4658