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*Dutch Carabidological Association*

# ECOLOGICAL CHARACTERIZATION OF CARABID SPECIES (COLEOPTERA, CARABIDAE) IN THE NETHERLANDS FROM THIRTY YEARS OF PITFALL SAMPLING

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An ecological characterization of 285 Dutch carabid species based on a large data set obtained by pitfall trapping in various habitats all over The Netherlands is presented. The data set contains ca. 1.5 million specimens, collected during thirty years in 1616 year-samples from 862 localities. Information about habitat, viz. type of vegetation, type of soil and humidity was recorded for each of the 862 sampling localities.

Two Way Indicator Species Analysis (TWINSPAN) as well as Detrended Correspondence Analysis (DECORANA) were used to classify the species into habitat groups. Seven principal habitat groups could be recognized. Indices for ecological amplitude, preference for soil type and humidity, are formulated and estimated for each species. This resulted in a description of the habitat preferences of the Dutch carabid species in far greater detail than was possible before. The classification is compared with others from the literature.

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In 1945, Lindroth published the first volume of his major work 'Die Fennoskandischen Carabidae' (Lindroth 1945). In this work he described the ecological preferences of the Fennoscandian carabid species. Since pitfall trapping was not practiced until about 1950, Lindroth's ecological characterizations were based on his own hand-collections, supplemented by those of other collectors, on laboratory experiments and on data taken from literature. This resulted in detailed descriptions of the species' ecological preferences. In 1949, Lindroth classified the species into a number of ecological groups, recognizing xerophilous species, mesophilous species (including ubiquists), hygrophilous species, arboreal species, forest species and synanthropous species (Lindroth 1949).

From about 1950 onwards, pitfall trapping became a commonly used technique in Europe. Thiele (1977) gave a summary of many ecological studies based on pitfall trapping carried out until ca. 1975. On basis of the results of these studies he characterized the carabid faunas of certain types of habitat, such as forests, sandy habitats and cultivated land, by presenting lists of characteristic species of these habitat categories. However, his tables only show the most abundant species in that particular habitat group giving no information about the occurrences of these 'typical' species in other types of habitat.

Luff et al. (1989) were the first to classify habitats of ground beetles based on a large data set from nearly 250 sites in North-East England. The carabid samples were grouped, based on presence/absence data, using the Two Way Indicator Species Analysis (TWINSPAN (Hill 1979a) and ordinated by Detrended Correspondence Analysis (DECORANA (Hill 1979b). Ten primary groups of carabid habitats were recognized, viz.: coastal, upland (dry, wet), woodland, grassland (dry, wet), riverside (boulders, shingle, sand) and marsh. Eyre & Luff (1990a) made a preliminary classification of European grassland habitats using carabids. The carabid assemblages of 363 pitfalled grasslands throughout Britain, were described by Eyre & Luff (1990b)

The characterizations of Lindroth (1945, 1949) are usually considered to be accurate, although they were obtained with a non-quantitative method. Furthermore, Lindroths classification applies to the Fennoscandian situation, and species preferences may show geographical variation.

The major disadvantage of the analyses of Thiele (1977) is, that his compilations are based on data from the British Isles to Russia. Many of the species only occur in a limited part of this area.

The present study was carried out because there is a need for adequate ecological characterizations for the Dutch area with respect to future work, especially in the field of nature management and conservation. The material that is available from The Netherlands allows us to use quantitative methods to describe the ecological preferences of 285 species in our area in great detail. The ecological characterizations can serve as a basis for future descriptions and evaluations of carabid faunas of specific areas within The Netherlands.

## Material and methods

### Material

When preparing the first edition of the Dutch carabid atlas (Turin, et al. 1977) it appeared that an enormous amount of data from pitfall trapping was available. Pitfalls were used in The Netherlands already in the early 1950's by Van der Drift, soon followed by Den Boer in 1953.

In the past, several studies concerning the efficiency of pitfall sampling have been carried out. A summary of the results of these investigations up to 1975 was published by Thiele (1977), concluding that pitfall trapping is a suitable technique for investigating carabid populations in a quantitative way. Den Boer (1977, 1990) reviewed investigations carried out by pitfall sampling at the Biological Station Wijster. It appeared that so-called year-catches of most carabid species give reliable relative estimates of the mean densities of active adult specimens around the pitfalls (Baars 1979, Den Boer 1979). A year-catch is defined as the summation per species of all specimens caught in one series of pitfalls during one year (or at least during the main reproductive period of carabids). These estimates are relative, meaning that they can be used only to compare the relative abundances within a certain species over a series of samples and/or years, but not between species. This is because each species has characteristic 'catch-parameters', such as activity pattern, way of living and catchability (see Luff 1975, Den Boer 1986).

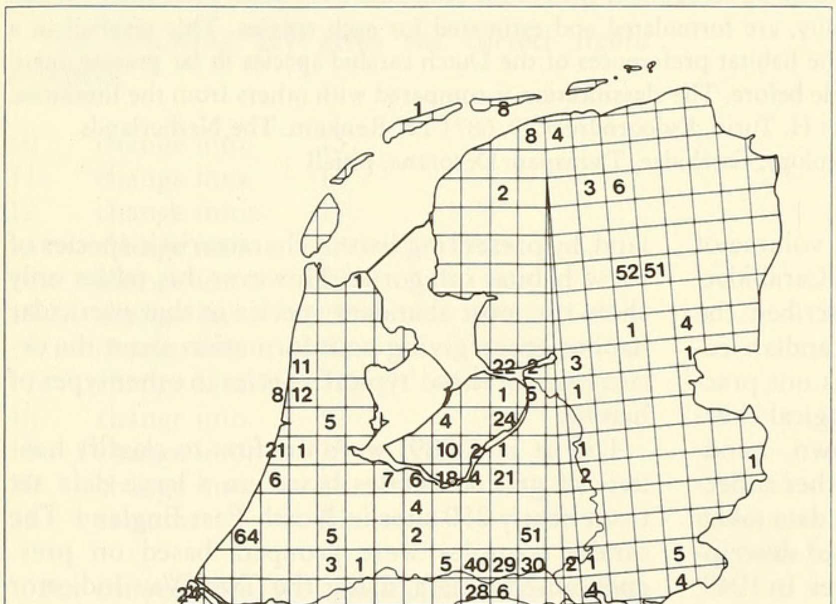


Fig 1. The number of sampled sites per 10 km square of the UTM-grid in the Netherlands.

The dataset for the present study consists of 1616 year-samples from 862 localities in The Netherlands (fig. 1), covering the period 1953-1983. A list of all year-samples included in the database is given by Turin & Penterman (1985).

The number of pitfalls used in a pitfall series and the sizes of the traps varied considerably between investigators. Therefore, the number of specimens in a year-sample were standardized by calculating the number of specimens per decimeter pitfall edge per year (SDY).

Before considering the catches, all sampling localities were uniformly described, using the 'ecocode' of the European Invertebrate Survey for The Netherlands (Van Tol 1979) in a slightly modified version (Penterman & Turin 1985). In this code information about type of vegetation, soil type, soil humidity, size of the locality and type of management is recorded. This information allowed us to recognize 33 habitats (table 1, p. 292), according to which the 1616 year-samples were coded.

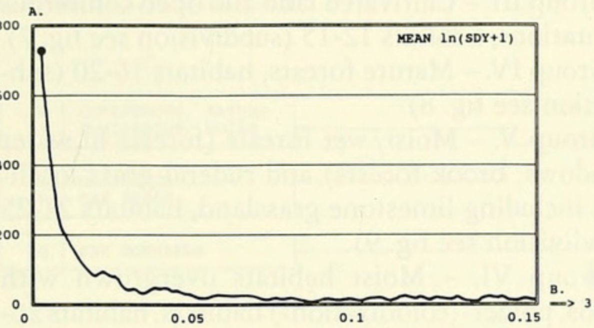



Fig. 2. The frequency distribution of the species mean ln(SDY+1)-values over each of the 33 habitats, taken from the data matrix. A: the Y-axis shows the number of relative abundances (see text) in the data matrix. B: the mean ln(SDY+1)-values; only a very small part of the X-axis is shown. This means that the values are very low all over the data matrix. These figures proved to be unworkable for TWINSPAN classification.

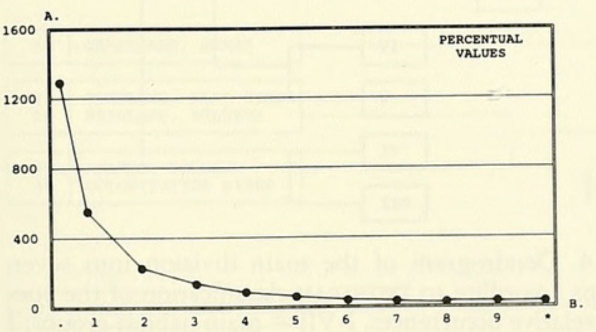



Fig. 3. The distribution of the pertage values after rescaling the mean abundances per species, with the maximum mean ln(SDY+1) put to 100% (relative occurrences). A: the Y-axis shows the number of relative occurrences. All figures from all 33 habitats are included except the first highest percentage value (* = 100%) of each species, which was used as a basic value for the rescaling. B: the percentage values, where: . = < 5%, 1 = 5-15%, 2 = 15-25% etc., 9 = 85-95% and * = > 95%; for further explanation see text and tables 2-9.

## Classification of habitats and habitat preferences of species

Catches of a single carabid species from a large number of pitfall samples over many years, tend to form a log-normal distribution (Den Boer 1977). Therefore, the number of specimens per decimeter per year (SDY), was transformed to natural logarithms. For each of the 33 habitat categories (table 1) the mean value of ln(SDY+1) was calculated per species. Since all year-samples contribute to the mean ln(SDY+1) of a species, including those where the species was not recorded or in very low numbers only, the resulting values were very low for the majority of the species (fig. 2). Therefore, the values for the relative abundances were rescaled, by setting the highest value for a species at 100% and recalculating the SDY-values for the other habitats accordingly (fig. 3), in this way transforming the relative abundances into relative occurrences. This also made the catches of different species better comparable. We did not rescale the abundances of the species per habitat, in order to save the differences in significance between habitats as suitable sites for survival.

TWINSPAN was applied to the relative occurrences of the species, to classify the habitats into habitat groups and to obtain a classification of the species according to their habitat preferences based on the rescaled mean ln(SDY+1)-values. TWINSPAN was used using cut-levels 20, 40, 60 and 80% and was run several times using different pseudospecies' cut-levels. The results of these runs were all very similar when using the rescaled mean ln(SDY+1)-values. The results with different cut-levels based on the mean ln(SDY+1) values without rescaling, however, differed considerably among each other and were not further used. The resulting classification of habitats will be presented in the form of hierarchical tree diagrams and scattergrams. The full two-way table is presented, showing the group division of the species and containing the values indicating the relative occurrences as defined by the pseudospecies' cut levels. The information presented in this table allows us to easily evaluate the habitat specificity of a particular species.

## Ecological amplitude

Two indices were defined and calculated that estimate the ecological amplitude of a species. The first measure (PRES) is based on the species presences over habitats, and is defined as:

$$PRES_j = \frac{n_j}{n}$$

where $PRES_j$ represents the ecological amplitude of the j-th species, $n_j$ the number of habitats in which this species is present, and n the total number of habitats recognized (33). PRES will range from 0 to 1.

For the second 'eurytopy' estimate (SIM) the index of Simpson (D) is used (Simpson 1949), which characterizes the distribution of the abundances over the habitats in the form of: 1-D. This may thus be written as:

$$1 - \sum_{j=1}^{n} \left(\frac{a_j}{a_{tot}}\right)^2$$

where $a_j$ is a measure of the relative abundance of a species in habitat group j and is equal to mean $\ln(SDY+1)_j$, while

$$a_{tot} = \sum_{j=1}^{n} \overline{\ln}\ (SDY + 1)_j$$

The value of SIM may range from 0 to 1.

## Soil type and humidity

When characterizing the sampling localities, three humidity classes were recognized, viz. 'dry', 'moist' and 'wet'. The humidity preference of a species was estimated at an ordinal scale from 1 (very xerophilous) to 5 (very hygrophilous). Species only caught in 'wet' localities score 5, species from 'wet' as well as from 'moist' localities score 4, species only from 'moist' localities score 3, species from 'moist' as well as from 'dry' localities score 2 and species only from 'dry' localities score 1.

Each sampling locality was also classified into one of seven soil types: limestone (li), loam (lo), loamy sand/sandy clay (ls), river clay (rc), sea clay (sc), peat moor (pm) and sand (s). A species is regarded to show a preference for a certain kind of soil when the ln(SDY+1), averaged over all localities with this specific soil type, is at least 2 times the sum of the mean ln(SDY+1) values of the localities from the other soil types taken together.

## Nomenclature and taxonomy

The nomenclature follows Turin (1990), except for three *Calathus* species of the *melanocephalus* group, for which is referred to Aukema (1990). The material from pitfall trapping presented here under the name of *C. melanocephalus* in fact is a mixture of *C. melanocephalus* and *C. cinctus* (Aukema 1990). Only in the more recent sampling (ca. after 1980), *C. cinctus* was recognized as a separate species. A similar problem exists where it concerns the species *Pterostichus nigrita* and *Asaphidion flavipes*. *Pterostichus rhaeticus* was not separated from *P. nigrita* (see: Koch 1984), and *Asaphidion curtum* as well as *A. stierlini* not from *A. flavipes* (see: Lohse 1983, Lompe 1989, Schweiger 1975). The full names of all species are given in the appendix.

## RESULTS

### Classification of habitats

Figs. 4-11 present the results from the TWINSPAN classification of the relative occurrences over the 33 habitats from table 1. Seven main habitat groups could be recognized (fig. 4):

Group I. – Peat and heath vegetations, habitats 1-5. A further subdivision of this end-group is presented in fig. 5.

Group II. – Poor grassland and dune habitats, habitats 6-11 (subdivision see fig. 6).

Group III. – Cultivated land and open coniferous plantations, habitats 12-15 (subdivision see fig. 7).

Group IV. – Mature forests, habitats 16-20 (subdivision see fig. 8).

Group V. – Moist/wet forests (forests in water meadows; brook forests) and ruderal grass localities, including limestone grassland, habitats 21-25 (subdivision see fig. 9).

Group VI. – Moist habitats overgrown with weeds, polder-(colonization-) habitats, habitats 26-30 (subdivision see fig. 10).

Group VII. – Wet habitats/shores, habitat 31-33 (subdivision see fig. 11).

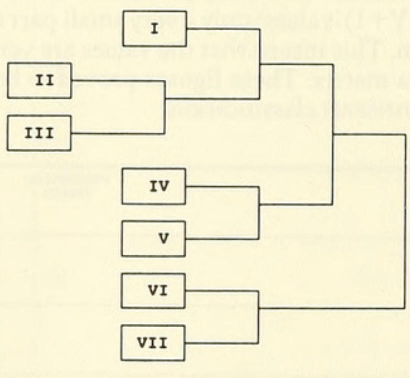
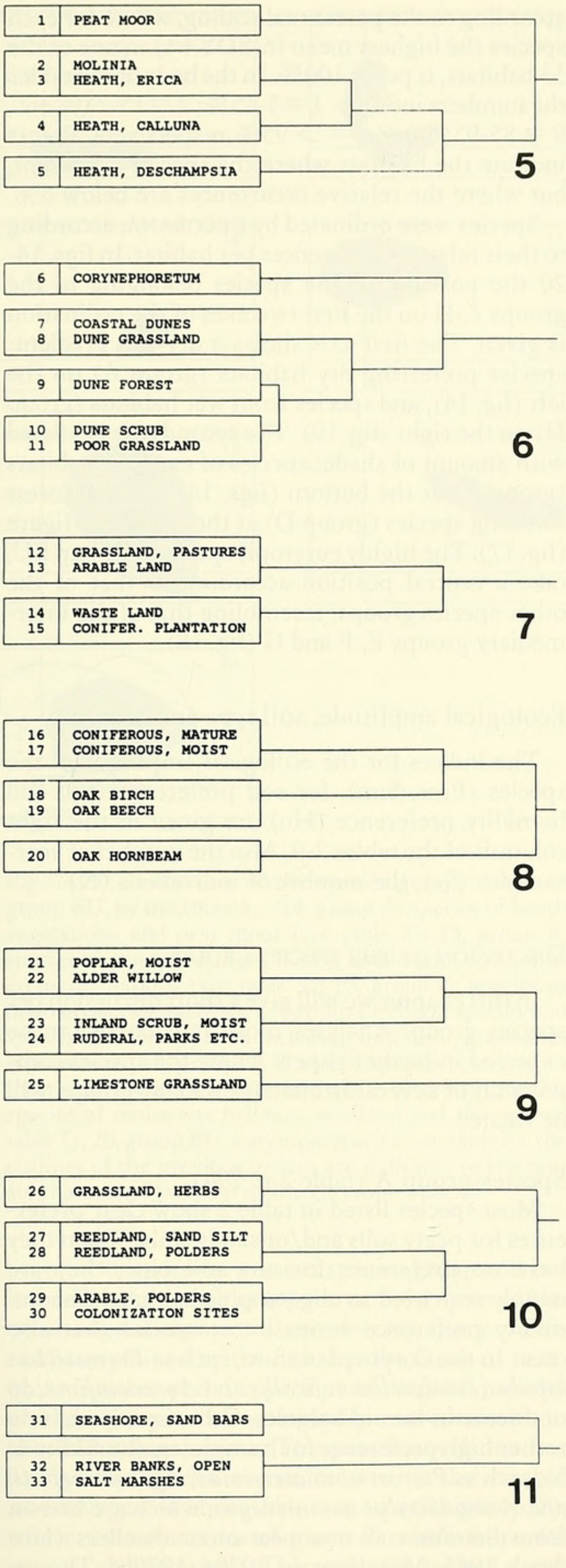



Fig. 4. Dendrogram of the main division into seven groups according to TWINSPAN classification of the species' relative occurrences. I-VII = main habitat groups: I = Peat and heathland vegetations (habitat 1-5, see fig. 5), II = Poor grassland and dune habitats (habitat 6-11, see fig. 6), III = Cultivated land and open coniferous plantations (habitat 12-15, see fig. 7), IV = Mature forests (habitat 16-20, see fig. 8), V = Moist / wet forests and ruderal grass localities, including limestone grassland (habitat 21-25, see fig. 9), VI = Moist habitats, overgrown with weeds, polder-(colonization-) sites (habitat 26-30, see fig. 10), VII = Wet habitats/shores (habitat 31-33, see fig. 11).




Figs. 5-11. Subdivision of habitat groups I-VII (see fig. 4 and table 1). – 5, group I; 6, group II; 7, group III; 8, group IV; 9, group V; 10, group VI; 11, group VII.

Fig. 12 shows the results of an ordination of the relative occurrences over the habitats by DECORANA, where the habitat groups mentioned above are indicated with dashed lines. The TWINSPAN divisions form rather coherent groups. The first axis of DECORANA is clearly correlated with moisture, dry habitats: 15-16, coniferous forest; 6, Corynephoretum; 4, Calluna-heath on the left, and wet: 31-33, shore habitats on the right. The second axis seems to be related in some way with the structure of the vegetation, open vegetations: 1-5, heath and peat habitats, 6-11, dune habitats in the lower part, and highly shaded vegetations: 16-22, forests in the upper part of the figure.

## Classification of species

The habitat preferences of the species are indicated by their relative occurrences over the 33 habitats. The species are divided into eight species groups: A-H (fig. 13), and are tabulated in tables 2-9. Most groups contained very eurytopic as well as rare species. These species have been taken from the original groups and are brought together into two separate tables: 8 (eurytopic species) and 9 (rare species).

Species group A (table 2): Species of heath vegetations and peat moor, mainly occurring in habitat group I.

Species group B (table 3): Species of sandy localities, such as dunes, arable land and coniferous plantations; principal occurrences in habitat-group II and/or III.

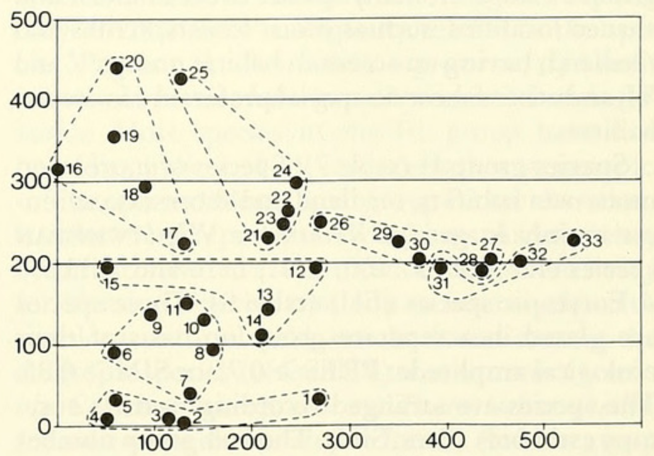



Fig. 12. Ordination by DECORANA, presenting on the first two axes the projections of the species scores for the 33 habitats (explanation see table 1). The dashed lines indicate the main habitat-groups: 1-5 = peat and heathland vegetations, 6-11 = poor grasslands and dune habitats, 12-15 = cultivated land and open coniferous plantations, 16-20 = mature forests, 21-25 = moist to wet forests and ruderal grassland habitats, including limestone grassland, 26-30 = moist habitats, reedland, pioneer (colonization-) habitats, polders, 31-33 = wet habitats, shores and river banks.

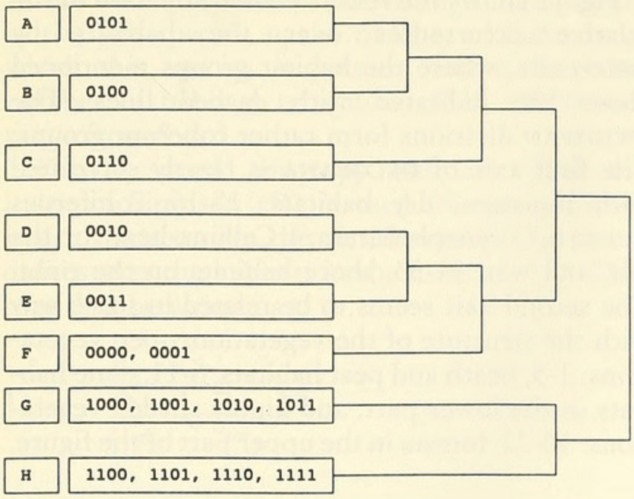



Fig. 13. Dendrogram of the species groups according to the TWINSPAN classification. The letters A-H indicate the TWINSPAN end-groups, treated in the respective species group. The numbers 0000-1111 indicate the first four levels of the TWINSPAN classification (compare table 2-7).

Species group C (table 4): Species of open areas, dune localities as well as colonization sites and shores, mainly in habitat-groups II, III and/or VI, VII.

Species group D (table 5): Species of forests and/or ruderal places, including limestone grassland; occurrences mainly in IV and/or V.

Species group E, F, G (table 6): These groups are not treated separately, because the separate end-groups are rather heterogeneous and less typical for a certain habitat group than the other species-groups. However, many species occur in moist and shaded localities, such as moist forests, scrubs and reedland; having an accent in habitat groups V and VI, and others show no special preference for moist habitats.

Species group H (table 7): Species of more open moist-wet habitats, reedland and shores; occurrences mainly in groups VI and/or VII, (TWINSPAN species end-groups 1100, 1101, 1110 and 1111).

Eurytopic species (EU) (table 8): These species are placed in a separate group on basis of their ecological amplitude: PRES > 0.75 or SIM > 0.85. The species are arranged according to their eurytopy estimates (Pres, Sim). The end-group number indicates from which of the species groups mentioned above (A-H) they originate.

Rare species (R) (table 9): Species have been placed in this group when the number of samples (Sa) < 6 and when the number of individuals < 50. If the species is merely present in 3-5 year-samples and these samples belong to the same habitat, the species was not placed into group H.

In tables 2-9 relative occurrences are presented according to the percentual scaling, where for each species the highest mean ln(SDY+1) in one of the 33 habitats, is put at 100%. In the body of the tables the numbers indicate: 1 = 5-15%; 2 = 15-25% etc., 9 = 85-95% and * = > 95% respectively. Points indicate the habitats where the species is present, but where the relative occurrences are below 5%.

Species were ordinated by DECORANA, according to their relative occurrences per habitat. In figs. 14-20 the position of the species belonging to the groups A-H on the first two axes of the ordination is given. The first axis shows a dry-wet gradient: species preferring dry habitats (group A) on the left (fig. 14), and species from wet habitats (group H) on the right (fig. 19). The second axis is related with amount of shade: species of exposed habitats (group A) at the bottom (figs. 14, 15), and forest dwelling species (group D) at the top of the figure (fig. 17). The highly eurytopic species of group EU, take a central position according to that of the other species groups, resembling that of the intermediary groups E, F and G (fig. 18).

## Ecological amplitude, soil type and humidity

The indices for the ecological amplitude of the species (Pres, Sim), for soil preference (So) and humidity preference (Hu) are given in the right columns of the tables 2-9. Also the number of year-samples (Sa), the number of individuals (N).

## DISCUSSION OF THE SPECIES GROUPS

In this chapter we will give a short discussion per species group. Analyses more into detail can be expected in further papers where the species composition of several habitats or habitat-groups will be treated.

**Species-group A** (table 2 p. 294)

Most species listed in table 2 show clear preferences for peaty soils and/or sandy soils. When they have no preference for any soil type, they are mainly restricted to oligotrophic habitats. The humidity preference varies: most species that also occur in the Corynephoretum, such as *Pterostichus lepidus*, *Bradycellus ruficollis* and *Amara infima*, do not occur in humid habitats. Other species have a rather high preference for humid sites (humidity 4-5), such as *Pterostichus aterrimus*, *Agonum ericeti*, and *Anisodactylus nemorivagus*, which are known from literature as true peat-moor dwellers (Lindroth 1945, Mossakowski 1970a, 1970b). The results agree with those of investigations in German heath-moor complexes (Horion & Hoch 1954, Grossecappenberg et al. 1978). According to the TWINSPAN-classification (figs. 4-5), peat moor has

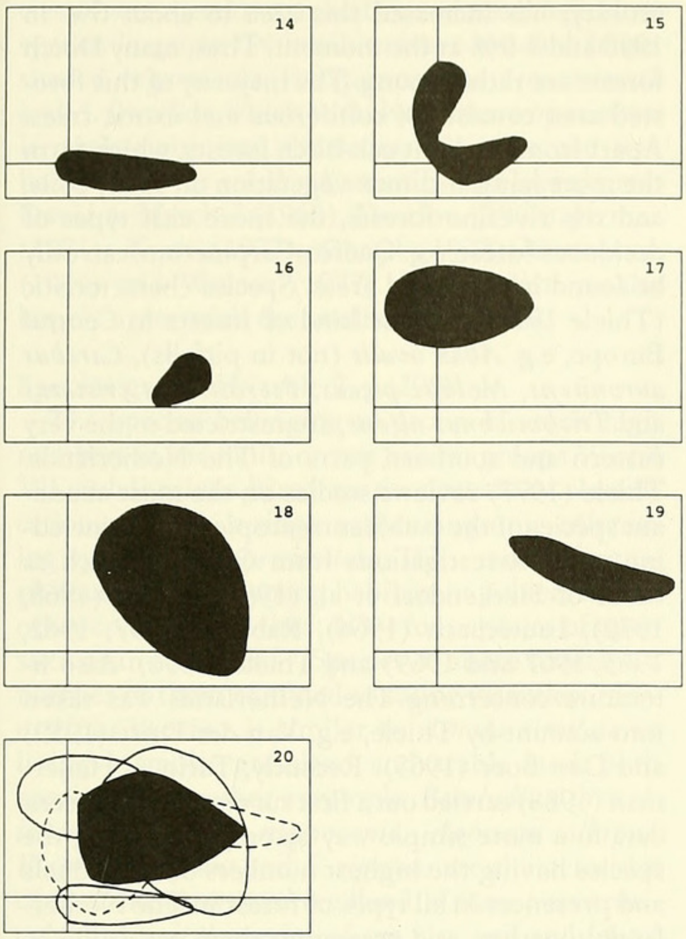



Fig. 14-20. Ordination of the species groups A-H and group EU, by DECORANA. – 14, group A: species of heath vegetations and peat moor (see table 2); 15, group B: species of sandy localities, dunes, arable land and coniferous plantations (see table 3); 16, group C: species of open areas (see table 4); 17, group D: forest species and species of ruderal places including limestone grasslands (see table 5); 18, groups E, F and G: species occurring in most and shaded habitats (see table 6); 19, group H: species of moist-wet habitats, reedland and shores (see table 7); 20, group EU: eurytopic species (see table 8); the outlines of the previous groups are indicated to accentuate the central position of the eurytopic species.

been included in the present species group and not in one of the moist groups E or F, in spite of the occurrence of many moist-preferring species. This can be explained by the fact that the fauna of peat-moor is rather poor in species and that the majority of these species is ecologically more related to heath-like vegetations. The peat-moor fauna has hardly any species in common with the carabid assemblages of shore habitats (species-group F), where the occurrence of many *Bembidion*-species is most characteristic. The results in table 2 agree well with those from the literature. Some studies carried out in Germany by Mossakowski (1970a, 1970b) and Rabeler (1947) also recognize *Agonum ericeti*, *Anisodactylus nemorivagus*, *Bradycellus ruficollis* and *Trichocellus cognatus* as characteristic species for peaty soil. Mossakowski (1964, 1970c) and Rabeler (1947) mention some species characteristic for heath vegetations, such as: *Amara infima*, *B. ruficollis*, *Carabus arvensis*, *C. nitens*, *Cicindela campestris*, *Olisthopus rotundatus* and *Pterostichus lepidus*. Some of the species mentioned by these authors can be found in the ecologically most related species group B (table 3) or they are arranged among the eurytopic or rare species (tables 8-9), e.g. *Bembidion nigricorne*, *Bradycellus caucasicus*, *Cicindela sylvatica*, *Pterostichus versicolor*, *Syntomus foveatus* as well as several *Calathus* and *Cymindis* species.

**Species group B** (table 3, p. 294 )

This group is divided into two subgroups, based on a sixth level TWINSPAN division: B1 – species mainly occurring in the Corynephoretum, dune habitats and poor grassland; B2 – species of sandy arable land, waste land and young coniferous plantations on sand. The species of group B1 are in general confined to poor, dry and open, sandy habitats especially in dune areas. Some species are very stenotopic and more or less restricted to drifting sands of coastal and inland dunes: *Harpalus servus*, *Harpalus vernalis*, *Masoreus wetterhali*, *Ophonus cordatus* and *Harpalus neglectus*. Some papers concerning dunes and Corynephoretum sites (Schjøtz-Christensen 1957, 1966a, 1966b) mention several *Harpalus* species e.g.: *H. anxius*, *H. solitaris*, *H. neglectus* and *H. smaragdinus* as being typical for dry and sandy areas in Denmark. The following species can also be found in heath vegetations and they are obviously ecologically related to the species of group A: *Bembidion nigricorne*, *Cymindis macularis*, *Notiophilus germinyi* and *Cicindela sylvatica*. Most species in the B1 group have low humidity indices (1-2), and are rather stenotopic.

The species belonging to group B2 are characteristic for many types of sandy habitats. As far as they occur in cultivated areas, most of them avoid heavy fertilization. Species common to intensively cultivated agricultural land, can be found among the eurytopic species (see table 8). *Laemostenes terricola*, *Calathus micropterus* and *Pterostichus quadrifoveolatus* are also related to forests (habitat group IV).

**Species group C** (table 4, p. 295)

This small group consists of four species that occur primarily in open localities, dry as well as rather wet ones. *Clivina collaris* is predominantly a riparian species. The other species are confined to open country with a sparse vegetation and show a preference for coastal areas; this especially applies to *Calathus mollis*.

**Species group D** (table 5, p. 296)

Three subgroups were grouped together based on their occurrences in the main habitat groups IV and V: D1 – Stenotopic species of cultivated and ruderal sites such as poor unfertilized fields, gardens and limestone grasslands, mainly on limestone soil in the southern part of the province of Limburg; D2 – Species of more or less moist and shaded places partly on limestone soil; D3 – Eurytopic and stenotopic forest species.

Belonging to the first subgroup are several heath-preferring species (xerotherm species: Becker 1975, Lindroth 1949) which in The Netherlands are exclusively confined to limestone soil: *Parophonus maculicornis*, *Amara nitida*, *Brachinus crepitans*, *Harpalus dimidiatus*, and *Ophonus melleti*. Other thermophilous species can also be found on localities outside the limestone area of The Netherlands, on open sun-exposed, xerotherm sites such as slopes of river dikes with a southern exposition (Turin 1983, Turin et al. 1977): *Amara montivaga*, *Ophonus puncticeps*, *Harpalus rubripes*, and *Lebia chlorocephala*. *Ophonus rufibarbis* is the least thermophilous and most eurytopic *Ophonus* species. It can be found on more or less shady sites (Lindroth 1974, 1986).

The species of the D2 subgroup are restricted to the southern part of the province of Limburg or have a more or less fluviatile distribution in The Netherlands. Most species prefer chalky, clayish soil or loam, some of them inhabiting shaded (wooded) sites: *Stomis pumicatus*, *Bradycellus sharpi*, *Carabus coriaceus*, and *Pterostichus madidus*. These species also occur in limestone grassland at slopes with a northern exposition (Turin 1983).

Subgroup D3 consists of the true forest species. The first six species are rather eurytopic, which also applies to *Leistus rufomarginatus* and *Carabus problematicus*. Some of the more stenotopic forest species are more or less restricted to the oak-hornbeam forests of the southern part of Limburg and the easternmost part of The Netherlands, e.g. *Abax parallelus*, *Molops piceus*, and *Trichotichnus nitens*. *Amara praetermissa* can be found in the Corynephoretum, but also at acid sites on top of the limestone hills in Limburg with a more heather-like (*Calluna*) vegetation, which explains the presence of this species in the D-group.

There are far more investigations into the composition of the carabid fauna of forests than in that of heathland vegetations. Nowadays heathland is rapidly disappearing from The Netherlands, but about a hundred years ago it was one of the most prominent components of the landscape. In 1850 the area covered with forest was below 3%. Afforestation, which started in the first part of this century, has increased this area to about 6% in 1950 and 8-9% at the moment. Thus, many Dutch forests are rather young. The majority of this forested area consists of coniferous and exotic trees. Apart from the light oak-birch forests, which form the more natural climax vegetation on sandy soils, and the riverine forests, the more rich types of deciduous forest, e.g. Querco-Carpinetum, can only be found in restricted areas. Species characteristic (Thiele 1977) of these kind of forests in Central Europe, e.g. *Abax ovalis* (not in pitfalls), *Carabus auronitens*, *Molops piceus*, *Pterostichus cristatus* and *Trichotichnus nitens*, are restricted to the very eastern and southern parts of The Netherlands. Thiele (1977) reviews studies on the most abundant species of the (sub)centreuropic forests, including many investigations from Germany, such as those of Heckendorf et al. (1986), Kolbe (1968, 1970), Lauterbach (1964), Rabeler (1957, 1962, 1963, 1967 and 1969) and Thiele (1956). Also literature concerning The Netherlands was taken into account by Thiele, e.g. Van der Drift (1959) and Den Boer (1965). Recently, Turin & Heijerman (1988) carried out a first survey on the present data in a more simple way by only examining the species having the highest numbers of individuals and presences in all types of forest in The Netherlands together, and arranging them according to the fraction of specimens caught in forests, as compared with those in other habitats. The terms 'stenotopic / eurytopic forest species' they use, only apply to the Dutch area. Especially the species of mountainous localities are missing (highest altitude in The Netherlands is below 400 m). Most stenotopic forest species mentioned by Turin & Heijerman are now listed in table 5. Heijerman & Turin (1989) found great differences in fauna composition between forests in different parts of The Netherlands. This can possibly be explained by the fact that most of the forested areas are rather young and have been colonized recently.

**Species group E, F, G** (table 6, p. 297)

This group is polythetic and in fact a compilation of seven small TWINSPAN end-groups. The species predominantly occur in moist and shaded habitats. Most species are hygrophilous, reaching high numbers in wet grassy forests, moist grasslands and reedland: E1 – species of moist forests, sometimes in dune valleys and in moist grassland; F1 – two species of rather open and dynamic habitats; F2 – species of moist and shaded sites; G1 – only a single species; G2 – species with high numbers in reedland and in moist grassland, *Oodes helopioides* lives at wet and shaded sites; G3 – only *Bembidion obtusum*, which more or less prefers cultivated country; G4 – mainly hygrophilous species of wet meadows, marshes and reedland. Most species in group G4 inhabit rather wet and dense, shaded vegetations. Exceptions are: *Amara ovata* and *A. famelica*, which both live in more open sites. Investigations into the fauna of moist and wet habitats are for reedland, swamps and lake shores: David & Marchal (1963), Dawson (1965), Jarmer (1971), Koch (1977), Obrtel (1972), Renkonen (1944) and Wasner (1977). The present results largely agree with the studies mentioned.

**Species group H** (table 7, p. 298)

The species belonging to group H reach high numbers in the moist or wet habitat groups VI and VII. Subdivisions based on the TWINSPAN classification are: H1 – a single rather eurytopic, colonizing species: *Amara similata*; H2 – mostly hygrophilous species of young habitats in polders and in other colonization sites; H3 – four species of open sites near water; H4 – Species of shore habitats, a number of them confined to saline localities. *Pterostichus cupreus* is similar to *Amara similata* in living in moist grassland and arable land, both species being rather eurytopic. *Bembidion bruxellense*, *Chlaenius nigricornis*, *Agonum albipes*, *Elaphrus cupreus* and *E. riparius* are characteristic of river meadows and reedland. *Amara convexiuscula* is a typical species of sea clay soil and found mostly along the coast, but it occurs, just as *Acupalpus exiguus*, *Lasiotrechus discus* and *Amara majuscula*, also in high numbers in the Dutch IJsselmeer polders (Turin et al. 1977). For large areas such as the Dutch polders, only constantly macropterous species and full-winged specimens of wing-dimorphic species are capable of colonizing such areas (Haeck 1971, Meijer 1973, 1974, 1980). In colonization of small sites, such as burnings and clearings, also big wingless species may be able to immigrate (Szyszko 1986), but in general, pioneer communities can be characterized by their high numbers of winged species. An example of long-term colonization and succession of carabids along rather homogenous road verges on clay soil in three Dutch polders of different age is given by Haeck et al. (1980). It illustrates that the carabid fauna of the Dutch polders keeps a coastal character for many decades.

Most species of the H4-group live close to water in open habitats. Several species of this group are restricted to the salt marshes of the Waddensea area and the islands of the province of Zeeland: *Dicheirotrichus gustavi*, *D. obsoletus*, *Pogonus chalceus*, *Bembidion normannum*, *B. pallidipenne*, *Dyschirius salinus*, *D. obscurus*, and *Bradycellus distinctus*. About saline habitats several studies are available: Heydemann (1962, 1967), Mossakowski (1971), Niemela (1988) and Rueda & Montes (1987) and they mention several species as typical for this habitat. The species occurring in saline habitats in The Netherlands are all treated in Turin (1991).

Many of the characteristic and abundant species of inland shores and river banks cannot be found in Group H, since pitfalls do not function well in shore habitats. Especially focused on the riparian fauna of running water are the studies of: Andersen (1970, 1982, 1983), Krogerus (1948), Lehmann (1965) and Plachter (1986). Species living so close to the water that they hardly can be trapped with pitfalls are for instance: *Agonum micans*, *Bembidion doris*, *B. obliquum*, *Dyschirius aeneus* and *Nebria livida*. The species *Bembidion articulatum*, *B. punctulatum*, *B. semipunctatum* and *B. testaceum*, all from river banks and often abundant in The Netherlands, are not present in the pitfall material. Some shore species that also can be found at some distance of the water, are listed among the rare species (table 9).

**Eurytopic species** (table 8, p. 299)

A group of 53 eurytopic species and ubiquists, extracted from all habitat groups on basis of their ecological amplitude. Most species in this group show high occurrences and abundances in one of the habitat groups III, V and/or VI. Apart from a few species, they do not clearly prefer a special soil type or humidity class. Some of them have high tolerances with respect to fertilizers and intensive agricultural management and can therefore be numerous in arable land and in pastures. Thiele (1977), who compared the carabid faunas of arable land, meadows / pastures and clover / alfalfa, in fact gives incomplete information of the species preferences. The species listed in Thiele's compilation are not characteristic for cultivated areas, but most of them simply are highly eurytopic species (see table 8). A similar survey was published by Basedow et al. (1976) and the results resemble those of Thiele.

*Notiophilus biguttatus* and *Nebria brevicollis* are eurytopic forest species that also occur in dense, shady grasslands and in other shaded sites, such as gardens and orchards (Turin & Heijerman 1988).

**Rare species** (table 9, p. 300-301)

A group of 59 rare species. Just as in the previous groups, the original TWINSPAN end-groups (GR) are mentioned after the species names. Twenty-six of the species only occur in one kind of habitat. For some species a lack of data is the main cause that the information on the species preferences is incomplete. However, for many species that have a highly restricted distribution in The Netherlands, especially those living near the fringes of their ranges, the relative occurrences shown in table 9 will give a reliable picture of the species preferences in the Dutch territory. The species of this group will be treated in a separate study.

## DISCUSSION

Only a few studies concerning classification of carabid species based on a large dataset are known from western and north-western Europe. The most important are chronologically: Lindroth (1945, 1949), Thiele (1977), Den Boer (1977), Luff et al. (1989) and Eyre & Luff (1990a, 1990b).

Lindroth (1945, 1949) indicated species preferences for humidity, and certain vegetation types, such as woodland. Although his conclusions were based mainly on material from Fennoscandia, his classification proved to be valuable for a much larger area. It was used in many carabidological studies all over northern and western Europe. When comparing the results of the present study with Lindroth's classification (table 10), one can conclude that they correlate rather well. The xerophilous species (X) in groups A1, B1, B2, C1 and D1 (table 10), the hygrophilous species (H) in groups A1, G4, H2, H3 and H4 (table 10) and the forest species (HW+W+WA) of Lindroth are found in groups D2, D3 and E1. Lindroth's mesophilous and more or less ubiquitous species (N) are scattered over a wide range of our species-groups with the highest numbers in the eurytopic EU-group (table 10). Fifty-nine species mentioned by Lindroth were caught in pitfalls in too low numbers for a characterization (group R) and 85 of the Dutch species mentioned by Lindroth, were not caught in pitfalls at all in The Netherlands (table 10 group O). From Lindroth's characterizations (table 10) we can conclude that these species that could not be characterized in the present study, belong to the inhabitants of shores and river banks (80 species, table 10). Others are very rare or even extinct in The Netherlands, e.g. many xerophilous species (see Desender & Turin 1989, Turin 1990).

Thiele (1977) attempted to characterize the carabid faunas of certain habitat groups such as forests, cultivated land and sandy habitats, comparing them on basis of species presence. He mainly used literature sources from the entire northwestern part of Europe. Although he included several lowland and mountain forests for the characterization of the forest fauna, we feel that this method gives an incorrect picture of the species preferences, especially because the relative occurrences and abundances in other localities were not taken into account.

Den Boer (1977) gives a far more complete picture for 75 of the most abundant species in his study area, by listing the data of hundreds of year-catches in many kinds of habitat in the province of Drenthe (The Netherlands). However, his study area is rather limited and many Dutch habitats and soil types are absent from his study (e. g. coastal dunes, clay soil and limestone grasslands). A comparison with Den Boer's results is not appropriate here, because his data form a significant part of our data set.

Several extensive studies on classification of carabid species have been published recently. Luff et al. (1989) is related to the classification of carabid habitats in north-east England, while another deals with the ground beetles of grassland habitats in Europe (Eyre & Luff 1990a). Finally, Eyre & Luff (1990b) presented a classification of ground beetles of the British grasslands in more detail. In all studies DECORANA and TWINSPAN were used as statistical methods. For the first study (Luff et al. 1989), very heterogenous material from 248 sites in North-East England was used, primarily collected for use in the British mapping scheme. Ten habitat groups were recognized based on the distribution of the species presence over the sites. A method was developed to fit in new sites. A first limitation of this method is that new sites can only be fit in using species that already contributed to the original ordination. Secondly, that only presence/absence data can be used. The original data set consists both of data from pitfalls, and sampling by hand. The possibility to include also samples from localities where pitfalls do not function, such as shore habitats, certainly is an advantage when using only the species presence. A main disadvantage is that the species' relative occurrences cannot be taken into account. The study of Luff et al. is, as they also notice in their discussion, in the first place a methodological one and the results do not give a definitive and complete picture of carabid habitats of the British Isles. Many habitats, for instance woodland, will have to be investigated more intensively. Three of the ten habitats do not occur in The Netherlands (upland dry, upland wet and boulder). The remaining habitat groups are rather broadly defined: coastal, woodland, dry grassland, wet grassland, wet running, wet still – silt, wet still – sand. It is rather difficult to compare the species preferences for British habitats with the present results, although many species preferences seem to correlate well, e.g. those of *Calathus erratus*, *Amara bifrons*, *Calathus rotundicollis* and those of many eurytopic species such as *Calathus melanocephalus*, *Loricera pilicornis*, *Pterostichus nigrita* and *Trechus obtusus*. From the present classification it can be learned that the most important environmental factor influencing the ordination of carabid species is soil moisture (fig. 14). This is in support of the analyses by Luff et al. (1989). It is therefore very plausible that carabids are good indicators for moisture conditions in the field.

In the study concerning the heathland and grassland habitats in northern and central Europe, Eyre & Luff (1990a) used material from 638 heath and grassland pitfall sites. A number of these sites have also been used in the present study. Classification with TWINSPAN resulted in the identification of 17 habitat groups. In this study, woodland sites as well as shore habitats were not included. Although it is not easy to compare this classification with the present results, it is clear that some primary divisions are similar, e.g. heath, cultivated land and polders (pioneer habitat sites).

The classification of Eyre and Luff (1990b) concerns the classification of British grasslands. The data consist of material from all over England, Wales and Scotland. The results are to some extent supporting the present analysis. 'Dry' species, such as *Broscus cephalotes*, *Calathus mollis* and *C. fuscipes* are found in the same habitats in Britain. Also heath and peat-moor species (group A, table 2) have been placed in similar habitat groups in the analysis of Eyre & Luff. Some species that are recognized as woodland species in the present analysis, are scattered over many habitat groups in the British study. This is probably because mature woodlands have not been taken into account. In the results of both British studies (Eyre & Luff 1990b, Luff et al. 1989) some species preferences differ obviously from the situation in The Netherlands, e.g. the above mentioned species *Carabus violaceus*, *Pterostichus cristatus* and *P. madidus* seem to be much more eurytopic in England.

In their discussion Eyre and Luff (1990a) mention the scale problem, stating that the greater the area covered by a study, the less precise the results will be. It is obvious that in such a case the classification will be influenced by the geographical distribution of the species. A geographical component is even present within a relatively small study area as The Netherlands, where, for instance, *Pterostichus madidus* occurs only in the southern and central part of The Netherlands. The mean ln(SDY+1) in our method, however, is calculated over all samples of a certain habitat, also those situated outside the range of *P. madidus*. This problem applies to all species with a restricted distribution within a certain study area. The problem becomes more pressing, however, when the study area is still larger, because the relative number of species with restricted distributions will increase. On the other hand too small areas such as the province of Drenthe in The Netherlands (Den Boer 1977) contain not enough habitats to make a classification useful.

The present results will probably surprise experienced carabidologists to some extent. Several species show rather unexpected occurrences. *Abax parallelepipedus*, for instance, is a species characterized by many authors as restricted to forests, forest edges and hedges (Koch 1989, Lindroth 1986, Thiele 1977, Turin & Heijerman 1988), but appears to occur in a wide range of habitats abundantly, and in an even wider range in low numbers. It is a well known fact that species preferences for certain types of vegetation (habitats) can shift over geographical distance or at different altitudes. *Pterostichus cristatus*, for instance, is an inhabitant of cool mountain Fagetalia forest (Thiele 1977), but it also occurs in open, moist sites in Cumberland and Northumberland in the British Isles (Lindroth 1974). *Pterostichus madidus*, which inhabits the Fagetalia and Querco-Carpinetum (oak-hornbeam forest) (Koch 1989, Thiele 1977) in Central Europe, prefers open country and cultivated soil in the British Isles (Lindroth 1974, Eyre & Luff 1990a, Luff et al. 1989). In The Netherlands it takes an intermediate position (table 5). In the southern part of the province of Limburg *P. madidus* is the most abundant species in the forest edges of the oak-hornbeam forest, but it also occurs quite frequently and abundantly in shaded meadows and limestone grasslands without an extremely southern exposition. In the central part of The Netherlands it can only be found in light forest and in low numbers. The above mentioned differences between the present classification and that of British Isles will partly be due to such geographical differences in species habitat preferences.

We support the conclusion of Eyre & Luff (1990a) that classifications based on large datasets, together with the data from pitfall sampling from all over Europe, make carabid beetles a reliable group for environmental monitoring.

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## Tables

Table 1. The 33 habitats recognized by the 'ecocode', and per habitat, the numbers of year-samples and the number of sites where pitfall series were situated.

| NR | HABITAT | SAMPLES n | SITES n |
|---|---|---|---|
| 1 | Peat moor (wet, Sphagnum) | 16 | 9 |
| 2 | Heath with Molinia (moist) | 28 | 9 |
| 3 | Erica heath (moist) | 14 | 7 |
| 4 | Calluna heath (dry) | 101 | 27 |
| 5 | Heath with grasses, Deschampsia (dry) | 119 | 26 |
| 6 | Corynethoretum (dry, open) | 65 | 24 |
| 7 | Coastal dunes (dry, open) | 53 | 20 |
| 8 | Dune grassland (coastal) | 69 | 29 |
| 9 | Dune forest (coastal) | 68 | 13 |
| 10 | Dune scrub (coastal) | 100 | 51 |
| 11 | Poor grassland on sandy soil (inland) | 23 | 14 |
| 12 | Cultivated, pasture (inland, sand, fertilized) | 33 | 22 |
| 13 | Cultivated, arable (inland, sand, fertilized) | 17 | 17 |
| 14 | Cultivated, waste land (inland, sand) | 26 | 11 |
| 15 | Coniferous forest, plantation (open) | 15 | 12 |
| 16 | Coniferous forest, mature | 65 | 64 |
| 17 | Coniferous forest, old (moist) | 11 | 11 |
| 18 | Deciduous forest, oak-birch | 126 | 73 |
| 19 | Deciduous forest, oak-beech | 41 | 34 |
| 20 | Deciduous forest, oak-hornbeam | 17 | 17 |
| 21 | Deciduous forest, poplar (moist, polders) | 19 | 13 |
| 22 | Deciduous forest, alder-willow (moist-wet) | 42 | 40 |
| 23 | Inland scrub (moist) | 44 | 22 |
| 24 | Ruderal, park, orchard (dynamic) | 40 | 40 |
| 25 | Limestone grassland, dike slopes (xerotherm) | 54 | 54 |
| 26 | Grassland with herbs (inland, unfertilized) | 98 | 70 |
| 27 | Reedland, Lauwersmeer polder (sand-silt) | 18 | 4 |
| 28 | Reedland, IJsselmeer polder (sea clay) | 52 | 22 |
| 29 | Cultivated, IJsselmeer polder (sea clay) | 52 | 26 |
| 30 | Colonization sites, building lands (recent) | 35 | 15 |
| 31 | Sand banks near salt water, seashore (open) | 93 | 40 |
| 32 | Inland shores, river banks (open) | 22 | 6 |
| 33 | Salt marshes (sea clay) | 40 | 20 |

Tables 2-9. The tables show the distribution of species relative occurrences over the 33 habitats recognized.

## Explanation

A-H. – Tables 2-7, show the main species groups A-H, recognized by TWINSPAN classification. The sub-division of the main species-groups B and D is based on a sixth level, and those of groups E, F, G and H is based on a fourth level TWINSPAN division.

EU, RA. – The tables 8 and 9 show respectively the eurotopic (EU) and rare (RA) species, which have been separated from the main groups A-H. Eurytopic species (Pres $> 0.75$ or Sim $> 0.85$), have been placed into one group (table 8) to get a more clear picture of the most typical species of the principal groups A-H. The rare species have been separated from these groups for statistical reasons. They occur in too low numbers in The Netherlands (Sa $< 6$ and N $< 50$, except when all were found in the same habitat), to get a reliable picture of the species habitat preferences

NUM. – Species numbers. The full names with references to this number, can be found in the index

GR. – In tables 2-7 in this column the species group subdivision is indicated. In tables 8 and 9 the letters A-H refer to the original primary group where the eurytopic and rare species were placed by TWINSPAN classification

I-VII. – In the heading of the tables: main habitat groups that have been recognized by TWINSPAN classification (see fig. 4).

1-33. – In the heading of the tables: habitats, explanation see table 1.

1-9 and *. – In the body of the table, give relative occurrences according to the percentual rescaling per species (see text): '.' = $\ln(SDY+1) \leq 5\%$, '1' = $5\% < \ln(SDY+1) \leq 15\%$, '2' = $15\% < \ln(SDY+1) \leq 25\%$, '3' = $25\% < \ln(SDY+1) \leq 35\%$, etc., '9' = $85\% \leq \ln(SDY+1) < 95\%$, '*' = $95\% \leq \ln(SDY+1) \leq 100\%$ (This value stands for the ln(SDY+1) value that is put to 100%, which was the highest value of that species)

Pres. – Eurytopy estimation based on species presences: a low value means that the species is present in a low number of the 33 habitats; 1 means that the species is present in all habitats).

Sim. – Eurytopy measure based on the index of SIM D-1 (a low value means that the species is very stenotopic; highest value=0.94).

So. – Soil-preference measure, based on mean ln(SDY+1) figures; soil type / (all other soil types) $> 2$, otherwise no indication of soil preference is given: c = riverclay + seaclay, li = limestone, ll = limestone + loam, lo = loam, ls = loamy sand / sandy clay, pm = peatmoor, rc = river clay, sa = sand, sc = sea clay, sm = sand + peatmoor.

Hu. – Humidity-preference measure (dry 456 samples, moist 690 samples, wet 461 samples), based on mean ln(SDY+1). 1 = mainly in dry samples [dry $> 10 \times$ (moist+wet)], 2 = not in wet samples [dry+moist $> 20 \times$ (wet)], 3 = not in dry and not in wet samples [moist $> 10 \times$ (dry+wet)], 4 = not in dry samples [wet+moist $> 20 \times$ (dry)], 5 = mainly in wet samples [wet $> 10 \times$ (dry+moist)]

Sa. – Number of year-samples

N. – Number of specimens.

Table 2. Species of peaty soils and/or oligotrophic sandy soils.

| Species group A1 | | | I | | | | | II | | | | | | III | | | | IV | | | | | V | | | | | VI | | | | | VII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUM | Species | GR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Pres | Sim | So | Hu | Sa | N |
| 1 | Acupalpus dubius | A1 | | 1 | * | . | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | .12 | .48 | pm | 5 | 7 | 43 |
| 2 | Pterostichus diligens | A1 | 4 | * | 3 | 4 | 6 | . | | | . | | | . | | | . | . | . | . | . | | . | 1 | 1 | . | . | 1 | . | 1 | . | 1 | . | | | .73 | .83 | | | 418 | 16045 |
| 3 | Carabus arvensis | A1 | 1 | 2 | 1 | * | 5 | . | | | | | | . | 1 | | | . | . | 1 | . | | | | 1 | | . | 1 | | | | | | | | .45 | .75 | pm | | 164 | 1756 |
| 4 | Pterostichus aterrimus | A1 | * | | | | | | | | | | | | | | | | | . | . | | | | | | | | | | | | | | | .09 | .03 | pm | 5 | 4 | 87 |
| 5 | Agonum ericeti | A1 | 8 | 1 | 8 | * | 1 | . | | | | | | | | | | | | . | | | | | . | | | | | | | | | | | .24 | .70 | pm | | 91 | 1199 |
| 6 | Amara equestris | A1 | | . | . | * | * | . | | | | | . | | | | | | | . | | | | | . | | . | . | | | | | | | | .30 | .55 | sm | | 172 | 1859 |
| 7 | Carabus nitens | A1 | 2 | * | * | 8 | 1 | 7 | | | | | | | | | | | | . | | | | | 1 | | | | . | | | | | | | .24 | .79 | pm | | 75 | 286 |
| 8 | Miscodera arctica | A1 | | | | * | 8 | 2 | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | .12 | .65 | | | 14 | 24 |
| 9 | Cymindis vaporariorum | A1 | | 1 | 2 | * | 4 | . | | | | | | | | | . | | | | | | | | | | | . | | | | | | | | .21 | .58 | pm | | 99 | 282 |
| 10 | Agonum versutum | A1 | 2 | * | 2 | | | 2 | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | .15 | .61 | ls | | 6 | 19 |
| 11 | Agonum krynickii | A1 | | | | * | * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | .06 | .50 | pm | 4 | 6 | 9 |
| 12 | Anisodactylus nemorivagus | A1 | | | * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | .03 | .00 | pm | 5 | 3 | 6 |
| 13 | Olistophus rotundatus | A1 | | . | 2 | * | 1 | 4 | | | | | . | | . | | . | | . | . | | | | | . | . | | | | | | | | | | .36 | .62 | pm | | 115 | 727 |
| 14 | Pterostichus lepidus | A1 | | 1 | 1 | * | 7 | 4 | | | | | | | 1 | 1 | 5 | . | . | . | | | | | . | | | . | | | | | | | | .39 | .80 | pm | | 307 | 13284 |
| 15 | Bradycellus ruficollis | A1 | . | 1 | 5 | * | 4 | 2 | | | | . | . | | | | 3 | | . | . | | | . | | 1 | | . | . | | . | | . | . | | | .55 | .78 | pm | | 275 | 5444 |
| 16 | Carabus cancellatus | A1 | 6 | 4 | 3 | 6 | 1 | * | | | | | | | | | | . | 2 | 1 | . | | | | 1 | | . | | | | | | | | | .36 | .83 | pm | | 113 | 400 |
| 17 | Notiophilus aesthuans | A1 | | | | * | | 2 | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | .09 | .39 | pm | | 7 | 12 |
| 18 | Trichocellus cognatus | A1 | . | 1 | . | * | 2 | 3 | | | | | | | | | . | | | . | | | | | . | | | . | | | | | | | | .30 | .56 | pm | | 180 | 3832 |
| 19 | Harpalus latus | A1 | . | 4 | 2 | 4 | * | . | | . | | . | | 2 | . | | 4 | . | 1 | . | . | . | . | . | 2 | . | 1 | 1 | | | | . | | | | .70 | .84 | | | 313 | 6742 |
| 20 | Harpalus solitaris | A1 | . | . | | 9 | * | 2 | | | | | | | . | | * | . | . | . | . | | | | 1 | | . | . | | | | | | | | .39 | .75 | sm | | 72 | 533 |
| 21 | Cicindela campestris | A1 | . | 1 | 3 | 3 | . | 2 | | | | | 1 | | 1 | | * | | | | | | | | | | | . | | | | | | | | .30 | .72 | pm | | 73 | 154 |
| 22 | Amara infima | A1 | | . | | 5 | 2 | * | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | .15 | .60 | sa | 2 | 101 | 2055 |
| 23 | Pterostichus minor | A1 | * | 1 | . | . | . | . | | | | . | | . | | | . | . | . | . | . | | . | 2 | 1 | 1 | | . | | 1 | | 2 | . | | | .64 | .70 | | 4 | 120 | 963 |
| 24 | Agonum sexpunctatum | A1 | 1 | 1 | * | 1 | . | 1 | | | | | . | . | 1 | 4 | . | | 1 | . | | | . | | 1 | | | 1 | . | . | . | 2 | 1 | | | .64 | .80 | | | 152 | 947 |

Table 3. Species of non-oligotrophic sandy soils with sparse vegetation. B1: species of *Corynephoretum*, dune habitats, and poor grassland. B2: species of sandy arable land and coniferous plantations.

| Species group B1, B2 | | | I | | | | | II | | | | | | III | | | | IV | | | | | V | | | | | VI | | | | | VII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUM | Species | GR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Pres | Sim | So | Hu | Sa | N |
| 25 | Calathus ambiguus | B1 | | | . | . | . | * | 8 | 3 | . | 3 | . | . | 1 | 5 | 3 | | | . | | | . | . | . | | | . | | . | . | . | 6 | | | .67 | .84 | sa | | 280 | 16294 |
| 26 | Notiophilus substriatus | B1 | 2 | | | . | . | 1 | . | 1 | | 1 | 1 | 6 | . | * | . | | | . | | | | . | . | | . | 1 | . | . | | | 1 | . | | .64 | .77 | | | 80 | 146 |
| 27 | Cicindela hybrida | B1 | | | | . | . | 8 | * | 1 | | . | | | | | . | | | | | | | . | . | | | | | | | | 3 | | | .30 | .68 | | 1 | 108 | 903 |
| 28 | Demetrias monostigma | B1 | | | | | | 1 | * | 2 | . | 1 | | | | | | | | | | | | | | | | | | | | | 2 | | | .18 | .55 | sa | 1 | 14 | 36 |
| 29 | Dromius spilotus | B1 | | | | | | | | 1 | * | 1 | | | | | | | | 3 | | | | | | | | | | | | | | | | .12 | .53 | | 2 | 10 | 15 |
| 30 | Amara curta | B1 | | | | | . | 1 | 6 | * | 2 | 5 | . | | . | | | | | . | | | . | . | | . | . | . | | | | | | . | | .45 | .73 | sa | 2 | 257 | 2936 |

Table 3. (continued).

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | Panagaeus bipustulatus | B1 | | | | | | 1 | 2 | 5 | 6 | * | 7 | | | | | | | . | | | 2 | . | . | . | 1 | | | | | | | | | .36 | .82 | sa | 2 | 161 | 457 |
| 32 | Harpalus servus | B1 | | | | . | . | 3 | * | 3 | . | 2 | . | | . | | 1 | | . | | | | | | | | | . | | | | | | . | | .39 | .68 | sa | 1 | 203 | 4861 |
| 33 | Harpalus vernalis | B1 | | | | | . | 1 | 3 | * | 1 | 4 | . | | 1 | | | | 1 | . | | | | 1 | | | | | | | | | | . | | .36 | .73 | sa | 1 | 98 | 540 |
| 34 | Harpalus xanthopus | B1 | | | | | . | . | . | . | * | 4 | 3 | | . | | | | | 1 | | | | | | | 1 | . | | | | | | . | | .36 | .65 | sa | 2 | 123 | 881 |
| 35 | Masoreus wetterhali | B1 | | | | . | 1 | 9 | 9 | * | . | 1 | 7 | | . | | | | | . | | | | | | | | . | | | | | | . | | .36 | .78 | sa | 2 | 143 | 653 |
| 36 | Bembidion nigricorne | B1 | | . | . | 5 | . | * | | | | | | . | | | . | | | . | . | | | | | | | | | | | | | | | .27 | .50 | pm | 2 | 103 | 5612 |
| 37 | Cymindis macularis | B1 | | | | 2 | . | * | | | | | | | | | 1 | | | . | | | | | | | | | | | | | | | | .18 | .38 | sa | 1 | 69 | 712 |
| 38 | Notiophilus germinyi | B1 | | | | 1 | 1 | * | 2 | 2 | 1 | 1 | . | | | | 3 | . | | . | | | | | . | | . | . | | | | | | | | .42 | .74 | sm | 2 | 291 | 2507 |
| 39 | Cymindis humeralis | B1 | | | | . | | * | | | | | | | | | 7 | . | | | | | | | | | | | | | | | | | | .12 | .51 | sa | 2 | 17 | 106 |
| 40 | Amara lucida | B1 | | | | | | 1 | 2 | 9 | . | 5 | | * | | | | | 1 | | | | | | | | | . | | | | | . | | | .27 | .74 | sa | 2 | 105 | 559 |
| 41 | Harpalus picipennis | B1 | | | | | | | | 6 | | * | 3 | | | | | | | | | | 3 | | | | | | | | | | | | | .12 | .68 | | 1 | 8 | 26 |
| 42 | Amara eyrinota | B1 | | | | | | | | * | | . | | | | | | | | | | | | | | | | | | | | | | | | .06 | .03 | sa | 1 | 2 | 72 |
| 43 | Ophonus cordatus | B1 | | | | | | | * | 1 | | . | | | | | | | | | | | | | | | | | | | | | | | | .09 | .26 | sa | 1 | 13 | 49 |
| 44 | Harpalus neglectus | B1 | | | | | 1 | * | . | . | | . | . | | | | | | | | | | | | | | | | | | | | | | | .18 | .26 | sa | 1 | 14 | 290 |
| 45 | Cicindela sylvatica | B1 | | | | 1 | . | * | | | | | | | | | | | | | | | | | | | | | | | | | | | | .09 | .25 | | | 14 | 24 |
| 46 | Amara anthobia | B2 | | | | | | . | | | | 5 | 5 | 2 | | * | | | | . | | | | 7 | 1 | | | | | | | | | | | .24 | .78 | sa | 2 | 21 | 256 |
| 47 | Broscus cephalotes | B2 | . | . | | . | . | 2 | 1 | . | | . | | . | * | . | . | | . | . | | | | . | . | . | | . | | | | . | . | | | .61 | .53 | | 2 | 160 | 3413 |
| 48 | Harpalus distinguendus | B2 | | | | . | . | . | | | | | | | 1 | * | | | | | | | | | | . | | . | | | | | | | | .21 | .25 | sa | 2 | 13 | 37 |
| 49 | Laemostenus terricola | B2 | | | | . | . | 4 | | | | | | | | 1 | * | 1 | | . | . | 2 | | | | . | . | | | | | | | | | .33 | .67 | | 2 | 43 | 381 |
| 50 | Leistus spinibarbis | B2 | | | | | | 3 | | | | | | | | | * | 1 | | . | | . | . | | | . | . | | | | | | | | | .24 | .49 | | 2 | 34 | 676 |
| 51 | Nebria salina | B2 | . | . | | 1 | . | 2 | | . | | | 1 | . | | * | 4 | . | | . | | . | | | | . | . | | | | | | | | | .45 | .63 | sm | | 119 | 1355 |
| 52 | Amara consularis | B2 | | | | . | . | . | | | | | | | 7 | * | | | | . | | | | . | | | | . | | | | | | | | .24 | .51 | sa | 3 | 40 | 201 |
| 53 | Amara fusca | B2 | | | | | | | | | | | | | * | | | | | | | | | | | | | | | | | | | | | .03 | .00 | | 3 | 9 | 29 |
| 54 | Harpalus anxius | B2 | | | | 1 | 1 | * | . | 1 | | . | 1 | | 4 | | 2 | | | . | | | | | | | | | | | | | | | | .33 | .70 | sa | 1 | 43 | 144 |
| 55 | Harpalus smaragdinus | B2 | | | | . | . | . | . | . | | . | 1 | | 7 | * | | | | | | | | | | | | | | | | | . | | . | .33 | .59 | sa | 2 | 33 | 201 |
| 56 | Calathus cinctus | B2 | | | | | . | 1 | | | | | . | 1 | | * | 1 | . | | . | | | | | . | | | . | | | | | | | | .30 | .42 | sm | 2 | 52 | 1186 |
| 57 | Harpalus froehlichi | B2 | | | | | | | | | | | | | | * | | | | | | | | | | | | | | | | | | | | .03 | .00 | sa | 3 | 5 | 19 |
| 58 | Harpalus rufipalpis | B2 | | . | | 1 | 1 | . | | | | | 4 | . | | 1 | * | . | . | . | . | | | | . | | . | . | | | | | | | | .45 | .65 | lo | 2 | 101 | 895 |
| 59 | Calathus micropterus | B2 | | . | 1 | . | 1 | . | | | | . | | | | | * | 2 | 1 | . | 1 | | . | | . | | . | | | | | | | | | .42 | .59 | sa | 2 | 92 | 1553 |
| 60 | Pterost. quadrifoveolatus | B2 | | | 1 | . | . | | | | | . | | | | | * | 1 | 1 | . | . | | . | . | . | | | . | | | | | | | | .39 | .38 | sm | | 56 | 1553 |

Table 4. Species from open sites, that differ from those of the B-species.

| Species group C1 | | | I | | | | | II | | | | | | III | | | | IV | | | | | V | | | | | VI | | | | | VII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUM | Species | GR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Pres | Sim | So | Hu | Sa | N |
| 61 | Amara tibialis | C1 | | | | . | 2 | 1 | | 4 | | 1 | 2 | | * | 6 | | | | . | | | | | | | | | | . | 3 | 2 | | 1 | | .39 | .84 | | | 24 | 63 |
| 62 | Clivina collaris | C1 | 3 | | | | | | | | | . | | 3 | * | 3 | | | | | | 2 | | . | 1 | 1 | | 5 | | . | 1 | 2 | . | | | .42 | .84 | | | 44 | 143 |
| 63 | Amara quenseli | C1 | | | | | | * | | | | | | | | | 1 | | | | | | | | | | | | | | | 1 | 1 | 2 | | .15 | .53 | | | 20 | 102 |
| 64 | Amara fulva | C1 | | | | . | . | 1 | | . | | . | 1 | . | . | * | | | | . | | | . | . | 1 | | | . | | . | 1 | . | 4 | 1 | . | .61 | .74 | | | 148 | 779 |
| 65 | Calathus mollis | C1 | | | | . | | . | 5 | 2 | . | 5 | . | . | 1 | | 1 | . | | . | | | | | . | | | . | | | | | * | 1 | . | .52 | .76 | sa | | 154 | 20441 |

Table 5. Species from shaded sites, either cultivated, ruderal or limestone grasslands (D1), moist shaded sites on chalky soil (D2), or forests (D3).

| Species group D1-D3 | | | I | | | | | II | | | | | | III | | | | IV | | | | | V | | | | | VI | | | | | VII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUM | Species | GR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Pres | Sim | So | Hu | Sa | N |
| 66 | Agonum gracile | D1 | * | | | 1 | | | | . | | . | | | | | | | | 1 | | | 8 | | . | | | . | | | | | | | | .24 | .61 | pm | | 15 | 28 |
| 67 | Amara montivaga | D1 | | | | | | | | | | | | | | | | | | | | | | | | 6 | * | | | | | | | | | .06 | .47 | li | 2 | 7 | 83 |
| 68 | Harpalus attenuatus | D1 | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | | .03 | .00 | li | 1 | 3 | 28 |
| 69 | Ophonus puncticeps | D1 | | | | | | | | | | | . | | | | | | | | | | | | | * | 9 | . | | | | | . | | | .15 | .53 | li | 2 | 22 | 621 |
| 70 | Harpalus rubripes | D1 | | | . | . | . | | | | | | 1 | . | | | | | | . | | 1 | | | 3 | * | 5 | . | | | | 1 | . | | | .39 | .69 | li | 2 | 50 | 691 |
| 71 | Ophonus rufibarbis | D1 | | | | | | | | | . | | 5 | . | | | | | | . | | | | 7 | 2 | 5 | * | 1 | | | | | | | | .27 | .78 | rc | 2 | 25 | 135 |
| 72 | Parophonus maculicornis | D1 | | | | | | | | | | | | | | | | | | | | | | | | * | | . | | | | | | | | .06 | .04 | li | 1 | 3 | 75 |
| 73 | Bembidion gilvipes | D1 | | | | | | | | | | | | | | | | | | | | | | 6 | | | * | 1 | | | | | | | | .09 | .53 | rc | 2 | 8 | 69 |
| 74 | Amara nitida | D1 | | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | .03 | .00 | lo | 2 | 4 | 14 |
| 75 | Brachinus crepitans | D1 | | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | .03 | .00 | li | 2 | 5 | 1831 |
| 76 | Harpalus dimidiatus | D1 | | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | .03 | .00 | li | 2 | 4 | 6 |
| 77 | Ophonus melleti | D1 | | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | .03 | .00 | li | 2 | 6 | 56 |
| 78 | Lebia chlorocephala | D1 | | | | | | | | | | | | | | | | | | | | | | | | | * | | . | | | | | | | .03 | .00 | | 2 | 4 | 4 |
| 79 | Stomis pumicatus | D2 | | | | | | | | | | | | | 2 | | . | . | | 3 | 3 | | * | 5 | 4 | 6 | 1 | . | | . | 1 | . | | | | .42 | .84 | | | 178 | 1737 |
| 80 | Leistus fulvibarbis | D2 | | | | | | | | | | . | | | | | | | 1 | . | . | 1 | | * | 1 | | . | . | | | | . | | | | .30 | .44 | | | 24 | 196 |
| 81 | Epaphius secalis | D2 | | | | | | | | | | | | | | | | | | * | . | | | 6 | * | | | 1 | | | | | | | | .15 | .67 | rc | 3 | 14 | 1063 |
| 82 | Agonum livens | D2 | | | | | | | | | | | | | | | | | | 2 | 1 | | 6 | * | | | | | | | | | | | | .12 | .62 | rc | 4 | 6 | 19 |
| 83 | Bradycellus sharpi | D2 | | | | | | | | | | | | | | | | | | 3 | | | 2 | * | | | 1 | | | | | | | | | .12 | .54 | lo | 4 | 6 | 43 |
| 84 | Carabus coriaceus | D2 | | | | | | | | | | | | | | | | 4 | | 2 | | * | | . | 1 | . | 6 | . | | | | | | | | .24 | .73 | ll | 2 | 55 | 703 |
| 85 | Carabus monilis | D2 | | | | | | | | | | | . | 2 | | | | | | . | | 4 | . | 1 | . | . | * | . | | | | | | | | .30 | .64 | ll | 2 | 77 | 1200 |
| 86 | Pterostichus madidus | D2 | | | | | | | | | | | . | . | | | | . | | . | . | * | | | . | 1 | 4 | . | | | | | | | | .30 | .50 | ll | 2 | 80 | 4117 |
| 87 | Carabus auratus | D2 | | | | | | | | | | | | | | | | | | | | 4 | | . | | | * | . | | | | | | | . | .15 | .47 | li | 2 | 55 | 2556 |
| 88 | Cychrus caraboides | D3 | | | 1 | | | | | . | | . | | | | 1 | 5 | * | 1 | 3 | 4 | . | 5 | 1 | | . | . | . | | | | | | | | .45 | .83 | lo | 2 | 88 | 337 |
| 89 | Notiophilus rufipes | D3 | | | . | . | . | . | . | | . | . | . | | | . | 1 | 3 | . | * | 3 | 1 | . | | 4 | . | . | . | | | | | | | | .61 | .77 | | | 206 | 4319 |
| 90 | Harpalus quadripunctatus | D3 | | | | . | . | | | | | | | | | | 1 | | 1 | * | 4 | | | . | 3 | | | | | | | | | | | .24 | .65 | pm | 4 | 85 | 1779 |
| 91 | Abax parallelepipedus | D3 | | . | | . | . | . | | | | . | | . | . | | 4 | 7 | | 2 | 4 | * | . | . | 1 | . | 1 | . | | | | | | | | .55 | .80 | ll | | 272 | 19720 |
| 92 | Carabus violaceus | D3 | | . | | . | 1 | . | | | | | | . | | | . | 4 | | 2 | 5 | * | | | 1 | 3 | 3 | . | | | | | | | | .42 | .81 | ll | 2 | 138 | 2097 |
| 93 | Pterost. oblongopunctatus | D3 | | . | . | . | . | . | | | | | | . | 1 | . | 7 | 7 | 2 | * | 8 | 2 | 1 | 1 | 2 | . | . | . | | | | . | | | | .64 | .85 | | | 374 | 46040 |
| 94 | Abax parallelus | D3 | | | | | | | | | | | | | | | | . | | . | 4 | * | | | . | | . | | | | | | | | | .18 | .44 | ll | 3 | 47 | 1917 |
| 95 | Molops piceus | D3 | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | | | | | | .03 | .00 | lo | 3 | 6 | 47 |
| 96 | Trichotichnus nitens | D3 | | | | | | | | | | | | | | | | 3 | | * | | 5 | | | | | | | | | | | | | | .09 | .58 | lo | 2 | 8 | 129 |
| 97 | Amara brunnea | D3 | | | | . | . | . | | | | . | | . | | | 3 | 1 | . | * | 3 | | | | 1 | | | . | | | | | | | | .36 | .68 | sa | 2 | 73 | 3263 |
| 98 | Amara pseudocommunis | D3 | | | | . | | . | | | | | | | | | | | | * | | | | | | | | | | | | | | | | .09 | .11 | pm | 4 | 29 | 146 |
| 99 | Leistus rufomarginatus | D3 | | | | . | . | . | | | . | . | | | | . | * | 4 | 2 | 6 | 3 | 2 | 1 | . | 1 | . | | . | | | | . | | | | .55 | .81 | | | 206 | 3451 |
| 100 | Bembidion genei | D3 | | | | | | | | | | | | | 4 | | | | | | | * | | | . | | | | | | | | | | | .09 | .44 | lo | 3 | 6 | 63 |
| 101 | Dromius agilis | D3 | 1 | | | | | | | | | | | | | | * | 9 | 4 | 1 | | | | | | | | | | | | | | | | .15 | .68 | lo | 2 | 21 | 28 |
| 102 | Carabus problematicus | D3 | . | . | 1 | 1 | 2 | 1 | | | | | . | . | . | | 8 | * | 1 | 3 | 1 | . | . | | 3 | | . | . | | | | | | | | .58 | .82 | | | 361 | 15886 |
| 103 | Amara praetermissa | D3 | | | | | | * | | | | 1 | | | | | | | | . | | | | | 2 | | * | . | | | | | | | | .18 | .63 | li | 2 | 17 | 37 |

Table 6. Miscellaneous species, mainly of moist-wet, shaded sites (E1,F2), reedland (G2), marshes and wet meadows (G4) and related species (F1,G1,G3).

| Species group E1, F1-F2, G1-G4 | | | I | | | | | II | | | | | | III | | | | IV | | | | | V | | | | | VI | | | | | VII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUM | Species | GR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Pres | Sim | So | Hu | Sa | N |
| 104 | Agonum viduum | E1 | 5 | | | | | | | | | . | | | | | | | | . | | | 2 | * | 5 | 8 | | 5 | | | | | | | | .24 | .81 | | | 21 | 64 |
| 105 | Acupalpus meridianus | E1 | | | | | | | 1 | . | . | | | | | | | | | | | 2 | | 1 | 2 | * | | | | | 1 | 1 | | | | .27 | .66 | li | | 16 | 28 |
| 106 | Badister unipustulatus | E1 | | | | | | | | | | 1 | | | | | | | | 1 | | | 4 | * | 3 | 5 | | 3 | | | | | | | | .21 | .79 | pm | | 10 | 16 |
| 107 | Badister meridionalis | E1 | | | | | | | | | | 3 | * | | | | | | 5 | | | | 4 | 6 | | | * | 3 | | | | | | | | .21 | .83 | rc | | 13 | 24 |
| 108 | Dromius quadrimaculatus | E1 | | | | | | | | 2 | 5 | 5 | | | | | | | | 2 | 3 | | 4 | * | | | | | | | | | | | | .21 | .81 | rc | | 27 | 33 |
| 109 | Amara bifrons | F1 | | | | . | . | . | . | 8 | . | 1 | 1 | . | 1 | 1 | | | . | . | | | . | . | 3 | * | | . | 1 | 1 | . | . | 5 | 2 | | .73 | .83 | rc | | 117 | 1083 |
| 110 | Asaphidion pallipes | F1 | | | | 1 | | 2 | | | | | | | | | | | | | | | | | * | 6 | 1 | . | | | | 2 | 4 | | | .24 | .77 | li | 2 | 20 | 59 |
| 111 | Trichocellus placidus | F2 | | 1 | . | . | . | . | . | . | . | . | . | | | | | | 1 | 4 | 3 | | * | 2 | 3 | . | . | . | . | 2 | . | 5 | . | | | .73 | .83 | | 257 | 5600 | |
| 112 | Bradycellus verbasci | F2 | | . | | | | | . | | | . | . | | | 1 | 1 | . | . | | | | 7 | 5 | 8 | 1 | . | 1 | | 3 | 1 | * | . | | | .55 | .84 | | | 103 | 868 |
| 113 | Badister sodalis | F2 | 3 | | | | | | | | | | | | | | | | | | | | 1 | * | 5 | * | 4 | 8 | | | | | | | | .21 | .81 | | | 37 | 151 |
| 114 | Patrobus atrorufus | F2 | | | | | . | | | | | | | | | | | | | 1 | | | 1 | 6 | 2 | * | . | 2 | | . | . | 3 | | | | .33 | .75 | rc | 4 | 49 | 1004 |
| 115 | Ophonus rupicola | G1 | | | | | | | . | | | | | * | | | | | | | | | | | | | . | | | | | | 7 | | | .12 | .51 | | 4 | 4 | 147 |
| 116 | Acupalpus flavicollis | G2 | * | | | | | . | | | | | | | | | | | | | | | | | | | | . | | * | . | 1 | | | | .18 | .59 | ls | 5 | 15 | 79 |
| 117 | Oodes helopioides | G2 | * | | | | | | | | | . | | | | | | | | . | | | | . | 1 | 1 | | 1 | | 5 | | . | . | | | .30 | .63 | | 4 | 29 | 251 |
| 118 | Carabus granulatus | G2 | * | | | | | | | | | . | . | 3 | 1 | | | | . | . | . | | . | 5 | 2 | . | . | 6 | | 5 | 1 | 2 | . | | | .55 | .84 | | | 131 | 1473 |
| 119 | Bembidion obtusum | G3 | | | | | | | . | . | . | . | | | 1 | | | | | | | . | | . | | * | . | . | | . | . | 1 | 5 | | | .42 | .59 | li | | 54 | 574 |
| 120 | Demetrias atricapillus | G4 | | | | | | | 2 | | | | | | | | | | | | | 6 | | | | | 2 | | | | | | * | | 4 | .15 | .71 | ll | | 10 | 15 |
| 121 | Omophron limbatum | G4 | | | | | | | | | | 1 | | | | | | | | | | | | | * | | | 1 | | . | | | 9 | 1 | | .18 | .62 | sa | | 8 | 159 |
| 122 | Amara ovata | G4 | | | | | | | | 2 | 1 | 2 | | 2 | | | | | | 2 | | | 2 | 3 | | 1 | 1 | 6 | | | | | * | | 2 | .36 | .84 | | | 21 | 74 |
| 123 | Bembidion biguttatum | G4 | | | | | | | | | | | | 2 | | | | | | | | | | 5 | 2 | 4 | 1 | * | | 1 | | 4 | | | | .24 | .78 | rc | | 18 | 51 |
| 124 | Bembidion dentelleum | G4 | | | | | | | | | | | | 1 | | | | | | | | | | 2 | 1 | 4 | . | * | | | 6 | 1 | 1 | 1 | | .30 | .79 | rc | 4 | 13 | 233 |
| 125 | Bembidion semipunctatum | G4 | | | | | | | | | | | | | | | | | | | | | | * | 2 | | 1 | 8 | | | | * | | 4 | | .18 | .78 | rc | | 6 | 25 |
| 126 | Pterostichus anthracinus | G4 | | | | | | | | | | | | 1 | | | | | | . | . | | | 5 | 1 | | . | * | | | | | | | | .21 | .58 | sc | | 27 | 388 |
| 127 | Bembidion harpaloides | G4 | | | | | | | | | | 3 | | | | | | | | | | | | 3 | 3 | | | * | | 3· | | | | | | .15 | .71 | c | | 9 | 14 |
| 128 | Elaphrus uliginosus | G4 | | | | | | | | | | | | | | | | | | | | | | | * | | | 7 | | 2 | | | | | | .09 | .58 | ls | | 6 | 10 |
| 129 | Agonum moestum | G4 | . | | . | . | . | . | | | | | | | | | | . | | 1 | . | . | 2 | 7 | 1 | . | . | 1 | 1 | * | 1 | 8 | . | | | .61 | .80 | 4 | | 112 | 1195 |
| 130 | Panagaeus cruxmajor | G4 | | | | 1 | | | | | | 1 | | | | | | | | . | | | 1 | | . | 8 | 3 | . | * | * | | | . | | | .33 | .76 | | | 33 | 71 |
| 131 | Amara famelica | G4 | | 3 | . | 3 | 1 | . | . | . | . | . | | . | 1 | . | . | . | | . | | | . | | . | | | . | . | 2 | . | * | 2 | . | | .73 | .78 | | | 163 | 1999 |

Table 7. Pioneer species of moist to wet habitats (H1-H3), including shore habitats (H4).

| Species group H1-H4 | | | I | | | | | II | | | | | | III | | | | IV | | | | | V | | | | | VI | | | | | VII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUM | Species | GR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Pres | Sim | So | Hu | Sa | N |
| 132 | Amara similata | H1 | | | | . | . | . | | . | | | | 1 | 2 | . | | | . | . | . | . | 2 | . | 1 | 4 | . | . | | 3 | 8 | * | 1 | | | .64 | .81 | c | | 163 | 4047 |
| 133 | Pterostichus cupreus | H2 | | . | | | | | | | | . | | 1 | 3 | | . | . | . | . | . | . | . | 1 | . | . | . | 2 | | 1 | * | 2 | . | | . | .61 | .73 | sc | | 184 | 16261 |
| 134 | Amara aulica | H2 | | | | . | | | . | . | . | | | . | | 1 | | | | . | | | | . | . | 1 | 1 | 1 | | . | 2 | * | 1 | . | . | .55 | .67 | | | 60 | 318 |
| 135 | Anisodactylus binotatus | H2 | . | . | 1 | . | . | . | | | | | . | . | | . | | | . | . | . | . | . | 1 | 2 | . | | 1 | 1 | 6 | 6 | * | 1 | | | .67 | .82 | | | 230 | 6660 |
| 136 | Acupalpus exiguus | H2 | | | . | | | | | | | | | | | | | | | | | | | . | . | | | . | | . | . | * | . | | | .24 | .10 | sc | 4 | 22 | 674 |
| 137 | Lasiotrechus discus | H2 | | | | | | | | | | | | . | | | | | | | | | 1 | 2 | 1 | | | 1 | 1 | 3 | 7 | * | 1 | . | . | .36 | .76 | sc | | 176 | 4537 |
| 138 | Chlaenius nigricornis | H2 | . | . | | . | . | | | | | | | | | | 1 | | | . | 1 | | | | 2 | | 1 | 2 | | 4 | | * | | 1 | | .39 | .73 | | | 40 | 123 |
| 139 | Bembidion bruxellense | H2 | 1 | . | | . | | . | | | | . | | . | 3 | | | | | | | . | | . | . | | | . | | 4 | 1 | * | 1 | 2 | . | .52 | .75 | | | 102 | 4516 |
| 140 | Agonum albipes | H2 | | | | | | | | | | | . | 2 | | | | | | . | | | | 1 | 1 | | | . | | * | | . | . | | | .30 | .50 | ls | 4 | 30 | 913 |
| 141 | Stenolophus mixtus | H2 | 1 | . | | | | | | | | . | | | | | | | | . | | | . | . | 2 | . | | . | . | 8 | 3 | * | 2 | | | .42 | .74 | | | 124 | 35365 |
| 142 | Amara majuscula | H2 | | | | | . | | | | | | | . | | | | | | | | | | | . | | | . | | 3 | 2 | * | . | | | .24 | .54 | sc | | 43 | 339 |
| 143 | Nebria livida | H2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | * | . | 1 | | .12 | .35 | | | 8 | 27 |
| 144 | Agonum thoreyi | H2 | . | | | | | | . | | | . | | | | | | | | | | | . | | . | . | | . | 1 | * | . | 2 | . | . | | .39 | .46 | 5 | | 93 | 12062 |
| 145 | Bembidion assimile | H2 | 1 | | . | | | | | | | | | | | | | | | . | | | . | . | 1 | | | . | 5 | * | 1 | 6 | 1 | . | | .42 | .74 | | | 148 | 22523 |
| 146 | Bembidion fumigatum | H2 | | | | | | | | | | | | | | | | | | | | | | | . | | | | | * | . | 1 | . | . | | .18 | .27 | sc | | 46 | 532 |
| 147 | Bembidion iricolor | H2 | . | | | | | | | | | | | . | | | | | | | | | | . | . | | | . | 2 | * | 2 | 2 | . | 1 | . | .36 | .62 | sc | 5 | 74 | 1260 |
| 148 | Dyschirius luedersi | H2 | | | | | | | . | | . | . | | | | | | | | | | | . | | | | | . | * | 1 | . | . | . | | . | .33 | .26 | ls | | 33 | 743 |
| 149 | Elaphrus cupreus | H2 | . | | | . | . | . | | | | | | 1 | | | | | | . | | | | 2 | 1 | 1 | | 1 | | * | | 1 | . | | | .39 | .59 | ls | 5 | 38 | 1248 |
| 150 | Bembidion lunulatum | H2 | | | | | | | | | | | | . | | | | | | . | | | . | . | . | . | | 2 | * | 5 | . | 5 | 4 | . | . | .42 | .78 | | 4 | 64 | 287 |
| 151 | Elaphrus riparius | H2 | | . | | | | | . | . | | . | 1 | . | | | | | | . | . | | | . | 1 | | | 1 | . | * | . | * | 7 | 2 | | .48 | .77 | | | 66 | 1957 |
| 152 | Acupalpus parvulus | H2 | . | . | | . | . | . | | | | . | | | | | | | | . | | | . | | 1 | . | . | . | * | 7 | . | 1 | . | 4 | | .55 | .69 | ls | 5 | 116 | 1765 |
| 153 | Bembidion femoratum | H3 | | | | | | . | | . | | | | . | 2 | . | | | | . | | . | | | 1 | . | | . | . | 1 | . | 1 | * | 1 | . | .52 | .58 | | | 121 | 25113 |
| 154 | Amara convexiuscula | H3 | | | | | | | | | | . | | . | . | | | | | | | | . | | . | . | | . | 1 | 3 | 1 | 5 | * | 1 | 1 | .42 | .74 | | | 142 | 6200 |
| 155 | Bembidion quadrimaculatum | H3 | | . | | . | | . | | | | | | . | 2 | | | | | | | . | . | . | . | 2 | | 1 | . | 1 | * | 3 | 3 | 2 | | .52 | .80 | | | 97 | 1005 |
| 156 | Dyschirius politus | H3 | | | | | | 3 | . | 8 | | . | | | | | | | | | | | | | | | | | * | 2 | | 2 | 5 | 4 | | .27 | .81 | | | 29 | 128 |
| 157 | Bembidion bipunctatum | H4 | | | | | | | | | | | | | | | | | | | | | | . | | | | . | * | 8 | . | 2 | 8 | 1 | . | .27 | .72 | | | 101 | 11807 |
| 158 | Agonum marginatum | H4 | | 1 | . | . | . | . | . | | | . | . | . | | | | . | | . | | | . | . | . | | | . | 9 | * | . | 6 | 5 | 7 | . | .67 | .81 | ls | | 139 | 1265 |
| 159 | Bembidion aeneum | H4 | | | | | | | | . | | | | . | | | | | | | | | . | . | . | | . | . | * | 1 | . | . | 1 | 7 | 1 | .42 | .65 | ls | 5 | 140 | 2565 |
| 160 | Bembidion minimum | H4 | | . | | | | | | | | . | | | | | | | | | | | | | . | | | . | 7 | 3 | . | . | 2 | * | 5 | .33 | .74 | ls | 4 | 151 | 12934 |
| 161 | Dicheirotrichus gustavi | H4 | | | | | | | | | | . | | | | | | | | | | | | | . | | | . | 7 | 4 | | . | 2 | * | 4 | .24 | .74 | ls | 5 | 140 | 62033 |
| 162 | Dyschirius salinus | H4 | | | | | | | | | | . | | | | | | | | | | | | | | | | . | 7 | 2 | | | 1 | * | 2 | .18 | .67 | ls | 5 | 110 | 17735 |
| 163 | Dyschirius obscurus | H4 | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 3 | | | * | | 1 | .12 | .53 | | 5 | 40 | 2303 |
| 164 | Bembidion varium | H4 | | | | | | | | | | | | | | | | | | | | | . | . | . | | | . | . | 3 | . | 1 | 1 | * | . | .36 | .51 | ls | | 105 | 12449 |
| 165 | Dyschirius thoracicus | H4 | | | | . | | 1 | . | . | . | . | | | | | | | | | | | | | 1 | | . | . | | 2 | . | 1 | * | 1 | 1 | .45 | .60 | | | 129 | 23405 |
| 166 | Bembidion argenteolum | H4 | | | | | | | . | | | | | | | | | | | | | | | | | | | . | | 3 | | . | * | 6 | | .18 | .62 | | | 30 | 883 |
| 167 | Pogonus chalceus | H4 | | | | | | | | | | | | . | | | | | | | | | | | | | | . | 5 | . | | | 1 | * | 9 | .21 | .66 | ls | 5 | 98 | 8615 |
| 168 | Bembidion normannum | H4 | | | | | | | | | | | | . | | | | | | | | | | | | | | . | 1 | . | | | . | 6 | * | .21 | .57 | | 4 | 62 | 959 |
| 169 | Pogonus luridipennis | H4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | * | | .03 | .00 | ls | 5 | 8 | 66 |
| 170 | Bembidion velox | H4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | . | 5 | * | | .09 | .46 | sa | | 5 | 186 |
| 171 | Dicheirotrichus obsoletus | H4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | . | | . | * | | 6 | .12 | .52 | sc | 4 | 51 | 931 |
| 172 | Bradycellus distinctus | H4 | | | | | | | | . | | | | | | | | | | | | | | | | | | | | | | | * | | | .06 | .02 | sa | 4 | 18 | 192 |
| 173 | Bembidion pallidipenne | H4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | * | | | .03 | .00 | sa | 5 | 16 | 161 |

Table 8. Eurytopic species.

| Eurytopic species, ubiquists, EU | | | I | | | | | II | | | | | | III | | | | IV | | | | | V | | | | | VI | | | | | VII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUM | Species | GR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Pres | Sim | So | Hu | Sa | N |
| 174 | Agonum dorsale | H | . | | . | . | . | . | | | | . | . | 2 | 1 | 1 | | | | . | . | . | . | . | 1 | . | 1 | . | | . | * | 1 | . | . | . | .76 | .69 | | | 311 | 16010 |
| 175 | Harpalus tardus | B | | . | | . | . | . | . | 1 | . | 1 | 2 | . | 2 | * | 2 | . | . | . | . | . | . | . | . | . | . | . | | | | | | . | . | .79 | .71 | | 2 | 166 | 1506 |
| 176 | Bembidion tetracolum | H | . | . | . | . | . | . | | | | . | | 1 | . | . | | | | . | . | . | . | 1 | 1 | 1 | . | 1 | . | 1 | * | 3 | 2 | . | . | .79 | .76 | | | 293 | 19171 |
| 177 | Asaphidion flavipes | G | | . | . | . | . | . | | | | . | | 1 | 1 | 1 | . | . | . | . | . | * | 1 | . | 1 | 2 | 1 | . | . | . | 6 | . | 2 | | . | .79 | .80 | | | 142 | 784 |
| 178 | Pterostichus melanarius | H | . | . | . | . | . | . | . | . | . | . | . | 5 | . | . | . | . | . | . | . | . | . | 1 | 1 | 1 | . | 2 | | 1 | * | 3 | 1 | . | . | .97 | .81 | | | 497 | 48335 |
| 179 | Amara spreta | G | | . | | . | . | . | . | 2 | . | . | 1 | 1 | 8 | * | | . | . | . | | 1 | 1 | . | 2 | . | . | 1 | . | . | 1 | 7 | 6 | . | | .85 | .85 | | | 247 | 9930 |
| 180 | Notiophilus aquaticus | A | . | 1 | 4 | * | 2 | 5 | . | 1 | 1 | 1 | . | . | 1 | 4 | 1 | . | . | . | . | | . | . | 1 | . | . | . | | | | | . | 1 | . | .85 | .85 | pm | | 397 | 13014 |
| 181 | Bembidion guttula | G | . | . | | . | . | . | | | . | | . | . | | | . | | | . | | | 2 | * | 4 | 2 | 1 | 4 | 2 | 1 | 2 | 4 | . | . | | .67 | .85 | | | 107 | 403 |
| 182 | Agonum assimile | D | | | . | . | . | | | | | | | . | | | . | . | 3 | * | 6 | 2 | 1 | 8 | 3 | 4 | | 1 | | . | | 1 | . | | | .52 | .85 | | | 118 | 3987 |
| 183 | Syntomus truncatellus | B | | . | | . | . | 1 | 1 | 4 | * | 8 | 5 | 3 | . | 1 | 4 | . | 1 | . | | | 1 | . | . | . | . | . | | | | | | . | | .70 | .85 | sa | 2 | 302 | 3713 |
| 184 | Calathus rotundicollis | D | | | . | . | . | . | | | | . | . | . | . | | 1 | 3 | * | 8 | 7 | 7 | 5 | 1 | 2 | . | . | . | | . | | | . | | . | .70 | .85 | | | 231 | 6538 |
| 185 | Pterostichus nigrita | G | * | 2 | 2 | 1 | . | . | | . | . | . | . | 1 | | . | . | . | . | 1 | . | | 1 | 3 | 1 | . | . | . | . | 9 | 2 | 3 | 1 | . | | .88 | .86 | | | 429 | 8000 |
| 186 | Bradycellus caucasicus | A | . | 1 | 1 | * | 6 | 3 | 1 | 1 | 4 | 1 | 1 | | | | 1 | | 1 | . | | | 1 | . | 1 | | . | . | | | | | 2 | 1 | | .64 | .86 | sm | | 284 | 1430 |
| 187 | Carabus nemoralis | D | | . | . | . | . | . | | . | | . | . | . | 1 | . | * | 9 | 1 | 3 | 5 | 7 | 1 | 1 | 2 | | 2 | 1 | | | | | | | | .67 | .86 | | | 334 | 7396 |
| 188 | Synuchus vivalis | E | | . | . | 1 | . | . | | . | . | . | 1 | 2 | 7 | 1 | | . | | . | | . | 1 | 1 | 2 | * | 2 | 1 | | . | 3 | . | | | | .73 | .86 | | | 108 | 377 |
| 189 | Amara convexior | B | | | . | . | . | 1 | 1 | 5 | 5 | 5 | 8 | 1 | . | | | | . | . | | 1 | . | . | . | 4 | * | 2 | | . | . | . | . | | | .70 | .86 | | 2 | 306 | 3625 |
| 190 | Trechus obtusus | F | | | . | . | . | . | | . | | . | 1 | 1 | . | 2 | . | . | 2 | . | . | . | * | 3 | 4 | 2 | . | 2 | | 1 | . | 3 | . | . | | .82 | .86 | | | 251 | 7930 |
| 191 | Trechus quadristriatus | G | | | | . | | . | . | . | 2 | 2 | . | 1 | 3 | | | | 1 | . | | . | . | . | 1 | 3 | . | . | 1 | 2 | * | 6 | 1 | 1 | . | .76 | .86 | | | 451 | 9616 |
| 192 | Badister lacertosus | E | | | | | | | | . | * | 3 | 2 | | | | | | 3 | 1 | | | 8 | 7 | 2 | 4 | 2 | 3 | | | | | | | | .36 | .86 | | | 113 | 411 |
| 193 | Amara lunicollis | A | 2 | 8 | 1 | 5 | * | 1 | | . | . | . | 2 | 1 | 1 | | 2 | 1 | 1 | . | . | . | . | . | 1 | . | 1 | 4 | | | | | . | . | | .79 | .87 | | | 545 | 50189 |
| 194 | Pterostichus versicolor | A | . | 4 | 3 | * | 8 | 1 | . | . | . | | . | 2 | . | 1 | 4 | . | . | . | . | | . | . | 2 | . | . | 5 | | . | . | . | . | | | .85 | .87 | sm | | 506 | 54592 |
| 195 | Trechoblemus micros | G | | | | | | | | 5 | | | | | | | | | | | | | 7 | 3 | 4 | | | 7 | | * | 3 | | 6 | | 4 | .27 | .87 | | | 30 | 66 |
| 196 | Dromius linearis | B | | 1 | | | | 1 | 2 | 8 | 3 | 4 | 3 | | 1 | * | 3 | | | | | | 5 | . | | 1 | | . | | | | . | . | | | .48 | .87 | | 2 | 107 | 236 |
| 197 | Leistus terminatus | E | . | 1 | 1 | 2 | . | 1 | . | . | | 1 | | . | | 1 | 3 | 1 | 8 | 3 | . | | 9 | * | 3 | . | | 1 | | . | . | 2 | . | | | .76 | .87 | | | 230 | 931 |
| 198 | Leistus ferrugineus | B | | . | | . | . | 2 | 1 | 1 | 3 | 4 | 1 | 1 | 1 | 3 | * | 2 | . | . | . | 1 | . | . | 1 | 1 | 1 | 1 | | | | | . | . | | .79 | .87 | | 2 | 317 | 2049 |
| 199 | Calathus erratus | B | . | . | . | 4 | 2 | * | 5 | 4 | . | 2 | 2 | . | * | 1 | 9 | . | . | . | . | . | . | . | 1 | | | . | . | . | . | . | 1 | . | | .88 | .88 | sm | | 620 | 54146 |
| 200 | Amara familiaris | G | . | . | . | . | . | 1 | . | 1 | . | 1 | . | 4 | 3 | * | . | . | 1 | . | . | . | 1 | 1 | 1 | 3 | . | 2 | . | . | * | 2 | 1 | 1 | . | 1.00 | .88 | | | 372 | 3281 |
| 201 | Amara apricaria | C | . | . | . | 3 | 2 | 1 | | . | | . | . | 4 | 6 | * | 3 | . | | . | | | . | . | . | | | 2 | | . | 3 | . | 9 | 1 | 1 | .76 | .88 | | | 170 | 662 |
| 202 | Syntomus foveatus | B | | 1 | | 4 | 1 | * | 1 | 7 | . | 2 | 5 | 1 | 5 | 3 | 1 | | . | . | . | . | 1 | . | . | . | . | . | . | . | . | . | . | . | | .76 | .88 | | | 364 | 3150 |
| 203 | Agonum fuliginosum | F | 3 | 4 | | 1 | . | . | | | | . | | . | | 1 | | . | 4 | 4 | . | | 1 | 3 | 1 | | . | . | 1 | 4 | . | * | . | | | .67 | .88 | | 4 | 168 | 690 |
| 204 | Amara aenea | C | | . | 1 | 1 | 1 | 1 | . | 1 | . | . | 1 | 7 | 3 | * | . | . | 1 | . | | . | . | . | . | 2 | 1 | 1 | 1 | . | 2 | 2 | 1 | . | . | .97 | .88 | | | 501 | 3541 |
| 205 | Clivina fossor | H | | . | . | . | 1 | . | | | | . | | 2 | . | 2 | . | . | . | . | . | . | 5 | 2 | 2 | . | . | 3 | * | 2 | 8 | 2 | 1 | 7 | . | .82 | .88 | | | 461 | 4141 |
| 206 | Dyschirius globosus | E | . | 5 | 7 | * | 4 | . | . | | | . | . | . | . | 2 | . | | . | . | . | | 3 | 1 | 1 | 2 | . | 2 | 6 | 2 | . | 1 | . | . | . | .88 | .88 | | | 439 | 25073 |
| 207 | Badister bullatus | E | | | | . | | . | 1 | 2 | 5 | 7 | 4 | 1 | | | . | . | 1 | 1 | . | . | 5 | 4 | 2 | * | 1 | 2 | | | | 1 | | . | . | .70 | .89 | | | 227 | 687 |
| 208 | Pterostichus strenuus | G | . | . | | . | . | . | . | . | 1 | 1 | . | 2 | | | . | . | 1 | 1 | . | . | 9 | 5 | 3 | 1 | . | 3 | * | 9 | 3 | 9 | 1 | 2 | . | .91 | .89 | | | 624 | 33119 |
| 209 | Bembidion lampros | A | | . | 4 | 3 | . | . | . | . | . | . | . | 4 | * | 6 | 4 | . | 1 | . | . | 1 | . | . | 2 | 7 | . | 1 | | . | 2 | 1 | 1 | . | . | .91 | .90 | | | 404 | 6530 |
| 210 | Bradycellus harpalinus | A | . | 1 | 1 | * | 4 | 3 | . | . | . | . | 1 | . | 1 | 8 | 4 | . | . | . | | | 5 | . | 2 | . | . | 1 | 2 | 1 | . | 1 | 1 | 1 | | .91 | .90 | sm | | 371 | 2612 |
| 211 | Amara plebeja | G | . | . | 1 | 1 | 1 | 1 | | . | | . | . | 2 | 2 | * | . | . | . | 1 | 1 | . | 1 | . | 2 | . | . | 1 | 3 | 4 | 5 | 7 | 1 | . | . | .94 | .90 | | | 459 | 6430 |
| 212 | Agonum obscurum | E | . | 4 | 1 | 6 | 3 | . | | | | . | | . | 2 | . | 2 | 1 | 7 | 1 | . | | 9 | 4 | 4 | 1 | . | 1 | . | . | . | * | . | | | .76 | .90 | | | 393 | 14600 |
| 213 | Harpalus affinis | E | . | . | . | 1 | 1 | . | . | . | . | 1 | 2 | 5 | 8 | 8 | . | | | . | | . | 1 | . | 1 | * | 1 | 3 | 2 | . | 4 | 2 | 4 | 1 | 1 | .85 | .90 | | | 343 | 3837 |
| 214 | Notiophilus palustris | D | | . | 1 | 1 | 1 | 2 | . | . | 5 | 1 | | 1 | | . | * | 6 | 1 | 3 | . | . | 3 | 1 | 4 | 3 | 3 | 1 | | | . | . | | . | | .79 | .90 | | | 314 | 1327 |
| 215 | Pterostichus vernalis | H | 3 | . | 1 | . | . | . | | . | . | . | . | 3 | . | 1 | 1 | . | 1 | . | . | . | 1 | 2 | 1 | 3 | 1 | 3 | * | 9 | 4 | 8 | 3 | 1 | . | .97 | .90 | | | 502 | 9221 |
| 216 | Bembidion properans | H | . | | | . | . | . | . | 1 | . | . | . | * | 4 | 2 | | | | | | . | . | . | . | 2 | 1 | 3 | 9 | 5 | 8 | 7 | 8 | 4 | 2 | .76 | .90 | | | 256 | 3223 |
| 217 | Dromius melanocephalus | B | 1 | 3 | | 1 | 7 | 1 | 1 | 4 | 2 | 5 | * | . | | 9 | 7 | | 5 | . | | | 1 | 1 | 1 | | . | 1 | | | . | . | | | | .67 | .90 | | | 118 | 230 |
| 218 | Pterostichus niger | G | 1 | 3 | 3 | 2 | 1 | . | . | . | . | . | . | 1 | | | 1 | . | 2 | 2 | 1 | . | 1 | 1 | 2 | 2 | . | 2 | . | 6 | 4 | * | 1 | . | | .88 | .91 | | | 641 | 23117 |

Table 8. (continued).

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 219 | Calathus melanocephalus | A | . | 2 | . | 7 | 6 | 3 | 1 | 2 | . | 2 | 2 | 2 | * | 2 | 3 | . | 1 | . | . | . | . | . | 1 | . | . | 1 | . | . | 1 | . | 4 | . | . | 1.00 | .91 | sm | | 874 | 78250 |
| 220 | Notiophilus biguttatus | D | | . | . | . | . | . | . | . | 2 | 1 | | . | 1 | . | 7 | 5 | 7 | * | 8 | 5 | * | 2 | 4 | 3 | 1 | . | . | . | . | 1 | . | | | .85 | .91 | | | 446 | 7507 |
| 221 | Agonum muelleri | G | . | . | 1 | . | . | 1 | . | | | | . | 9 | . | 3 | | 1 | 1 | 1 | . | 2 | 6 | 1 | 1 | 5 | 5 | 5 | . | 5 | 6 | * | 1 | | . | .85 | .91 | | | 225 | 725 |
| 222 | Calathus fuscipes | B | | . | 1 | 1 | 2 | 6 | 2 | * | 1 | 4 | 9 | 7 | * | 7 | 8 | . | 3 | 1 | . | . | . | 1 | 1 | . | 3 | 2 | | | | . | 1 | . | . | .88 | .92 | | | 575 | 23387 |
| 223 | Harpalus rufipes | E | . | . | 3 | 2 | 1 | . | . | . | . | . | 1 | * | 5 | 9 | 5 | . | . | 1 | . | . | . | 1 | 2 | 5 | 2 | 4 | 4 | 1 | 7 | 1 | 4 | 2 | . | 1.00 | .93 | | | 532 | 5656 |
| 224 | Loricera pilicornis | H | . | . | . | . | . | 1 | . | . | . | . | . | 5 | 3 | 2 | . | 1 | 1 | 2 | 2 | . | 3 | 3 | 2 | 1 | . | 2 | 8 | 4 | * | 6 | 2 | 3 | . | 1.00 | .93 | | | 685 | 7387 |
| 225 | Amara communis | G | 1 | 3 | 1 | 1 | 2 | . | . | 1 | 3 | 4 | 2 | 9 | . | . | 5 | 1 | 1 | 1 | 2 | | 2 | 3 | 3 | . | 1 | * | 4 | 1 | 1 | 5 | . | . | . | .97 | .93 | | | 704 | 12776 |
| 226 | Nebria brevicollis | E | | . | 3 | 1 | 1 | 1 | . | 1 | . | 1 | 2 | 7 | 2 | 3 | * | 1 | 5 | 4 | 4 | 7 | 3 | 6 | 4 | 4 | 2 | 2 | . | . | 5 | 2 | 1 | . | . | .97 | .94 | | | 665 | 30853 |

Table 9. Rare species

| Rare species, RA | | | I | | | | | II | | | | | | III | | | | IV | | | | | V | | | | | VI | | | | | VII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUM | Species | GR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Pres | Sim | So | Hu | Sa | N |
| 227 | Bembidion doris | A | * | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | .06 | .23 | | 5 | 2 | 2 |
| 228 | Carabus clathratus | A | | | | * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | .03 | .00 | | 5 | 1 | 7 |
| 229 | Cicindela germanica | A | | | | * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | .03 | .00 | | | 1 | 1 |
| 230 | Agonum munsteri | A | * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | .03 | .00 | | 5 | 1 | 1 |
| 231 | Blethisa multipunctata | A | 3 | * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | .06 | .35 | | 5 | 4 | 7 |
| 232 | Dromius angustus | B | | | | | 4 | | | | * | | | | | | | 7 | | | | | | | | | | | | | | | | | | .09 | .63 | | 1 | 5 | 5 |
| 233 | Microlestes minutulus | B | | | | | | * | | | | 1 | | | | | | | | | | | | | | | 6 | | | | | | | | | .09 | .52 | li | 2 | 5 | 9 |
| 234 | Harpalus luteicornis | B | | | | | | | | | 7 | * | | | | | | | | | | | | | | | | | | | | | | | | .06 | .48 | | 2 | 3 | 3 |
| 235 | Harpalus serripes | B | | | | | | * | | | | | | | | | | | | | | | | | | | | | | | | | | | | .03 | .00 | | 1 | 1 | 1 |
| 236 | Harpalus melancholicus | B | | | | | | | | * | | | | | | | | | | | | | | | | | | | | | | | | | | .03 | .00 | | 1 | 2 | 7 |
| 237 | Harpalus flavescens | B | | | | | | | | | | | * | | | | | | | | | | | | | | | | | | | | | | | .03 | .00 | | 1 | 1 | 2 |
| 238 | Stenolophus teutonus | B | 2 | | | | | | | | | | | | | * | | | | | | | | | | | | | | | | | | | | .06 | .26 | | 4 | 2 | 2 |
| 239 | Cicindela maritima | C | | | | | | | * | | | * | | | | | | | | | | | | | | | | 5 | | | | | 5 | | | .12 | .73 | | 4 | 5 | |
| 240 | Amara cursitans | D | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | | .03 | .00 | li | 1 | 2 | 6 |
| 241 | Bembidion deletum | D | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | | .03 | .00 | li | 1 | 1 | 1 |
| 242 | Dyschirius angustatus | D | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | | .03 | .00 | li | 1 | 1 | 1 |
| 243 | Tachys parvulus | D | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | | .03 | .00 | li | 1 | 2 | 18 |
| 244 | Bembidion quinquestriatum | D | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | | | .03 | .00 | rc | 3 | 1 | 1 |
| 245 | Abax carinatus | D | | | | | | | | | | | | 3 | | | | | | | | | | | | | * | | | | | | | | | .06 | .37 | | 5 | 2 | 7 |
| 246 | Carabus convexus | D | | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | .03 | .00 | li | 2 | 2 | 4 |
| 247 | Ophonus puncticollis | D | | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | 4 | | | .06 | .40 | li | 2 | 2 | 5 |
| 248 | Lebia cruxminor | D | | | | | | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | .03 | .00 | li | 1 | 1 | 1 |
| 249 | Bembidion mannerheimi | D | | | | | | | | | | | | | | | | | | | | 3 | | | * | 1 | | | | | | | | | | .09 | .44 | pm | 5 | 3 | 29 |
| 250 | Harpalus calceatus | D | | | | | | | | 2 | | 1 | | | | | | | | 2 | | | * | | | | | | | | | | | | | .12 | .49 | | | 5 | 7 |
| 251 | Ophonus nitidulus | D | | | | | | | | | | | | | | | | | | | | * | | | | | 6 | 2 | | | | | | | | .09 | .56 | li | 2 | 4 | 4 |
| 252 | Carabus auronitens | D | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | | | | | | .03 | .00 | sc | 5 | 1 | 5 |
| 253 | Pterostichus cristatus | D | | | | | | | | | | | | | | | | | | | | * | | | | | | | | | | | | | | .06 | .08 | lo | 3 | 2 | 9 |
| 254 | Pterostichus macer | D | | | | | | | | | | | | | | | | | | | * | | | | | | | | | | | | | | | .03 | .00 | | | 1 | 1 |
| 255 | Bembidion humerale | D | | | | | | | | | | | | | | | | | | * | | | | | | | | | | | | | | | | .03 | .00 | pm | 5 | 1 | 1 |
| 256 | Calosoma inquisitor | D | | | | | | | | | | | | | | | | * | | 1 | | | | | | | | | | | | | | | | .06 | .11 | | 3 | 2 | 6 |

Table 9. (continued).

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 257 | Pterostichus gracilis | D | | | | | | | | | * | | | | | | | | | | .03 | .00 | | 3 | 1 | 1 |
| 258 | Dromius quadrisignatus | D | | | | | | | * | | | | | | | | | | | | .03 | .00 | | 3 | 1 | 1 |
| 259 | Harpalus honestus | D | | | | | | | | * | | | | | | 2 | | | | | .06 | .24 | | 1 | 2 | 2 |
| 260 | Microlestes maurus | D | | | | | | | | * | | | | | | 1 | | | | | .09 | .23 | | 3 | 4 | 10 |
| 261 | Amara strenua | D | | | | 8 | | | | | | * | | | | | | | | | .06 | .49 | | 1 | 3 | 4 |
| 262 | Agonum micans | E | | | | | | | | | | | * | | | 2 | | | | | .06 | .23 | rc | 3 | 2 | 23 |
| 263 | Dromius sigma | E | | | | | * | | | | | | 9 | | | | | | | | .06 | .50 | | | 2 | 2 |
| 264 | Agonum piceum | F | | | | | | | | * | 2 | | | | | 5 | | | | | .09 | .53 | ls | 3 | 4 | 4 |
| 265 | Badister dilatatus | F | | | | | | | | | | | | * | | 3 | | | | | .06 | .38 | pm | 5 | 2 | 3 |
| 266 | Bradycellus csikii | G | | 1 | 1 | 2 | | | | | | | | | * | * | | | | | .15 | .65 | | | 5 | 9 |
| 267 | Ophonus azureus | G | | | | | | | | | | | | | * | 8 | | | | | .06 | .50 | li | 3 | 2 | 2 |
| 268 | Harpalus griseus | G | | | | | | | | | 9 | | | | | * | | | | | .06 | .50 | | 3 | 2 | 4 |
| 269 | Badister peltatus | G | * | | | | | | | | | | | | | 6 | | | 2 | | .09 | .59 | | 4 | 3 | 3 |
| 270 | Trechus rubens | H | | | | | | | | | | | | 2 | | | * | | | | .06 | .32 | ls | | 3 | 6 |
| 271 | Chlaenius vestitus | H | | | | | | 1 | | | | | | | | * | | 7 | | | .09 | .52 | rc | 5 | 3 | 7 |
| 272 | Dyschirius aeneus | H | | | | | | | | | | | | | | * | | 7 | | | .06 | .48 | rc | 5 | 2 | 6 |
| 273 | Acupalpus consputus | H | | | | | | | | | | | | | | * | | | | | .03 | .00 | | 5 | 1 | 5 |
| 274 | Badister anomalus | H | | | | | | | | | | | | | | * | | | | | .03 | .00 | | 3 | 1 | 2 |
| 275 | Acupalpus brunnipes | H | | | | | | | | | | | | | | | * | 3 | | | .06 | .34 | | | 3 | 7 |
| 276 | Odacantha melanura | H | 3 | | | | | | | | | | | | | | * | 5 | | | .09 | .58 | sc | 4 | 5 | 8 |
| 277 | Chlaenius tristis | H | | | | | | | | | | | | | | | * | | | | .03 | .00 | | 5 | 1 | 1 |
| 278 | Stenolophus skrimshiranus | H | | | | | | | | | | | | | | | * | | | | .03 | .00 | sc | 5 | 2 | 13 |
| 279 | Bembidion lunatum | H | | | | 2 | | | | | | | | | | | * | | | | .06 | .32 | | | 2 | 2 |
| 280 | Bembidion quadripustulatum | H | | | | | | | | | | | | | | | | * | 4 | | .06 | .40 | | | 2 | 2 |
| 281 | Acupalpus elegans | H | | | | | | | | | | | | | | | * | | 6 | | .06 | .46 | | | 2 | 2 |
| 282 | Bembidion obliquum | H | | | | | | | | | | | | | | 1 | | | | * | .06 | .13 | | 5 | 2 | 2 |
| 283 | Dyschirius nitidus | H | | | | | | | | | | | | | | | | | | * | .06 | .07 | sc | 5 | 4 | 14 |
| 284 | Bembidion laterale | H | | | | | | | | | | | | | | | | | * | | .03 | .00 | | 5 | 1 | 2 |
| 285 | Dyschirius chalceus | H | | | | | | | | | | | | | | | | | * | | .03 | .00 | | 5 | 1 | 1 |

Table 10. A comparison between the classification made by Lindroth (1945, 1949, 1985 and 1986) for Fennoscandia and the present classification. The figures indicate the number of species that belong to the respective ecological groups. The columns A1-H4, EU, and RA in the heading of the table, refer to the species groups in the present classification (see tables 2-9), O = species common to Scandinavia and the Netherlands, but not present in the Dutch pitfall material. The rows in the table present the figures for the ecological groups of Lindroth: X = xerophilous species, N = ruderal and ubiquitous species, H = hygrophilous species; W = forest species and A = arborical species.

| Group | A1 | B1 | B2 | C1 | D1 | D2 | D3 | E1 | F1 | F2 | G1 | G2 | G3 | G4 | H1 | H2 | H3 | H4 | EU | RA | O | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | 12 | 17 | 12 | 3 | 9 | | 2 | | 1 | 1 | 1 | | | | | | | | 12 | 15 | 19 | 104 |
| NX | | | 1 | | 1 | 1 | | | | | | | | | | | | | 1 | | 1 | 5 |
| N | 2 | 2 | | | 1 | | | 1 | | | | | 1 | 1 | 1 | 2 | 1 | | 18 | 4 | 3 | 37 |
| NH HW | 1 | | 1 | | | 2 | 1 | | | 1 | | | | | | 2 | | | 8 | 1 | 1 | 18 |
| H | 7 | 1 | | 1 | 2 | 1 | 1 | 1 | 1 | 1 | | 3 | | 11 | | 16 | 3 | 17 | 7 | 31 | 49 | 153 |
| HW | 2 | | | | | 2 | 1 | 2 | | 1 | | | | | | | | | 6 | 4 | 6 | 24 |
| W WA | | 1 | 1 | | | 3 | 11 | 1 | | | | | | | | | | | 1 | 4 | 6 | 28 |
| Sum | 24 | 21 | 15 | 4 | 13 | 9 | 16 | 5 | 2 | 4 | 1 | 3 | 1 | 12 | 1 | 20 | 4 | 17 | 53 | 59 | 85 | |

## Alphabetic list of species names with index to tables 2-9

Abbreviations: NUM = species number (table 2-9); So = soil preference; Hu = humidity preference; GR = species group; T = table number. For explanation see table 2-9, pp. 293-301.

| Species | NUM | So | Hu | GR | T |
|---|---|---|---|---|---|
| Abax carinatus (Duftschmid) | 245 | | 5 | RA | 9 |
| Abax parallelepipedus (Piller & Mitterpacher) | 91 | ll | | D3 | 5 |
| Abax parallelus (Duftschmid) | 94 | ll | 3 | D3 | 5 |
| Acupalpus brunnipes (Sturm) | 275 | | | RA | 9 |
| Acupalpus consputus (Duftschmid) | 273 | | 5 | RA | 9 |
| Acupalpus dubius Schilsky | 1 | pm | 5 | A1 | 2 |
| Acupalpus elegans (Dejean) | 281 | | | RA | |
| Acupalpus exiguus (Dejean | 136 | sc | 4 | H2 | 7 |
| Acupalpus flavicollis (Sturm) | 116 | ls | 5 | G2 | 6 |
| Acupalpus meridianus (L.) | 105 | li | | E1 | 6 |
| Acupalpus parvulus (Sturm) | 152 | ls | 5 | H2 | 7 |
| Agonum albipes (F.) | 140 | ls | 4 | H2 | 7 |
| Agonum assimile (Paykull) | 182 | | | EU | 8 |
| Agonum dorsale (Pontoppidan) | 174 | | | EU | 8 |
| Agonum ericeti (Panzer) | 5 | pm | | A1 | 2 |
| Agonum fuliginosum (Panzer) | 203 | | 2 | EU | 8 |
| Agonum gracile (Gyllenhal) | 66 | pm | | D1 | 5 |
| Agonum krynickii (Sperk) | 11 | pm | 4 | A1 | 2 |
| Agonum livens (Gyllenhal) | 82 | rc | 4 | D2 | 5 |
| Agonum marginatum (L.) | 158 | ls | | H4 | 7 |
| Agonum micans (Nicolai) | 262 | rc | 3 | RA | 9 |
| Agonum moestum (Duftschmid) | 129 | | 4 | G4 | 6 |
| Agonum muelleri (Herbst) | 221 | | | EU | 8 |
| Agonum munsteri (Hellen) | 230 | | 5 | RA | 9 |
| Agonum obscurum (Herbst) | 212 | | | EU | 8 |
| Agonum piceum (L.) | 264 | ls | 3 | RA | 9 |
| Agonum sexpunctatum (L.) | 24 | | | A1 | 2 |
| Agonum thoreyi Dejean | 144 | | 5 | H2 | 7 |
| Agonum versutum Sturm | 10 | ls | | A1 | 2 |
| Agonum viduum (Panzer) | 104 | | | E1 | 6 |
| Amara aenea (Degeer) | 204 | | | EU | 8 |
| Amara anthobia A. Villa & G.B. Villa | 6 | sa | 2 | B2 | 3 |
| Amara apricaria (Paykull) | 201 | | | EU | 8 |
| Amara aulica (Panzer) | 134 | | | H2 | 7 |
| Amara bifrons (Gyllenhal) | 109 | rc | | F1 | 6 |
| Amara brunnea (Gyllenhal) | 97 | sa | 2 | D3 | 5 |
| Amara communis (Panzer) | 225 | | | EU | 8 |
| Amara consularis (Duftschmid) | 52 | sa | 3 | B2 | 3 |
| Amara convexior Stephens | 189 | | 2 | EU | 8 |
| Amara convexiuscula (Marsham) | 154 | | | H3 | 7 |
| Amara cursitans (Zimmermann) | 240 | li | 1 | RA | 9 |
| Amara curta Dejean | 30 | sa | 2 | B1 | 3 |
| Amara equestris (Duftschmid) | 6 | sm | | A1 | 2 |
| Amara eyrinota (Panzer) | 42 | sa | 1 | B1 | 3 |
| Amara famelica Zimmermann | 131 | | | G4 | 6 |
| Amara familiaris (Duftschmid) | 200 | | | EU | 8 |
| Amara fulva (Mueller) | 64 | | | C1 | 4 |
| Amara fusca Dejean | 53 | | 3 | B2 | 3 |
| Amara infima (Duftschmid) | 22 | sa | 2 | A1 | 2 |
| Amara lucida (Duftschmid) | 40 | sa | 2 | B1 | 3 |
| Amara lunicollis Schioedte | 193 | | | EU | 8 |
| Amara majuscula Chaudoir | 142 | sc | | H2 | 7 |
| Amara montivaga Sturm | 67 | li | 2 | D1 | 5 |
| Amara nitida Sturm | 74 | lo | 2 | D1 | 5 |
| Amara ovata (F.) | 122 | | | G4 | 6 |
| Amara plebeja (Gyllenhal) | 211 | | | EU | 8 |
| Amara praetermissa (C.R. Sahlberg) | 103 | li | 2 | D3 | 5 |
| Amara pseudocommunis Burakowski | 98 | pm | 4 | D3 | 5 |
| Amara quenseli (Schoenherr) | 63 | | | C1 | 4 |
| Amara similata (Gyllenhal) | 132 | c | | H1 | 7 |
| Amara spreta Dejean | 179 | | | EU | 8 |
| Amara strenua Zimmermann | 261 | | 1 | RA | 9 |
| Amara tibialis (Paykull) | 61 | | | C1 | 4 |
| Anisodactylus binotatus (F.) | 135 | | | H2 | 7 |
| Anisodactylus nemorivagus (Duftschmid) | 12 | pm | 5 | A1 | 2 |
| Asaphidion flavipes (L.) | 177 | | | EU | 8 |
| Asaphidion pallipes (Duftschmid) | 110 | li | 2 | F1 | 6 |
| Badister anomalus (Perris) | 274 | | 3 | RA | 9 |
| Badister bullatus (Schrank) | 207 | | | EU | 8 |
| Badister dilatatus Chaudoir | 265 | pm | 5 | RA | 9 |
| Badister lacertosus Sturm | 192 | | | EU | 8 |
| Badister meridionalis Puel | 107 | rc | | E1 | 6 |
| Badister peltatus (Panzer) | 269 | | 4 | RA | 9 |
| Badister sodalis (Duftschmid) | 113 | | | F2 | 6 |
| Badister unipustulatus Bonelli | 106 | pm | | E1 | 6 |
| Bembidion aeneum Germar | 159 | ls | 5 | H4 | 7 |
| Bembidion argenteolum Ahrens | 166 | | | H4 | 7 |
| Bembidion assimile Gyllenhal | 145 | | | H2 | 7 |
| Bembidion biguttatum (F.) | 123 | rc | | G4 | 6 |
| Bembidion bipunctatum (L.) | 157 | | | H4 | 7 |
| Bembidion bruxellense Wesmael | 139 | | | H2 | 7 |
| Bembidion deletum Serville | 241 | li | 1 | RA | 9 |
| Bembidion dentelleum (Thunberg) | 124 | rc | 4 | G4 | 6 |
| Bembidion doris (Panzer) | 227 | | 5 | RA | 9 |
| Bembidion femoratum Sturm | 153 | | | H3 | 7 |
| Bembidion fumigatum (Duftschmid) | 146 | sc | | H2 | 7 |
| Bembidion genei Kuester | 100 | lo | 3 | D3 | 5 |
| Bembidion gilvipes Sturm | 73 | rc | 2 | D1 | 5 |
| Bembidion guttula (F.) | 181 | | | EU | 8 |
| Bembidion harpaloides Serville | 127 | c | | G4 | 6 |
| Bembidion humerale Sturm | 255 | pm | 5 | RA | 9 |
| Bembidion iricolor Bedel | 147 | sc | 5 | H2 | 7 |
| Bembidion lampros (Herbst) | 209 | | | EU | 8 |
| Bembidion laterale (Samouelle) | 284 | | 5 | RA | 9 |
| Bembidion lunatum (Duftschmid) | 279 | | | RA | 9 |
| Bembidion lunulatum (Fourcroy) | 150 | | 4 | H2 | 7 |

| Species | NUM | So | Hu | GR | T |
|---|---|---|---|---|---|
| Bembidion mannerheimi C.R. Sahlberg | 249 | pm | 5 | RA | 9 |
| Bembidion minimum (F.) | 160 | ls | 4 | H4 | 7 |
| Bembidion nigricorne Gyllenhal | 36 | pm | 2 | B1 | 3 |
| Bembidion normannum Dejean | 168 | | 4 | H4 | 7 |
| Bembidion obliquum Sturm | 282 | | 5 | RA | 9 |
| Bembidion obtusum Serville | 119 | li | | G3 | 6 |
| Bembidion pallidipenne (Illiger) | 173 | sa | 5 | H4 | 7 |
| Bembidion properans (Stephens) | 216 | | | EU | 8 |
| Bembidion quadrimaculatum (L.) | 155 | | | H3 | 7 |
| Bembidion quadripustulatum Serville | 280 | | | RA | 9 |
| Bembidion quinquestriatum Gyllenhal | 244 | rc | 3 | RA | 9 |
| Bembidion semipunctatum (Donovan) | 125 | rc | | G4 | 6 |
| Bembidion tetracolum Say | 176 | | | EU | 8 |
| Bembidion varium (Olivier) | 164 | ls | | H4 | 7 |
| Bembidion velox (L.) | 170 | sa | | H4 | 7 |
| Blethisa multipunctata (L.) | 231 | | 5 | RA | 9 |
| Brachinus crepitans (L.) | 75 | li | 2 | D1 | 5 |
| Bradycellus caucasicus (Chaudoir) | 186 | sm | | EU | 8 |
| Bradycellus csikii Laczo | 266 | | | RA | 9 |
| Bradycellus distinctus (Dejean) | 172 | sa | 4 | H4 | 7 |
| Bradycellus harpalinus (Serville) | 210 | sm | | EU | 8 |
| Bradycellus ruficollis (Stephens) | 15 | pm | | A1 | 2 |
| Bradycellus sharpi Joy | 83 | lo | 4 | D2 | 5 |
| Bradycellus verbasci (Duftschmid) | 112 | | | F2 | 6 |
| Broscus cephalotes (L.) | 47 | | 2 | B2 | 3 |
| Calathus ambiguus (Paykull) | 25 | sa | | B1 | 3 |
| Calathus cinctus Motschulsky | 56 | sm | 2 | B2 | 3 |
| Calathus erratus (C.R. Sahlberg) | 199 | sm | | EU | 8 |
| Calathus fuscipes (Goeze) | 222 | | | EU | 8 |
| Calathus melanocephalus (L.) | 219 | sm | | EU | 8 |
| Calathus micropterus (Duftschmid) | 59 | sa | 2 | B2 | 3 |
| Calathus mollis (Marsham) | 65 | sa | | C1 | 4 |
| Calathus rotundicollis Dejean | 184 | | | EU | 8 |
| Calosoma inquisitor (L.) | 256 | | 3 | RA | 9 |
| Carabus arvensis Herbst | 3 | pm | | A1 | 2 |
| Carabus auratus L. | 87 | li | 2 | D2 | 5 |
| Carabus auronitens F. | 252 | lo | 5 | RA | 9 |
| Carabus cancellatus Illiger | 16 | pm | | A1 | 2 |
| Carabus clathratus L. | 228 | | 5 | RA | 9 |
| Carabus convexus F. | 246 | li | 2 | RA | 9 |
| Carabus coriaceus L. | 84 | ll | 2 | D2 | 5 |
| Carabus granulatus L. | 118 | | | G2 | 6 |
| Carabus monilis F. | 85 | ll | 2 | D2 | 5 |
| Carabus nemoralis Mueller | 187 | | | EU | 8 |
| Carabus nitens L. | 7 | pm | | A1 | 2 |
| Carabus problematicus Herbst | 102 | | | D3 | 5 |
| Carabus violaceus L. | 92 | ll | 2 | D3 | 5 |
| Chlaenius nigricornis (F.) | 138 | | | H2 | 7 |
| Chlaenius tristis (Schaller) | 277 | | 5 | RA | 9 |
| Chlaenius vestitus (Paykull) | 271 | rc | 5 | RA | 9 |
| Cicindela campestris L. | 21 | pm | | A1 | 2 |
| Cicindela germanica L. | 229 | | | RA | 9 |
| Cicindela hybrida L. | 27 | | 1 | B1 | 3 |
| Cicindela maritima Latreille & Dejean | 239 | | | RA | 9 |
| Cicindela sylvatica L. | 45 | | | B1 | 3 |
| Clivina collaris (Herbst) | 62 | | | C1 | 4 |
| Clivina fossor (L.) | 205 | | | EU | 8 |
| Cychrus caraboides (L.) | 88 | lo | 2 | D3 | 5 |
| Cymindis humeralis (Fourcroy) | 39 | sa | 2 | B1 | 3 |
| Cymindis macularis Fischer von Waldheim | 37 | sa | 1 | B1 | 3 |
| Cymindis vaporariorum (L.) | 9 | pm | | A1 | 2 |
| Demetrias atricapillus (L.) | 120 | li | | G4 | 6 |
| Demetrias monostigma Samouelle | 28 | sa | 1 | B1 | 3 |
| Dicheirotrichus gustavi Crotch | 161 | ls | 5 | H4 | 7 |
| Dicheirotrichus obsoletus (Dejean) | 171 | sc | 4 | H4 | 7 |
| Dromius agilis (F.) | 101 | lo | 2 | D3 | 5 |
| Dromius angustus Brulle | 232 | | 1 | RA | 9 |
| Dromius linearis (Olivier) | 196 | | 2 | EU | 8 |
| Dromius melanocephalus Dejean | 217 | | | EU | 8 |
| Dromius quadrimaculatus (L.) | 108 | rc | | E1 | 6 |
| Dromius quadrisignatus (Dejean) | 258 | | 3 | RA | 9 |
| Dromius sigma (Rossi) | 263 | | | RA | 9 |
| Dromius spilotus (Illiger) | 29 | | 2 | B1 | 3 |
| Dyschirius aeneus (Dejean) | 272 | rc | 5 | RA | 9 |
| Dyschirius angustatus (Ahrens) | 242 | li | 1 | RA | 9 |
| Dyschirius chalceus Erichson | 285 | | 5 | RA | 9 |
| Dyschirius globosus (Herbst) | 206 | | | EU | 8 |
| Dyschirius luedersi Wagner | 148 | ls | | H2 | 7 |
| Dyschirius nitidus (Dejean) | 283 | sc | 5 | RA | 9 |
| Dyschirius obscurus (Gyllenhal) | 163 | | 5 | H4 | 7 |
| Dyschirius politus (Dejean) | 156 | | | H3 | 7 |
| Dyschirius salinus Schaum | 162 | ls | 5 | H4 | 7 |
| Dyschirius thoracicus (Rossi) | 165 | | | H4 | 7 |
| Elaphrus cupreus Duftschmid | 149 | ls | 5 | H2 | 7 |
| Elaphrus riparius (L.) | 151 | | | H2 | 7 |
| Elaphrus uliginosus F. | 128 | ls | | G4 | 6 |
| Epaphius secalis (Paykull) | 81 | rc | 3 | D2 | 5 |
| Harpalus affinis (Schrank) | 213 | | | EU | 8 |
| Harpalus anxius (Duftschmid) | 54 | sa | 1 | B2 | 3 |
| Harpalus attenuatus Stephens | 68 | li | 1 | D1 | 5 |
| Harpalus calceatus (Duftschmid) | 250 | | | RA | 9 |
| Harpalus dimidiatus (Rossi) | 76 | li | 2 | D1 | 5 |
| Harpalus distinguendus (Duftschmid) | 48 | sa | 2 | B2 | 3 |
| Harpalus flavescens (Piller & Mitterpacher) | 237 | | 1 | RA | 9 |
| Harpalus froehlichi Sturm | 57 | sa | 3 | B2 | 3 |
| Harpalus griseus (Panzer) | 268 | | 3 | RA | 9 |
| Harpalus honestus (Duftschmid) | 259 | | 1 | RA | 9 |
| Harpalus latus (L.) | 19 | | | A1 | 2 |
| Harpalus luteicornis (Duftschmid) | 234 | | 2 | RA | 9 |

| Species | NUM | So | Hu | GR | T |
|---|---|---|---|---|---|
| Harpalus melancholicus Dejean | 236 | | 1 | RA | 9 |
| Harpalus neglectus Serville | 44 | sa | 1 | B1 | 3 |
| Harpalus picipennis (Duftschmid) | 41 | | 1 | B1 | 3 |
| Harpalus quadripunctatus Dejean | 90 | pm | 4 | D3 | 5 |
| Harpalus rubripes (Duftschmid) | 70 | li | 2 | D1 | 5 |
| Harpalus rufipalpis Sturm | 58 | lo | 2 | B2 | 3 |
| Harpalus rufipes (Degeer) | 223 | | | EU | 8 |
| Harpalus serripes (Quensel) | 235 | | 1 | RA | 9 |
| Harpalus servus (Duftschmid) | 32 | sa | 1 | B1 | 3 |
| Harpalus smaragdinus (Duftschmid) | 55 | sa | 2 | B2 | 3 |
| Harpalus solitaris Dejean | 20 | sm | | A1 | 2 |
| Harpalus tardus (Panzer) | 175 | | 2 | EU | 8 |
| Harpalus vernalis (Duftschmid) | 33 | sa | 1 | B1 | 3 |
| Harpalus xanthopus Gemmiger & Harold | 34 | sa | 2 | B1 | 3 |
| Laemostenus terricola (Herbst) | 49 | | 2 | B2 | 3 |
| Lasiotrechus discus (F.) | 137 | sc | | H2 | 7 |
| Lebia chlorocephala (Hoffmann) | 78 | | 2 | D1 | 5 |
| Lebia cruxminor (L.) | 248 | li | 1 | RA | 9 |
| Leistus ferrugineus (L.) | 198 | | 2 | EU | 8 |
| Leistus fulvibarbis Dejean | 80 | | | D2 | 5 |
| Leistus rufomarginatus (Duftschmid) | 99 | | | D3 | 5 |
| Leistus spinibarbis (F.) | 50 | | 2 | B2 | 3 |
| Leistus terminatus (Hellwig) | 197 | | | EU | 8 |
| Loricera pilicornis (F.) | 224 | | | EU | 8 |
| Masoreus wetterhali (Gyllenhal) | 35 | sa | 2 | B1 | 3 |
| Microlestes maurus (Sturm) | 260 | | 3 | RA | 9 |
| Microlestes minutulus (Goeze) | 233 | li | 2 | RA | 9 |
| Miscodera arctica (Paykull) | 8 | | | A1 | 2 |
| Molops piceus (Panzer) | 95 | lo | 3 | D3 | 5 |
| Nebria brevicollis (F.) | 226 | | | EU | 8 |
| Nebria livida (L.) | 143 | | | H2 | 7 |
| Nebria salina Fairmaire & Laboulbene | 51 | sm | | B2 | 3 |
| Notiophilus aesthuans (Motschulsky) | 17 | pm | | A1 | 2 |
| Notiophilus aquaticus (L.) | 180 | pm | | EU | 8 |
| Notiophilus biguttatus (F.) | 220 | | | EU | 8 |
| Notiophilus germinyi Fauvel | 38 | sm | 2 | B1 | 3 |
| Notiophilus palustris (Duftschmid) | 214 | | | EU | 8 |
| Notiophilus rufipes Curtis | 89 | | | D3 | 5 |
| Notiophilus substriatus Waterhouse | 26 | | | B1 | 3 |
| Odacantha melanura Paykull | 276 | sc | 4 | RA | 9 |
| Olistophus rotundatus (Paykull) | 13 | pm | | A1 | 2 |
| Omophron limbatum (F.) | 121 | sa | | G4 | 6 |
| Oodes helopioides (F.) | 117 | | 4 | G2 | 6 |
| Ophonus azureus (F.) | 267 | li | 3 | RA | 9 |
| Ophonus cordatus (Duftschmid) | 43 | sa | 1 | B1 | 3 |
| Ophonus melleti Heer | 77 | li | 2 | D1 | 5 |
| Ophonus nitidulus Stephens | 251 | li | 2 | RA | 9 |

| Species | NUM | So | Hu | GR | T |
|---|---|---|---|---|---|
| Ophonus puncticeps Stephens | 69 | li | 2 | D1 | 5 |
| Ophonus puncticollis (Paykull) | 247 | li | 2 | RA | 9 |
| Ophonus rufibarbis (F.) | 71 | rc | 2 | D1 | 5 |
| Ophonus rupicola Sturm | 115 | | 4 | G1 | 6 |
| Panagaeus bipustulatus (F.) | 31 | sa | 2 | B1 | 3 |
| Panagaeus cruxmajor (L.) | 130 | | | G4 | 6 |
| Parophonus maculicornis (Duftschmid) | 72 | li | 1 | D1 | 5 |
| Patrobus atrorufus (Stroem) | 114 | rc | 4 | F2 | 6 |
| Pogonus chalceus (Marsham) | 167 | ls | 5 | H4 | 7 |
| Pogonus luridipennis (Germar) | 169 | ls | 5 | H4 | 7 |
| Pterostichus anthracinus (Illiger) | 126 | sc | | G4 | 6 |
| Pterostichus aterrimus (Herbst) | 4 | pm | 5 | A1 | 2 |
| Pterostichus cristatus (Dufour) | 253 | lo | 3 | RA | 9 |
| Pterostichus cupreus (L.) | 133 | sc | | H2 | 7 |
| Pterostichus diligens (Sturm) | 2 | | | A1 | 2 |
| Pterostichus gracilis (Dejean) | 257 | | 3 | RA | 9 |
| Pterostichus lepidus (Leske) | 14 | pm | | A1 | 2 |
| Pterostichus macer (Marsham) | 254 | | | RA | 9 |
| Pterostichus madidus (F.) | 86 | ll | 2 | D2 | 5 |
| Pterostichus melanarius (Illiger) | 178 | | | EU | 8 |
| Pterostichus minor (Gyllenhal) | 23 | | 4 | A1 | 2 |
| Pterostichus niger (Schaller) | 218 | | | EU | 8 |
| Pterostichus nigrita (Paykull) | 185 | | | EU | 8 |
| Pterostichus oblongopunctatus (F.) | 93 | | | D3 | 5 |
| Pterostichus quadrifoveolatus Letzner | 60 | sm | | B2 | 3 |
| Pterostichus strenuus (Panzer) | 208 | | | EU | 8 |
| Pterostichus vernalis (Panzer) | 215 | | | EU | 8 |
| Pterostichus versicolor (Sturm) | 194 | sm | | EU | 8 |
| Stenolophus mixtus (Herbst) | 141 | | | H2 | 7 |
| Stenolophus skrimshiranus Stephens | 278 | sc | 5 | RA | 9 |
| Stenolophus teutonus (Schrank) | 238 | | 4 | RA | 9 |
| Stomis pumicatus (Panzer) | 79 | | | D2 | 5 |
| Syntomus foveatus (Fourcroy) | 202 | | | EU | 8 |
| Syntomus truncatellus (L.) | 183 | sa | 2 | EU | 8 |
| Synuchus vivalis (Illiger) | 188 | | | EU | 8 |
| Tachys parvulus (Dejean) | 243 | li | 1 | RA | 9 |
| Trechoblemus micros (Herbst) | 195 | | | EU | 8 |
| Trechus obtusus Erichson | 190 | | | EU | 8 |
| Trechus quadristriatus (Schrank) | 191 | | | EU | 8 |
| Trechus rubens (F.) | 270 | ls | | RA | 9 |
| Trichocellus cognatus (Gyllenhal) | 18 | pm | | A1 | 2 |
| Trichocellus placidus (Gyllenhal) | 111 | | | F2 | 6 |
| Trichotichnus nitens (Heer) | 96 | lo | 2 | D3 | 5 |