Five leafhoppers and one planthopper new for the Netherlands (Homoptera: Auchenorrhyncha: Cicadellidae & Tettigometridae)

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The leafhoppers *Empoasca affinis*, *Megophthalmus scabripennis*, *Kybos abstrusus*, *K. calyculus*, *Macrosteles sardus* and the planthopper *Tettigometra impressopunctata* were recorded for the first time in the Netherlands. The discovery of *Tettigometra impressopunctata* was remarkable. It is the first time in more than a century that specimens of the family Tettigometridae were collected in the Netherlands. Of each newly reported species, the ecology and distribution are discussed. The discovery of these six Auchenorrhyncha species was the result of more intense collection in recent years.

Introduction

The most recent checklist of the Dutch plant- and leafhopper fauna was published in 2011 (Den Bieman *et al.* 2011). Intensified sampling activities during recent years resulted in a number of Auchenorrhyncha species newly discovered for the Netherlands. These include three species of planthoppers, of which two belong to the family Cixiidae (De Haas & Den Bieman 2018) and one that belongs to the family Delphacidae (Den Bieman 2016), and 25 leafhopper species. Seventeen new leafhopper species belong to the subfamily Typhlocybinae, seven to the subfamilie Deltocephalinae and one to the subfamily Iassinae (Den Bieman 2017, Den Bieman & Belgers 2017, Den Bieman & De Haas 2017, 2018, Den Bieman & Klink 2015). This rapid increase in species numbers suggests that the diversity of the Dutch Auchenorrhyncha is still insufficiently known.

In 2018, six additional new Auchenorrhyncha species were collected in the Netherlands, and these are described here. Until then, only one record of the planthopper family Tettigometridae existed in the Netherlands: *Tettigometra leucophaea* (Preyssler, 1792) (in Fokker 1891 as *T. obliqua* Panzer, 1799 var. *platytaenia* Fieber, 1865), collected in Ruurlo (province of Gelderland) in July by Groll. Unfortunately, this species could not be retrieved from any Dutch collection, so reinvestigation of its identity was not possible. Surprisingly, in 2018, a second *Tettigometra* species (*T. impressopunctata* Dufour, 1846) was collected in the most southern part of the Netherlands. A second visit to this locality did not yield additional specimens but nevertheless resulted in the discovery of another new leafhopper species: *Empoasca affinis* Nast, 1937.

In 2018, an extensive flora and fauna inventory ('5000 species year') was conducted in national parc 'Hollandse Duinen'. The Auchenorrhyncha fauna of this park was studied and two new species for our country were discovered: *Megophthalmus scabripennis* Edwards, 1915 and *Kybos abstrusus* (Linnavuori, 1949). During the 25th Central-European Auchenorrhyncha Meeting, the occurrence of a *Kybos abstrusus* (Linnavuori, 1949) population in the Millingerwaard nature reserve could be confirmed. Recently, Jef Hendrix collected two specimens of *Macrosteles sardus* Ribaut, 1948 on the plant *Epilobium hirsutum* (personal communication). Additionally, an interesting photo of *Macrosteles cf. sardus* on the same plant species, posted on the website Waarneming.nl by Koen Verhoogt, encouraged to search for this species on *E. hirsutum*. This resulted in the discovery of several populations of *M. sardus* in the Netherlands. Including the six species discussed in this paper, the Auchenorrhyncha fauna of the Netherlands currently comprises 420 species.

Of the collection sites mentioned below, the Dutch geographical coordinates (Amersfoortcoördinaten = AC) are given. Unless stated otherwise, the material was collected by the authors and preserved in their collections.

Tettigometridae

Tettigometra impressopunctata (figure 1)

Material Province of Limburg: nature reserve De Piepert, 1 km nw Eys (AC 192.4-315.6), 9.ix.2018, 2♀♀, leg. & coll. B. Pater. De Piepert is a botanically rich calcareous grassland that is partly mown once a year and has a south-facing, sun exposed slope (figure 2).

The family Tettigometridae is small with less than 100 species worldwide (Bourgoin 2019). In Europe, it is widely distributed in the Mediterranean area with only a few species reaching to the north. In the Netherlands, this family was represented by only one species (*Tettigometra leucophaea*), which was collected only once and probably went extinct a long time ago. Taxonomically, it is the most difficult Auchenorrhyncha family in Europe. Identification is not easy due the slight interspecific differences in male genitalia and the considerable intraspecific

1. *Tettigometra impressopunctata* ♀, De Piepert (province of Limburg), 9.ix.2018. Photo: Brian Pater
1. *Tettigometra impressopunctata* ♀, De Piepert (Limburg), 9.ix.2018.

variation in head shape and body colouration (Holzinger *et al.* 2003, Nickel 2003).

Tettigometra impressopunctata is found in west, central and southern Europe and its range extends eastwards to Russia: Albania, Austria, Belgium, British Isles, Czech Republic, France, Germany, Hungary, Italy, Poland, Portugal, Romania, Russia (Central European part), Slovakia, Spain, Switzerland, Ukraine and former Yugoslavia (Jach & Hoch 2013).

During the last ten years, nature reserve De Piepert has regularly been sampled by the first author, but *T. impressopunctata* was not discovered. This indicates that the species might have settled recently or that its population is extremely local. Several comparable calcareous grasslands are located nearby De Piepert and these plots were also visited regularly and sampled with pitfall traps for several years. *Tettigometra* species were never found during these visits. The dispersal capacity of *Tettigometra* species is limited. Their front wings are leathery and the front and hind wings just reach the tip of the abdomen. Catches of Tettigometridae in airborne traps are not known. In this respect, the finding of this probable new population of *T. impressopunctata* in De Piepert remains intriguing.

This species is restricted to high quality chalk and limestone grassland and calcareous dunes, typically occurring in fairly short or thin grassy vegetation, often with patches of bare ground or sand. It is usually found in sheltered hollows and on south-facing slopes. In England, the associated vegetation usually contains thyme *Thymus* and other low calcicoles (Kirby 1992) in addition to grasses. This description of English localities corresponds to the Dutch situation except for the occurrence of thyme. *Tettigometra impressopunctata* is probably a polyphagous species, but the hostplant(s) are not known (Nickel 2003). Adults are found almost all year round. It is a univoltine species and adults overwinter (Nickel 2003). The overwintering sites are unknown but probably include tussocky vegetation or thick moss layers. All stages appear to spend most of their time on or near the ground. Presumably all central European *Tettigometra*

2. Collection site of *Tettigometra impressopunctata*: De Piepert (province of Limburg), 4.x.2018. Photo: Kees den Bieman
2. Vindplaats van *Tettigometra impressopunctata*: De Piepert (Limburg), 4.x.2018.

3. *Megophthalmus scabripennis* ♂, Bedoin (France: Vaucluse), 20.v.2013, genitalia removed. Photo: Theodoor Heijerman
3. *Megophthalmus scabripennis* ♂, Bedoin (Frankrijk: Vaucluse), 20.v.2013, genitaliën verwijderd.

4. *Empoasca affinis* ♂, 1 km nw Eys (province of Limburg), 4.x.2018, genitalia removed. Photo: Theodoor Heijerman
4. *Empoasca affinis* ♂, 1 km nw Eys (Limburg), 4.x.2018, genitaliën verwijderd.

species are associated with ants but the character of this relationship is not well understood (Lehouck *et al*. 2004, Nickel 2003).

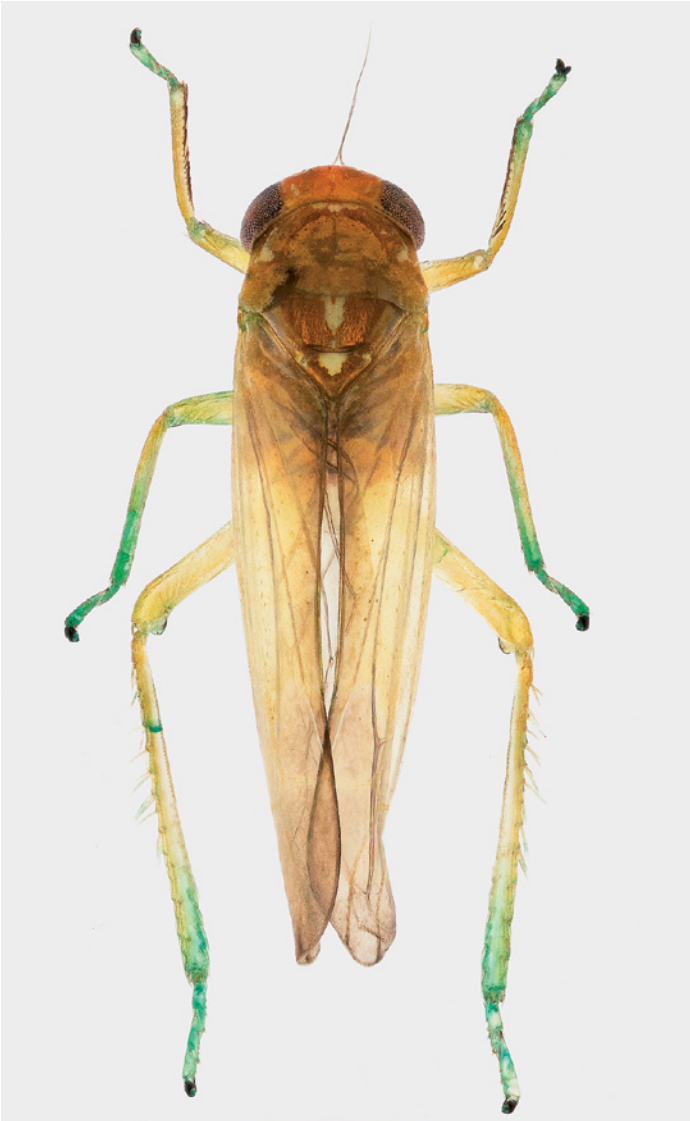
Tettigometra impressopunctata is associated with calcareous grasslands that are rich in plant species and vegetation structure. However, in many European countries, including the Netherlands, the area of such high-quality calcareous grassland has been reduced drastically by fertilization, ploughing and by the cessation of livestock grazing. Conservation management of calcareous grassland should aim to maintain species-rich vegetation and a range of vegetation structure with a small-scale mosaic of areas of bare ground, including shorter and taller vegetation. Such structures are best maintained by grazing. Due to local circumstances, grazing is not possible in De Piepert (Provincie Limburg 2017). A rotational cutting regime may be used instead, but is less likely to lead to appropriate conditions for *Tettigometra* species. A consistent management regime is preferable (Holzinger 2009, Kirby 1992).

Cicadellidae - Megophthalminae

Megophthalmus scabripennis (figure 3)

Material Province of Zuid-Holland: national parc 'Hollandse Duinen', Berkheide, 4 km sww Katwijk aan Zee (AC 085.9-466.9), sampled with a pan trap, 12-13.vi.2018, 2♂♂, leg. B. Braakman, coll. C.F.M. den Bieman.

The very distinctive genus *Megophthalmus* is easily recognized by the morphology of its head with an angular vertex and ridges forming a raised X shape on the face. In Europe, one other *Megophthalmus* species is known: *M. scanicus* (Fallen, 1806). This species is also known from the Netherlands but is not common. The shape of the aedeagus clearly distinguishes both species (Biedermann & Niedringhaus 2004). Both species are ground dwelling. *Megophthalmus scabripennis* is found at sun-exposed sandy places in open xerothermic forest, especially at the margins (Botting & Bantock 2013, Nickel 2003). Information on the hostplant range is limited. Della Giustina (1989) collected it on *Helichrysum microphyllum* in Corsica, while it has been recorded on *Cystus monspeliensis* on the Maltese islands (D'Urso & Mifsud 2012); both plant species do not occur in the Netherlands.



5. *Kybos abstrusus* ♂, nature reserve Millingerwaard (province of Gelderland), 16.ix.2018, genitalia removed. Photo Theodoor Heijerman
5. *Kybos abstrusus* ♂, Millingerwaard (Gelderland), 16.ix.2018, genitaliën verwijderd.

The distribution range of *M. scabripennis* includes the Mediterranean region and parts of western Europe: Albania, Austria, Belgium, Bulgaria, France, Germany, Great Britain, Greece, Italy, South European Russia and former Yugoslavia (Jach & Hoch 2013). In Germany, it is a rare species only known from two southern localities. In France, it has been collected in the coastal departments along the Mediterranean and the Atlantic (Ribaut, 1952), while it is reasonably common in southern England and Wales (Botting & Bantock 2013). *Megophthalmus scabripennis* is univoltine, and overwinters in the egg stage. In Germany, adults were only collected in June, in accordance with the single Dutch find (Nickel 2003). In Austria and England, adults were collected between April and October (Botting & Bantock 2013, Holzinger 2009)

Cicadellidae – Typhlocybinae

Empoasca affinis (figure 4)

Material Province of Limburg: 1 km nw Eys (AC 191.8-315.4), sampled at a steep, sun exposed calcareous hill side, close to a *Quercus robur* tree, 4.x.2018, 1♂, parasitized by a Dryinid, leg. & coll. C.F.M. den Bieman.

Species identification is difficult in the genus *Empoasca*, and even impossible for females (Biedermann & Niederinghaus 2004). *Empoasca* species are only recognizable by small differences in male genitalia. The shape of the pygofer appendages is most characteristic for *E. affinis*. This species has a limited distribution in Europe: Austria, Czech Republic, France, Germany, Hungary, Italy, Luxembourg, Republic of Moldova, Poland, Russia (Central and South European parts) and Switzerland (Jach & Hoch 2013, Niedringhaus *et al.* 2010). In Germany, this species occurs at the edge of its range and is mainly found in the warmer and eastern parts (Nickel 2003).

Empoasca affinis occurs at sunny sites along forest margins and hedges and at ruderal localities. It is a polyphagous species and adults are found on a number of shrub and tree species (*Carpinus, Corylus, Populus, Rubus, Ulmus, Salix* and others) and in the herbaceous vegetation layer. It is often found in low numbers only. In Austria and Germany, there is probably one generation a year and adults hibernate (Holzinger 2009, Nickel 2003).

6. Collection site of *Kybos abstrusus*: Millingerwaard (province of Gelderland), 16.ix.2018. Photo: Kees den Bieman
6. Vindplaats van *Kybos abstrusus*: Millingerwaard (Gelderland), 16.ix.2018.

7. *Kybos calyculus* ♂, national parc 'Hollandse Duinen' (province of Zuid-Holland), 17.vii.2018, genitalia removed. Photo: Theodoor Heijerman
7. *Kybos calyculus* ♂, Nationaal Park Hollandse Duinen (Zuid-Holland), 17.vii.2018, genitaliën verwijderd.

Kybos abstrusus (figure 5)

Material Province of Gelderland: nature reserve Millingerwaard, 1.5 km nw Kekerdom (AC 196.5-431.4), larvae were also observed on seedlings of *Populus nigra* on the sand bank of the river Waal, 24.viii.2017, 3♂♂, 1♀, leg. & coll. M. de Haas; same locality and hostplant, 16.ix.2018, 3♂♂, 11♀♀, leg. & coll. C.F.M. den Bieman (figure 6).

The identification of *Kybos* species is primarily based on male genitalia and for most species identification of females is difficult or impossible (Mühletaller *et al.* 2009). In north west Europe, two *Kybos* species live on *Populus*: *K. populi* (Edwards, 1908) and *K. abstrusus*. The males differ in the shapes of the appendages of the pygofer and anal tube appendages as well as the 3th abdominal tergum and 1th-5th sterna. In contrast to most other *Kybos* species, also the females of these two species show a clear difference in the shape of the seventh abdominal sternum (Biedermann & Niedringhaus 2004).

Kybos abstrusus is distributed over most of Europe with the exception of the Mediterranean area: Austria, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Lithuania, Luxembourg, Poland, Romania, Russia (Central European part), Sweden, Switzerland, Ukraine and former Yugoslavia (Jach & Hoch 2013, Malenovský & Lauterer 2010, Niedringhaus *et al.* 2010).

Kybos abstrusus is monophagous on *Populus nigra* and its variety *Populus nigra* 'Italica'. This tree grows near rivers, and in Germany *K. abstrusus* is therefore mainly found on river floodplains (Nickel 2003). This is in accordance with the Dutch locality: the bank of the large river Waal. This locality is probably flooded in periods of high water. In Germany and Austria, this species is also found on its hostplant in urban surroundings such as parks, sport grounds and road verges. In these countries *K. abtrusus* is bivoltine: adults were collected from June till October and overwintering takes place in the egg-stage (Holzinger 2009, Nickel 2003).

Kybos calyculus (figure 7)

Material Province of Zuid-Holland: national parc 'Hollandse Duinen', close to the visitor's center in Meijendel (AC 83.1-460.3), beaten of *Betula pubescens* in a hedge with only a few *B. pubescens* trees together with *Populus alba* and *Crateagus* at

8. *Macrosteles sardus* ♀, Wageningen (province of Gelderland), 22.viii.2018. Photo: Marco de Haas
8. *Macrosteles sardus* ♀, Wageningen (Gelderland), 22.viii.2018.

the edge of a meadow, 17.xii.2018, 2♂♂, leg. & coll. C.F.M. den Bieman.

The shape of the aedeagus, the processes of the anal collar and of the apodemes of sternite II are distinctive for *K. calyculus*. This insect had a limited distribution and is a rare species all over its range: Czech Republic, Germany, Great Britain, Poland and Switzerland (Jach & Hoch 2013, Mühlethaler *et al.* 2009, Nickel 2003). Not much information is available concerning its biology. It is monophagous on *Betula* and occurs on *B. pubescens* in most of its range. However, in the Czech Republic it is also found on *B. pendula*, mostly on solitary trees (Malenovský & Lauterer 2010). It is probably bivoltine and overwinters in the egg-stage. In Germany adults were found from June until August (Nickel 2003). The reasons for the very localized distribution of this species are not clear, since its hostplants are widely distributed. It is suggested that *K. calyculus* usually feeds higher in the canopy than other *Kybos* species, and is consequently under-recorded, although it seems unlikely that this is the full explanation (Kirby 1992).

Cicadellidae - Deltocephalinae

Macrosteles sardus (figure 8)

Material Province of Gelderland: Wageningse Bovenpolder, Wageningen (AC 174.4-441.7), on *Epilobium hirsutum*, 22.viii.2018, 5♂♂, 5♀♀, leg. & coll. M. de Haas; Meinerswijk-Doorlaatsluis, Arnhem (AC 188,4-442,4), on *E. hirsutum*, 31.viii.21018, 1♂, 1♀ leg. & coll. M. de Haas. Province of Flevoland: nature reserve Oostvaardersplassen, Oostvaardersveld (AC 156-495), on *E. hirsutum*, 2♂, 4♀, 17.ix.2018, leg. & coll. R. van Klink.

Within the large genus *Macrosteles, M. sardus* is characterized by its male genitalia. It is a species with a limited distribution in central and western Europe: Austria, Czech Republic, France, Germany, Italy, Luxembourg, Slovakia, Slovenia and Spain (Holzinger 2009, Jach & Hoch 2013, Niedringhaus *et al.* 2010, Seljak 2004).

The hostplant of *M. sardus* was recognized by Seljak (2004) as *E. hirsutum*, but perhaps other *Epilobium* species are also suitable. However, in Slovenia in a mixed stand of *E. hirsutum* and *E. parviflorum*, only the former was used as hostplant. *Epilobium hirsutum* was also the hostplant in the Dutch populations. The description of the German habitats fits with the Dutch populations: moist, sometimes moderately shady sites on river floodplains and along lake shores. In Austria and Germany, *M. sardus* is a bivoltine species with adults found from May until September. It overwinters in the egg stage (Holzinger 2009, Nickel 2003, Seljak 2004).

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Samenvatting

Vijf dwergcicaden en een mierencicade nieuw voor Nederland (Homoptera: Auchenorrhyncha: Cicadellidae & Tettigometridae)

De dwergcicaden (Cicadellidae) *Megophthalmus scabripennis*, *Empoasca affinis*, *Kybos abstrusus*, *K. calyculus*, *Macrosteles sardus* en de mierencicade (Tettigometridae) *Tettigometra impressopunctata* zijn in 2017/2018 voor het eerst in Nederland verzameld. De vondst in Zuid-Limburg van *T. impressopunctata* is opmerkelijk. Het is de eerste keer in meer dan een eeuw dat een vertegenwoordiger van de familie Tettigometridae in ons land waargenomen is. *Tettigometra impressopunctata* is een soort van goed ontwikkelde kalkgraslanden, maar de waardplant is onbekend. De waardplant van *M. scabripennis* is ook onbekend en deze soort wordt vooral gevonden op open, zonnige, zandige plekken. De polyfage soort *E. affinis* komt voor op zonnige locaties als bosranden. *Kybos abstrusus* komt uitsluitend voor op *Populus nigra*, vooral in de uiterwaarden. De waardplant van de zeldzame soort *K. calyculus* is *Betula pubescens*, maar verder is over de biologie weinig bekend. Op vochtige soms beschaduwde plekken wordt *M. sardus* gevonden op *Epilobium hirsutum*. De gerapporteerde uitbreiding van de cicadenfauna in Nederland is te danken aan een intensivering van de verzamelactiviteiten en het gericht zoeken op specifieke waardplanten.

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