# A two-year survey of Trichoptera caught on light in the Kaaistoep (The Netherlands)

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**KEYWORDS**
**Dispersion, flight distance, life cycle**

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**A screen and light source were operated at a fixed place in the Kaaistoep, a nature reserve near the city of Tilburg (province Noord-Brabant, The Netherlands). Some 75 nights per year have been spent catching insects by hand, and among these many caddis flies (Trichoptera). We collected and identified caddis flies during 2005 and 2006. In both years together more than 16,000 specimens were caught, comprising 52 species, including quite some rare and unexpected species. Flight periods could be constructed, which sometimes showed great difference between the two years. Weather conditions are likely to be responsible for these differences.**

## Introduction

Trichoptera are being trapped on light all over the world. Light-trapping reveals information on distribution patterns and life cycles of the species caught. In most cases the traps consist of a lamp and a container with some fluid, that kills the animals attracted by the light. Continuous light trapping of Trichoptera over a period of eighteen years has been reported from Great Britain (Crichton 1984), as part of the famous Rothamstead Insect Survey, which started in 1964. Many other studies comprised the flight period of one year (e.g., Mey 1981, Armitage & Tennessen 1984, Harris *et al.* 1984, Van Kleef & Esselink 2004, Waringer & Graf 2006, and many more). Numerous investigations comprise shorter periods.

Lepidopterologists mostly use a vertical white screen with a strong lamp. The advantage is twofold. Most moths can be recognized without killing them and the time of arrival per species can be observed and related to the momentary weather conditions. It is necessary to inspect the screen regularly, which can be very exciting, but is also time-consuming. Light traps with a killing fluid, however, are installed, left overnight and emptied the next morning.

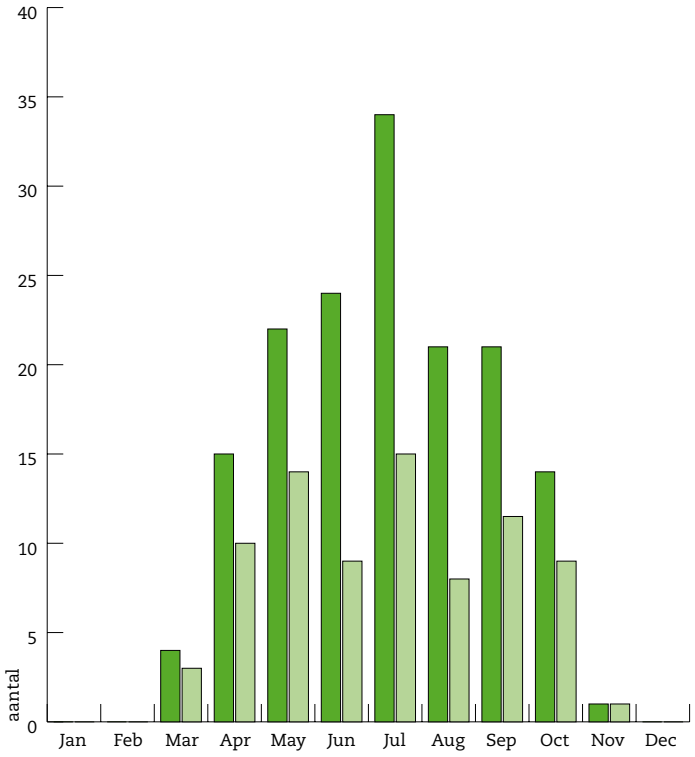
Starting in 2004 Trichoptera were preserved incidentally, when caught in the Kaaistoep on the illuminated screen. In 2005 and 2006 Trichoptera have been collected systematically (this paper), and collection is ongoing since then.

## Study area

The area called the Kaaistoep lies immediately west of the town of Tilburg, province Noord-Brabant, in the south of The Netherlands (at ca. 5°01'E and 51°31.5'N). It belongs to TWM Gronden BV (= Tilburg Water Company). This formerly agricultural area is being developed (since 1994) to become a more varied natural landscape. The section Tilburg of the Royal Dutch Natural History Society (KNNV) is monitoring the flora and fauna of the area since 1995 to follow the developments and possible changes (Van Wielink 1999). The western part of the Kaaistoep is the site of our research. The light source was placed at about 20 m in front of a row of oaks and other deciduous trees and shrubs. To the east there is a neglected open grassland on poor sandy soil, crossed by straight rows of deciduous trees and shrubs. Here four artificial small pools were dug in the autumn of 1994 and a bigger one (the Prikven) of about 1 ha in 1998. About 700 m to the east of the light source, the Kaaistoep-west is bordered by a little canalized lowland brook, the Oude Leij. In December 2005 this brook has been partially restored into a more or less natural condition (the restored Oude Leij). To the west and north of the light source big areas of coniferous wood are situated and in the south the Kaaistoep is next to a motorway


**1.** The study area in the western part of the Kaaistoep. Numbers 1-4 indicate ponds. At 5 three flight interception screens (lines) were operational for more than two years.
**1.** Het westelijk gedeelte van de Kaaistoep, waar het onderzoek plaatsvond. 1-4 zijn poelen. Bij 5 stonden drie raamvallen, die meer dan twee jaar operationeel waren. © Topografische Dienst


**2.** The screen with lights in operation (a), as well as the first author (b). Photos: Paul van Wielink.
**2.** Het scherm met lampen in werking (a), evenals de eerste auteur (b).




**3.** Number of Trichoptera sampling nights 'on light' in the Kaaistoep. In 2005 and 2006 sampling was done on 155 nights in total (dark green). Of these more than half (81) were quantitative (>90% of specimens found was collected) (light green).
**3.** Aantal avonden waarop Trichoptera-waarnemingen zijn gedaan 'op licht' in de Kaaistoep. In 2005 en 2006 werd in totaal op 155 avonden waargenomen (donkergroen). In meer dan de helft van de gevallen (81x) werd het materiaal kwantitatief verzameld (>90% van de waargenomen exemplaren) (lichtgroen).

connecting Tilburg and Breda (A58) (figure 1). The river Meuse is about 20 km to the north. In the near vicinity (less than 5 km) two other lowland brooks and several small and big ponds are present.

## Material and methods

As a light source four lamps of 500 Watt each (Philips ML and Osram HWL, color temperature 3700 and 4100 K) were used. Two lamps were at the top corners and two in the middle of a vertical white polyester screen of 3.5 m wide and 1.9 m high (figure 2). The lights were always put on at sundown. Basically all insects (except Diptera) were identified on the screen and if necessary collected manually and either killed with ethylacetate or directly put into 70% alcohol with 1% of glycerol for storage. The various taxonomic groups were transferred to specialists and almost always identified under magnification. Insects were collected in a total of 155 nights, 79 in 2005 (March 16 till October 31) and 76 in 2006 (March 26 till November 15) (figure 3).

Three acrylate flight interception traps, with a surface area of about 2 $m^2$ each and an interception height of 1.25-2.25 m, were operational for more than two years, from April 2002 till July 2004. Their location was halfway the light source and the Oude Leij. Two of them were placed in the open field (one sampling insects flying east-west, the other north-south) and the third in a row of oaks (*Quercus robur* L.) just between two trees (as indicated in figure 1). The insects were collected weekly and preserved in a solution of ethyleneglycol or formaldehyde in water with a detergent. They were dried and put in 70% alcohol for storage.

To get a complete as possible overview of the aquatic fauna, recognizable (micro)habitats (such as ponds and brooks) were sampled with large hand nets, in the vicinity of the light source till a distance of about 800 m. Larvae were stored in 70% alcohol.

**Table 1.** Families and species of caddis flies, captured in the Kaaistoep on light during 2005 and 2006.
**Tabel 1.** Families en soorten van kokerjuffers, verzameld in De Kaaistoep op licht in 2005 en 2006.

| Family | Species | 2005 | | 2006 | |
|---|---|---|---|---|---|
| | | ♂ | ♀ | ♂ | ♀ |
| Leptoceridae | *Athripsodes aterrimus* | 1 | 6 | 3 | 35 |
| | *Athripsodes cinereus* | 1 | | | 1 |
| | *Ceraclea albimacula* | 4 | 19 | 31 | 73 |
| | *Ceraclea dissimilis* | 157 | 415 | 444 | 1012 |
| | *Ceraclea fulva* | | 1 | | 12 |
| | *Ceraclea senilis* | | 15 | | 46 |
| | *Leptocerus tineiformis* | 46 | 80 | 138 | 300 |
| | *Mystacides azurea* | 3 | 42 | 19 | 39 |
| | *Mystacides longicornis* | 40 | 385 | 106 | 918 |
| | *Mystacides nigra* | 7 | 11 | 1 | 5 |
| | *Oecetis lacustris* | 126 | 477 | 109 | 907 |
| | *Oecetis furva* | | 20 | 14 | 75 |
| | *Oecetis notata* | | 1 | 3 | 4 |
| | *Oecetis ochracea* | 111 | 532 | 199 | 1012 |
| | *Oecetis testacea* | | | | 1 |
| | *Triaenodes bicolor* | 1 | | 5 | 22 |
| Phryganeidae | *Agrypnia pagetana* | 22 | | 14 | |
| | *Agrypnia varia* | 51 | 8 | 79 | 32 |
| | *Phryganea bipunctata* | | 8 | 3 | 10 |
| | *Phryganea grandis* | | | | 1 |
| Hydropsychidae | *Hydropsyche angustipennis* | | 10 | 9 | 19 |
| | *Hydropsyche bulgaromanorum* | | | | 2 |
| | *Hydropsyche pellucida* | | | | 1 |
| Hydroptilidae | *Agraylea multipunctata* | 12 | 8 | 33 | 71 |
| | *Agraylea sexmaculata* | 234 | 78 | 4000 | 1300 |
| | *Hydroptila* sp. | | 11 | | |
| | *Hydroptila sparsa* group | | | | 7 |
| | *Orthotrichia costalis* | | 1 | | 7 |
| | *Oxyethira flavicornis* | | | 2 | 1 |
| | *Tricholeiochiton fagesi* | 1 | 4 | | |
| Goeridae | *Goera pilosa* | | | | 1 |
| Lepidostomatidae | *Lepidostoma hirtum* | | | | 1 |
| Molannidae | *Molanna angustata* | 33 | 2 | 22 | 5 |
| Polycentropodidae | *Cyrnus crenaticornis* | 2 | 2 | 2 | 2 |
| | *Cyrnus flavidus* | 21 | 4 | 29 | 13 |
| | *Cyrnus trimaculatus* | | | 1 | 14 |
| | *Holocentropus dubius* | | 1 | 2 | 2 |
| | *Holocentropus picicornis* | 38 | 94 | 33 | 112 |
| | *Holocentropus stagnalis* | | 3 | 5 | |
| | *Polycentropus flavomaculatus* | | | | 6 |
| Ecnomidae | *Ecnomus tenellus* | 22 | 152 | 98 | 810 |
| Psychomyiidae | *Tinodes waeneri* | 1 | | 2 | 3 |
| Limnephilidae | *Glyphotaelius pellucidus* | 5 | 2 | 4 | 7 |
| | *Limnephilus affinis* | 1 | 2 | | |
| | *Limnephilus auricula* | 5 | 1 | 27 | 29 |
| | *Limnephilus binotatus* | | | 1 | |
| | *Limnephilus flavicornis* | 1 | 2 | 3 | 6 |
| | *Limnephilus griseus* | | | 1 | 1 |
| | *Limnephilus lunatus* | 5 | 1 | 7 | 6 |
| | *Limnephilus marmoratus* | 10 | 10 | 17 | 34 |
| | *Limnephilus rhombicus* | | | 2 | |
| | *Limnephilus subcentralis* | 1 | | | |
| | *Limnephilus vittatus* | 2 | 3 | 23 | 16 |
| Total numbers | | 969 | 2413 | 5491 | 6981 |
| | | 3382 | | 12472 | |

## Weather conditions

It is well known that flight conditions in the evening and night have a large impact on catch success. Warm, windless, cloudy nights with high air moisture are excellent and a mild drizzle is no problem at all. Data on the temperature range from beginning to end of the evenings and strength and direction of wind have been registered, as well as conditions of clouds and moonshine. In 2005, temperatures fluctuated with a few peaks around and above 20°C in late April, late May, late July and the end of August. In between, there were cold nights with temperatures around and below 15°C. June and July 2006 were very warm with three heat waves, August was extremely wet and cold and September was again warm.


**4.** *Mystacides longicornis*, a common species in The Netherlands. (a) on the light screen in the Kaaistoep, photo: Paul van Wielink; (b) in July 2005 in Westzaan (North-Holland), photo: Roy Kleukers.
**4.** *Mystacides longicornis*, een algemene soort in Nederland. (a) Op het valscherm in De Kaaistoep; (b) in Westzaan (juli 2005).

## Results

### Light screen trapping

Almost 16,000 caddis flies have been collected in 2005 plus 2006, from the end of April till the end of October. Fifty-two species from 24 genera and 11 families were counted (table 1). Some *Hydropsyche* ♀ and some *Hydroptila* ♀ could not be identified with certainty. In 2005, collecting has been performed more or less qualitatively, in 2006 most specimens have been conserved. Some species deserve more attention.

#### *Oecetis notata* (Rambur)

This species is typical for streams, like the river Rhine, and adhering flood plains, and it is also found in moderately flowing regions of large rivers (Robert & Wichard 1994, Wallace *et al.* 2003). Recently, more specimens have been caught far from the rivers Rhine and Meuse. The catches (on light) were near oligotrophic moorland pools and slowly flowing streams. Larvae have been found in small rivers in the southern part of Limburg. The catches in the Kaaistoep were on windless, warm nights (lowest and highest temperatures were 16 and 26°C).

#### *Ceraclea albimacula* (Rambur)

Also a species from rivers (Tobias & Tobias 1981, Moog 1995), which is very rare in The Netherlands. In the last decade, several new finding places could be added in the provinces Noord-Brabant and Limburg. We caught them from the end of May till the beginning of August and clearly more ♀ than ♂ (ratio 2.6). As with the former species, catches were done on warm evenings (around 20°C).

#### *Ceraclea dissimilis* (Stephens)

This species is found in the eastern and southern part of the country, and in higher numbers over the past ten years. Wallace *et al.* (2003) consider this species as 'living in rivers, large streams and stony lake shores; on and under big stones, also on submerged tree roots, but only in slow-flowing water'. However, the many catches of adults near standing waters suggest that they can also occur in non-flowing waters. This is in accordance with Robert & Wichard (1994) who state that it is a very common species in running and standing waters in Nordrhein-Westfalen (Germany). Larvae have been collected from the rivers Rhine and Meuse and several small rivers in the southern part of Limburg.

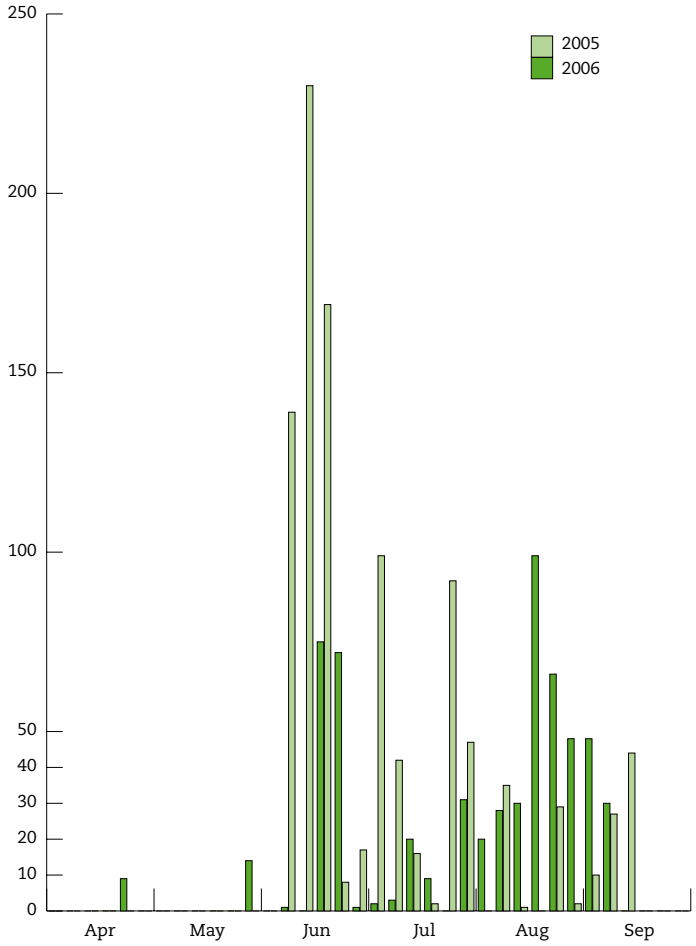
It was one of the most common species in the Kaaistoep, which has been caught from May till the beginning of September. Probably, there is one reproduction cycle per year. The ratio ♀/♂ is 2.5-3 and both sexes appear to react in the same way on weather conditions. It is not clear why some evenings have much higher numbers than others. Generally, temperature has to be 16°C or higher for any flight activity, and there seems to be a positive correlation between (very) high numbers and maximum temperatures above 20°C. But not on all warm evenings were high numbers caught. On nights with catches the minimum temperature was generally between 15 and 20°C and the catches follow the trends of the maximum temperatures. An exception was May 2006, when minimum temperatures were below 15°C. Strong wind had a negative effect on the numbers, but clear or overcast sky did not make much difference.

#### *Leptocerus tineiformis* Curtis

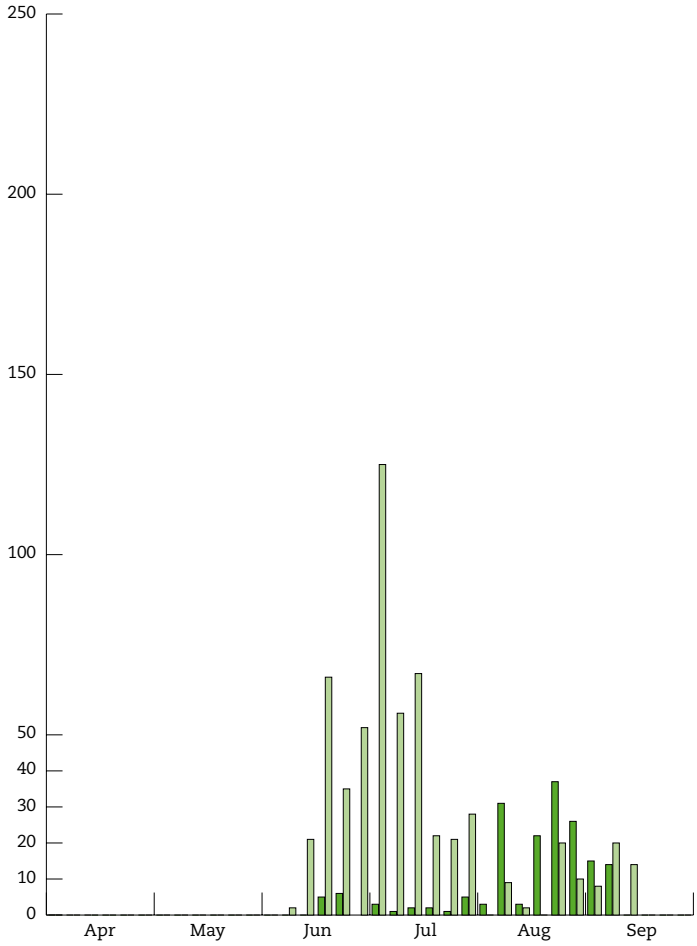
This species has a rather short flight period. In 2005 the flight period started later and peaked about three weeks later, than in 2006. In 2006 a small second generation seems to occur in September, probably caused by the warm month of September after the cold August. The high peaks in July 2006 were all on windless nights with maximum temperatures from 17-24°C and minimum temperatures from 14-18°C

#### *Mystacides longicornis* (Linnaeus)

A very common species, recognizable by its striped wings (figure 4). Probably, there are two generations a year: one in the period May-July and one in August-September.




**5.** Flight periods of *Oecetis lacustris* in the Kaaistoep in 2005 (dark green) and 2006 (light green). Each bar represents a period of five days. Sample sizes: 600 (2005) and 1,000 (2006) individuals.
**5.** Vliegtijd van *Oecetis lacustris* in De Kaaistoep in 2005 (donkergroen) en 2006 (lichtgroen). Iedere staaf heeft betrekking op een periode van vijf dagen. Monstergrootte: 600 (2005) en 1.000 (2006) exemplaren.




**6.** Flight periods of *Ecnomus tenellus* in the Kaaistoep in 2005 (dark green) and 2006 (light green). Each bar represents a period of five days. Sample sizes: 167 (2005) and 908 (2006) individuals.
**6.** Vliegtijd van *Ecnomus tenellus* in De Kaaistoep in 2005 (donkergroen) en 2006 (lichtgroen). Iedere staaf heeft betrekking op een periode van vijf dagen. Monstergrootte: 167 (2005) en 908 (2006) exemplaren.

### *Agraylea sexmaculata* Curtis

This remarkable species is a small hydroptilid of 4-5 mm. Many more ♂♂ than ♀♀ are caught (ratio 3.1). The highest numbers were captured in September 2006 (more than 3,000) on warm evenings. According to Crichton (1984) and Mey (1981) this species should hardly fly on light! There are two generations a year. The larvae eat filamentous algae and they also incorporate them in their case, which is only constructed in the fifth instar. We have not found larvae in the near vicinity.

### *Oecetis lacustris* (Pictet) and *Oecetis ochracea* (Curtis)

These two common species have two generations a year. The first generation of *O. lacustris* in 2006, as with other species (*Ceraclea dissimilis, O. ochracea, Mystacides longicornis*), shows much higher numbers, although the flight period starts late (figure 5). In 2005, the second generation is larger. *Oecetis ochracea* is a large leptocerid and an excellent flyer, attracted by light far from waterbodies. Unlike with the other leptocerids, flight activity was high as early as the beginning of May.

### *Ecnomus tenellus* (Rambur)

Of this small species (ca. 5 mm) many more females than males were caught (ratio 8.0). The ♀♀ have a roseate body and eggs are produced in the form of a beads chain. Probably there is only one generation with an extended flight period from May till mid September (figure 6) (Higler 2007). Depending on the temperature, its peak can be early as in 2006 or late as in 2005. Van der Velde & Bergers (1987) drew a flight diagram that corresponds with our 2006 results, while Van Urk *et al.* (1991)'s diagram resembles our 2005 results.

## Light trapping – in conclusion

Leptoceridae are well represented: 16 species (31% of the total) and 8,000 specimens (accounting for 50%). *Agraylea sexmaculata* Curtis (Hydroptilidae) was the most abundant species. We caught several species that are supposedly very rare or as larvae occurring in biotopes that are not found near the Kaaistoep (*Lepidostoma hirtum, Oecetis notata, Hydropsyche bulgaromanorum*).

Life cycles and flight periods are more difficult to construct than expected, despite the large number of data. This is caused by the heterogeneity of the data set: top-days with ideal flight conditions yield very high numbers of specimens, that may blur the overall pattern. Longer series (more years) of data will be necessary. It is remarkable that top-days do not result in high numbers for all species. Apparently some species have fixed flight patterns, that are less influenced by favourable flight conditions.

Our data confirm literature data on the ratio ♂-♀ flying on light for several species, but in some cases they are clearly contradictory (*Athripsodes aterrimus, Ceraclea dissimilis, C. senilis, Oecetis lacustris, O. ochracea*).

**Table 2.** Adults and larvae (L) from ponds (PV = Prikven, KP = Koningspoel, p 1-4 = pond 1-4) and streams (OL = Oude Leij, rOL = restored Oude Leij) in the vicinity of the light trap.
**Tabel 2.** Adulten en larven uit poelen (PV = Prikven, KP = Koningspoel, p 1-4 = poel 1-4) en beken (OL = Oude Leij, rOL = herstelde Oude Leij) in de omgeving van de lichtval.

| | Pond / poel | | | | | | Stream / beek | |
|---|---|---|---|---|---|---|---|---|
| | p 1 | p 2 | p 3 | p 4 | PV | KP | OL | rOL |
| *Limnephilus lunatus* | 3 L | | 2 L | | | | 10 L | 9 L |
| *Limnephilus marmoratus* | 1 L | 1 L | | | 2 L | | | 1 L |
| *Limnephilus flavicornis* | | 1 L | 5 L | | 1 L | | | 3 L |
| *Limnephilus rhombicus* | | | | | | 2 ♂ | | |
| *Limnephilus vittatus* | | 1 L | | 1 L | | 5 ♂, 5 L | | |
| *Anabolia nervosa* | | | | | | | | 1 L |
| *Agrypnia varia* | 1 L | | | | | | | |
| *Phryganea bipunctata* | | | | | | 1 ♂, 50 L | | |
| *Phryganea grandis* | | | | | | 1 ♀ | | |
| *Holocentropus picicornis* | | | | | 1 L | | | |
| *Holocentropus stagnalis* | | flying ♂ | | | | | | |
| *Cyrnus flavidus* | | | | | 1 L | | | |
| *Mystacides longicornis* | | | | | | 1 L | | |
| *Triaenodes bicolor* | | | | | | 8 L | | |
| *Oecetis furva* | | | | | | 4 L | | |

## Alternative trapping

In ponds near the light source and in the Oude Leij, larvae of only 12 Trichoptera species were sampled (table 2). All except *Anabolia nervosa* (Curtis) were also collected as adults by light.

The results of the interception screens were very meagre with respect to Trichoptera. Only eight species were caught and they all were collected on light as well. A Malaise trap caught only one species, *Enoicyla pusilla* (Burmeister). These were all males, of course, because the females cannot fly. Apparently, this species is not attracted by light. Huge numbers of their terrestrial larvae were caught in pot traps.

## Discussion

The investigation of caddis flies on a scale as large as this is unprecedented in The Netherlands. The many specimens collected provide new information on geographical distribution and life history of species. It is remarkable that so many species have been collected from one single place. Fifty-two species is about one third of the present number of species in The Netherlands!

Both years had extreme weather conditions, which influenced the development of larvae and the flight conditions of adults. The rise of the water temperature during spring may speed up the larval metabolism, but it cannot be excluded that also day length is a limiting factor for larval development. Both springs were extremely cold, resulting in late hatching and probably reduced numbers of the first generation in species where two generations or cohorts are common. This applies especially to 2005. The development of larvae and pupae in summer is generally not restricted by water temperature, because it is high enough, and hatching is determined by growth conditions of the larvae. Peaks in air temperature in 2005 were reflected in catches of the adults of many species. In 2006, many species started their flight period only in June, despite a warm period in the beginning of May. Immediately, very high numbers were caught. It is possible, that the much higher numbers of caddis flies in 2006 are partially a result of the more favourable temperature conditions. The strong fluctuations in catches could, however, not always be related to weather conditions.

We had assumed that most species live as larvae in water bodies in or near the Kaaistoep as it is commonly thought that most Trichoptera do not fly far. However, only 15 species were collected in nearby ponds and streams (table 2). Comparison of tables 1 and 2 indicates that many species must have flown over large distances. The species caught as larvae were all caught on light as well, with the exception of *Anabolia nervosa*. Crichton (1987) caught this common species on light, but in relatively low numbers. It is a day-active species that flies in autumn. It is well known that some Limnephilidae can fly large distances of tens of kilometres (Bitch & Frochot 1962, Lempke 1962, Hickin 1967), but based on our results we must conclude that this also holds for other families. Dispersion may be initiated by flying high into the sky, and then they may float on the wind until a light-source is discovered. In general, flying over larger distances is known to be part of migration strategies in many water insects (Johnson 1969). Especially females fly away and lay eggs in new habitats, i.e. waters that are different from the ones where they themselves emerged. This is less urgent for males after mating.

Despite the fact that so many specimens have been collected, interpretation of the flight diagrams is tricky. Certain nights result in very high numbers, but their causes may be variable. In spring, warm days and especially temperatures rising during a period of several days, are optimal for many species. Emergence from pupae is triggered by rising water temperatures, and in the following days, many adults are flying and mating. In some species, a second generation flies during summer and early fall. This second generation may result from eggs laid by the first generation. This has been demonstrated for *Cyrnus flavidus* McLachlan (Higler 2007), where rapid development in about three months seems feasible. However, in many cases a so-called second generation is in fact a second cohort of the first generation with a slower development. This implies that a second peak in numbers is difficult to relate to the life history of species. More data on larval development and flight of adults are needed to unravel life cycles with certainty.

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## References

Armitage BJ & Tennessen KJ 1984. The Trichoptera of Raven Fork, North Carolina – a stream subject to low pH events. In: Proceedings of the 4th International Symposium on Trichoptera (Morse JC ed): 21-26. Dr. W. Junk.

Bitch J & Frochot B 1962. Données récentes sur les Trichoptères cavernicoles. Spelunca Mémoires 2: 64-70.

Crichton MI 1984. Trichoptera from a Rothamstead light trap in Mortimer, Berkshire, 1965-1982. In: Proceedings of the 4th International Symposium on Trichoptera (Morse JC ed): 99-103. Dr. W. Junk.

Crichton MI 1987. A study of egg masses of *Glyphotaelius pellucidus* (Retzius), (Trichoptera: Limnephilidae). In: Proceedings of the 5th International Symposium on Trichoptera (Bournaud M & Tachet H eds): 165-169. Dr. W. Junk.

Johnson CG 1969. Migration and dispersal of insects by flight. Methuen & Co.

Harris SC, O'Neil PE & Lago PK 1984. Emergence patterns and distribution of Trichoptera in the Cahaba river system, Alabama, USA. In: Proceedings of the 4th International Symposium on Trichoptera (Morse JC ed): 169-174. Dr. W. Junk.

Hickin NE 1967. Caddis larvae. Larvae of the British Trichoptera. Hutchinson.

Higler B 2007. Life cycles of some stagnant water caddisflies. Lauterbornia 61: 35-42.

van Kleef H & Esselink H 2004. Monitoring van abiotiek, vegetatie, dansmuggen en kokerjuffers in gerestaureerde zwak gebufferde oppervlaktewateren. Kolonisatie van diersoorten. Rapport EC-LNV nr. 2005/667-O.

Lempke BJ 1962. Insecten gevangen op het lichtschip 'Noord Hinder'. Entomologische Berichten Amsterdam 22: 101-112.

Mey W 1981. Lichtfangergebnisse bei Köcherfliegen im Havelseengebiet (Trichoptera). Beiträge zur Entomologie 2: 333-339.

Moog O 1995. Fauna aquatica Austriaca. Bundesministerium

Robert B & Wichard W 1994. Kartierung der Köcherfliegen (Trichoptera) in Nordrhein-Westfalen. Entomologische Mitteilungen aus dem Löbbecke-Museum + Aquazoo, Beiheft 2: 1-227.

Tobias W & Tobias D 1981. Trichoptera Germanica. Bestimmungstafeln für die deutschen Köcherfliegen. Teil I: Imagines. Courier Forschungsinstitut Senckenberg.

van Urk G, Kerkum FCM & Bij de Vaate A 1991. Caddis flies of the lower Rhine. – Proc. of the Sixth Int. Symp. on Trichoptera: 89-94. In: Proceedings of the 6th International Symposium on Trichoptera (Tomaszewski C ed): 319-324. Adam Mickiewicz University Press.

van der Velde G & Bergers PJM 1987. The temporal and spatial distribution of adult Trichoptera on the upper surfaces of the floating leaves of nymphaeids. A study using adhesive traps. In: Proceedings of the 5th International Symposium on Trichoptera (Bournaud M & Tachet H eds): 319-324. Dr. W. Junk.

Wallace ID, Wallace B & Philipson GN 2003 (2nd edition). A key to the case-bearing caddis larvae of Britain and Ireland. FBA Scientific Publications 51.

Waringer J & Graf W 2006. Light-trapping of Trichoptera at the March, a lowland river in Eastern Austria. Archiv für Hydrobiologie Supplement Large Rivers 16: 351-372.

van Wielink P 1999. De Kaaistoep onder de loep. Natura 96: 35-39.

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## Samenvatting

**Een tweejarig onderzoek naar kokerjuffers (Trichoptera), gevangen op licht in De Kaaistoep (Noord-Brabant)**

De Kaaistoep is een natuurreservaat ten zuid-westen van Tilburg, waar al jaren insecten op licht worden gevangen. Dit gebeurt op een vaste plaats met een groot scherm, waarop vier sterke lampen zijn opgesteld. In de jaren 2005 en 2006 zijn kokerjuffers (Trichoptera) verzameld en gedetermineerd op in totaal 155 avonden. Het is voor het eerst dat in Nederland een zo grootschalige bemonstering van volwassen kokerjuffers heeft plaatsgevonden. In totaal zijn meer dan 16.000 exemplaren gevangen, verdeeld over 52 soorten. De resultaten zijn in diverse opzichten verrassend. Er werden soorten gevangen, die als zeldzaam worden beschouwd en bijvoorbeeld alleen voorkomen in grote rivieren. Enkele soorten, die in relatief grote aantallen zijn gevangen, zijn tot op heden niet als larve in Nederland gevonden. Bemonstering van wateren in de omgeving van De Kaaistoep leverde slechts 12 soorten als larve op, die alle, op één na, ook op het scherm zijn gevangen. De meeste soorten komen derhalve van (zeer) grote afstand aangevlogen. Opmerkelijk is dat de talrijkste soort (*Agraylea sexmaculata*) in buitenlandse literatuur vermeld wordt als zelden op licht vliegend. De best vertegenwoordigde familie is die van de Leptoceridae met 16 soorten. De familie Limnephilidae, met zeer goede vliegers die elders dikwijls in grote aantallen op licht afkomen, was naar verhouding ondervertegenwoordigd. Vliegdiagrammen bleken voor diverse soorten nogal te verschillen tussen beide jaren. Dit is ongetwijfeld een gevolg van het temperatuurverloop, dat in beide jaren grote verschillen vertoonde. Warme 'topdagen' verstoren het beeld van een verwachte Gauss-curve. Ondanks de grote aantallen, blijkt interpretatie van de resultaten daarom moeilijk.

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