

PALEARCTIC MIRIDAE IN NORTH AMERICA: RECORDS OF
NEWLY DISCOVERED AND LITTLE-KNOWN SPECIES
(HEMIPTERA: HETEROPTERA)

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Abstract.—The Palearctic mirids *Orthotylus viridinervis* (Kirschbaum), *Psallus betuleti* (Fallén), and *Sthenarus rotermundi* (Scholtz) are reported in North America for the first time, and additional locality records are given for four previously reported Palearctic species. *Orthotylus viridinervis* was discovered in Ontario, Canada on *Ulmus americana*; *P. betuleti* was taken at one locality in Pennsylvania on *Betula populifolia* and is also recorded from Alaska, based on museum specimens; and *S. rotermundi* was found at two localities in Pennsylvania feeding on the seeds of *Populus grandidentata* and *P. tremuloides*, and in Ontario, Canada on *P. alba*. *Megalocoleus molliculus* (Fallén), previously recorded from Massachusetts, Wisconsin and Ontario, Canada, is reported for the first time from Pennsylvania and West Virginia breeding on yarrow, *Achillea millefolium*, and from Connecticut and New Jersey, based on museum specimens. *Camptozygum aequale* (Villers) and *Plagiognathus vitellinus* (Scholtz) are recorded for the first time in Canada, based on collections from Ontario on *Pinus banksiana* and *Picea pungens*, respectively; and a single specimen of *Orthotylus nasatus* (F.) was taken on *Acer pseudoplatanus* in Bucks Co., Pennsylvania. Seasonal occurrence and diagnoses are given for *M. molliculus*, *O. viridinervis*, *P. betuleti*, and *S. rotermundi*. Illustrations of the adult and 5th instar of *M. molliculus* and *S. rotermundi* and the male genitalia of *O. viridinervis* are provided. Nursery stock is considered the most likely means of introduction for most of these species.

In the course of our studies on the mirid fauna of Pennsylvania and eastern North America we have collected three Palearctic species previously unrecorded from North America, *Orthotylus viridinervis* (Kirschbaum), *Psallus betuleti* (Fallén) and *Sthenarus rotermundi* (Scholtz), as well as a fourth species, *Megalocoleus molliculus* (Fallén), reported as an introduced species from Massachusetts (Knight, 1922) and not mentioned again in the

North American literature until 1972. Our distribution records and biological observations for these four mirids, with additional notes on three other previously reported Palearctic Miridae (Wheeler and Henry, 1973; Henry and Wheeler, 1973; Henry, 1977), are made available for inclusion in the forthcoming catalogue of the Hemiptera-Heteroptera of America north of Mexico. Characters of the adults are given, and descriptions and illustrations of the adults and fifth instars of *M. molliculus* and *S. rotermundi* and genitalia for *O. viridinervis* are provided to facilitate recognition of these species in the Nearctic fauna.

Megalocoleus molliculus (Fallén)

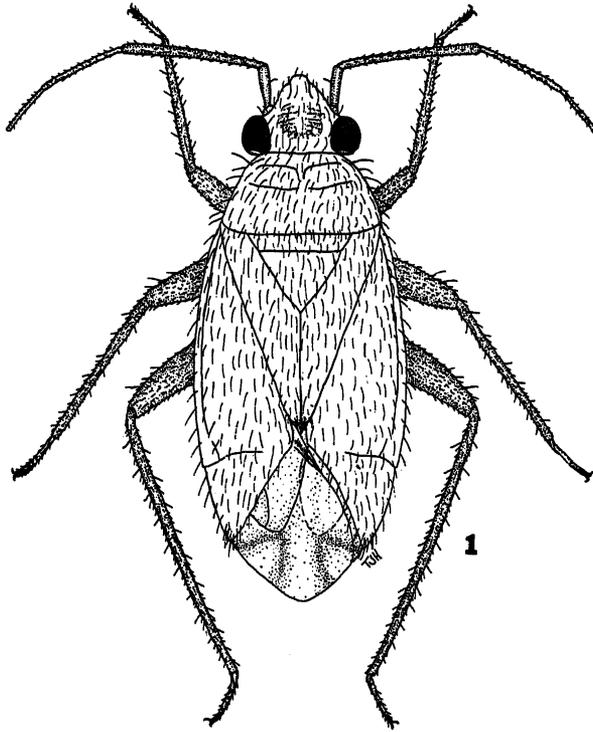
Figs. 1-2

This species is widely distributed throughout much of Europe and Great Britain and is known to occur in northern Africa (Carvalho, 1958; Wagner, 1975). *Megalocoleus molliculus* breeds on composites, mainly yarrow, *Achillea millefolium* L., but other composites such as *Anthemis tinctoria* L., *Artemisia* spp., *Matricaria maritima* L., and *Tanacetum vulgare* L. may also serve as hosts (Kullenberg, 1944; Stichel, 1956). Adults feed in the flower heads of yarrow where they blend in with the color of the involucre. Eggs deposited in the flower stalks hatch in early June in England. Adults mature in early July and are present until September (Butler, 1923; Southwood and Leston, 1959).

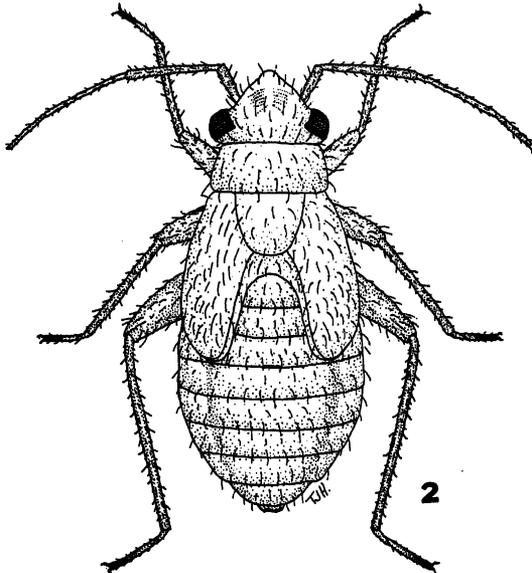
Kullenberg (1944) described the egg and illustrated the fifth instar nymph. Several workers, including Reuter (1875) and Southwood and Leston (1959), have described the adult. Kullenberg (1941) and Wagner (1975) figured male genitalia.

Knight (1922) first reported *M. molliculus* from North America based on specimens collected during 1916-17 by H. M. Parshley and C. E. Olsen at Beach Bluff (Essex County, near Marblehead) on the coast of Massachusetts and subsequently included it in his "Miridae (Capsidae) of Connecticut" (1923). This mirid was not recorded again from North America until Akingbohunge et al. (1972) reported it from Wisconsin and Reid et al. (1976) mentioned taking specimens by sweeping goldenrod, *Solidago canadensis* L., in Ontario. J. A. Slater (personal communication) has collected this species in Connecticut (Mansfield Center, June 19, 1957). We found specimens in the U.S. National Museum of Natural History (USNM) from New Jersey (Newark, B/L Ser. #991, 7/1/64) and Pennsylvania (Springbrook, Lackawanna Co., VII-11, 1945, Sailer, DDT Exp.) The Pennsylvania State University collection contains an additional specimen from Pennsylvania (Centre Co., State College, 7-30-76, L. E. Adams).

In 1977 and 1978 we collected large numbers of *M. molliculus* in Pennsylvania on flowers of yarrow growing along roadsides and in old fields. We found this phytline in 10 counties: Allegheny (Allison Park, 6 July 77), Centre



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Figs. 1-2. *Megalocoleus molliculus*. 1, Adult female. 2, 5th instar nymph.

(Scotia Barrens, 26 July 77), Clarion (Rts. 36 & 208 near Tylersburg, 25 July 78), Crawford (Rt. 8, 2.3 mi S of Tillotson, 25 July 78), Dauphin (Bow Creek Rd. 1.5 mi N of Grantville, and Jonestown Rd., Shellsville, 15 July 77), Erie (Presque Isle and Erie, 26 and 27 July 78), Montgomery (Montgomeryville, 19 July 78), Northumberland (Dornsife and 2 mi S of Augustaville, 12 July 77, 1 August 78), Somerset (Thomas Mills, 8 July 77), and Venango (Rt. 36 just W of Forest Co. line, 25 July 78).

Only adults were taken in Pennsylvania, but we collected a few fifth instars with larger numbers of adults in mid-July at higher elevations in West Virginia (Tucker Co., Dolly Sods Wilderness Area, 17 July 77, on yarrow). Adults were also taken in Greenbrier Co., West Virginia (I-65 near Alta exit, 16 July 78, on yarrow).

Adult male.—Length 4.58 mm, width 1.66 mm, generally pale yellowish green, thickly clothed with erect, brown to golden setae. *Head*: Width 0.92 mm, vertex 0.42 mm. *Rostrum*: 2.28 mm, reaching base of genital segment. *Antennae*: Testaceous; I, length 0.32 mm; II, 1.30 mm; III, 0.42 mm; IV, 0.20 mm. *Pronotum*: Length 0.68 mm, width at base 1.40 mm. *Hemelytra*: Pale yellowish green, clavus, embolium, middle of corium and cuneus often tinged with pale brown or golden yellow; membrane brownish to golden yellow. Venter yellow. *Legs*: Yellowish to testaceous; tibial spines brown to fuscous; tarsi brown, last segment and claws fuscous.

Females are similar to males in coloration, although they are distinctly broader and the head is more strongly convex and produced than in males, which gives them a superficial resemblance to *Amblytulus nasutus* (Kirschbaum).

Fifth instar.—Length 3.00 mm, pallid yellow, dorsum clothed with erect, stout, black setae. *Head*: Pale yellow, eyes red, frons strongly produced in front of eyes; antennae uniformly pale, clothed with erect, black setae, segments II and III subequal; rostrum pale to testaceous, apex fuscous, reaching middle of abdomen. *Pronotum*: Pale yellowish, width at base about 2× length at middle, wing pads and scutellar area pale yellow, pads reaching 3rd abdominal segment. Abdomen pale yellow, dorsal scent gland opening weakly pigmented, not easily visible. Venter pale yellow. *Legs*: Pale; femora clothed with erect, black setae, especially near apices; tibiae pale, spines stout, black; tarsi testaceous, apical ½ of last segment and claws fuscous.

Orthotylus viridinervis (Kirschbaum)

Fig. 3a–c

Orthotylus viridinervis is also a common species throughout Europe and Great Britain (Carvalho, 1958). Wych or Scotch elm, *Ulmus glabra* Huds., is the most common host (Butler, 1923), but it has also been taken on *Alnus*, *Corylus*, *Quercus*, and *Salix* (Stichel, 1957). In Britain eggs overwinter and adults are found from early July until late August (Southwood and Leston, 1959). Southwood (1953) figured male and female genitalia.

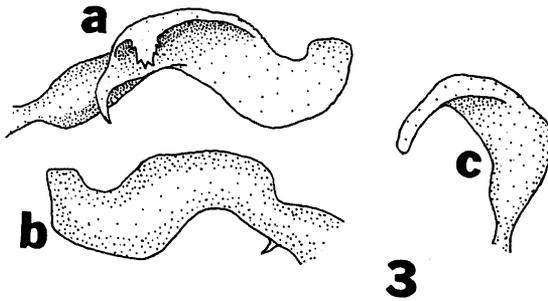


Fig. 3a-c. *Orthotylus viridinervis*. a, Right paramere, inside lateral view. b, Right paramere, lateral view. c, Left paramere, inside lateral view.

Our only record of *viridinervis* in North America is from Niagara Falls, Ontario, Canada, June 17, 1978 on American elm, *Ulmus americana* L., heavily infested with woolly elm aphid, *Eriosoma americanum* (Riley). Six males and two females were collected; three of these were teneral. *Campylomma verbasci* (Meyer), *Deraeocoris aphidiphagus* Knight, and *Microphyllellus modestus* Reuter were also found on the same trees.

Adult male.—Length 5.80 mm, width 1.76 mm, generally translucent green, clothed with erect, pale setae. *Head*: Width 0.86 mm, vertex 0.42 mm, testaceous, frequently tinged with green. *Rostrum*: Length 1.64 mm, reaching metacoxae. *Antennae*: Testaceous; I, length 0.58 mm, II, 2.00 mm; III, 1.00 mm; IV, 0.68 mm, fuscous. *Pronotum*: Length 0.68 mm, width at base 1.28 mm, greenish, mesoscutum and scutellum pale green. *Hemelytra*: Uniformly translucent green, clothed with erect pale setae; membrane transparent, veins and spot inside large areole green. *Venter and legs*: Pale greenish, tibial spines brownish, apex of last tarsal segment and claws fuscous. *Genitalia*: See Fig. 3.

The female is very similar to the male in color and form. Length 5.83 mm, width 1.84 mm. *Head*: Width 0.88 mm, vertex 0.46 mm. *Rostrum*: Length 1.72 mm, reaching metacoxae. *Antennae*: I, length 0.60 mm; II, 2.32 mm; III, 1.16 mm; IV, 0.64 mm. *Pronotum*: Length 0.72 mm, width at base 1.40 mm.

Remarks.—This is our only large green *Orthotylus* that breeds on elm. *Orthotylus viridinervis* keys to *basicornis* Knight in Knight (1941) but differs in the uniformly testaceous antennae, the longer rostrum which reaches the metacoxae, and the unique genitalia.

Psallus betuleti (Fallén)

Like *M. molliculus* and *O. viridinervis*, *P. betuleti* is a widely distributed species in Europe and Great Britain (Carvalho, 1958). Birches, especially *Betula alba* L., serve as the principal hosts, although this mirid has been

taken on alder (*Alnus glutinosa* (L.) Gaertn.) and willows (*Salix* spp.). On willow *P. betuleti* is associated with the flowers and fruits (Kullenberg, 1944). *Psallus betuleti* is both phytophagous and predacious (Kullenberg, 1944; Southwood and Leston, 1959). Eggs deposited in young wood of birch hatch in late April or early May in England; adults mature in late May or early June and are present until August (Southwood and Leston, 1959; Wagner, 1975).

Kullenberg (1944) described and figured the egg and both Kullenberg (1944) and Butler (1923) described and illustrated the fifth instar. Reuter (1875) and Southwood and Leston (1959) illustrated the adult. Wagner (1975) included a figure of male genitalia.

Our only collections of *P. betuleti* were made at Wilkes-Barre, Luzerne Co., Pennsylvania, during May 1977 and June 1978. On May 5, two fifth instars were beaten from gray birch, *Betula populifolia* Marsh., growing on coal spoil banks. Ten adults (five males, five females) were taken on the same trees on May 19 and three adults were taken at the same locality on June 7, 1978.

Although the occurrence of *P. betuleti* in North America has not previously been published, we found that R. I. Sailer had made an earlier collection from Alaska in 1948. The USNM has eight specimens (six males, two females) with the following data: Nabesna, Alaska, 15 mi W, 13-VII-48, R. I. Sailer; Alaska Insect Project.

Adult male.—Length 5.00 mm, width 1.83 mm, generally fuscous to black, clothed with silvery, sericeous pubescence intermixed with semierect, simple, black setae. *Head*: Black, eyes red, width 0.92 mm, vertex 0.38 mm. *Rostrum*: Length 1.42 mm, reaching middle of mesocoxae. *Antennae*: Black; I, length 0.32 mm; II, 1.50 mm; III, 0.68 mm; IV, 0.46 mm. *Pronotum*: Length 0.82 mm, width at base 1.64 mm, shiny black; mesoscutum and scutellum black. *Hemelytra*: Uniformly fuscous to black; cuneus black (sometimes largely tinged with red), pale along cuneal fracture, more reddish at apex. *Venter*: Black, ostiolar peritreme pale. *Legs*: Fuscous to dark reddish brown; pro- and mesofemora dark with a row of black spots on anterior surface, hind femora with 2 rows of black spots, apices of all femora frequently more reddish; tibiae yellow to reddish yellow with large black spots at bases of black spines; tarsi and claws largely fuscous.

Females differ from males by being more broadly formed and having red largely replacing black or fuscous on pronotal disc, scutellum, clavus, embolium, cuneus, abdomen, all femora and the outer and inner margins of the corium.

Remarks.—In Knight (1941) females of *betuleti* will key most closely to *alnicola* Douglas and Scott (although the dorsum is not distinctly flecked with fuscous), and males will key somewhat poorly to the couplet containing *strobicola* Knight and *bakeri* (Bergroth). *Psallus betuleti* can be distin-

guished from all other *Psallus* species by its large size (rivalled only by *parshleyi* Knight), the black antennae, the reddish cuneus in males and the reddish pronotal disc, scutellum, corium (in part), and cuneus in females, and the fuscous and red legs with black spots. The sexual dimorphism in this species is so great that the two sexes could be mistaken for different species if collected separately.

Sthenarus rotermundi (Scholtz)

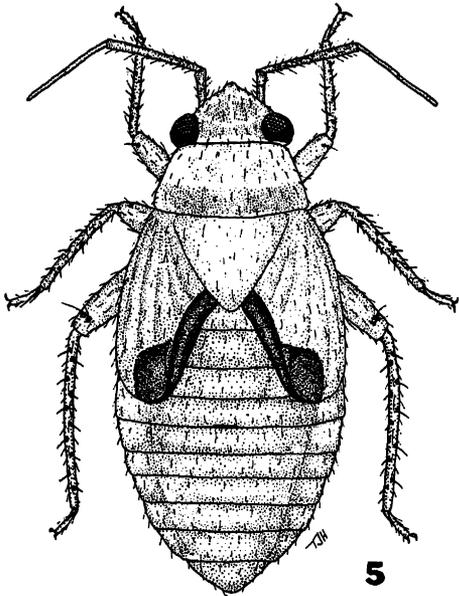
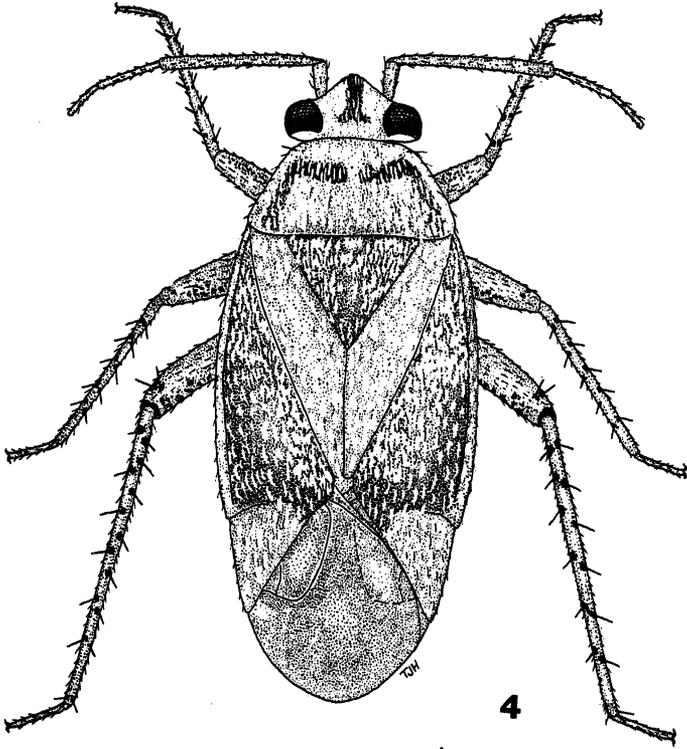
Figs. 4–5

This phyline mirid occurs throughout most of Europe and Great Britain and in Algeria (Carvalho, 1958; Wagner, 1975). White or silver poplar, *Populus alba* L., is the main host plant; *P. canescens* Smith, and *Alnus glutinosa* are additional hosts. The eggs overwinter and in England adults are present from late June until mid-August or September (Butler, 1923; Southwood and Leston, 1959).

Butler (1923) briefly described the egg, Reuter (1878) and Southwood and Leston (1959) illustrated the adult, and Wagner (1975) figured male genitalia.

Our records of *S. rotermundi* in North America are based on collections from western and eastern Pennsylvania and Ontario, Canada. At Monroeville, Allegheny Co., Pennsylvania, four males and three fifth instars were beaten from large-toothed aspen, *Populus grandidentata* Michx., during May 24–26, 1977. On May 7, 1978, a population of several hundred individuals was found on *P. grandidentata* near Wilkes-Barre in Luzerne Co. Late instars and adults were feeding on the seeds and were well camouflaged against the white pubescence of the capsules. Only a few adults were taken on quaking aspen, *P. tremuloides* Michx., growing among the large-toothed aspens. At Niagara Falls, Ont., a few adults and large numbers of fifth instars were found June 17, 1978, on seeds of silver poplar, the principal host of this mirid in Europe.

Adult male.—Length 3.80 mm, width 1.76 mm, generally grayish brown to fuscous, thickly clothed with silvery, sericeous pubescence (which gives a pale, silvery brown appearance). *Head*: Width 0.46 mm, vertex 0.24 mm, median line from vertex to tylus fuscous or black. *Rostrum*: Length 1.20 mm, reaching middle of mesocoxae. *Antennae*: Testaceous; I, length 0.28 mm, lightly fuscous at base; II, 1.16 mm, clothed with recumbent, golden setae; III, 0.48 mm, lightly infuscated at base; IV, 0.36 mm. *Pronotum*: Length 0.38 mm, width at base 0.76 mm, grayish brown, calli black with a lateral black ray extending back to base of disc; mesoscutum and scutellum black. *Hemelytra*: Grayish brown, corium, apex of clavus and paracuneus fuscous (thickly set silvery sericeous setae often mask fuscous coloration), cuneus pale grayish brown, often tinged with red. *Venter*: Mostly fuscous, ostiolar peritreme pale, genital segment frequently orange red. *Legs*: Grayish brown; pro- and mesofemora with a row of fuscous spots on either side;



metafemora with 2 rows of large fuscous spots (these spots made up of clusters of very small spots) on either side, apex frequently tinged with red or orange; tibial spines black with distinct black spots at bases; last tarsal segment and claws fuscous.

Females are very similar to males in color and pubescence and differ mainly by their broader form.

Fifth instar.—Length 3.52 mm, pale grayish green, shaded with more testaceous yellow, clothed with suberect and erect pale to golden setae. *Head*: Pale yellowish green, eyes reddish, antennae pale yellow, basal $\frac{1}{2}$ of 2nd antennal segment with a few fuscous spots at bases of more prominent setae. *Pronotum*: Pale green, basal $\frac{1}{3}$ more testaceous, wing pads testaceous, streaked with darker brown, apical area fuscous, hind wing pads fuscous. *Abdomen*: Pale green, dorsal scent gland opening narrow, weakly pigmented. *Venter*: Pale green. *Legs*: Pale green, tibial spines brownish, with distinct fuscous spots at bases, these fading apically.

Remarks.—*Sthenarus rotermundi* will key to the genus *Psallus* Fieber in Knight (1941) but does not fit smoothly in the species key.¹ This distinct mirid can be separated from all other phylines in our fauna by the brown dorsum thickly clothed with silvery white, sericeous pubescence, the infuscated calli, the translucent or red-tinged cuneus and the stout, black tibial spines with distinct spots at the bases.

NOTES ON PREVIOUSLY REPORTED SPECIES

Henry (1977) first reported *Orthotylus nassatus* (F.) from Dauphin and Lehigh counties in eastern Pennsylvania, based on single specimens from each county. A third specimen was discovered in Bucks Co., Pennsylvania, Danboro, along Rt. 611, July 26, 1973, by T. J. Henry and A. G. Wheeler, Jr. on *Acer pseudoplatanus* L.; thus, this record helps to confirm the establishment of this interesting species in the United States.

Two additional conifer-inhabiting species previously reported from Pennsylvania (Wheeler and Henry, 1973; Henry and Wheeler, 1973), were collected at Niagara Falls, Ontario, June 18, 1978. A few late-instar nymphs of *Camptozygum aequale* (Villers) were taken on Jack pine, *Pinus banksiana* Lamb., and both nymphs and adults of *Plagiognathus vitellinus* (Scholtz) were common on Colorado spruce, *Picea pungens* Engelm. These

¹ In Knight's key, couplet 2, choice 2 should be modified to read "Second antennal segment black or entirely pale." Otherwise, at least one species included in that key cannot be properly keyed (i.e., *strobicola* Knight, with the 2nd antennal segment entirely yellow).

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Figs. 4–5. *Sthenarus rotermundi*. 4, Adult male. 5, 5th instar nymph.

records represent a considerable range extension and are the first known Canadian records for both species.

DISCUSSION

Interest in the origin of the Palearctic insect fauna of North America has been stimulated by Lindroth's (1957) general review and recent papers on Hemiptera-Heteroptera (Slater, 1974) and ichneumonoid parasites (Mason, 1978). Slater (1974) analyzed the heteropteran fauna of the northeastern United States and recorded 43 species of Miridae as Holarctic in distribution, with 22 representing definite or probable introductions by man. It should be noted that a number of mirids previously thought to have been introduced to the Nearctic fauna have been shown distinct from their Palearctic congeners and have been described as new species (Wagner and Slater, 1952). Conversely, a number of species described as new from this continent may actually be invaders from abroad; detailed examination of specimens in North American and European museums may reveal such synonymies.

Often it proves impossible to determine whether a species recently discovered in North America is truly Holarctic or an artificial introduction. A disjunct distribution that fits Lindroth's (1957) "geographic criterion," usually in habitats modified by human habitation, might normally suggest that a species has been introduced via man's commerce. However, a conclusion regarding origin may prove incorrect if based on inadequate collecting. The discovery of *Pithanus maerkeli* (Herrich-Schaeffer) along the eastern coast of the U.S. and in Nova Scotia (Olsen, 1915; Parshley 1916), and its further recovery on the coast of British Columbia (Parshley, 1919), led early workers to regard this species as a European introduction. Further collecting of this mirid from undisturbed habitats of Canada and the United States suggests that *P. maerkeli* is genuinely Holarctic (Kelton, 1966).

Our discovery of *Orthotylus viridinervis*, *Psallus betuleti*, and *Sthenarus rotermundi* in the U.S. or Canada brings the number of known Holarctic Miridae to approximately 51. Despite the problems mentioned in determining the origin of a particular taxon in North America, *O. viridinervis* and *S. rotermundi* most likely represent fairly recent invaders, probably having gained entrance as eggs inserted in stems of nursery stock. Other mirids discussed in this paper (*Camptozygum aequale*, *Orthotylus nassatus*, and *Plagiognathus vitellinus*) have also been thought to have become established in the same manner (Wheeler and Henry, 1973; Henry and Wheeler, 1973; Henry, 1977). The distribution of *P. betuleti* in eastern North America, one locality in Pennsylvania, again suggests a recent introduction by commerce. Its occurrence in Alaska, however, may indicate that this species long ago crossed the Bering Sea land bridge into North America (Sailer, 1978).

ACKNOWLEDGMENTS

We give special thanks to J. A. Slater (University of Connecticut, Storrs) for lending examples of Palearctic species used to verify our findings of species reported in this paper and for his record of *M. molliculus* in Connecticut, and to J. L. Herring (Systematic Entomology Laboratory, SEA, USDA) for the loan of additional specimens which helped to expand our distributional data. We also thank our colleague Karl Valley (Pennsylvania Department of Agriculture) for reviewing the manuscript and making useful comments.

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