

The Indian leafhopper *Pediopsoides sharmai* discovered in Europe (Auchenorrhyncha: Cicadellidae: Eurymelinae: Macropsini)

M.G. (Marco) de Haas
C.F.M. (Kees) den Bieman
C.A. (Chandra) Viraktamath
Egon Lind
Gernot Kunz
Werner E. Holzinger

TREFWOORDEN

Cicadomorpha, distribution, alien species, *Juglans regia*, plant trade

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In July 2020, a strange looking Macropsini was found in a light trap in Tilburg, the Netherlands. The specimen was collected and sent to the first author. After more specimens were photographed and collected, it was identified as *Pediopsoides (Sispocnis) sharmai*. Since this species was only known from the male type-material, collected in Jammu & Kashmir in India in a light dome, no information on the female and ecology of this species was available. Based on our European records, the species lives on *Juglans regia* and has two generations per year, overwintering probably in the egg stage. A short description of the female is given. In Europe, *P. sharmai* is now known from the Netherlands, Belgium, Germany and Austria.

Introduction

Since the summer of 2020, photos of a strange looking leafhopper belonging to the tribe Macropsini were posted on the citizen science internet platforms Waarneming.nl (Dutch observations) and Waarnemingen.be (Belgian observations). The first specimen was found by Kees Boele in a light trap on July 9, 2020 in a garden in Tilburg (province of Noord-Brabant), the Netherlands. This female was collected and sent to the first author. Identification with European literature failed. The venation of the forewings was striking with only two antepical cells, a phenomenon not known in European Macropsini.

In 2021, more specimens captured at light and observed on a fence were photographed, including the first record from Belgium (Borchtlombeek, province of Vlaams-Brabant, observed by Timon Boumon). Since all 2021-2022 specimens were captured at light or found on artificial structures, there were no indications to conduct a targeted search for this species. Despite collecting efforts in early summer of 2023 on several locations where specimens were photographed, no individuals could be found. Also in the early summer of 2023, the first author re-studied the single specimen in his collection, using a wider range of literature. The presence of only two antepical cells in the forewings led to a tentative identification as *Pediopsoides* Matsumura, 1912, probably belonging to the subgenus *Sispocnis* Anufriev, 1967. A short study of the genus resulted in a tentative identification as *Pediopsoides (Sispocnis) sharmai* Viraktamath, 1981 (figure 1-2), primarily based on the colouration of the forewings and the typical spots on pronotum and frons. This identification was strengthened after the study of the male genitalia of the first male collected by B. Schoenmakers on June 12, 2023 in Arnhem (province of

Gelderland, the Netherlands). The final identification was done by the third author, the author of *P. (S.) sharmai*, after comparison of the Dutch material with the holotype of the species.

The host-plant relationships of most *Pediopsoides* species are unknown. Two species live on *Juglans*: the Old World species *P. kogotensis* (Matsumura, 1912) and the New World species *P. distinctus* (Van Duzee, 1890). For a second Nearctic species, *P. davisi* (Knull, 1940), a relationship with willows *Salix* is indicated (Tishechkin 2016). These data suggested to focus the collecting efforts to *Juglans*. In northwestern Europe *Juglans regia* is the only established species. Records on the citizen-science platforms in 2022 (the Netherlands) and mid June 2023 (Belgium) of this leafhopper on *Juglans regia* reinforced the idea that this tree was the sought-after hostplant. This led to an extensive search on *J. regia*, which easily yielded many more records of *P. sharmai* in the Netherlands.

In May 2024, the first specimen was photographed in Germany, close to the Dutch border (Rindern, state of Nordrhein-Westfalen, observed by Steffi). In August 2024, the species was collected in northwestern Austria (Bregenz and Dornbirn, province of Vorarlberg, by the fourth and fifth authors) and in September 2024 in Graz (province of Steiermark, by the sixth author).

Between 2020 and September 9, 2024, 114 observations of *P. sharmai* were made in Europe, many of which can be found on the citizen science platforms Waarneming.nl (Dutch observations), Waarnemingen.be (Belgian observations), Observation.org (German record) and iNaturalist (Austrian records). Additional observations were made by some of the authors. The authors can provide an overview of the observations from 2020 to September 1, 2024 upon request.



1. Adults of *Pedioipsoides sharmai*: (a, e, g) male, (b-d, f, h) female; Dornbirn (Vorarlberg), Austria, 31.viii.2024 (a, c-e, g-h), Wageningen (province of Gelderland), the Netherlands, 3.vii.2023 (b, f). Photos: Egon Lind, Gernot Kunz & Marco de Haas.

1. Adulten van *Pedioipsoides sharmai*: (a, e, g) mannetje, (b-d, f, h) vrouwtje; Dornbirn (Vorarlberg), Oostenrijk, 31.viii.2024 (a, c-e, g-h), Wageningen (Gelderland), Nederland, 3.vii.2023 (b, f).



2. Adults and nymphs of *Pediospoides sharmai*: (a-c) adult female frontal view, (d-h) fifth instar nymphs. Dornbirn (Vorarlberg), Austria, 31.viii.2024 (a, c-g), Wageningen (province of Gelderland), the Netherlands, 27.ix.2023 (b, h). Photos: Egon Lind, Gernot Kunz & Marco de Haas.
2. Adulten en nimfen van *Pediospoides sharmai*: (a-c) adult vrouwtje in frontal aanzicht, (d-h) vijfdestadiumnimfen. Dornbirn (Vorarlberg), Oostenrijk, 31.viii.2024 (a, c-g), Wageningen (Gelderland), Nederland, 27.ix.2023 (b, h).

***Pediopsoides (Sispocnis) sharmai* Viraktamath, 1981**

New for Europe: Austria, Belgium, Germany and the Netherlands

Netherlands First record in 2020. When the hostplant became known in 2023, the species was easily found throughout central and southern parts of the Netherlands by the first and second authors. The citizen-science platform Waarneming.nl provides many additional records, mostly from light traps. Till September 1, 2024 there are 82 records from the Netherlands.

Belgium First record in 2021, since then regularly recorded from light traps in northern and central parts of Belgium on the citizen-science platform Waarnemingen.be. Till September 1, 2024 there are 28 records from Belgium.

Germany A single record from westernmost Germany (Rindern) on Observation.org in May 2024.

Austria After an accidental finding of a single male on *Ligustrum vulgare* in Bregenz on August 30, 2024 by the fourth author, more specimens were collected from *Juglans regia* on August 31, 2024 in Dornbirn by the fourth and fifth authors during the 30th Central European Auchenorrhyncha Meeting. In September, the species was found south of the Alps in Graz by the sixth author.

Distribution

The species is originally described from Kishtwar, in the union territory Jammu and Kashmir in northern India and was only known from the type series (2 males). In Europe the hostplant is *Juglans regia*, an Old World walnut tree species native to the region stretching from the Balkans eastward to the Himalayas and southwest China. It is widely cultivated all over Europe and the Caucasus (Roor et al. 2017). The area of the hostplant also defines the potential distribution of *P. sharmai*.

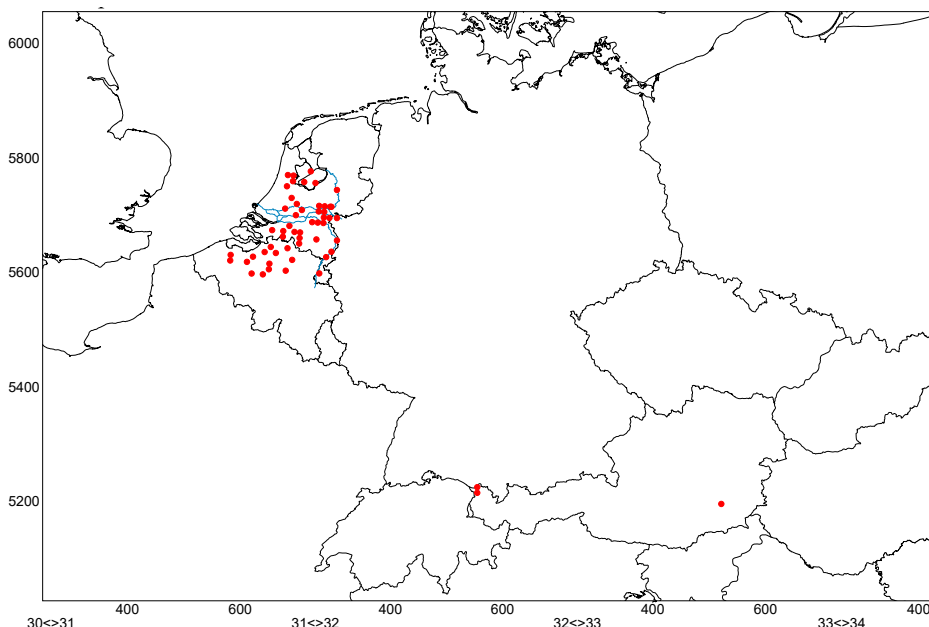
In Europe, the species is found in central and southern parts of the Netherlands, northwestern and central parts of Belgium, westernmost Germany and western and southeastern Austria (figure 3). Attempts in 2023 and 2024 to collect this leafhopper in other European countries – France (by C.F.M. den Bieman), eastern, northern and southern parts of Germany (by R. van Klink & H. Nickel), Serbia (by A. Kosovac & M. Šćiban) and Spain (by A. Miralles) – were not yet successful.

Identification and taxonomic position

The male can be identified with the original description in Viraktamath (1981), a brief description of the female is given below. *Pediopsoides* Matsumura, 1912 is a genus in the arboreal leafhopper tribe Macropsini (Eurymelinae). Within Macropsini, *Pediopsoides* is recognized by the weak striations on the pronotum and by the posterior margins of the pygofer usually showing short, inturned spines (Li et al. 2023). Up till now, *Pediopsoides* comprises 31 species (Dmitriev 2024) and is represented in all zoogeographical regions except for the Australian and Neotropical regions. In the Palaearctic region, the genus is absent from the west, with no species known from Europe. Hamilton (1980) differentiated four subgenera including *Sispocnis* Anufriev, 1967, based on the features of the facial and tegminal proportions and the male genitalia. The subgenus *Sispocnis* comprises six species. Four species occur only in China, *P. kogotensis* (Matsumura, 1912) is known from China, Japan, Korea and Russia, while *P. sharmai* occurs in northern India (Li et al. 2019). *Pediopsoides (Sispocnis) sharmai* is the only described species within the subgenus *Sispocnis* that has five black spots on the frons (large oblong apical spot, circular thyridial spots and smaller circular discoidal spots) and three large spots (and in darker specimens with four, very small, spots between them) on the anterior margin of the pronotum (figure 1-2). A key to the males of species of this subgenus is given by Li et al. (2019).

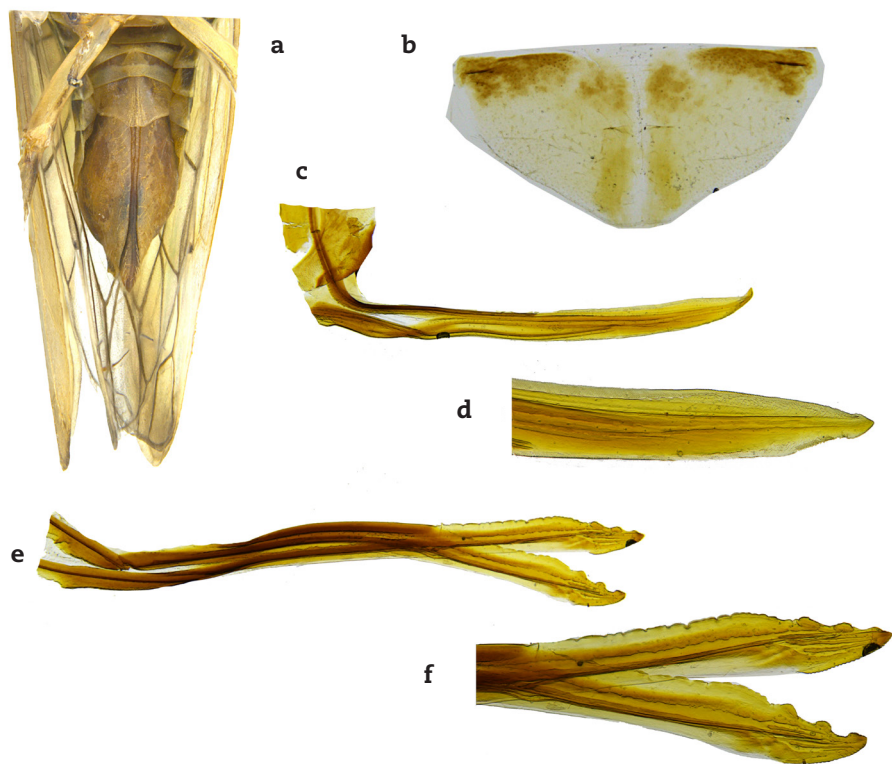
Description of female

Colouration and form similar to that in male. Pregenital segment twice as long as broad, narrowed posteriorly, almost parabolic (figure 4). Ovipositor slightly longer than pygofer. Valvula I almost straight and of uniform width except near apical region, where it is narrowed into a pointed apex; the sculpturing of the dorsal margin is confined to the apical half, consisting of short oblique strigate, occupying about dorsal 1/4 width. Valvula II more or less straight and of uniform width in basal 2/3 length, toothed area occupying apical 1/3 length and consisting of three prominent teeth apically preceded by a crenulate dorsal margin.



3. Distribution of *Pediopsoides sharmai* in Europe, 2020-2024.

3. Verspreiding van *Pediopsoides sharmai* in Europe, 2020-2024.



4. Female genitalia of *Pediopsoides sharmai*, Breda (province of Noord-Brabant), the Netherlands, 17.x.2023. (a) Abdomen ventral view, (b) pregenital segment ventral view, (c) valvula I lateral view, (d) tip valvula I, (e) valvula II, and (f) tip valvula II. Photos: H.M. Yeshwanth

4. Vrouwelijke genitalia van *Pediopsoides sharmai*, Breda (Noord-Brabant), Nederland, 17.x.2023. (a) Abdomen ventraal aanzicht, (b) pregenitaal segment ventraal aanzicht, (c) valvula I lateraal aanzicht, (d) top valvula I, (e) valvula II, en (f) top valvula II.

Intraspecific variation

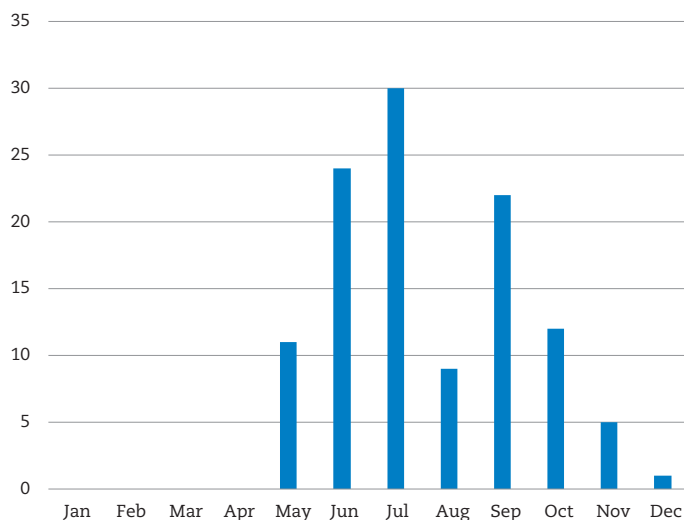
The large number of collected and photographed specimens of *P. sharmai* in Europe show a considerable variation in colouration. The complete range of variation appears to be present in both males and females. Most notably is the variation in dark markings on the forewings, with very distinct dark brown markings in some specimens (figure 1a), while these markings are faint, light brown in most specimens (figure 1b-d). The dark spots on the pronotum and frons are also variable in size, though always clearly present (figure 2a-c). Another notable colouring difference is found between the first and second generation; the first generation has a bright green to yellow thorax while the second generation has a brown to yellow brown thorax (compare figure 1b, f (first generation) with figure 1a, c-e, g-h (second generation)). However, intermediate yellow brown specimens can be found in both generations.

Ecology

Occurring in natural areas, parks, gardens, walnut orchards and roadsides. *Pediopsoides sharmai* lives monophagous on *Juglans regia*. Records from other plants (e.g. *Ligustrum vulgare*, *Rubus* and *Cornus sanguinea*) concerns vagrant individuals, usually not far from *Juglans regia* trees. Adults and nymphs can be found on both young and older trees, usually on young twigs. Adults are found between May and December, with peaks in June/July and September, suggesting the presence of two generations (figure 5). Nymphs have been found in May, August, September, October and November. Teneral adults have been found from September till November. During the first four months of the year this species is not collected with light traps, which suggests that the species overwinters in the egg-stage and the first generation appears in May. Collecting efforts in early 2024, with first nymphs and adults found in May, confirm this. However, since teneral adults were collected till November, it is possible that at least some adults hibernate.

Discussion

A growing number of alien true hoppers (Auchenorrhyncha: leaf- and planthoppers) has been introduced to Europe in recent years. Mifsud *et al.* 2010 reported twelve alien Auchenorrhyncha species (mostly leafhoppers Cicadellidae: eight species) in Europe. In the last thirteen years another 32 alien true hoppers were reported from Europe (Sanna & Poggi 2022; Poggi *et al.* 2024) to which *P. sharmai* is added as the 44th alien Auchenorrhyncha in Europe. This significant increase in alien leaf- and planthoppers in Europe raises the question how they reached



5. Phenology of *Pediopsoides sharmai*, number of Dutch, Belgian, German and Austrian observations of adults from the years 2020 till September 9, 2024 combined.

5. Fenologie van *Pediopsoides sharmai*, aantal Nederlandse, Belgische, Duitse en Oostenrijkse waarnemingen van adulten uit de jaren 2020 tot en met 9 september 2024 gecombineerd.

Europe. As all introduced leaf- and planthoppers are phytophagous species, an introduction with the import of plant material seems the most obvious pathway (Mifsud *et al.* 2010).

The actual distribution of *P. sharmai* based on the records of the last four years in Europe suggest that this species is initially introduced in the southern or central part of the Netherlands or the northern part of Belgium. Information obtained from major growers of walnut trees in the Netherlands shows that there is no import known of walnut trees from Asia to Europe. Still, the most likely pathway of introduction is obviously with the import of plant material containing eggs, nymphs or adults of *P. sharmai*, but information on such an import from Asia is not available.

Commercial walnut cultivation is a very small activity in the Netherlands and Belgium. In Europe, France and Italy are larger producers. The effect of feeding by *P. sharmai* on the growth of walnut trees or nut production is presently unknown. It is striking that this leafhopper occurs in high densities in the walnut orchard that was sampled in Breda (province of Noord-Brabant), the Netherlands.

At the sampling site in Graz, together with *P. sharmai*, numerous individuals of *Tremulicerus vitreus* (Fabricius, 1803) and *Acericerus ribauti* Nickel & Remane, 2002 were collected on *Juglans regia*. This is remarkable, as *Juglans* is generally regarded as a tree species that is largely unutilised by Auchenorrhyncha in Central Europe (Nickel 2008). Based on the distribution of

Juglans regia in Europe, it should be expected that *Pediopsoides sharmai* will expand its distribution throughout central and southern parts of Europe. The Austrian records are interesting for the fact that the closest records are from Bunde (province of Limburg), the Netherlands which is 477 km northwest of Bregenz, Austria. During the early summer of 2024, an attempt by the first author to collect *P. sharmai* in southwestern Germany, was unsuccessful. It is unclear if *P. sharmai* is capable of long-distance migration and thus creating a disjunct distribution. Perhaps, the Austrian records are the result of a separate introduction. On the other hand, it is also possible that the species is already more widespread, without being noticed.

Acknowledgements

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Samenvatting

De Indiase dwergcicade *Pediopsoides sharmai* ontdekt in Europa (Auchenorrhyncha: Cicadellidae: Eurymelinae: Macropsini)

In juli 2020 werd een afwijkende Macropsini gevonden in een lichtval in Tilburg. Het exemplaar werd verzameld en naar de eerste auteur gestuurd. Nadat meer exemplaren waren gefotografeerd en verzameld, werd de soort geïdentificeerd als *Pediopsoides (Sispocnis) sharmai* Viraktamath. Omdat deze soort alleen bekend was van het mannelijke typemateriaal, verzameld in Jammu & Kasjmir in India in een lichtkoepel, was er geen informatie over het vrouwtje en de ecologie van deze soort beschikbaar. Gebaseerd op de Europese gegevens leeft de soort op *Juglans regia*, heeft ze twee generaties per jaar en overwintert vermoedelijk als ei. Een korte beschrijving van het vrouwtje wordt gegeven. In Europa is *P. sharmai* nu bekend uit Nederland, België, Duitsland en Oostenrijk.



M.C. (Marco) de Haas

Netherlands Institute for Vectors, Invasive plants and Plant health
Wageningen, the Netherlands
m.c.dehaas@nvwa.nl

C.F.M. (Kees) den Bieman

Ulvenhout, the Netherlands

C.A. (Chandra) Viraktamath

Bengaluru, India

Egon Lind

V.I.N.C.A – Institut für Naturschutzforschung und Ökologie GmbH
Vienna, Austria

Gernot Kunz

Institute of Biology so as Universalmuseum Joanneum
Graz, Austria

Werner E. Holzinger

Ökoteam – Institut für Tierökologie und Naturraumplanung
Graz, Austria