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NOTES ON GEOGRAPHIC DISTRIBUTION

First record of the non-native leafhopper *Hishimonus hamatus* Kuoh, 1976 (Hemiptera, Cicadellidae, Deltocephalinae, Opsiini) in Bulgaria

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Abstract. We report *Hishimonus hamatus* Kuoh, 1976 from Bulgaria for the first time. We collected 36 specimens, including a nymph, at eight localities in six widely separated cities. All records originated from urban parks and gardens. Identification was based on external morphology and the male genitalia. The broad geographic spread of the records, from the Black Sea coast and southern Bulgaria to the Danube region in the north-west, suggests that this adventive East Asian leafhopper is already more widely distributed in Bulgarian urban areas than currently documented.

Keywords. Adventive species, host plants, introduced species, new record, non-indigenous insect, urban territories

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Introduction

The leafhopper genus *Hishimonus* Ishihara, 1953 belongs to Opsiina within the tribe Opsiini, subfamily Deltocephalinae (Cicadellidae). The genus is principally distributed in the temperate and subtropical regions of the Old World, with its greatest diversity in the Oriental Region and extensions into the eastern Palaearctic, Afrotropical, and Australian regions (Knight 1970; Dai et al. 2013; Fletcher and Dai 2013; Viraktamath and Murthy 2014; Du and Dai 2019). The World Auchenorrhyncha Database currently recognises 69 valid species (Dmitriev et al. 2022 onward). Reliable identification of *Hishimonus* species requires examination of the male genitalia, as external morphological characters are not sufficiently diagnostic (Du and Dai 2019; Bella et al. 2022).

Three species have been documented in Europe. *Hishimonus sellatus* (Uhler, 1896) was found in the Krasnodar Territory of European Russia in 2007 (Gnezdilov 2008). *Hishimonus hamatus* Kuoh, 1976 was first reported outside its native East Asian range from Slovenia, based on material collected in 2012 and 2013 (Seljak 2013), although material collected in Switzerland in 2011 and published later represents the earliest known European occurrence (Trivellone et al. 2015). It was subsequently documented from Italy, Corsica, Germany, Austria, mainland France, Spain, Hungary, and the Netherlands (Albre and Gibernau 2019; Quaglino et al. 2019; Holzinger et al. 2020; Winterhagen 2020; Bella et al. 2022; Orosz et al. 2024; de Haas et al. 2025) (Fig. 1A). The third species, *Hishimonus diffractus* Dai, Fletcher & Zhang, 2013, has been recorded from several parts of southern and western Europe; the earliest known European material was collected in Mallorca, Spain, in 2007 (Bella et al. 2022).

Hishimonus hamatus is native to eastern Asia and is confirmed from China, the Korean Peninsula and Japan (Okada 1978; Seljak 2013; Du and Dai 2019; de Haas et al. 2025). Published records from Australia, Fiji, India, Indonesia, and Ethiopia resulted from an erroneous attribution and do not represent the distribution of this species (de Haas et al. 2025). Its verified non-native range is therefore currently European.

Hishimonus hamatus is a broadly polyphagous species associated with woody plants, including trees and shrubs. In its native range, it has been collected from *Euonymus japonicus* Thunb. (Celastraceae), *Sambucus javanica* Blume (Adoxaceae), *Ilex crenata* Thunb. (Aquifoliaceae), and *Serissa japonica* (Thunb.) Thunb. (Rubiaceae) (Okada 1978; Seljak 2013). European host plants confirmed by the presence of nymphs include *Ligustrum lucidum* W.T.Aiton and *L. japonicum* Thunb. (Oleaceae), *Lagerstroemia indica*

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L. (Lythraceae), *Euonymus japonicus* Thunb. (Celastraceae), and *Chamaecyparis lawsoniana* (A.Murray bis) Parl. and *Cupressus sempervirens* L. (Cupressaceae) (Seljak 2013). Adults have also been collected from *Thuja occidentalis* L. (Cupressaceae), while German material, including nymphs, was obtained from *Ligustrum ovalifolium* Hassk.; a fifth-instar nymph accepted both grapevine and privet leaves in a feeding test (Seljak 2013; Winterhagen 2020). Other published associations include vineyards and *Vitis vinifera* L. (Vitaceae), as well as mixed stands of *Amelanchier* × *lamarckii* F.G.Schroed. (Rosaceae) and *Ligustrum vulgare* L.; several conifers have been reported as possible overwintering plants in Hungary (Quaglino et al. 2019; Bella et al. 2022; Orosz et al. 2024). The frequent association with ornamental woody plants provides a plausible pathway for transport with nursery stock. Here, we report the first records of *H. hamatus* from Bulgaria, document its occurrence in urban green spaces across a large part of the country, provide data on the plants from which it was collected, and discuss these records in the context of other non-native Auchenorrhyncha recorded in Bulgaria.

Methods

Field surveys were conducted in urban parks and gardens in southern, eastern, and north-western Bulgaria from 12 to 19 August 2026. Specimens were collected by sweeping vegetation with an entomological net, killed in a freezer and dry-mounted by gluing them to entomological mounting cards. Adults were identified from external morphology and the structures of the male genitalia following Okada (1978), Seljak (2013), Du and Dai (2019), and Bella et al. (2022). The voucher specimens were deposited in the Zoological Collection of Sofia University, Faculty of Biology, Sofia, Bulgaria (BFUS).

The living male BFUS-I-IG036483 was photographed by Ilia Gjonov using a Sony α7 IV camera fitted with a Laowa 25 mm Ultra Macro 2.5–5.0× lens and two TTArtisan M01 Mini Xenon Flash units, fired using a J01 trigger.

The distribution map was created from coordinates recorded in the field using QGIS v. 3.40 (QGIS Development Team 2024) and a shapefile from the Database of Global Administrative Areas, v. 4.1 (GADM 2022). Coordinates are presented in decimal degrees and rounded to four decimal places; elevations are rounded to the nearest 10 m, following the journal guidelines.

Results

Order Hemiptera Linnaeus, 1758
Suborder Auchenorrhyncha Duméril, 1805
Infraorder Cicadomorpha Evans, 1946
Superfamily Membracoidea Rafinesque, 1815
Family Cicadellidae Latreille, 1825
Subfamily Deltocephalinae Fieber, 1869
Tribe Opsiini Emeljanov, 1962
Subtribe Opsiina Emeljanov, 1962
Genus *Hishimonus* Ishihara, 1953

***Hishimonus hamatus* Kuoh, 1976**
Synonym: *Hishimonus araii* Okada, 1978
Figures 1, 2

New records. BULGARIA — Yambol Province • Yambol, Central Park; 42.4863°N, 026.4987°E; 140 m elev.; 13.VIII.2026; R. Angelova leg.; 1 ♀, BFUS-I-IG035629 — Burgas Province • Burgas, Sea Garden; 42.5082°N, 027.4800°E; 0 m elev.; 14.VIII.2026; R. Angelova leg.; 2 ♂, BFUS-I-IG035630, BFUS-I-IG036483 (Fig. 2) — Haskovo Province • Haskovo, City Garden; 41.9335°N, 025.5427°E; 180 m elev.; 12.VIII.2026; R. Angelova leg.; 2 ♂, 1 ♀, BFUS-I-IG035631–BFUS-I-IG035633 • Haskovo, Kenana Forest Park; 41.9441°N, 025.5417°E; 230 m elev.; 12.VIII.2026; R. Angelova leg.; 3 ♂, 2 ♀, BFUS-I-IG035634–BFUS-I-IG035638 — Stara Zagora Province • Stara Zagora, Artileriyski Park; 42.4190°N, 025.6122°E; 220 m elev.; 12.VIII.2026; R. Angelova leg.; 1 ♀, BFUS-I-IG035639 — Vidin Province • Vidin, Rowing Base; 43.9962°N, 022.8917°E; 40 m elev.; 18.VIII.2026; I. Gjonov leg.; 1 ♀, BFUS-I-IG036459 • Vidin, Vladikina Bahcha Garden; 43.9924°N, 022.8676°E; 40 m elev.; 18.VIII.2026; I. Gjonov leg.; 7 ♂, 10 ♀, BFUS-I-IG036460–BFUS-I-IG036476 — Montana Province • Montana, Montanezium Garden; 43.4087°N, 023.2206°E; 190 m elev.; 19.VIII.2026; I. Gjonov leg.; 1 ♂, 4 ♀, 1 nymph, BFUS-I-IG036477–BFUS-I-IG036482 (Figure 1B).

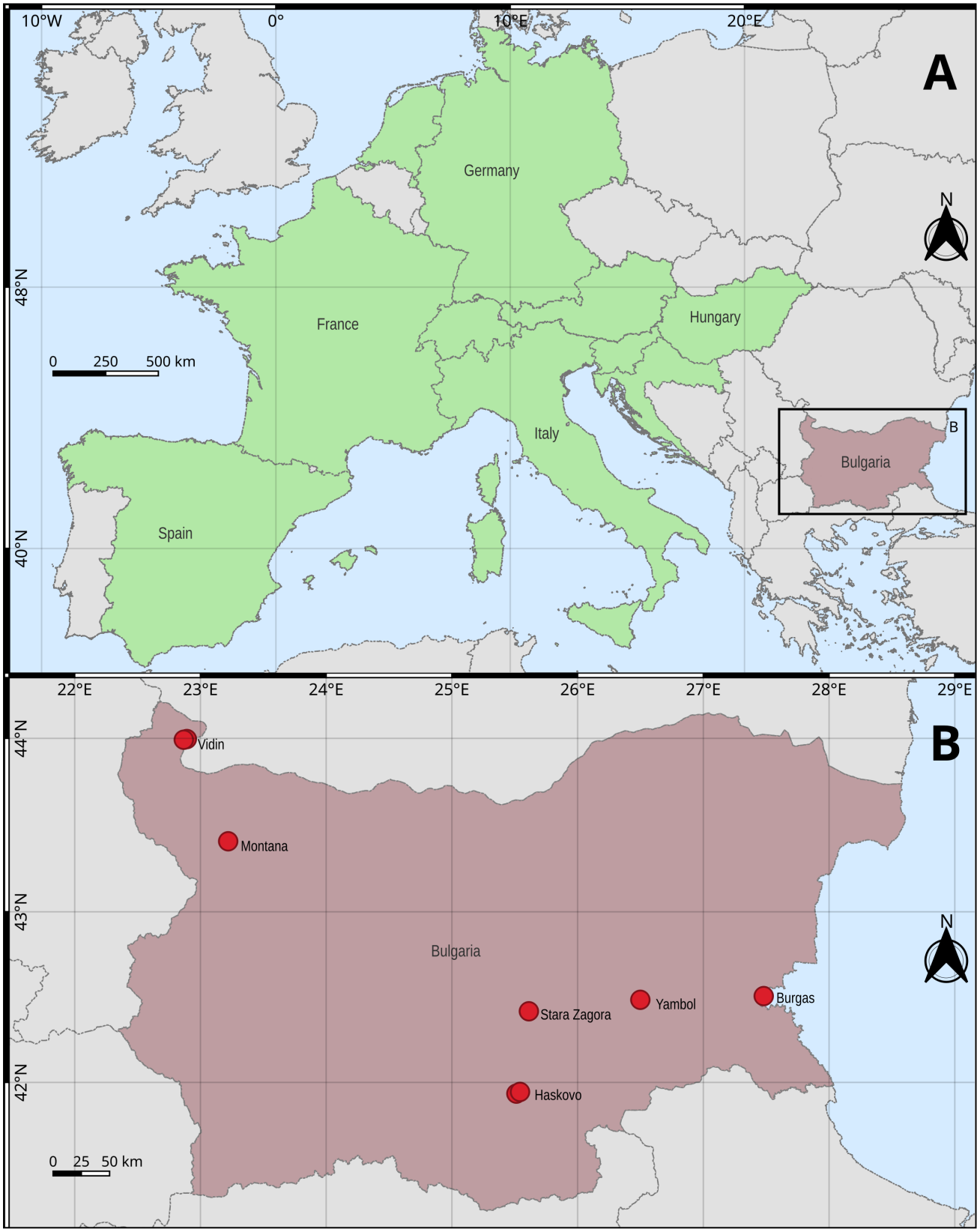

Figure 1. Distribution of *Hishimonus hamatus* in Europe and collecting localities in Bulgaria. **A.** Known European distribution (countries shaded in green), with Bulgaria separately highlighted. **B.** Collection localities in Bulgaria (red circles).

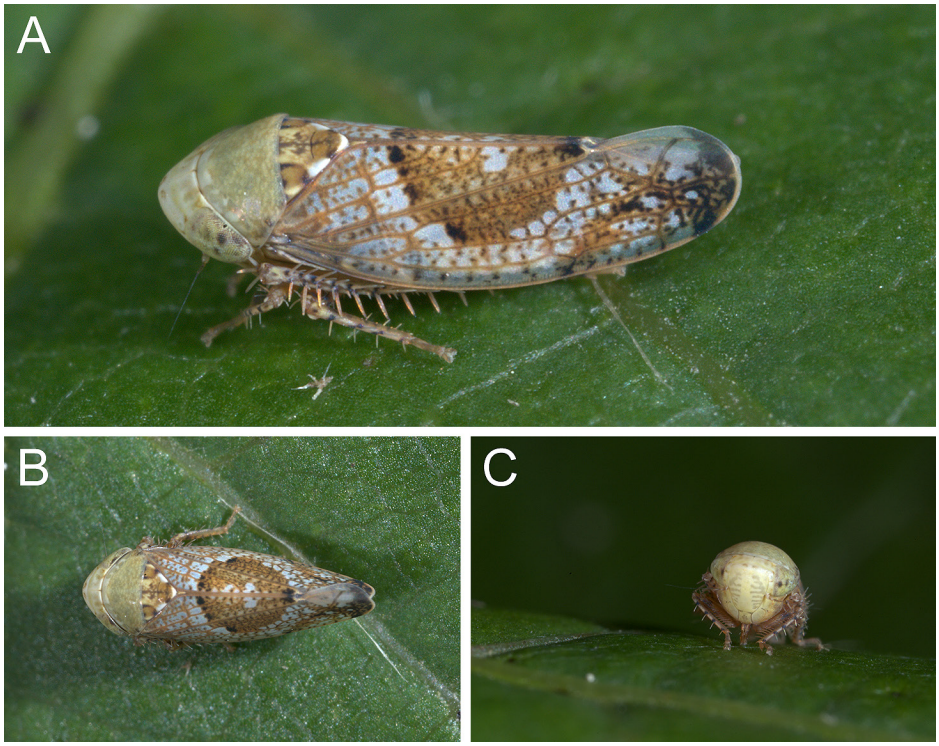

Figure 2. Living male of *Hishimonus hamatus* from Burgas Sea Garden, Bulgaria, 14 August 2026, BFUS-I-IG036483. **A.** Dorsolateral view. **B.** Dorsal view. **C.** Frontal view. Photographs: Ilia Gjonov.

Plant associations. Specimens in Vidin were swept from *Ligustrum vulgare* L. and *Fraxinus* spp. (Oleaceae), *Juglans regia* L. (Juglandaceae), *Ulmus* spp. (Ulmaceae), and *Acer platanoides* L. (Sapindaceae). In Montana, specimens were collected from *Ligustrum vulgare* L. and *Fraxinus* sp. and *Buddleja davidii* Franch. (Scrophulariaceae). The specimens from Haskovo City Garden were collected from *Fraxinus excelsior* L., and those from Kenana Forest Park and Artileriyski Park in Stara Zagora from *Acer* sp. The specimens from Yambol Central Park and Burgas Sea Garden were collected from *Hedera helix* L. (Araliaceae).

Identification. Adults of *Hishimonus* are small, pale greenish-yellow leafhoppers with silvery-white forewings mottled with brown. A large semicircular brown mark on the inner half of each forewing forms a conspicuous diamond-shaped patch when the wings are held at rest. This external pattern is characteristic of the genus but does not allow reliable species-level identification because congeners are very similar in colour and habitus (Knight 1970; Du and Dai 2019; Bella et al. 2022). In *H. hamatus*, the male subgenital plates are broad basally and narrow gradually into long, finger-like apical processes. The aedeagus is V-shaped and has two tubular shafts, each with a subapical gonopore. In posterior view, the shafts are constricted basally, expand slightly near the subapex, and terminate in a rounded apex with a shallow medial notch. In lateral view, each shaft curves dorsally, bears a lamellar subapical expansion, and terminates in an acute process reflexed anteriorly (Okada 1978; Seljak 2013; Du and Dai 2019).

Hishimonus hamatus is distinguished from the other species known in Europe by the configuration of the aedeagus. In *H. sellatus*, the aedeagal shafts lack the apical hooks characteristic of *H. hamatus*. In *H. diffractus*, each shaft bears a short, sharp process on its inner margin at approximately ½–⅔ of its length, and the subgenital plates narrow abruptly before the apical finger-like process (Du and Dai 2019; Bella et al. 2022). Among non-European congeners, *H. hamatus* resembles *H. callisto* Linnavuori, 1969 and *H. lindbergi* Knight, 1970; the latter has much more slender, outwardly convex aedeagal shafts, whereas those of *H. hamatus* are broader and have concave lateral margins below the distal lamellar expansion (Seljak 2013). The female seventh sternite is approximately twice as wide as long and has a broad V-shaped median emargination with a small median projection (Seljak 2013; Du and Dai 2019). The habitus of living adults is shown in Figure 2.

Discussion

The Bulgarian records extend the verified non-native range of *Hishimonus hamatus* to the eastern Balkan Peninsula. The European chronology is more complex than the sequence of publications. The

earliest known specimen was collected in Switzerland in July 2011 but published in 2015 (Trivellone et al. 2015). The first published European record was based on material collected in Slovenia from 2012 onwards (Seljak 2013). The species was then found in northern Italy in 2014, in Corsica during a survey conducted from March 2017 to March 2018, in Germany from July to September 2020 and in an Austrian garden centre in August 2020 (Albre and Gibernau 2019; Quaglino et al. 2019; Holzinger et al. 2020; Winterhagen 2020). Confirmed records from mainland France and Spain date from 2021 (Bella et al. 2022). In Hungary, photographed individuals were observed in 2022 and specimens suitable for genital examination were collected in 2023 (Orosz et al. 2024). Photographs of unidentified *Hishimonus* have been available from the Netherlands since 2019, but the first males confirmed as *H. hamatus* were collected in 2024 (de Haas et al. 2025). The Bulgarian records from 2026 are therefore the first from the country. The localities extend from Haskovo, Stara Zagora, Yambol, and Burgas in southern and eastern Bulgaria to Montana and Vidin in the north-west. Their wide separation makes a highly localised occurrence unlikely, and *H. hamatus* is probably already more widely distributed in Bulgarian urban areas than the available records indicate.

All Bulgarian specimens were found in parks or gardens within cities. This pattern agrees with the species' European association with ornamental woody vegetation and with records from gardens, garden centres, vineyard margins, and other anthropogenic habitats (Seljak 2013; Trivellone et al. 2015; Holzinger et al. 2020; Winterhagen 2020; Bella et al. 2022). The numerous adults in Vidin and the occurrence of a nymph in Montana indicate established local populations rather than isolated interceptions. Trade and movement of ornamental plants are plausible mechanisms for both long-distance introduction and subsequent dispersal, although the present data cannot identify the source, number or direction of introductions.

The Bulgarian material was collected from woody plants belonging to seven families and supports the classification of *H. hamatus* as a broad polyphage. *Ligustrum vulgare* has already been reported in association with the species in Hungary (Orosz et al. 2024), whereas *Fraxinus*, *Juglans*, *Ulmus*, *Acer*, *Buddleja*, and *Hedera* were not found among the published plant records reviewed here. These are therefore apparently new plant associations for *H. hamatus*. They should not all be regarded as confirmed host-plant records, because most Bulgarian specimens were adults collected by sweeping and the individual plant on which the single nymph developed was not recorded. Targeted searches for nymphs and direct feeding observations are needed to establish which of these plants support development.

The detection of *H. hamatus* adds to a growing series of non-native Auchenorrhyncha recorded from Bulgaria. Six such species were reviewed by Gjonov and Shishiniova (2014), and subsequent additions include *Arboridia kakogawana* (Matsumura, 1932) and *Erasmoneura vulnerata* (Fitch, 1851) (Cicadellidae, Typhlocybinae), *Orientus ishidae* (Matsumura, 1902) (Cicadellidae, Deltocephalinae), *Acanalonia conica* (Say, 1830) (Acanaloniidae), and *Pochazia shantungensis* (Chou & Lu, 1977) (Ricaniidae) (Tomov 2020, 2022; Gjonov et al. 2023, 2025; Gjonov and Simov 2025). Several of these were first detected in Bulgarian cities or other strongly modified habitats. Urban green spaces contain diverse ornamental plants, are repeatedly supplied through plant trade and are sampled less systematically than agricultural crops; they can therefore support non-native hopper populations for some time before detection.

Some *Hishimonus* species are vectors of economically important phytoplasmas, but there is currently no evidence that *H. hamatus* transmits phytoplasmas (Seljak 2013; Winterhagen 2020). Its presence should consequently not be interpreted as evidence of an immediate phytosanitary impact. Nevertheless, its broad host range, continued spread in Europe and occurrence in several Bulgarian cities justify targeted surveys of ornamental woody plants and vineyards, supported by examination of male genitalia. Such surveys are needed to delimit its distribution, establish its host plants in Bulgaria and evaluate whether it acquires plant pathogens under local conditions.

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Additional information

Conflict of interest
The authors declare that no competing interests exist.

Ethical statement
No ethical statement is reported.

Use of artificial intelligence (AI)
The authors accept full responsibility for the content of the manuscript, including the disclosure of any use of AI. In the preparation of this manuscript, the authors declare the use of GPT for language, style, and writing.

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Author contributions
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Data availability
All data that support the findings of this study are available in the main text.

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