Flight periods of Scirtidae (Coleoptera) based on weekly samples from a malaise trap

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Abstract: A malaise trap in the nature reserve "De Brand" near Udenhout (The Netherlands) was operated from 17 March till 24 November 1990. Weekly samples resulted in 4690 specimens of Scirtidae (Coleoptera) in 9 species. *Cyphon variabilis, C. phragmiteticola* and *Scirtes hemisphaericus* occurred in low numbers. Flight activity, sex-ratio and presence of mature eggs in relationship with the life cycle were analysed for the more abundant species *Cyphon padi, C. pubescens, C. coarctatus, C. ochraceus, C. hilaris* and *Microcara testacea.*

The differences in flight periods for the Scirtidae species together with the occurrence of ripe eggs in females indicate an univoltine life cycle for all abundant species. Hibernation as adult seems to be the normal strategy for *Cyphon padi* and *C. pubescens*, while hibernation as larvae is the normal stategy for *C. coarctatus, C. hilaris, C. ochraceus* and *Microcara testacea.* The flight periods of Scirtidae in The Netherlands do not significantly differ from those in Scandinavia.

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Introduction

Scirtidae (Helodidae), a small and neglected family of semi-aquatic beetles, are represented in Western Europe by about 25 species (Lucht, 1987) with 16 species known from The Netherlands (Drost et al., 1992). The adults live terrestrial, while the five larval instars are aquatic. Some genera (*Hydrocyphon, Helodes*) are mainly confined to shaded running waters, while others (*Cyphon, Microcara, Scirtes*) are confined to stagnant waters. *Scirtes* most often occurs along the edges of permanent, eutrophic waters, while most *Cyphon* species and *Microcara* are frequently encountered in shallow, temporary waters with an abundant emergent vegetation of *Carex, Phragmites, Typha* or *Glyceria maxima* (Hartman) Holmberg and soils covered by coarse organic debris of these plants. Also temporary waters heavily shaded by *Salix, Alnus* or *Populus* form a suitable habitat for many species. The larvae of the Scirtidae feed on small organic particles which have been sedimented on soil or vegetation. *Prionocyphon serricornis* (Müller) is the only Central European beetle known to inhabit temporary waters in hollow trees (phytotelmen) (Klausnitzer, 1984).

The present paper deals with the flight activity, sex-ratio and presence of mature eggs in relationship with the life cycle of Scirtidae collected with a malaise trap.

Description of sampling locality and methods

The material was collected by means of a malaise trap which was emptied at weekly intervals from 17 March till 24 November 1990.

The south orientated malaise trap was put up in a wet grassland on the north-eastern bank of a ditch in the nature reserve "De Brand", about 1 km north of Udenhout (province of Noord-Brabant, The Netherlands (UTM FT 476,225). This ditch dried up in August. A second ditch was situated at a distance of 5 m from the first in a western direction. The vegetation in these ditches mainly consisted of *Hottonia palustris* L. and *Ranunculus peltatus* Schrank. The borders of the ditches and the grassland consisted of a rich meso/eutrafent vegetation of *Carex nigra* (L.) Reichard, *C. elata* All., *C. curta* Good., *Juncus effusus* L., *J. conglomeratus* L., *J. bulbosus* L.,

J. acutiflorus Ehrh. ex Hoffm., *Glyceria fluitans* (L.) R. Br., *Cirsium palustre* (L.) Scop., *Mentha aquatica* L., *Lycopus europaeus* L., *Rumex hydrolapathum* Hudson, *Oenanthe aquatica* (L.) Poiret, *Alisma plantago-aquatica* L. and *Lotus uliginosus* Schkuhr. Within 50 m distance from the trap the following main vegetation types were present: marshlands with dominance of *C. elata* and *Solanum dulcamara* L., reed marshes, hay-fields, willow (*Salix cinerea* L.) brushwoods and deciduous forests with dominance of *Quercus robur* L., *Betula pendula* Roth and *Alnus glutinosa* (L.) Gaertner. Especially the presence of ditches and marshlands, in which the larval instars grow up, explains the great number of Scirtidae trapped during the survey.

The beetles were dissected for identification under low (40-80 ×) magnification. Number of specimens, sex and presence/absence of mature eggs were recorded.

Identification

A reliable identification of the adults of Scirtidae is possible with most keys since the publication of Nyholm (1955), which gives figures of male and female genitalia of Western European species. Keys relying entirely on external morphological characters are not usefull as some members of the genera *Cyphon, Helodes* and *Scirtes* are nearly indistinguishable on the basis of these characters. For the identification of adults of the genus *Cyphon* the keys of Nyholm (1955, 1972), Wiebes & Wiebes-Rijks (1964) and Klausnitzer (1971), which give figures of both male and female genitalia of all species, are strongly recommended. Both species of *Scirtes* can be identified with Drake (1987).

The identification of larvae of the Scirtidae is problematic. Till now only keys to the genera are available (e.g. Klausnitzer, 1975, 1984) and even these enable only the identification of the last instar larva, which can not be separated from younger instars. For population and life-cycle studies of *Cyphon* and *Helodes*, with often more than one species on a locality, keys to the larvae are urgently needed.

Results

The results of the weekly catches of Scirtidae in the malaise trap are presented in figures 1-8. The sequence of the treated species follows the checklist in Drost et al. (1992). In total 4690 Scirtidae, comprising nine species, were collected between 17 March and 24 November.

Microcara testacea (Linnaeus)

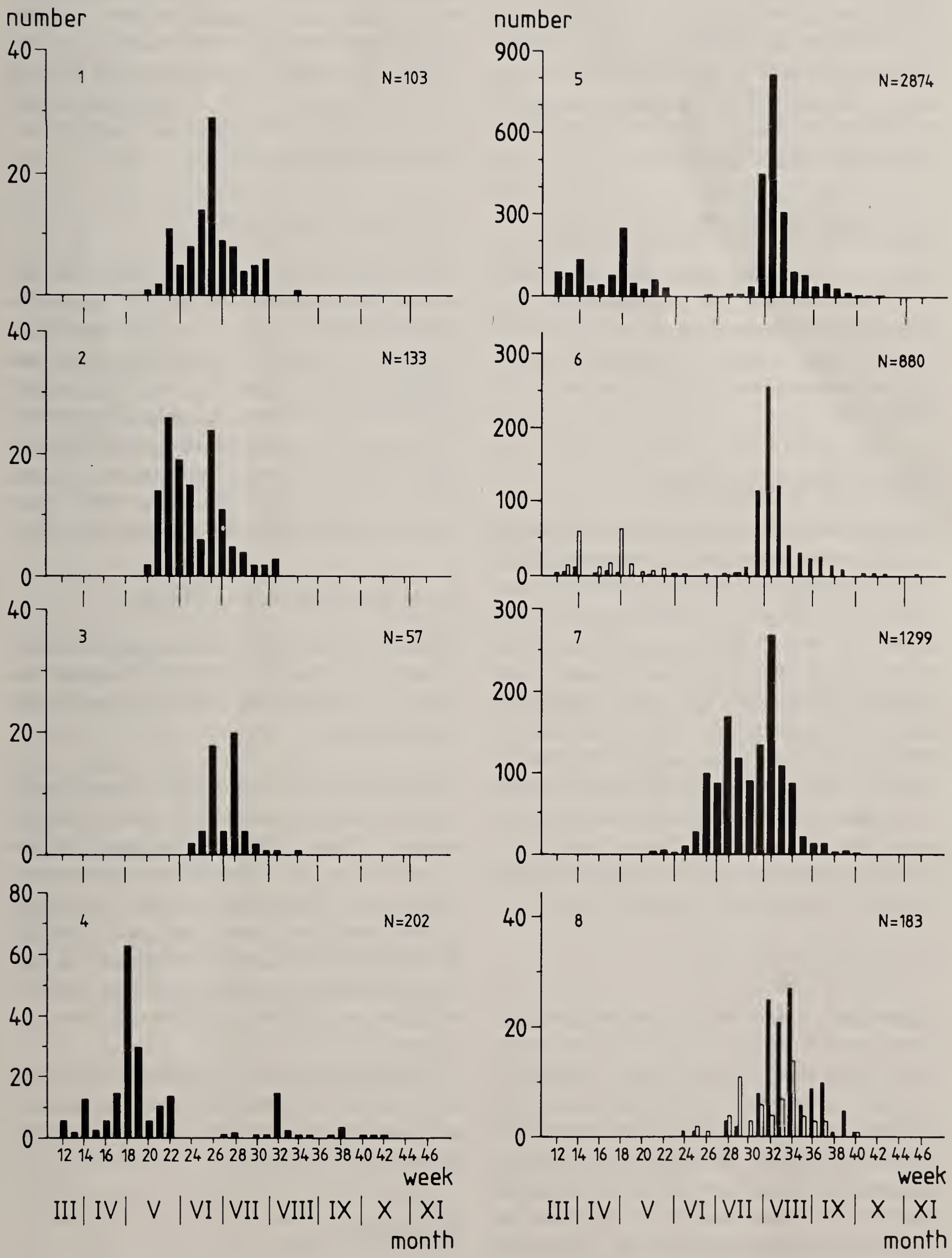
The only Western European member of the genus *Microcara* showed a flight period of about two and a half month from the end of May till the first week of August, with a peak in week 26 (fig. 1). There was hardly any difference in flight period between males and females, though the outliers were only males. Males were nearly four times as numerous as females. Three quarter of the females of *M. testacea* were carrying ripe eggs in their ovaries.

Cyphon coarctatus Paykull

The flight period of *Cyphon coarctatus* lasted from mid May till the beginning of August, with relatively high numbers from the start till the beginning of July (fig. 2). Remarkably, the flight consisted of males only, except for one female without eggs in week 22 and one female with ripe eggs in week 27. *Cyphon coarctatus* and *M. testacea* showed more or less the same flight period and were caught in approximately equal numbers.

Cyphon ochraceus Stephens

Cyphon ochraceus showed a flight period from mid June till the end of July with some outliers till the end of August (fig. 3). Two distinct flight peaks occurred in respectively week 26 and 28. Very remarkably the flight consisted of males only. The maxima in the flight period of *C. ochraceus* fell in the same period as the flight of *C. coarctatus* and *M. testacea*, but the start was about one month later.



Figs 1-8. Weekly catches of Scirtidae from the malaise trap at Udenhout during 1990. 1, *Microcara testacea*; 2, *Cyphon coarctatus*; 3, *Cyphon ochraceus*; 4, *Cyphon pubescens*; 5, *Cyphon padi*; 6, females of *Cyphon padi*; 7, *Cyphon hilaris*; 8, females of *Cyphon hilaris* (black bars: females without eggs; white bars: females with mature eggs).

Cyphon variabilis (Thunberg)

The number of specimens for *Cyphon variabilis* was only twelve (5 ♂♂, 7 ♀♀). A distinct flight period could not be deduced from such small numbers. Most specimens occurred however till the beginning of May. Only one specimen was taken in autumn.

Cyphon phragmiteticola Nyholm

Only seven specimens of *Cyphon phragmiteticola* were taken till the beginning of May, with, in addition, one male in week 26 and a further female in week 35. Again no distinct flight period could be deduced from the observations.

Cyphon pubescens (Fabricius)

Cyphon pubescens showed a distinct flight period from the start of the experiment till the end of May with a maximum in the first two weeks of May (fig. 4). From the beginning of July till the end of October *C. pubescens* occurred in very low numbers with a peak in the beginning of August. The total number of males was twice the total number of females during the main flight period; for the remainder of the year the abundancies of males and females were equal. During the first flight period nearly all females carried well developed eggs, while during the second the females had undeveloped ovaries without eggs.

Cyphon padi (Linnaeus)

Cyphon padi was the most abundant species of Scirtidae in the samples with 2874 specimens. The species was collected during the whole sampling period, with two distinct peaks (figs 5-6). The first flight period lasted from the start of the sampling till the end of May with a maximum in the first week of May. During this flight period about one third of the total numbers of *C. padi* was collected. The second flight period lasted from the end of July till the end of September with maximum numbers in the first decade of August. Also in this species the number of males was twice the number of females. This sex-ratio existed during the whole year, except for late summer and autumn when the sex-ratio was nearly 1 : 1. During the first flight period nearly all females carried ripe eggs in their ovaries, while in the second flight period females had undeveloped ovaries without eggs (fig. 6).

Cyphon hilaris Nyholm

With 1299 specimens *Cyphon hilaris* was the second most abundant of the Scirtidae in the survey. One flight period from mid June till the end of August without a distinct peak was observed in this species (figs 7-8). The number of males was five times as high as the number of females. The number of females without eggs was twice the number of females with well developed eggs; flight periods, however, were the same for both groups of females (fig. 8).

Scirtes hemisphaericus (Linnaeus)

One female with well developed eggs was taken in week 31 (28.vii-4.viii.1990). Probably this refers to an accidental dispersal outside the normal habitat.

The flight periods for Scirtidae showed considerable overlap between some species and gaps between others. From the beginning of the survey till the end of September two or more species were present in the samples; after September hardly any scirtid was taken. The different flight periods, with a maximum of four species occurring together from mid May till mid July, is a reflection of their different life histories.

The sex-ratio varied considerably between all common Scirtidae in the samples, but always with a surplus of males (ratio's from two till infinite).

Discussion

Information on capacity for flight, phenology, life-cycle and sex-ratio of Scirtidae in literature is scarce and quite often based on few obser-

vations. Due to lack of data on larvae and larval development, sex-ratio's of emerging adults and the behaviour of adults, only part of the problems involved with the description of life histories and life strategies of Scirtidae can be answered.

A normal sex-ratio of 1 : 1 for emerging adult Scirtidae is assumed as no data contradicting to this assumption could be found. Wiebes & Wiebes-Rijks (1964), who give comprehensive, semi-quantitative data on phenology of Dutch *Cyphon* species, do not mention differences in sex-ratio. Their data are separated in two categories: males and females without eggs, and females with eggs. Striking differences in sex-ratio's in their material, which was based on several museum and private collections, and therefore on diverse sampling techniques, certainly would have been noticed. Nyholm (1972) also assumed a sex-ratio of 1 : 1 in *Cyphon*-populations. He found a surplus of males in net-samples and a surplus of females in samples collected by "trampling down". In his opinion females live more hidden between the low vegetation and on the soil, while males are found more often in the vegetation. Scirtidae from the malaise trap showed strikingly different sex-ratio's from 2 : 1 for most species upto nearly infinite for *C. ochraceus*. A more hidden way of living for females of *Cyphon* and *Microcara*, close to their oviposition sites, seems a logical explanation for the aberrant sex-ratio's. It also proves that the males are more active flyers in all species and suggests that males actively search for partners, while females most often stay near the breeding places. For all species (except *C. ochraceus*), however, females with mature eggs were taken in the malaise trap and dispersal and colonization of new habitats by flight seems more or less possible for all species. The colonization power of the *Cyphon*-species will certainly depend on the flight capacity of females with mature eggs and this might explain why *C. hilaris* and *C. ochraceus* belong to the rarer species in The Netherlands. However, *Cyphon coarctatus* (with only two females in the malaise trap) is a common species. Aberrant sex-ratio's based on a certain sampling technique, and therefore caused by different behaviour between males and females, are known in many beetles, e.g. click-beetles (Elateridae) (Leseigneur, 1972). Also loss of or a reduced flight capacity due to wing muscle reduction during the development of eggs can explain these sex-ratio's.

Wiebes & Wiebes-Rijks (1964) for The Netherlands and Nyholm (1972) for Scandinavia present data on the catches of Scirtidae based on different sampling techniques. Data are presented respectively as semi-quantitative catches per month and as numbers per month (per half month in the summer period) for Denmark, Norway, Sweden and Finland. A comparison of the phenology of Scirtidae of these studies with the present shows that:

1. In the present study *C. padi* starts its activity much earlier than in both other studies; the summer minimum in the present study has not been observed by Wiebes & Wiebes-Rijks (1964). Low collector's activity during spring and high activity during summer may explain these differences better than differences in method or activity of *C. padi* themselves.
2. Activity periods of *Cyphon* fairly well agree in all three studies despite different methods. A slightly earlier start of the activity period (of about two weeks) in the present study compared with the Scandinavian data is however indicated. The end of the flight period, however, agrees more or less with these data.

Nilsson (1980) presents data from light- and malaise traps in northern Sweden. The most striking difference is the start of the flight period of *Microcara testacea* at the end of June, a month later than in The Netherlands; the end of the flight period is, however, the same.

Based on the observed flight periods and the occurrence of mature eggs in females it can be concluded that hibernation as adults is the normal strategy for *C. padi* and *C. pubescens*. This is also the normal strategy for *C. variabilis* and *C. phragmiteticola* (Wiebes & Wiebes-Rijks, 1964; Nyholm, 1972; Nilsson, 1980; Klausnitzer, 1984; personal observations), though the number of observations from the malaise trap is rather low for this conclusion. Hibernation as larvae is the normal strategy for the remaining species of *Cyphon, Micro-*

cara testacea and *Scirtes hemisphaericus*. Nyholm (1972) mentioned *C. hilaris* as probably hibernating in the adult stage in The Netherlands referring to two adult specimens taken in February and March mentioned by Wiebes & Wiebes-Rijks (1964). The large number of specimens of *C. hilaris* in the present study during only the summer period strongly suggest that the observations in spring are incidentally. The position of *S. hemisphaericus* in this group is based on personal observations of adults mainly in July, small larvae in autumn and winter and large larvae in early summer.

The observed abundancy curves for all species were rather smooth. Large gaps or peaks within flight periods hardly occurred or, when they occurred, did not coincide with other species. For this reason the influence of the weather conditions on the actual flight moments of the Scirtidae were not further examined. Besides that, the trap was emptied weekly, while the weather conditions are presented in decades (KNMI, 1991), so even on this basis both datasets do not completely coincide. The actual flight moments can only be deduced from daily measurements of weather conditions and daily emptying of the traps. Separation of day and night catches is then advisable.

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References

DRAKE, C. M., 1987. Taxonomic and ecological notes on British Scirtes (Coleoptera: Scirtidae). – *Entomologist's Gaz.* 38: 83-85.

DROST, M. B. P., H. P. J. J. CUPPEN, E. J. VAN NIEUKERKEN & M. SCHREIJER, 1992. *De waterkevers van Nederland (Coleoptera):* 1-280. Uitgeverij KNNV, Utrecht.

KLAUSNITZER, B., 1971. Beiträge zur Insekten-Fauna der DDR: Coleoptera-Helodidae. 17. Beitrag zur Kenntnis der Helodidae. – *Beitr. Ent.* 21: 477-494.

KLAUSNITZER, B., 1975. Zur Kenntnis der Larven der mitteleuropäischen Helodidae (22. Beitrag zur Kenntnis der Helodidae) (Col. Helodidae). – *Dt. ent. Z. (N.F.)* 22: 61-65.

KLAUSNITZER, B., 1984. Käfer im und am Wasser. – *Neue Brehm Büch.* 567: 1-148.

KNMI, 1991. Het weer jaar 1990. – *Jaaroverzicht van het weer in Nederland* 87 (13): 1-10.

LESEIGNEUR, L., 1972. Coléoptères Elateridae de la faune de France continentale et de Corse. – *Bull. mens. Soc. linn. Lyon* 41 (Suppl.): 1-379.

LUCHT, W. H., 1987. *Die Käfer Mitteleuropas, Katolog:* 1-342. Goecke & Evers, Krefeld.

NILSSON, A. N., 1980. Utbredning och flygperiodik hos Helodidae vid norra Ångermanlandskusten. – *Ent. Tidskr.* 101: 151-153.

NYHOLM, T., 1955. Die mitteleuropäischen Arten der Gattung Cyphon Payk. In: *Faunistik der mitteleuropäischen Käfer*, iv (A. Horion ed.): 251-267. Ent. Arb. Mus. Frey, Sonderband.

NYHOLM, T., 1972. Die nordeuropäischen Arten der Gattung Cyphon Paykull (Coleoptera). Taxonomie, Biologie, Ökologie und Verbreitung. – *Ent. scand.* (Suppl.) 3: 1-100.

WIEBES, J. T. & A. A. WIEBES-RIJKS, 1964. De Nederlandse soorten van het genus Cyphon Paykull (Coleoptera, Helodidae). – *Zool. Bijdr.* 7: 1-16.

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