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**JUNCUS EFFUSUS (JUNCACEAE) AS A HOST PLANT OF
NOTHODELPHAX OCCLUSA (VAN DUZEE)
(HEMIPTERA: FULGOROIDEA: DELPHACIDAE) IN
THE PACIFIC NORTHWEST**

A. G. WHEELER, JR., E. RICHARD HOEBEKE, AND CHARLES R. BARTLETT

(AGW) Department of Plant and Environmental Sciences, Clemson University, Clemson, SC 29634-0310, U.S.A. (e-mail: awhlr@clemson.edu); (ERH) Georgia Museum of Natural History and Department of Entomology, University of Georgia, Athens, GA 30602, U.S.A. (e-mail: rhoebeke@uga.edu); (CRB) Department of Entomology and Wildlife Ecology, University of Delaware, 250 Townsend Hall, Newark, DE 19716-2130, USA (e-mail: bartlett@udel.edu)

Abstract.—*Nothodelphax occlusa* is a little-known delphacid planthopper of the subfamily Delphacinae, tribe Delphacini. All records are from western North America: British Columbia in Canada; Arizona, California, Colorado, Nevada, Oregon, and Washington in the United States; and Baja California in Mexico. Its host plants have remained unknown. Based on fieldwork in Oregon and Washington (2007–2009), *N. occlusa* is reported to develop on common rush, *Juncus effusus* (Juncaceae), in natural stands and ornamental plantings. The presence of *N. occlusa* in waterside gardens and other landscape plantings suggests that it can be transported with *Juncus* nursery stock. It was not found on grasses (Poaceae) or sedges (Cyperaceae). All adult males collected (n = 170) were brachypterous; females were mainly brachypterous (n = 47), with the remainder macropterous (n = 19). The adult male and female are described, and color photographs of the male and female (dorsal habitus) and hindleg (showing calcar and teeth) are included.

Key Words: Insecta, Fulgoroidea, planthopper, host plant, rushes, Pacific Northwest, taxonomy

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The Delphacidae are the most speciose family of North American planthoppers, with more than 300 species in 61 genera recorded from the contiguous United States (Bartlett et al. 2014). Although the family generally is considered host-plant restricted, hosts remain undocumented or inadequately known for most North American species. Delphacids are found mainly on monocots, especially graminoids: grasses (Poaceae), rushes (Juncaceae), and

sedges (Cyperaceae). Among graminoids, grasses serve as hosts for the largest number of North American Delphacidae, followed by sedges; comparatively few species specialize on rushes (Wilson et al. 1994).

Nothodelphax occlusa (Van Duzee) is a delphacine planthopper described (as *Liburnia occlusa*) on the basis of a male and two females from southern California (Van Duzee 1897). This delphacid apparently is

restricted to western North America, with subsequent U.S. records from Arizona, Colorado, Nevada, Oregon, and Washington. Its distribution also includes British Columbia, Canada, and Baja California, Mexico. The U.S. record from Ohio is based on a misidentification, and the Canadian record from Quebec is questionable (Bartlett et al. 2014). Host-plant relationships of *N. occlusa* have been unknown.

We document common rush, *Juncus effusus* L., as a host plant of *N. occlusa* based on collections and observations in Oregon and Washington (AGW, ERH). The brachypterous male and female of this dimorphic planthopper and male terminalia are described and illustrated (CRB). Also included are color images of the adult dorsal habitus. Females collected from *J. effusus* in the Pacific Northwest were testaceous rather than piceous black, as noted by Van Duzee (1897) in the original description of *N. occlusa*. We suggest that the two females available to Van Duzee were not conspecific with the male on which he based his description.

MATERIALS AND METHODS

Nymphs and adults of *N. occlusa* were collected from *J. effusus* by placing a beating net at the base of this rush of bunched growth (densely cespitose) habit and using an ax handle to dislodge insects from the crowns. At one site (Closed Loop Park, Lacey, WA) where the planthopper was abundant, the rush's sprawling stems were shaken over the net. Adults were collected into small plastic vials and point mounted for subsequent identification. Grasses and sedges were sampled similarly in an attempt to associate the delphacid with additional graminoids. Voucher specimens are deposited in the Cornell University Insect Collection, Ithaca, NY; University of Delaware Insect Reference Collection,

Newark; University of Georgia Collection of Arthropods, Athens; and U.S. National Museum of Natural History, Smithsonian Institution, Washington, DC.

Photographs and measurements were taken using a digital imagery system consisting of a Nikon SMZ1500 microscope, Nikon Digital Sight DS-U1 camera and NIS Elements Imaging software (version 3.0). Line art was digitally traced from photographs. Specimens were provided 2D barcode labels, and data were captured for online presentation following publication (visualized at www.discoverlife.org) using "Arthropod Easy Data Capture" (Schuh et al. 2010, Schuh 2012, Arthropod Easy Capture 2013).

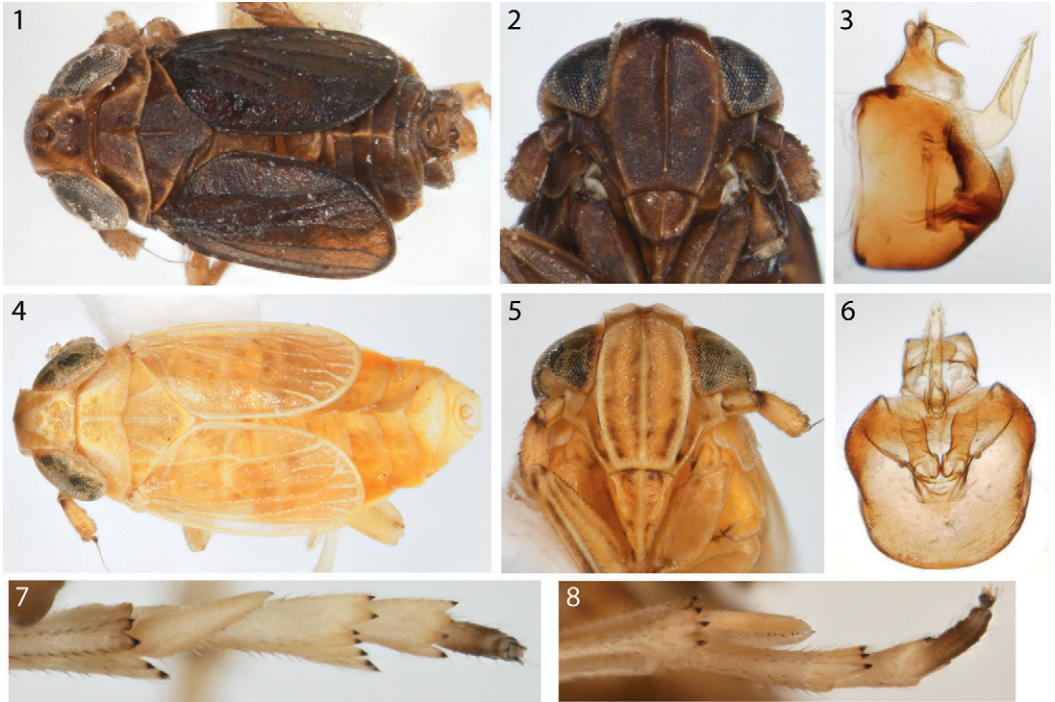
Nothodelphax occlusa (Van Duzee)

(Figs. 1–11)

Taxonomy

The genus *Nothodelphax* Fennah consists of 18 primarily Holarctic species [*N. atlanticus* (China) is found in temperate South America], including five that are circumboreal. The genus was described by Fennah (1963) with *occlusa* subsequently included by Fennah (1965). New World species have not been revised, except those of Alaska and the Yukon (Wilson 1988, 1992). Species diagnosis generally relies on features of the aedeagus, with females identified by their association with males. Like many other species of *Nothodelphax*, *N. occlusa* is dimorphic with males darker and females much paler. Brachypterous individuals strongly outnumber macropters for *N. occlusa*, and all macropters observed were females.

Description.—Brachypterous males are piceous, about 2.08 mm long (range 1.82–2.19, $n = 4$), carinae slightly paler than body and legs distinctly paler; head slightly wider than pronotum; vertex length subequal to width (W:L 1.07, $n = 4$) and

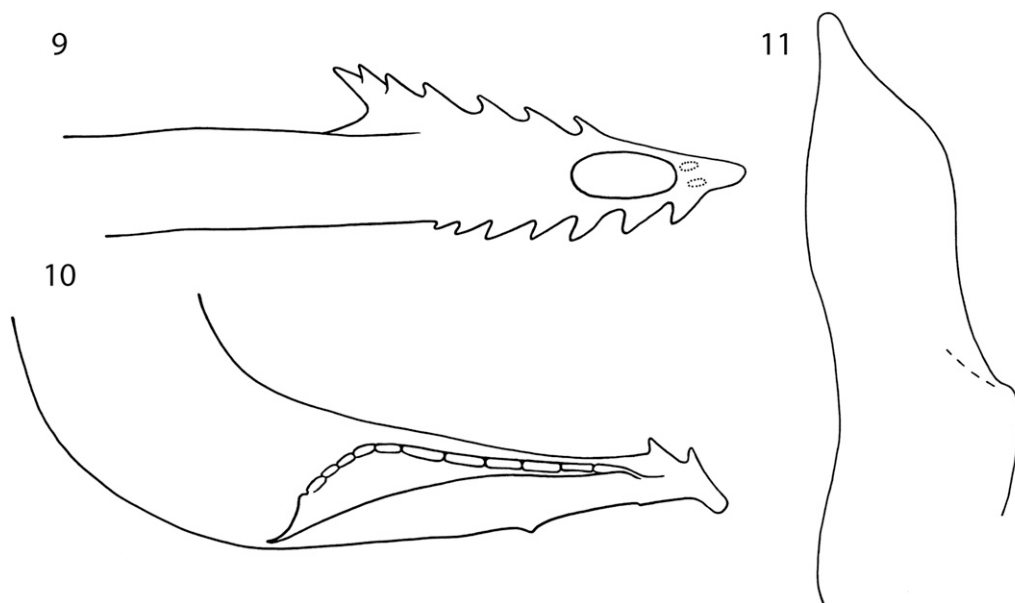


Figs. 1–8. *Nothodelphax occlusa*. 1, Male, dorsal habitus. 2, Male, frontal view. 3, Male terminalia, lateral view. 4, Female, dorsal habitus. 5, Female, frontal view. 6, Male terminalia, ventrocaudal view. 7, Apex of hindleg with calcar, ventral view. 8, Same, lateral view showing teeth of calcar (all Budd Inlet, Olympia, Washington, except A and B from Sardine Creek (elev. 8500'), Mono Co., California).

about 1.4× length of pronotum. Frons broad, lateral margins arced and widest near level of antennae, length along midline about 1.6× width; median carina of frons forked close to vertex. Antennae short, segment I dark, about as long as wide; II paler, >2× length I. Pronotum about 1/2 length of mesonotum along midline. Brachypterous tegmina rounded apically and typically reaching the 6th abdominal tergite (sometimes shorter). Calcar tectiform, almost 2/3 length of basitarsus with few (~10–12), fine pale or black-tipped teeth (partly hidden by curled calcar in dry specimens). Pygofer in lateral view forming a rounded trapezoid, opening in caudal view wider than tall, margins weakly carinate; diaphragm strongly developed, dorsal margin concave, armature

bilobed and weakly projected caudally for reception of aedeagus in repose. Gonostyli flattened, diverging, abruptly narrowing to a blunt apex in distal fourth. Aedeagus flattened, in lateral view up-curved, widest near base, distally tapering in apical third to rounded apex. Aedeagus with 2 subapical dorsal teeth and lateral serrate fringe on both sides; fringe slightly curved and diagonally directed, in ventral view, left side expanded into distinct flange; gonopore ventral in apical fourth. Anal tube bearing a pair of stout, relatively short, downcurved spines on ventrocaudal margin, widely separated basally.

The mainly brachypterous females are testaceous, with dark flecks in foveae of frons, clypeus, and genae (distal tarsal segment and ovipositor also dark).



Figs. 9–11. *Nothodelphax occlusa*, aedeagus. 9, Ventral view. 10, Lateral view. 11, Left gonostylus, widest view.

Brachypterous females are about 2.55 mm long (range 2.24–2.87, $n = 5$) and generally of similar build as males, although the vertex is slightly longer ($W:L$ 0.94, $n = 5$) and about $1.5\times$ length of pronotum. Antennae with segment I pale, slightly longer than wide, II about $2\times$ length of I, with dark marking at joint. Brachypterous tegmina rounded apically and typically reaching 6th abdominal tergite. Macropterous females have clear wings.

Remarks.—Van Duzee’s (1897: 256) original description was based on a male and two females from Los Angeles, California, that he received from the dipterist D. W. Coquillett. The female was noted to resemble the male in coloration (“piceous black”), rather than pallid as in the morphologically similar *N. lineatipes* (Van Duzee), which was described in the same work (p. 255) from New York and Ontario. Contrariwise, all females of *N. occlusa* that we collected ($n = 66$; see specimens examined) and observed in the field were testaceous. We

suggest that the two females Van Duzee (1897) used to describe *N. occlusa* were not conspecific with the male. Coquillett might have swept the male and females from different plant species. Van Duzee (1897) noted that his new species *N. occlusa* is “closely allied” to *N. lineatipes*, which now is also known from California (Bartlett et al. 2014). The females included in the original description of *N. occlusa*, however, are not necessarily those of *N. lineatipes* and might refer to another species of delphacine planthopper of the nominotypical tribe.

Specimens examined (b = brachypterous; m = macropterous; all specimens collected from *Juncus effusus*).—OREGON: Clackamas Co., Clackamas Community College, Oregon City, 45°19.361’N 122°34.570’W, 5 July 2009, 3b♂, 1b♀. Clatsop Co., Rt. 26, Sunset Rest Area, ca. 50 km E of Seaside, 45°53.4’N 123°37.9’W, 3 July 2009, 4b♂, 1b♀, >100 nymphs. Multnomah Co., Hoyt Arboretum, Portland, 45°30.920’N 122°42.931’W, 24 July 2007, 2b♂, 2b♀, 1m♀; Lewis

& Clark College, Portland, 45°27.00'N 122°40.35'W, 5 July 2009, 1b♂, 2b♀; Reed College, Portland, 45°28.304'N 122°37.602'W, 3 July 2008, 4b♂, 1b♀ & 5 July 2009, 9b♂, 2b♀. *Yamhill Co.*, Linfield College, McMinnville, 45°12.12'N 123°11.98'W, 4 July 2009, 14b♂, 7b♀, 1m♀. WASHINGTON: *Clark Co.*, Washington State University, Vancouver, 45°43.830'N 122°38.354'W, 22 July 2007, 24b♂, 9b♀ & 3 July 2008, 7b♂, 3b♀, 1m♀. *Thurston Co.*, Budd Inlet (southern tip), Olympia, 47°03.141'N 122°54.726'W, 1 July 2008, 8b♂, 4b♀, 2 nymphs; Evergreen State College, Olympia, 47°04.362'N 122°58.506'W, 23 July 2007, 14b♂, 1b♀, 2m♀ & 2 July 2008, 7b♂; South Puget Sound Community College, Olympia, 47°01.531'N 122°55.658'W, 23 July 2007, 29b♂, 6b♀, 6m♀, 1 nymph; Closed Loop Park, Lacey, 47°04.012'N 122°45.682'W, 24 July 2007, 35b♂, 5b♀, 8m♀, >300 nymphs & 2 July 2008, 9b♂, 3b♀.

Host-Plant Association

We first observed *N. occlusa* on *Juncus effusus* in 2008 along Budd Inlet at the southern tip of Puget Sound in Olympia, Washington. Ranging widely in North America from Newfoundland and Labrador to Florida in the East and Alaska to California and Arizona in the West, this variable rush might represent a species complex (Brooks 2000). The delphacid also was found in ornamental plantings of *J. effusus* in the Pacific Northwest (Oregon, 6 sites; Washington, 4 sites), suggesting that this planthopper can be transported with *Juncus* nursery stock. *Nothodelphax occlusa* was syntopic with the immigrant Palearctic delphacid *Conomelus anceps* (Germar) (Wheeler and Hoebeke 2008) in a planting of *J. effusus* on the Evergreen State College campus in Olympia. Nymphs and adults

were particularly numerous on *J. effusus* in the Demonstration Garden of Closed Loop Park, Lacey, Washington; each time ($n = 3$) sprawling stems were placed over a beating net and shaken, at least 100 individuals were obtained. Another large population, comprised mainly of nymphs, was observed in a rest area along Rt. 26 in Clatsop County, Oregon. In the Pacific Northwest, we collected a total of 236 adults: 170 brachypterous males, 47 brachypterous females, and 19 macropterous females.

We did not find *N. occlusa* on *J. effusus* at three sites in Oregon in July 2009 (Benton Co., Corvallis; Clackamas Co., Marylhurst; Jefferson Co., Warm Springs) or on any species of grasses and sedges sampled in Oregon and Washington in July of 2007 to 2009.

The term *host plant* has been used inconsistently in the literature for phytophagous insects (e.g., [Fothergill et al. 2013](#), [Mound 2013](#), [Burckhardt et al. 2014](#)), at times referring merely to a plant on which an adult was found (incidental occurrence or “sitting record”; Wilson and Wheeler 2010). Under certain conditions, such as drought or high winds, even the collection of a few hemipteran nymphs from a plant can be incidental ([Wheeler 2001](#), [2016](#)). *Juncus effusus*, however, can be considered a true host of *N. occlusa*—a plant that supports nymphal development over successive generations (Donnelly 2002, Roderick and Percy 2008). Additional field studies are needed to determine the host range within *Juncus* of this apparent specialist on Juncaceae.

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