

Auchenorrhyncha and Psylloidea collected during the 25th Central European Auchenorrhyncha meeting, Arnhem, The Netherlands (Hemiptera: Auchenorrhyncha and Psylloidea)

Roel van Klink¹, Kees den Bieman, Lysann Funke, Marco de Haas, Felix Helbing, Sigrun Herwig, Elisabeth Huber, Igor Malenovský, Herbert Nickel, Rolf Niedringhaus, Dominik Poniatowski, Verena Rösch, Freya Seyen and Werner Witsack

Summary: The 25th Central European Auchenorrhyncha meeting took place in Arnhem, The Netherlands on 14-17 September 2018. It was the first time the meeting was held in The Netherlands, and for this reason, excursions were undertaken to five typical Dutch landscapes. Three of the excursions involved newly created nature reserves, located on former agricultural land. The other two were old, protected heathlands. In total, 115 Auchenorrhyncha species, and 6 Psylloidea species were collected. Three species were new for the Netherlands: *Macrosteles spinosus* (presented in this paper), *Kybos abstrusus* (monophagous on *Populus nigra*) and *Macrosteles sardus* (*Epilobium hirsutum*). For a number of rare species new occurrences were reported: *Kelisia monoceros*, *Aphrophora major*, *Stroggylocephalus agrestis*, *Edwardsiana diversa*, *E. tersa*, *Fruticidia bisignata*, *Ophiola russeola* and *Psammotettix pallidinervis*. Our results show that also in young, newly created nature reserves interesting species can be found.

Keywords: Zikaden, Blattflöhe, Niederlande, *Macrosteles spinosus*, rewilding, cicaden, blad-vlooien, Millingerwaard, Oostvaardersplassen, Kootwijkerzand

1. Introduction

The 25th Central European Auchenorrhyncha meeting took place in Arnhem, Province of Gelderland, The Netherlands on 14-17 September 2018. It was the first time the meeting was held in The Netherlands, and for this reason, excursions were undertaken to five typical Dutch landscapes. Three of the excursions involved newly created nature reserves: two located on former agricultural lands, and one on the former sea floor. The other two sites were protected heathlands. Here, we present and discuss the species of Auchenorrhyncha and Psylloidea collected during these excursions.

2. Study areas

During the meeting excursions the following five sampling areas were visited:

Wolfhezerheide (15-09-2018) N51°59'33" - E5°47'57": The Wolfhezerheide is a 265 ha heathland in the south of the Veluwe, a large complex of forest and heathlands, located on the sandy soils of a terminal moraine from the Saalian glaciation. A wildlife overpass connects the two parts of the area, which were previously isolated by a highway. Some ancient oak trees (Wodan's oaks) are located in this area, which were frequently featured on paintings in the 19th century. The vegetation consists of a matrix of heathland dominated by *Calluna vulgaris*, interspersed with *Molinia caerulea* and other grasses, different tree species, and a small streambed (Fig. 1).

¹Corresponding author, e-mail: roel.klink@idiv.de

Reijerscamp (15-09-2018) N52°0'56" - E5°46'41": Reijerscamp is a former crop field which was restored to nature in 2004. Thanks to the wildlife overpass to The Veluwe, the reserve is now frequented by many species of animals. On four patches (15 ha out of 180 ha) the agricultural topsoil was removed as restoration measure, exposing the bare sand (Fig. 2). Each of these patches was partially seeded with clippings originating from reference heathlands and dry grasslands (Noppen et al. 2015). The management consists of grazing by cattle. Research on ground beetles has shown that after the restoration the area harboured an exceptionally rich fauna, but this has declined as vegetation succession progressed (Turin et al. 2017).

Millingerwaard (16-09-2018) N51°59'33" - E5°47'57": The Millingerwaard is an 800 ha reserve along the river Waal, the main branch of the Rhine in the Netherlands. The area is an important example of nature development and rewilding (Torres et al. 2018), and has been 'under construction' since 1993. To restore the natural processes of the area after decades of use for agriculture and brick manufacturing, five large water inlets were created. The area is also an important water retention area, and by redirecting the river water the water level of the Waal can be reduced by 6 cm. The area is characterized by periodic floods and has a variety of habitats, including riverine sand dunes (Fig. 3), flood plain forests and a variety of wetland types (Fig. 4). Konik horses and Galloway cattle graze in the area year-round, and beaver has been reintroduced.

Oostvaardersplassen (17-09-2018) N52°26'59" - E5°24'59": The Oostvaardersplassen is a 5.000 ha nature reserve located 5 m below sea level in the province of Flevoland. Since the creation of the province by means of land reclamation in 1969, the area has attracted many rare bird species, and was thus put under nature protection. The area is famous for its uncontrolled rewilding management, which led to Serengeti-like scenes of horses, Heck cattle and red deer running over vast plains. However, this management also led to the reduction of trees and marsh vegetation (Cornelissen et al. 2014), causing severe population declines of many bird species (van Manen 2013). The vegetation is best described as a mix of nitrophilous grassland dominated by *Lolium perenne*, *Sisymbrium officinale* and *Carduus crispus*, fringed by woodland. An enclosure experiment has shown that insect diversity can increase markedly when grazing refuges are present (Van Klink et al. 2016, Van Klink and WallisDeVries 2018). In the winter of 2018, public protests concerning starving animals due to lack of food during the winter months have enforced a management change. Therefore, since late 2018, the populations of large grazers will be controlled by culling and translocation (Van Geel et al. 2018).

We visited a part of the reserve called Oostvaardersveld, that is being developed as nature reserve since 2005 (Fig. 5). This part of the reserve is less frequented by the large herbivores, and therefore characterized by a vegetation of tall herbs, shrubs and trees.

Kootwijkerzand (17-09-2018) N52°10'09" - E5°45'58": With some 700 ha, Kootwijkerzand is the largest area of inland sand dunes of Western Europe. Like the Wolfhezerheide, it is located on the sandy glacial terminal moraine of the Veluwe. The sand dune system emerged around the year 1.000 because of too intensive land use. Presently, the area is a natural and cultural heritage site, and the open sand is maintained by livestock grazing and trampling by visitors, who have access to the whole area. The vegetation consists of a mosaic of different successional stages, starting from open sand, to sparse vegetation of *Corynephorus canescens* and *Agrostis vinealis*, to heathland dominated by *Calluna vulgaris*, and coniferous forest (Fig. 6).



Fig. 1: Vegetation mosaic at Wolfezerheide (Photo: Dominik Poniatowski).



Fig. 2: Site with bare sand due to topsoil removal at Reijerscamp (Photo: Dominik Poniatowski).



Fig. 3: Sandy soil vegetation at Millingerwaard (Photo: Dominik Poniatowski).



Fig. 4: Wetland habitats at Millingerwaard (Photo: Dominik Poniatowski).



Fig. 5: Wet grassland at Oostvaardersplassen (Photo: Dominik Poniatowski).



Fig. 6: Sand dune habitats at Kootwijkerzand (Photo: Verena Rösch).

3. Results

In total, 2951 individuals, belonging to 115 species of Auchenorrhyncha and six species of Psylloidea were sampled (see Table A1, Appendix). The highest number of species was collected in the Millingerwaard (80), where sampling intensity was highest with most conference participants taking part for several hours. The fewest species were found in the extremely dry Kootwijkerzand (22), where also the sampling effort was lowest since not all conference participants joined in this excursion.

The species with the highest relative abundance was *Psammotettix confinis*, which made up a quarter of the catch, and was collected at four out of five sites. The most widespread species was *Zyginidia scutellaris*, which was collected at all sites and by all authors. Other species that were collected at all sites were *Anaceratagallia ribauti* and *Macrosteles laevis*.

Three of the collected species were new for the Dutch fauna: *Kybos abstrusus* and *Macrosteles sardus* (published in Den Bieman and De Haas 2019). Here we present *Macrosteles spinosus* Kwon 2013 as new for the Netherlands (see below).

Based on these data, nature conservation and habitat management advice will be given to the landowners and conservation organizations.

4. New and uncommon species for the Netherlands

4.1 Auchenorrhyncha

Millingerwaard

One species, *Macrosteles spinosus* Kwon, 2013 (Fig 7), was collected for the first time in the Netherlands. This species was recently described using material from France, Bulgaria, Turkey, the Astrakhan district of Russia, China and New Zealand (Zhang et al. 2013). The report from New Zealand may represent an introduction from Europe. In the Czech Republic *Macrosteles spinosus* seems to be widespread (though probably uncommon) at least in the southern and eastern lowlands (Malenovský et al. 2013). The report from the Netherlands shows that *M. spinosus* is probably a widespread species in Europe, but it is likely that it previously has often been misidentified as *M. fieberi* (Edwards, 1889) or *M. lividus* (Edwards, 1894). These three species can only be distinguished by details of the aedeagus (lack of lateral flanges and presence of teeth on aedeagus stem ventrally) and sternal apodemes (Zhang et al. 2013). An examination of the two closely related species may reveal hints about the poorly known biology of *M. spinosus*.

In contrast, *Macrosteles fieberi* is a species of raised and intermediate bogs and lives on *Eriophorum angustifolium* (Nickel 2003). It is known from only a few localities in the Netherlands. *Macrosteles lividus* is a fairly common species in the Netherlands living on the shores of ponds, sand pits and ditches on its hostplant *Eleocharis palustris*. A second *Eleocharis* species, *E. uniglumis*, might also be a hostplant in Germany (Nickel 2003). In the Millingerwaard *M. spinosus* was probably collected at the wet, disturbed shores of the former sand excavations, which are now flooded with water (Malenovský, pers.comm.). The habitat requirements of *M. spinosus* and *M. lividus* thus seem to overlap, as already concluded by Malenovský et al. (Malenovský et al. 2013) for the situation in the Czech Republic. A revision of the Dutch material of *M. fieberi* and *M. lividus* will show whether *M. spinosus* also occurs in other parts of the Netherlands.



Fig 7. *Macrosteles spinosus* Kwon, 2013 (genitalia removed) was collected in the Netherlands for the first time during our excursion in the Millingerwaard (Photo: Theodoor Heijerman).

Until recently, *Aphrophora major* Uhler, 1896 was considered a rare species in the Netherlands, only known from five localities in the southwest of the country. Only at one locality this species was collected regularly. There is some evidence that *A. major* expanded its range from the southwest to the entire east of the Netherlands since 2008. At this moment it is known from more than 25 localities and is regularly collected in raised bogs, lowland marshes and heathlands. It has one generation and mainly lives in cool, moist to wet places. Adults are collected from several tree species: *Betula*, *Salix*, *Pinus* and *Quercus*, the nymphal hostplants are not well known, for Germany *Phragmites* and *Pedicularis* have been mentioned (Nickel 2003).

Stroggylocephalus agrestis (Fallén, 1806) is known from only 10 localities in the Netherlands. It has one generation and lives on tall *Carex* species (e.g. *C. acutiformis*, *C. acuta* and *C. nigra*) at wet places such as fens, bogs and wet extensively used meadows (Nickel 2003 and Dutch data).

Edwardsiana tersa (Edwards, 1914) is an uncommon species in the Netherlands, Millingerwaard is only the fourth locality where it was found. Last year it was discovered in neighbouring Belgium (Lock 2019). It is widespread in Germany, where it has two generations and overwinters as egg. Its prime hostplant is *Salix viminalis* (Nickel 2003).

Fruticidia bisignata (Mulsant & Rey, 1855) was collected in Millingerwaard and also at Wolfhezerheide. It was reported as a Dutch newcomer only recently (Den Bieman and Van Klink 2015). It is a species with a more southern distribution, not occurring in Northern Europe. Recently it was discovered in Belgium (Lock 2019). After the first Dutch record, this

species spread rapidly over the Netherlands, and at this moment it is known to occur at more than 40 localities. It has one generation and adults can be found almost year-round. It lives mainly on *Crataegus*, as was the case in Millingerwaard and Wolfhezerheide, but can also be found on other woody species of Rosaceae such as *Malus* and *Amelanchier*. Adults overwinter on *Calluna* and coniferous trees (Nickel 2003 and Dutch data).

Kybos abstrusus (Linnavuori, 1949) was collected for the first time in the Netherlands in 2017 and Millingerwaard is the only known Dutch locality (Den Bieman and De Haas 2019). *Kybos abstrusus* lives monophagously on *Populus nigra* and its variety *Populus nigra 'italica'*. This tree grows near rivers and lakes, and in Germany *K. abstrusus* is therefore mainly found in river floodplains (Nickel 2003). This is in agreement with the Millingerwaard locality: the bank of the river Waal, the main branch of the Rhine in the Netherlands. This locality is probably flooded in periods of high water. Millingerwaard is one of the few Dutch places with a natural stand of *Populus nigra*. In Germany and Austria, *K. abstrusus* is also found on its hostplant in urban surroundings such as parks, sport grounds and road verges. In these countries *K. abstrusus* is bivoltine and overwintering takes place in the egg stage (Nickel 2003, Holzinger 2009).

Oostvaardersplassen

Kelisia monoceros Ribaut, 1934 was collected for the first time in the Netherlands in 2015 (Den Bieman 2016) and Oostvaardersplassen is the second Dutch locality. *Kelisia monoceros* has one generation and overwinters in the egg stage. It is reported from several *Carex* species (Nickel 2003). At the only other Dutch locality it was found on *Carex otrubae*, a common species in the Netherlands (Den Bieman 2016).

Edwardsiana diversa (Edwards, 1914) is known from the Netherlands since 2017 (Den Bieman and De Haas 2018). Oostvaardersplassen was the third Dutch locality of this species which lives monophagously on *Cornus*. At Oostvaarderplassen it was collected on *Cornus sanguinea*. It has two generations per year and overwinters in the egg stage (Nickel 2003).

Macrosteles sardus (Ribaut, 1948) was first found at two Dutch localities in 2018, including our excursion at the Oostvaardersplassen (Den Bieman and De Haas 2019). It is usually found in moist, open or moderately shady sites on river floodplains, along lake shores, streams and ditches. Most records are from *Epilobium hirsutum*. In Austria and Germany, *M. sardus* is a bivoltine species overwintering in the egg stage (Nickel 2003, Holzinger 2009).

Reierscamp and Kootwijkerzand

Prokelisia marginata (Van Duzee, 1897) is an exotic species from North America, which is in Europe confined to coastal salt marshes where it lives on its host plant *Spartina anglica*. It was first found in the Netherlands in 2010 (Den Bieman and van Klink 2016), and has since then colonized much of the German coast until at least the Danish border (personal observation by the first author). *Prokelisia marginata* populations often reach high densities, which will increase the proportion of macropterous adults (Denno et al. 1985). Macropterous animals often migrate long distances, and in the last years *P. marginata* individuals were collected at several inland places, at large distance from its hostplant (data of the second author). It is likely that these individuals including the macropterous one reported here from Kootwijkerzand were dispersed inland by the predominantly westerly winds.

Ophiola russeola (Fallén, 1826) is an uncommon species in the Netherlands, but was collected at two localities during the CEAM, both times in heathlands. According to Nickel (2003), it is a species living on dwarf shrubs of the Ericaceae family, mainly *Calluna vulgaris* but also on *Erica carnea* and *Vaccinium oxycoccos* in bogs, heaths and open pine forests, usually in acidic sites. This description of the German localities fits well with both Dutch sites. It has one generation and eggs overwinter (Nickel 2003).

Psammotettix pallidinervis (Dahlbom, 1850) was collected in small numbers (1♂ 3♀♀) at Kootwijkerzand. This is a rare species that has been even more declining during recent decades, possibly caused by the disappearance of traditional low-intensity grazing (Nickel 2019). Most records are from open and grazed habitats with dominating *Festuca ovina* (s.l.), usually (but not exclusively) on sandy substrates (Nickel 2003). So far, there are four known Dutch localities with altogether only 31 individuals collected. Two of these date from the 1950s and were the basis for Cobben & Gravestein (1958) to mention the species as new for The Netherlands. Thereafter Den Bieman (unpublished records) found two more localities in 1981 and 1984. According to Nickel (2003) it has two annual generations and overwinters as egg.

4.2 Psylloidea

Only six psyllid species were recorded during our excursions. This represents only 9 % of the Dutch psyllid fauna compared to 27 % of the Dutch Auchenorrhyncha fauna that have been collected. All these psyllid species are fairly common in The Netherlands.

5. Conclusions

Despite collecting late in the season, we were able to observe a significant number of the Dutch Auchenorrhyncha. Three species (*Kybos abstrusus*, *Macrosteles sardus* and *Macrosteles spinosus*) were new for the Netherlands. For seven rare species, new records provide valuable information regarding their distribution in The Netherlands. The three new species have probably historically been present in the country, but were, until now, overlooked or misidentified. Further studies of Dutch museum records might shed light on their distribution in the Netherlands, as well as on the taxonomic issues concerning the genus *Rhopalopyx* (see Table A1). Altogether, the total number of Auchenorrhyncha species known from the Netherlands has now been increased to 421. This work furthermore shows that even in recently created nature reserves, many new and interesting species can be discovered.

6. Zusammenfassung

Die 25. Mitteleuropäische Zikadentagung fand vom 14.-17. September 2018 in Arnheim in den Niederlanden statt. Da es die erste Tagung in den Niederlanden war, wurden Sammelexkursionen in fünf typische niederländische Landschaften unternommen. Drei der Exkursionsziele befanden sich in neu geschaffenen Schutzgebieten, die sich auf ehemals landwirtschaftlich genutzten Flächen befinden. Die beiden weiteren Exkursionsziele waren alte, geschützte Heideflächen. Insgesamt konnten 117 Zikadenarten und 6 Psylloidea-Arten nachgewiesen werden. Drei Arten waren neu für die Niederlande: *Macrosteles spinosus* (in dieser Publikation vorgestellt), *Kybos abstrusus* (monophag an *Populus nigra*) und *Macrosteles sardus* (an *Epilobium hirsutum*). Für einige seltene Arten konnten neue Fundpunkte ermittelt werden: *Kelisia monoceros*, *Aphrophora major*, *Stroggylocephalus agrestis*, *Edwardsiana diversa*, *E.*

tersa, *Fruticidia bisignata*, *Ophiola russeola* und *Psammotettix pallidinervis*. Durch die drei Neufunde erhöht sich die Anzahl der bislang in den Niederlanden nachgewiesenen Zikadenarten auf 421. Diese Arbeit zeigt zudem, dass selbst in erst seit kurzem bestehenden Schutzgebieten seltene und interessante Arten nachgewiesen werden können.

Acknowledgements

We thank the Uijtenboogaart-Eliassen foundation for financial support of the 25th Central European Auchenorrhyncha meeting and we thank Staatsbosbeheer and Natuurmonumenten for permission to collect insects on their properties. In addition, we thank Theodoor Heijerman for the photo of *Macrosteles spinosus*.

5. References

- Den Bieman C. (2016): Twee bijzondere spoorcicaden voor Nederland: *Kelisia monoceros* en *Ditropsis flavipes* (Homoptera: Auchenorrhyncha: Delphacidae). – Nederlandse Faunistische Mededelingen 46: 1-9.
- Den Bieman C. and De Haas, M. (2018): Vier nieuwe dwergcicaden voor Nederland (Homoptera: Cicadomorpha: Cicadellidae). – Entomologische berichten 78: 102-106.
- Den Bieman C. and De Haas M. (2019): Five leafhoppers and one planthopper new for the Netherlands (Homoptera: Auchenorrhyncha: Cicadellidae & Tettigometridae). – Entomologische berichten 79: 147-153.
- Den Bieman C. and Van Klink R. (2015): Een forse uitbreiding van de Nederlandse dwergcicadenfauna met vijftien soorten (Hemiptera: Auchenorrhyncha: Cicadellidae). – Entomologische Berichten 75: 211-226.
- Den Bieman C. and van Klink R. (2016): De slijkgrascicade *Prokelisia marginata*: een Amerikaanse spoorcicade in Nederland (Homoptera: Auchenorrhyncha: Delphacidae). – Entomologische berichten 76: 218-225.
- Cobben R.H., Gravestijn W.H. (1958): 95 Cicaden, nieuw voor de Nederlandse fauna (Hom. Auchenorrhyncha). – Ent. Ber. Amsterdam 18: 122-124.
- Cornelissen P., Gresnigt M.C., Vermeulen R.A., Bokdam J. and Smit R. (2014): Transition of a *Sambucus nigra* L. dominated woody vegetation into grassland by a multi-species herbivore assemblage. – Journal for Nature Conservation 22: 84-92.
- Denno R.F., Douglas L.W. and Jacobs D. (1985): Crowding and host plant nutrition: Environmental determinants of wing-form in *Prokelisia marginata*. – Ecology 66: 1588-1596.
- Van Geel P.L.B.A., Poelman P.J.M., Van der List M.J. and Externe Begeleidingscommissie beheer Oostvaardersplassen (2018): Advies Beheer Oostvaardersplassen. – Kaders voor provinciaal beleid Provincie Flevoland.
- Holzinger W.E. (2009): Rote Liste der Zikaden (Hemiptera: Auchenorrhyncha) Österreichs. – In: Rote Listen gefährdeter Tiere Österreichs. Grüne Reihe des Lebensministeriums, Band 14/3: 41-317.
- Van Klink R., Ruifrok J.L. and Smit C. (2016): Rewilding with large herbivores: direct effects and edge effects of grazing refuges on plant and invertebrate communities. – Agriculture Ecosystems & Environment 234: 81-97.
- Van Klink R. and WallisDeVries M.F. (2018): Risks and opportunities of trophic rewilding for arthropod communities. – Philosophical Transactions of the Royal Society B: Biological Sciences 373: 1-8.
- Lock K. (2019): Fifty leafhoppers new to Belgium (Hemiptera: Cicadellidae). Belgian journal of Entomology 88:1-28.

- Malenovsky I, Buckle C, Koczor S, Guglielmino A., Nickel H., Seljak G., Schuch S and Witsack W. (2013): Contribution to the Auchenorrhyncha fauna of the Palava Protected Landscape Area (Czech Republic) (Hemiptera: Fulgoromorpha et Cicadomorpha). - *Cicadina* 13: 29-41.
- van Manen W. (2013): Broedvogels van de buitenkaadse Oostvaardersplassen in 1997, 2002, 2007 en 2012. - Sovon rapport 2013/30. Nijmegen.
- Nickel H. (2003): The leafhoppers and planthoppers of Germany (Hemiptera: Auchenorrhyncha). - Pensoft Publishers, Sophia and Moscow.
- Nickel H. (2019): Zikaden. In: Bunzel-Driike M., Bohm C., Buse J, Dalbeck L, Ellwanger G., Finck P., Freese J, Grell H., Hauswirth L, Herrmann A., Ide! A., Jedicke E., Joest R, Kammer G., Kapfer A., Kohler M., Kolligs D., Krawczynski R, Lorenz A., Luick R, Mann S, Nickel H., Rath U., Reisinger E., Riecken U., Roder N., RoBling H., Rupp M., Schoof N., Schulze-Hagen K., Sollmann R, Ssymank A., Thomsen K., Tillmann J, Tischew S, Vierhaus H., Vogel C, Wagner H.-G. and Zimball O. (2019): Natumahe Beweidung und NATURA 2000 - Ganzjahresbeweidung im Management von Lebensraumtypen und Arten im europai.ischen Schutzgebietssystem NATURA 2000. 2nd edition. - ABU, Bad Sassendorf. pp. 267-277.
- van Noppen F., Bosch M., Wubs J, Haanstra L., Verbaan W., van Houwelingen D., Philippona J, van Ekeris R, van der Putten W. and Bezemer T.M. (2015): Afgraven, bodemtransplantaties en uitstrooien van maaisel op voormalige landbouwgronden: Het Reijerscamp experiment. - *De Levende Natuur* 116: 222-227.
- Torres A., Fernandez N., Ermgassen S.Z., Helmer W., Revilla E., Saavedra D., Perino A., Mimet A., Rey-Benayas J. M., Selva N., Schepers F., Svenning J.C. and Pereira H.M. (2018): Measuring rewilding progress. - *Philosophical Transactions of the Royal Society B Biological Sciences* 373.
- Turin H., Heijerman T. and Alders K. (2017): Tien jaar loopkeveronderzoek in het natuurontwikkelingsgebied de Reijerscamp (Coleoptera: Carabidae). - *Nederlandse Faunistische Mededelingen* 49: 47-72.
- Zhang Y., Lu L. and Kwon Y.J. (2013): Review of the leafhopper genus *Macrosteles* Fieber (Hemiptera: Cicadellidae: Deltocephalinae) from China. - *Zootaxa* 3700: 361-392.

Addresses of authors

[Redacted addresses]

Table A1. Number of individuals of each species of Psylloidea and Auchenorrhyncha collected at the five sites during the 25th CEAM in Arnhem, The Netherlands.

Sampling sites (sampling date): RC = Reijerscamp (15-09-2018), WH = Wolhezer Heide (15-09-2018), MW = Millingerwaard (16-09-2018), OP = Oostvaardersplassen (17-09-2018), KS = Kootwijkerzand (17-09-2018). Abbreviations of collectors: Kees den Bieman (KdB), Lysann Funke (LF), Marco de Haas (MdH), Felix Helbing (FH), Sigrun Herwig (SH), Elisabeth Huber (EH), Roel van Klink (RvK), Igor Malenovský (IM), Herbert Nickel (HN), Rolf Niedringhaus (RN), Dominik Poniatowski (DP), Verena Rösch (VR), Freya Seyen (FS), Werner Witsack (WW).

Taxon	RC	WH	MW	OP	KS	Collectors	N
AUCHENORRHYNCHA							
FULGOROMORPHA							
Cixiidae							
<i>Cixius distinguendus</i> Kirschbaum, 1868	1		2	9		KdB, IM, RvK	12
Delphacidae							
Kelisiinae							
<i>Prokelisia marginata</i> (Van Duzee, 1897)					1	HN	1
<i>Kelisia monoceros</i> Ribaut, 1934				3		IM	3
<i>Kelisia sabulicola</i> W. Wagner, 1952	15	4	26		1	KdB, EH, IM, HN, VR, WW	46
Stenocraninae							
<i>Stenocranus major</i> (Kirschbaum, 1868)				1		RvK	1
Delphacinae							
<i>Conomelus anceps</i> (Germar, 1821)		20	1			IM, HN, WW	21
<i>Javesella dubia</i> (Kirschbaum, 1868)			24	2		KdB, FH, DP, IM, RvK, WW	26
<i>Javesella pellucida</i> (Fabricius, 1794)	1		10			IM, HN, WW	11
<i>Muellerianella fairmairei</i> (Perris, 1857)	5		16			KdB, IM	21
CICADOMORPHA							
Aphrophoridae							
<i>Aphrophora alni</i> (Fallén, 1805)			12			FS, SH, RN, IM, RvK, WW	12
<i>Aphrophora major</i> Uhler, 1896			2			FS, SH, RN	2
<i>Aphrophora salicina</i> (Goeze, 1778)			20	5		KdB, FH, DP, FS, SH, RN, IM, HN, RvK, WW	25
<i>Neophilaenus campestris</i> (Fallén, 1805)	4					EH, IM, WW	4
<i>Neophilaenus lineatus</i> (Linnaeus, 1758)	1				13	IM, VR, HN	14
<i>Neophilaenus minor</i> (Kirschbaum, 1868)	4				1	KdB, EH, HN, RvK, WW	5
<i>Philaenus spumarius</i> (Linnaeus, 1758)	4		68	5		KdB, FH, DP, FS, SH, RN, IM, HN, LF, RvK, WW	77
Cicadellidae							
Agalliinae							
<i>Anaceratagallia ribauti</i> (Ossiannilsson, 1938)	12	4	9	1	1	KdB, IM, HN, LF, MdH, RvK, VR, WW	27
Aphrodinae							
<i>Aphrodes makarovi</i> Zachvatkin, 1948	1		2			FS, SH, RN, VR, WW	3
<i>Stroggylocephalus agrestis</i> (Fallén, 1806)			2			WW	2

Taxon	RC	WH	MW	OP	KS	Collectors	N
Cicadellinae							
<i>Cicadella viridis</i> (Linnaeus, 1758)	2	1	13	12		FH, DP, FS, SH, RN, IM, HN, LF, RvK, WW	28
Dorycephalinae							
<i>Eupelix cuspidata</i> (Fabricius, 1775)	8	1	4			IM, HN, MdH, VR, WW	13
Iassinae							
<i>Iassus lanio</i> (Linnaeus, 1761)		1			1	KdB, RvK	2
Idiocerinae							
<i>Acericerus heydenii</i> (Kirschbaum, 1868)			1			IM	1
<i>Idiocerus herrichii</i> Kirschbaum, 1868			1			IM	1
<i>Idiocerus lituratus</i> (Fallén, 1806)			1			FS, SH, RN	1
<i>Idiocerus stigmatalis</i> Lewis, 1834			3			IM, HN, LF	3
<i>Rhytidodus decimusquartus</i> (Schrank, 1776)			14			KdB, FS, SH, RN, IM, HN, LF	14
<i>Tremulicerus distinguendus</i> (Kirschbaum, 1868)	2					RvK	2
<i>Tremulicerus vitreus</i> (Fabricius, 1803)			3			IM, HN, WW	3
Macropsinae							
* <i>Macropsis brabantica</i> W. Wagner, 1964			2			IM	2
Typhlocybinae							
<i>Dikraneura variata</i> Hardy, 1850		1				IM	1
<i>Edwardsiana crataegi</i> (Douglas, 1876)			5	2		KdB, HN	7
<i>Edwardsiana diversa</i> (Edwards, 1914)				2		KdB	2
<i>Edwardsiana flavescens</i> (Fabricius, 1794)				1		RvK	1
<i>Edwardsiana frustrator</i> (Edwards, 1908)			2			IM	2
<i>Edwardsiana plebeja</i> (Edwards, 1914)			1			IM	1
<i>Edwardsiana rosae</i> (Linnaeus, 1758)				2		KdB	2
<i>Edwardsiana tersa</i> (Edwards, 1914)			1			IM	1
<i>Edwardsiana ulmiphagus</i> Wilson & Claridge, 1999)			2	2		KdB, IM	4
<i>Empoasca decipiens</i> Paoli, 1930		3	5	4		KdB, IM, RvK	12
<i>Empoasca pteridis</i> (Dahlbom, 1850)		1	1			LF, VR	2
<i>Empoasca vitis</i> (Göthe, 1875)	1	8	3	2		KdB, IM, HN	14
<i>Eupteryx atropunctata</i> (Goeze, 1778)			2			IM, HN	2
<i>Eupteryx aurata</i> (Linnaeus, 1758)			18	4		KdB, IM, RvK, WW	22
<i>Eupteryx calcarata</i> Ossiannilsson, 1936				1		KdB	1
<i>Eupteryx curtisii</i> (Flor, 1861)	1	3				KdB, WW	4
<i>Eupteryx cyclops</i> Matsumura, 1906			1			IM	1
<i>Eupteryx filicum</i> (Newman, 1853)		2				MdH	2
<i>Eupteryx thoulessi</i> Edwards, 1926	1		92	1		KdB, FS, SH, RN, IM, HN, RvK, VR, WW	94
<i>Eupteryx urticae</i> (Fabricius, 1803)			1	1		IM, RvK	2

Taxon	RC	WH	MW	OP	KS	Collectors	N
<i>Eupteryx vittata</i> (Linnaeus, 1758)			13			KdB, HN, RvK, WW	13
<i>Eurhadina pulchella</i> (Fallén, 1806)			1			KdB	1
<i>Fagocyba cruenta</i> (Herrich-Schäffer, 1838)			4			HN	4
<i>Forcipata citrinella</i> (Zetterstedt, 1828)		4				HN	4
<i>Fruticidia bisignata</i> (Mulsant & Rey, 1855)		3	1			KdB, MdH	4
<i>Kybos abstrusus</i> (Linnavuori, 1949)			16			KdB, IM,	16
<i>Kybos butleri</i> (Edwards, 1908)			1			RvK	1
<i>Kybos cf. lindbergi</i> (Linnavuori, 1951)	1					FS, SH, RN	1
<i>Kybos strigilifer</i> (Ossiannilsson, 1941)				1		IM	1
<i>Kybos virgator</i> (Ribaut, 1933)				1		RvK	1
<i>Lindbergina aurovittata</i> (Douglas, 1875)			2		1	IM	3
<i>Linnavuoriana decempunctata</i> (Fallén, 1806)		3				HN, MdH	3
<i>Linnavuoriana sexmaculata</i> (Hardy, 1850)			2	2		IM, RvK	4
<i>Notus flavipennis</i> (Zetterstedt, 1828)			5			FS, SH, RN, RvK	5
<i>Ribautiana cruciata</i> (Ribaut, 1931)			1			KdB	1
<i>Ribautiana tenerrima</i> (Herrich-Schäffer, 1834)		3	23			KdB, IM, HN, RvK	26
<i>Ribautiana ulmi</i> (Linnaeus, 1758)			2	35		KdB, HN, RvK	37
<i>Zonocyba bifasciata</i> (Boheman, 1851)				1		KdB	1
<i>Zygina angusta</i> Lethierry, 1869		2		1		KdB	3
<i>Zygina hyperici</i> (Herrich-Schäffer, 1836)	8					KdB, EH, IM	8
<i>Zygina rubrovittata</i> (Lethierry, 1869)		2			5	KdB, EH, IM	7
<i>Zygina suavis</i> Rey, 1891		3				IM	3
<i>Zyginella pulchra</i> P. Löw, 1885			2			IM	2
<i>Zyginidia scutellaris</i> (Herrich-Schäffer, 1838)	43	74	30	17	55	KdB, EH, FH, DP, FS, SH, RN, IM, HN, LF, MdH, RvK, VR, WW	219
Deltocephalinae							
<i>Arthaldeus pascuellus</i> (Fallén, 1826)			47	23		FH, DP, IM, HN, LF, RvK, WW	70
<i>Arthaldeus striifrons</i> (Kirschbaum, 1868)			1			HN	1
<i>Balclutha punctata</i> (Fabricius, 1775)		15				KdB, EH, IM, WW	15
<i>Cicadula persimilis</i> (Edwards, 1920)				1		RvK	1
<i>Cicadula quadrimotata</i> (Fabricius, 1794)			42	2		KdB, EH, IM, HN, RvK, VR, WW	44
<i>Deltocephalus pulicaris</i> (Fallén, 1806)			39			IM, RvK, WW	39
** <i>Doratúra homophyla</i> (Flor, 1861)	2		103		1	KdB, EH, IM, HN, LF, VR, WW	106
<i>Errastunus ocellaris</i> (Fallén, 1806)			37	3		KdB, EH, IM, HN, LF, VR, WW	40
<i>Erzaleus metrius</i> (Flor, 1861)			5			IM, RvK	5
<i>Euscelis incisus</i> (Kirschbaum, 1858)	1					IM	1
<i>Fieberiella florii</i> (Stal, 1864)			1			HN	1

Taxon	RC	WH	MW	OP	KS	Collectors	N
<i>Grypotes puncticollis</i> (Herrich-Schäffer, 1834)					3	KdB, RvK	3
<i>Henschia collina</i> (Boheman, 1850)			31			KdB, EH, IM, HN	31
<i>Jassargus pseudocellaris</i> (Flor, 1861)	3	20				KdB, FS, SH, RN, IM, LF, MdH, WW	23
<i>Jassargus sursumflexus</i> (Then, 1902)		10				IM, HN, WW	10
<i>Macrosteles cristatus</i> (Ribaut, 1927)			57			IM, LF, RvK	57
<i>Macrosteles laevis</i> (Ribaut, 1927)	39	3	17	1	34	KdB, EH, IM, HN, RvK, WW	94
<i>Macrosteles lividus</i> (Edwards, 1894)			3			KdB	3
<i>Macrosteles ossianilssoni</i> Lindberg, 1954			6			KdB	6
<i>Macrosteles quadripunctulatus</i> (Kirschbaum, 1868)			1			IM	1
<i>Macrosteles sardus</i> Ribaut, 1948				6		RvK	6
<i>Macrosteles sexnotatus</i> (Fallén, 1806)	10		99		1	KdB, EH, FS, SH, RN, IM, LF, RvK, WW	110
<i>Macrosteles spinosus</i> Kwon, 2013			4			IM	4
<i>Macrosteles variatus</i> (Fallén, 1806)			4			IM, WW	4
<i>Macrosteles viridigriseus</i> (Edwards, 1922)			110	2		KdB, FH, DP, IM, HN, LF, RvK, WW	112
<i>Mocydia crocea</i> (Herrich-Schäffer, 1837)			2			KdB, HN	2
<i>Ophiola</i> cf. <i>decumana</i> (Kontkanen, 1949)	1					LF	1
<i>Ophiola russeola</i> (Fallén, 1826)	1				1	IM	2
<i>Paralimnus phragmitis</i> (Boheman, 1847)			1			LF	1
<i>Psammotettix albomarginatus</i> W. Wagner, 1941					89	KdB, FH, DP, IM, HN, RvK, VR,	89
<i>Psammotettix confinis</i> (Dahlbom, 1850)	271	167	272		77	KdB, EH, FH, DP, FS, SH, RN, IM, HN, LF, MdH, RvK, VR, WW	787
<i>Psammotettix excisus</i> (Matsumura, 1906)					62	FH, DP, IM, HN	62
<i>Psammotettix nodosus</i> (Ribaut, 1925)	4				3	KdB, FS, SH, RN	7
<i>Psammotettix pallidinervis</i> (Dahlbom, 1850)					4	IM	4
<i>Psammotettix sabulicola</i> (Curtis, 1837)			177			KdB, EH, IM, HN, VR, WW	177
*** <i>Rhopalopyx elongata</i> W. Wagner, 1952			4		1	KdB, EH, WW, VR	5
*** <i>Rhopalopyx vitripennis</i> (Flor, 1861)	1				1	IM	2
<i>Rhytistylus proceps</i> (Kirschbaum, 1868)					2	IM, VR	2
<i>Sagatus punctifrons</i> (Fallén, 1826)			2			HN	2
<i>Streptanus sordidus</i> (Zetterstedt, 1828)			25			KdB, FH, DP, IM	25
<i>Thamnotettix diluitor</i> (Kirschbaum, 1868)		3				EH, IM, HN	3

Taxon	RC	WH	MW	OP	KS	Collectors	N
STERNORRHYNCHA							
Psylloidea							
Psyllidae							
Aphalarinae							
<i>Aphalara cf. freji</i> Burckhardt & Lauterer, 1997			1			IM	1
<i>Aphalara maculipennis</i> Löw, 1886			3			KdB, IM	3
Liviinae							
<i>Livia junci</i> (Schrank, 1789)		1	2			KdB, RvK	3
Psyllinae							
<i>Cacopsylla peregrina</i> (Foerster, 1848)			3	1		KdB, IM, RvK	4
Triozidae							
<i>Triozia galii</i> Foerster, 1848			51			KdB, IM	51
<i>Triozia urticae</i> (Linnaeus, 1758)			3			IM	3
Sum of individuals	448	362	1.626	157	358		2.951
Total number of species	29	27	80	34	22		121

Notes:

* Taxonomic status in comparison to *M. fuscula* unclear.

** One individual with characteristics of *D. littoralis* Kuntze, 1937 was collected (leg WW), but since this species is only known from the Baltic sea coast, this find will need to be confirmed for the Netherlands.

*** Both *Rhopalopyx elongata* and *R. vitripennis* are published from the Netherlands, but also specimens with intermediate characters were collected during our excursions.