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THE PREDACEOUS AND PHYTOPHAGOUS PLANT BUGS (HETEROPTERA: MIRIDAE) FOUND ON APPLE TREES IN QUÉBEC

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Résumé

On a inventorié 32 espèces de Miridae vivant sur les pommiers dans le sud du Québec, dont 22 espèces sont prédatrices, 7 phytophages et 3 à la fois prédatrices et phytophages. On donne des clés d'identification des sous-familles, genres et espèces rencontrés, ainsi que l'illustration des adultes de 31 espèces, en plus de renseignements sur leur biologie et leur distribution en Amérique du Nord. Les nouvelles mentions pour le Québec sont: *Taedia pallidula* (McAtee), *Phytocoris husseyi* Knight, *P. canadensis* Knight, *Ceratocapsus digitulus* Knight, *C. fuscinus* Knight, *Heterocordylus malinus* Reuter, *Pilophorus perplexus* Douglas & Scott, *Lepidopsallus minisculus* Knight et *Hyaliodes harti* Knight.

Abstract

Thirty-two species of Miridae are reported from apple trees in southern Québec. Of this number 22 are predaceous, 7 phytophagous, and 3 are predaceous and phytophagous. Keys to subfamilies, genera and species are given; adults of 31 species are illustrated; short descriptions, biology, and North American distributions are also provided. New records for Québec are: *Taedia pallidula* (McAtee), *Phytocoris husseyi* Knight, *P. canadensis* Knight, *Ceratocapsus digitulus* Knight, *C. fuscinus* Knight, *Heterocordylus malinus* Reuter, *Pilophorus perplexus* Douglas & Scott, *Lepidopsallus minisculus* Knight, and *Hyaliodes harti* Knight.

Introduction

The plant bugs, or Miridae, are of great economic importance to man because they are either harmful or beneficial. Individuals are numerous, and are found on a great variety of plants.

In apple orchards the phytophagous species are injurious. This lowers the crop yield and the commercial grade of apples. Large populations may completely destroy the fruit crop. These pests often require control programs which are an added

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expense to the apple grower. Damage and loss caused by the bugs often amount to thousands of dollars.

The predaceous species are important natural agents for controlling the pests that live on apple trees. They prey on pests such as mites, aphids, leafhoppers, caterpillars, and other small arthropods. Without the predaceous mirids, damage to apple crops would be considerably greater.

Plant bugs that occur on apple trees are inadequately known and little is known of their natural history. In 1978 a study was initiated to collect the mirids in apple orchards, to observe their feeding, and study their natural history. The aim of this report is to help research scientists and apple growers in Québec to recognize orchard species of plant bugs and to provide biological information necessary to control pest species.

Collections were made from unsprayed orchards in Rigaud, Sainte-Anne-de-Bellevue, Hemmingford, and Agriculture Canada Research Farm at Frelighsburg, Québec. Collections were made throughout the summers of 1978-1980 commencing in May and concluding in early September. All specimens were mounted on points, identified, and deposited in the Lyman Museum, Macdonald College. Illustrations of adults were made with the aid of a camera lucida attached to a stereo-binocular microscope. Distributions for North America were taken from Carvalho (1957, 1958a, 1958b, 1959) and Kelton (1980b).

This study shows that 32 species of Miridae representing 17 genera occur on apple trees in southern Québec. Of this number 22 species are predaceous, 7 species are phytophagous, and 3 species are predaceous and phytophagous. The study also includes notes about their behaviour, seasonal occurrence, and life history. Keys to subfamilies, tribes, genera and species are given; 31 adults are illustrated, brief descriptions of adults, and their distribution are also provided.

Collecting Miridae

There are three methods to collect Miridae on apple trees: sweeping over branches with a regular sweep net, beating the branches using a beating stick and sheet, and searching for individual specimens on trunks and branches.

A sweep net is used on young flexible branches but as mirids are fragile and delicate insects, sweeping should be done carefully. After a few sweeps the mirids are removed from the net with an aspirator. Leaves, fruit, and other debris picked up in sweeping can damage the bugs if sweeping is prolonged. Sweeping should be done under dry conditions as moisture in the net ruins the specimens.

The beating method is used on thicker branches. A nylon sheet approximately 1 m square and supported diagonally by metal rods is held under a branch, which is sharply struck from above with a stick. Bugs on the branch are jarred loose and fall on the sheet where they are picked off quickly with an aspirator. Most specimens for this study were collected by the two methods above.

The third method is to search for individual specimens on trunks and limbs of apple trees. Plant bugs that live on the bark are well camouflaged and usually hide in the crevices so are difficult to spot until they move. When discovered they can be picked up directly with the aspirator.

Collected specimens are killed promptly in cyanide. All mirids should be mounted on narrow triangular cardboard points and not pinned directly. The point tip is bent to fit the angle of the thorax so that the specimen will be level when mounted. Use the minimum amount of glue on the tip and attach to the right side of the thorax above the middle coxa. Miridae should not be placed in alcohol.

Morphology

Adult Miridae are distinguished from other bugs collected on apple trees by: four-segmented antennae, four-segmented rostrum and absence of ocelli. The hemelytron is typically separated into clavus, corium, embolium, and wing membrane. The abdomen consists of eight normally exposed segments. Each leg consists of coxa, trochanter, femur, tibia and tarsus. Tarsal claws and the structures between them, the parempodia and pulvilli, provide reliable characters for separating the subfamilies. Figure 1 shows the typical mirid structures and illustrates the structural terms.

Mirid nymphs, especially in the early instars are small and delicate, and generally look alike. Last instar nymphs assume the

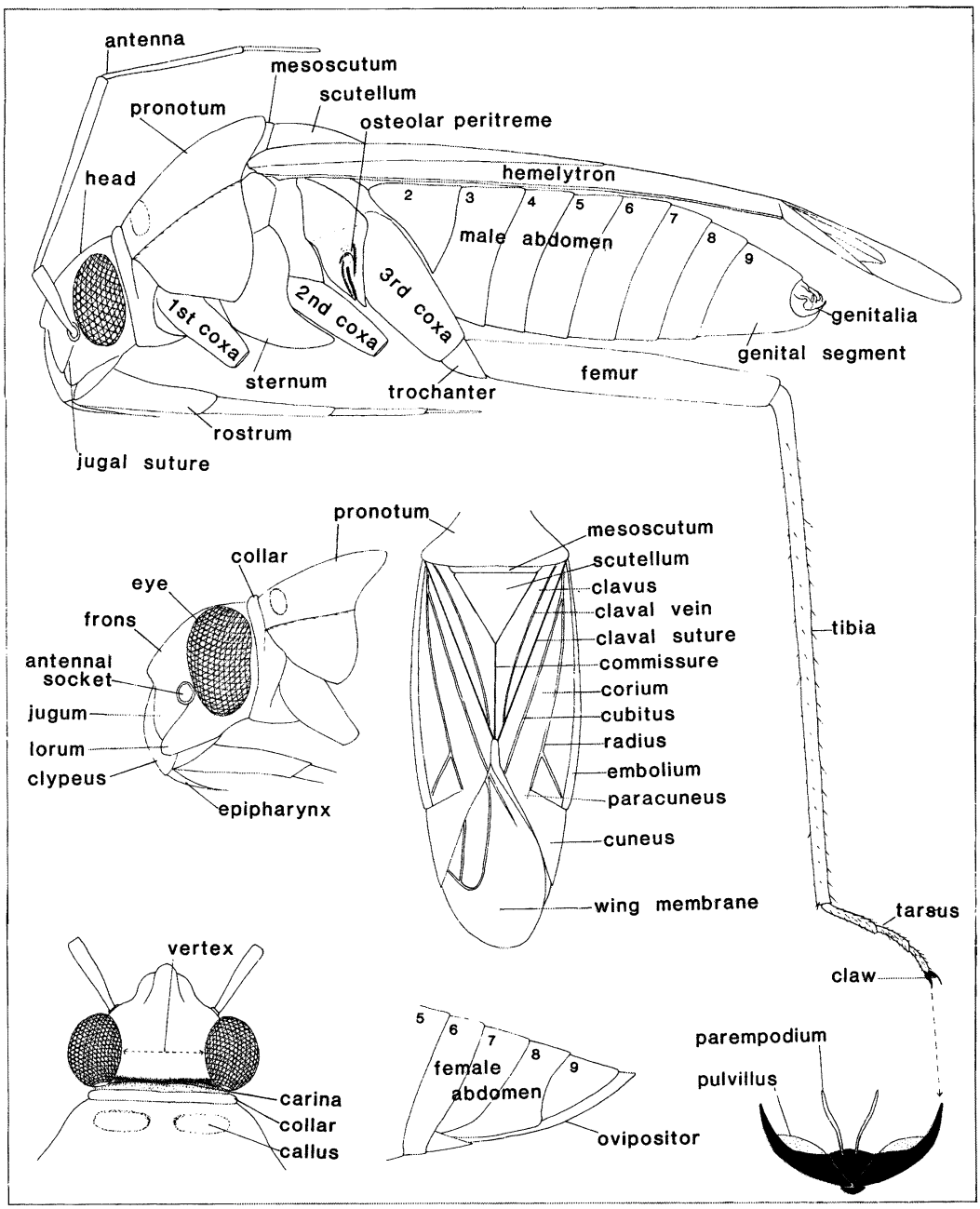


Figure 1. Adult mirid, showing typical mirid structures and illustrating structural terms (Kelton, 1980a).

appearance of adults except that they do not have the fully developed wings and they do not have the male or female genital structures. Thus, the identity of the nymphs in most situations depends on their association with the adults.

Biology

Most mirids, both predaceous and phytophagous, pass the winter in the egg stage. Eggs are laid during summer in tender growing stems of the host plant, and overwinter. They hatch the following spring when the host plant is sprouting new shoots. Nymphs feed on new growth by sucking out sap, or prey on other arthropods present on the host plant. The nymphs pass through five stages of development, each instar normally requiring approximately 5-7 days. On the fifth molt they become adults and continue feeding. Males die soon after mating, but females live longer to oviposit.

Relatively few species of Miridae hibernate. Those that do seek shelter in the fall under bark or litter on the ground. In the spring adults emerge and commence feeding on available prey or on tender new shoots. After mating females commence to lay eggs and continue to do so for a prolonged time. Eggs incubate for approximately 10-14 days, and then nymphs emerge and commence feeding, passing through five nymphal stages and develop into adults. Thus, during summer overwintered adults overlap the new generation adults; however, the latter are in much larger numbers. By mid-summer overwintered adults gradually die out and new adults continue to feed until hibernation.

The phytophagous Miridae collected on apple trees in Québec are not restricted to apple alone but are also found on native trees that are closely related to apple. The bugs readily migrate from native trees to apples growing nearby. The predaceous species readily disperse from plant to plant and their presence on apple trees indicates an abundant food supply. Most studies of mirid predation have been conducted in Nova Scotia apple orchards. Gilliatt (1935), Lord (1949, 1956, 1962, 1971), MacPhee & Sanford (1954, 1956, 1961), Sanford (1964), MacLellan (1962, 1963, 1977, 1979), Sanford & Herbert (1966), and Herbert & Sanford (1969) have observed the influence of spray programs on seven or eight predatory mirids. However, no effort was made to study what other plant bugs occur on apple and why they are there.

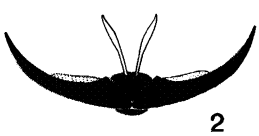
Classification

The classification of the Miridae in this report is the same as used by Kelton (1980b). The four subfamilies represented in this report are Mirinae Hahn, Orthotylinae Van Duzee, Phylinae Douglas & Scott, and Deraeocorinae Douglas & Scott.

KEY TO SUBFAMILIES OF MIRIDAE

1. Parempodia large and membranous (Figs. 2, 3) 2
   Parempodia slender and hairlike (Figs. 4, 5) 3
2. Parempodia divergent toward apices (Fig. 2); pronotal collar distinct (Fig. 6) ..... Mirinae Hahn
   Parempodia parallel or convergent at apices (Fig. 3); pronotal collar depressed, inconspicuous (Fig. 7) ..... Orthotylinae Van Duzee
3. Collar depressed as in Figure 7; pulvilli present (Figs. 2-4) ..... Phylinae Douglas & Scott
   Collar exposed as in Figure 6; pulvilli absent (Fig. 5) ..... Deraeocorinae Douglas & Scott

Figures 2-19. Miridae structures. Figs. 2-5. Claws of Miridae; Fig. 2. Mirinae; Fig. 3. Orthotylinae; Fig. 4. Phylinae; Fig. 5. Deraeocorinae; Fig. 6. Pronotum of Mirinae; Fig. 7. Pronotum of Orthotylinae and Phylinae; Fig. 8. Head of *Lygidea mendax*; Figs. 9-10. Head of *Lygus lineolaris*; Figs. 11-17. Male claspers of *Phytocoris* spp.; Fig. 11. *corticevivens*; Fig. 12. *conspurcatus*; Fig. 13. *salicis*; Fig. 14. *husseyi*; Fig. 15. *neglectus*; Fig. 16. *erectus*; Fig. 17. *canadensis*; Fig. 18. Wing membranes of Hyaliodini; Fig. 19. Wing membrane of Deraeocorini.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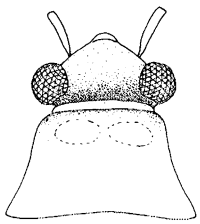
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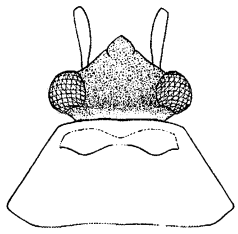
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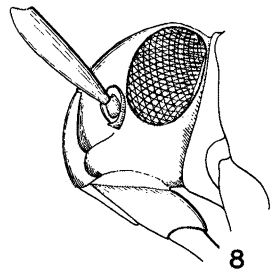
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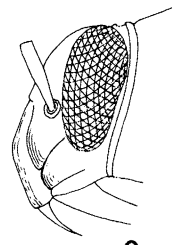
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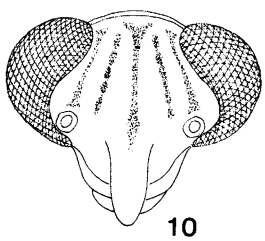
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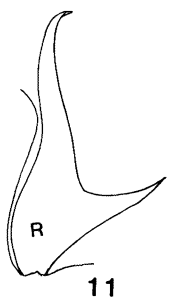

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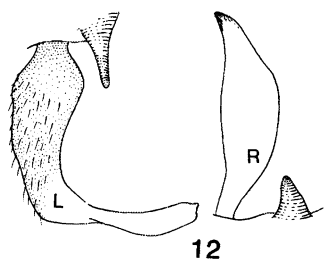

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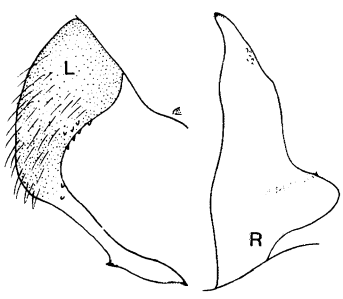

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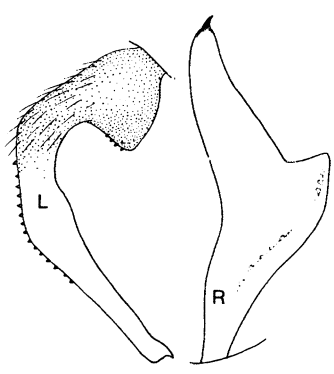

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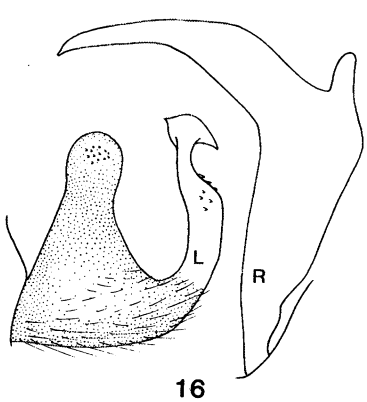

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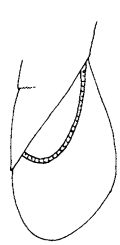
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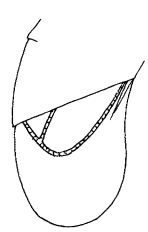
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Subfamily Mirinae Hahn

This is the largest subfamily in North America. Species are distinguished by the large and free parempodia diverging at the apices, and by the distinct collar.

This subfamily is represented by the tribe Mirini, seven genera, and 14 species. Eight species are predaceous, six species are phytophagous. Three species are new provincial records.

KEY TO GENERA OF MIRINAE

1. First antennal segment with numerous flattened black hairs (Fig. 20) ..... *Neurocolpus* Reuter
   First antennal segment without flattened hairs 2
2. Pronotum with depressed black spot behind each callus (Fig. 21) ..... *Taedia* Distant
   Pronotum without depressed black spots behind calli 3
3. Black, densely pubescent; second antennal segment clavate (Fig. 22) ..... *Capsus* Fabricius
   Not black; second antennal segment linear 4
4. Pronotum impunctate; carina between eyes absent; pubescence on dorsum simple and sericeous ..... *Phytocoris* Fieber
   Pronotum punctate; carina between eyes present; dorsum with simple pubescence 5
5. Eyes nearly spherical (Fig. 8) ..... *Lygidea* Reuter
   Eyes elliptical (Fig. 9) 5
6. Pronotum coarsely punctate (Fig. 31); frons with oblique lines (Fig. 10) ..... *Lygus* Hahn
   Pronotum finely punctate (Fig. 32); frons without oblique lines ..... *Lygocoris* Reuter

Genus *Neurocolpus* Reuter

Robust species. Eyes large, carina between them absent. First antennal segment stout with flattened black hairs. Hemelytra with simple and sericeous pubescence. Legs markedly pilose.

One species was collected.

Neurocolpus nubilus (Say) (Fig. 20)

Capsus nubilus Say, 1832: 22.
Neurocolpus nubilus: Reuter, 1875: 70.

Length 7.0-7.7 mm; width 2.5-2.8 mm. Yellowish brown species; pronotum with tufts of black hairs (Fig. 20).

Overwinters in the egg stage. Nymphs appear in early June and the adults in early July; adults gradually die out by mid-August. Phytophagous. Also breeds on staghorn sumac, and adults may readily migrate to nearby apple trees.

Distribution: widespread in USA; Manitoba, Ontario, Québec.

Genus *Taedia* Distant

Elongate, robust species. Eyes large, carina between them absent. Pronotum with black velvety spot behind each callus. Hemelytra with simple and sericeous pubescence. Legs long and slender.

One species was collected.

Taedia pallidula (McAtee) (Fig. 21)

Paracalocoris hawleyi var. *pallidulus* McAtee, 1916: 380.
Paracalocoris pallidulus: Knight, 1930: 822.
Taedia pallidulus: Carvalho, 1959: 262.

Length 6.3-7.0 mm; width 2.3-2.7 mm. Brown species mottled with yellow (Fig. 21).

Overwinters in the egg stage. Nymphs appear about mid-May and adults about mid-June; adults gradually die out by end of July. Phytophagous. Also breeds on hawthorn, adults readily migrate to nearby apple trees.

Distribution: New York, north central States; Saskatchewan, Manitoba, Ontario; now known to occur in Québec.

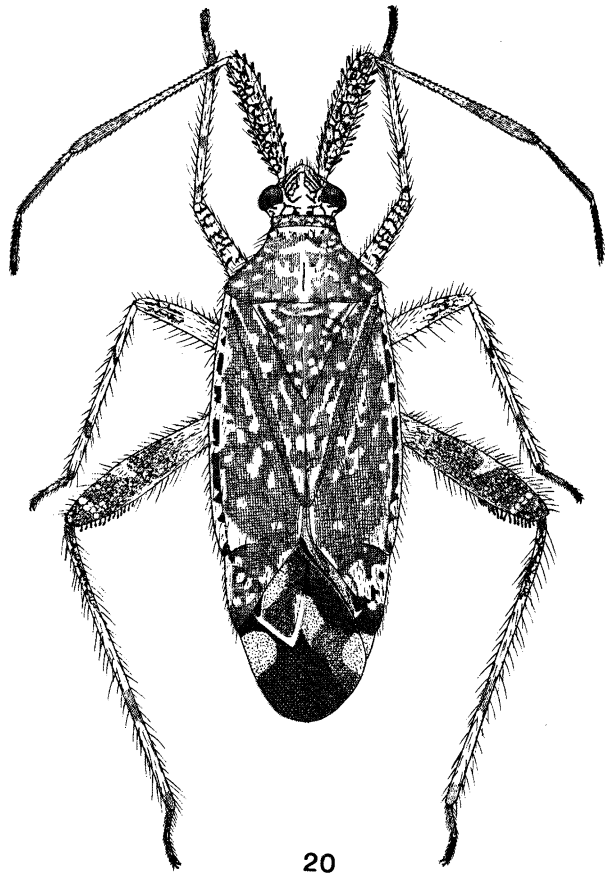

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Figure 20. *Neurocolpus nubilus*

Genus *Capsus* Fabricius

Black, shiny species. Carina between eyes absent. Pubescence simple, appressed.

One species introduced from Europe, was collected.

Capsus ater (Linnaeus)
(Fig. 22)

Cimex ater Linnaeus, 1758 : 447.
Capsus ater : Fabricius, 1803 : 241.

Length 5.7-6.1 mm; width 2.5-3.0 mm. Second antennal segment clavate (Fig. 22).

Overwinters in the egg stage. Nymphs appear in early May and adults in early June, often earlier; adults gradually die out by end of July. Phytophagous. Breeds on grasses but when grass is cut or during a dry season, adults migrate to nearly apple trees and feed on the fruit or foliage.

Distribution: Alaska, eastern USA; British Columbia, Ontario, Québec, Nova Scotia.

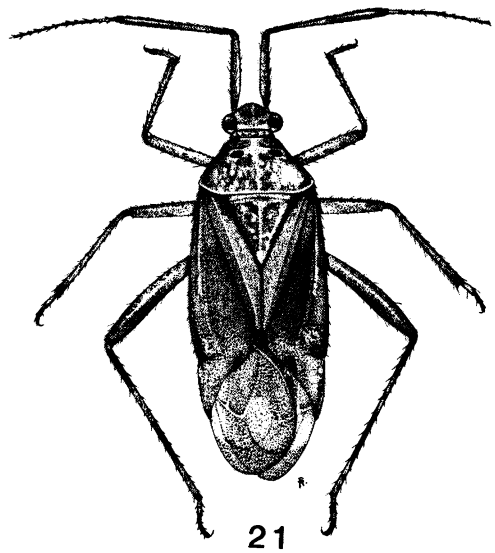

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Figure 21. *Taedia pallidula*

Genus *Phytocoris* Fallén

Elongate, parallel-sided species. Eyes large, carina between them absent. Pronotum impunctate. Pubescence of two types, sericeous and simple. Legs long and slender.

The species in this genus all look alike and are difficult to identify by external appearance. Thus males are identified by the details of genital claspers and females by association with males.

Eight species were collected. They overwinter in the egg stage. Nymphs appear about mid-June and adults about mid-July. The adults gradually die out by early September. All are predaceous.

KEY TO SPECIES OF *PHYTOCORIS*

1. First antennal segment thickened (Fig. 23) ..... *lasiomerus* Reuter
   First antennal segment slender (Fig. 24) 2
2. Wing membrane speckled with dark spots or with pale spots (Figs. 24, 25) 3
   Wing membrane marbled (Figs. 26-29) 4
3. First antennal segment reddish brown with few small pale spots; femora mostly reddish brown (Fig. 24); right clasper (Fig. 11) ..... *corticevivens* Knight
   First antennal segment mostly pale with large brown areas; femora mostly pale with large connected brown areas (Fig. 25); claspers (Fig. 12) ..... *conspurcatus* Knight
4. Apical corium without large black area (Fig. 26); claspers (Fig. 13) ..... *salicis* Knight
   Apical corium with large black area (Figs. 27-29) 5
5. Rostrum less than 2.4 mm long, scarcely extending beyond hind coxae; right clasper (Fig. 14) ..... *husseyi* Knight
   Rostrum more than 2.5 mm long, extending beyond hind coxa 6
6. Rostrum 2.8 mm or longer; claspers (Fig. 15) ..... *neglectus* Knight
   Rostrum shorter than 2.6 mm 7
7. Left clasper with a large knobbed process near base; right clasper curved with small knob at middle (Fig. 16) ..... *erectus* Van Duzee
   Left clasper with short slender process; right clasper straight, forked (Fig. 17) ..... *canadensis* Van Duzee

Phytocoris lasiomerus Reuter (Fig. 23)

Phytocoris lasiomerus Reuter, 1909: 34.

Length 7,3-8.0 mm; width 2.1-2.2 mm. Head yellowish brown marked with red. First antennal segment thickened with long, black bristles. Second antennal segment pale, apex black. Pronotum, scutellum and hemelytra pale, often with reddish tinge. Wing membrane reticulate (Fig. 23).

Nymphs and adults prey on mites, mite eggs, aphids, and other small arthropods.

Distribution: transcontinental in northern USA; British Columbia, Prairie Provinces, Ontario, Québec.

Phytocoris corticevivens Knight (Figs. 11, 24)

Phytocoris corticevivens Knight, 1920: 63.

Length 6.6-6.8 mm; width 2.3-2.5 mm. Head brown. First antennal segment long and slender, reddish brown, with few pale spots; second segment reddish brown, base and narrow area at middle pale. Pronotum, scutellum and hemelytra dark brown, corium with rounded pale spot at apex. Wing membrane reticulate.

Nymphs and adults prey on mites and aphids, and other small arthropods.

This species is distinguished by the long and slender first antennal segment, by the overall dark brown color (Fig. 24), and by the claspers (Fig. 11). Collected on trunks, usually hiding in the crevices of the bark.

Distribution: Texas, north central and northwestern USA; Nova Scotia, Québec, Ontario.

Phytocoris conspurcatus Knight (Figs. 12, 25)

Phytocoris conspurcatus Knight, 1920: 61.

Length 5.7-5.9 mm; width 2.1-2.3 mm. Head gray with brown and reddish brown markings. Second antennal segment brown, base and narrow area at middle pale. Heme-

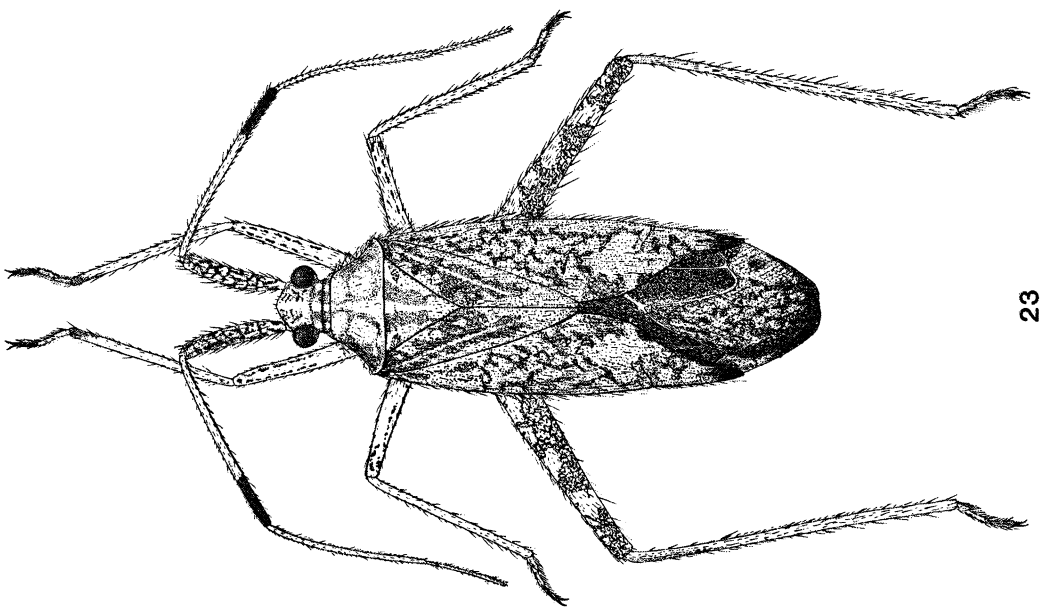

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Figure 23. *Phytocoris lasiomerus*

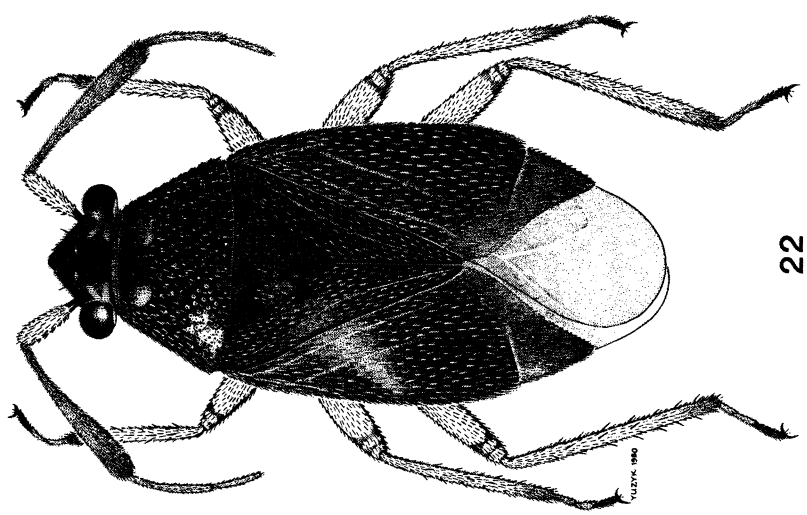

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Figure 22. *Capsus ater*

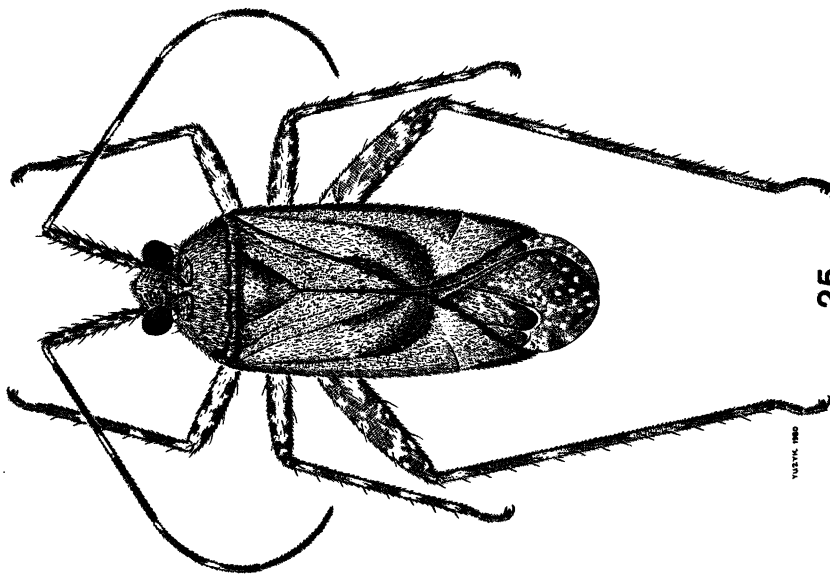

Figure 25. *Phytocoris conspurcatus*

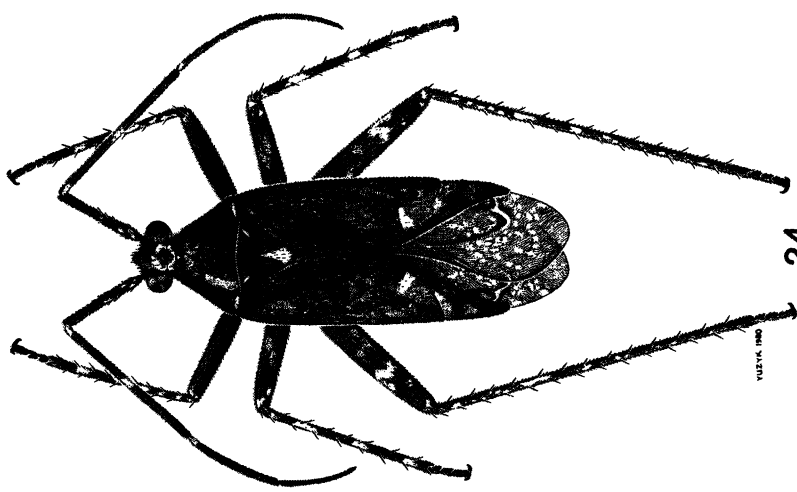

Figure 24. *Phytocoris corticevivens*

lytra gray marked with brown. Sericeous pubescence white and black. Wing membrane reticulate (Fig. 25).

Nymphs and adults prey on mites, aphids and small caterpillars.

This species is distinguished by the banded second antennal segments and by the claspers (Fig. 12). Collected on trunks and branches.

Distribution: eastern USA; Nova Scotia, Québec, Ontario, Prairie Provinces, British Columbia.

Phytocoris salicis Knight (Figs. 13, 26)

Phytocoris salicis Knight, 1920: 56.

Length 5.6-6.1 mm; width 2.1-2.3 mm. Head, pronotum and hemelytra light brown mottled with black. Corium uniformly light brown. Wing membrane marbled (Fig. 26).

Nymphs and adults prey on mites, mite eggs, aphids, and other soft bodied arthropods.

This species is distinguished by the claspers (Fig. 13).

Distribution: eastern and central USA; Québec, Ontario, Manitoba, Saskatchewan.

Phytocoris husseyi Knight (Figs. 14, 27)

Phytocoris husseyi Knight, 1923: 639.

Length 5.2-5.9 mm; width 1.9-2.1 mm. Head gray marked with dark brown. Rostrum less than 2.4 mm, scarcely extends beyond hind coxae. Hemelytra gray mottled with black; apical corium with large black area; sericeous pubescence occurs in clumps. Wing membrane marbled (Fig. 27).

Nymphs and adults prey on mites, mite eggs, aphids and small caterpillars.

This species is distinguished by the short rostrum, and by the straight right clasper (Fig. 14).

Distribution: Minnesota, Ohio; now known to occur in Québec.

Phytocoris neglectus Knight (Fig. 15)

Phytocoris neglectus Knight, 1920: 54.

Length 6.1-6.5 mm; width 2.1-2.3 mm. Head brown. Rostrum 2.8 mm or longer. Hemelytra light brown mottled with brown; apical half of corium with large oblique black area. Wing membrane marbled (Fig. 15).

Nymphs and adults prey on aphids and mites. Knight (1941) observed the species preying on psocids.

This species is very similar to *husseyi* in appearance but is larger and has a longer rostrum. It is also distinguished by the claspers (Fig. 15).

Distribution: eastern USA; Nova Scotia, Québec, Ontario, Prairie Provinces, British Columbia.

Phytocoris erectus Van Duzee (Figs. 16, 28)

Phytocoris erectus Van Duzee, 1920: 345.

Length 5.4-5.8 mm; width 1.9-2.3 mm. Head yellowish brown marked with reddish brown. Hemelytra gray marked with brown; apical corium with dark brown oblique area and large gray area just behind. Wing membrane marbled (Fig. 28).

Nymphs and adults prey on mites, mite eggs, aphids, and small caterpillars.

This species is distinguished by the uniformly gray and brown hemelytra, by the large gray area on apical half of corium (Fig. 28), and by the claspers (Fig. 16).

Distribution: eastern USA; Nova Scotia, Québec, Ontario, Saskatchewan.

Phytocoris canadensis Van Duzee (Figs. 17, 29)

Phytocoris canadensis Van Duzee, 1920: 346.

Length 5.2-5.7 mm; width 1.8-2.0 mm. Head yellowish brown marked with reddish brown. Hemelytra gray shaded with brown, apical half of corium with large oblique black area. Wing membrane marbled (Fig. 29).

Nymphs and adults prey on aphids, mites, and other small arthropods.

This species is similar to *erectus* in appearance but differs from it by the forked right clasper (Fig. 17).

Distribution: eastern USA; Nova Scotia, Ontario, now known to occur in Québec.

Genus *Lygidea* Reuter

Elongate, reddish brown species. Head nearly vertical, eyes nearly spherical, carina

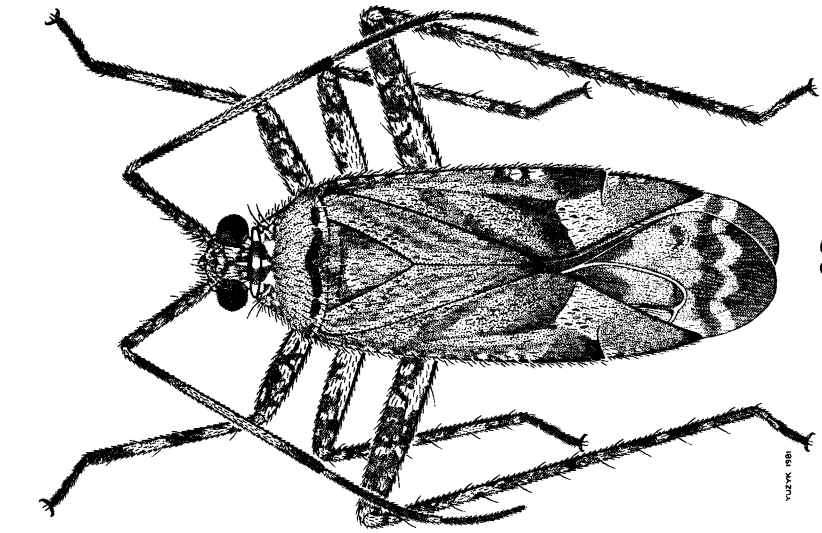

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Figure 28. *Phytocoris erectus*

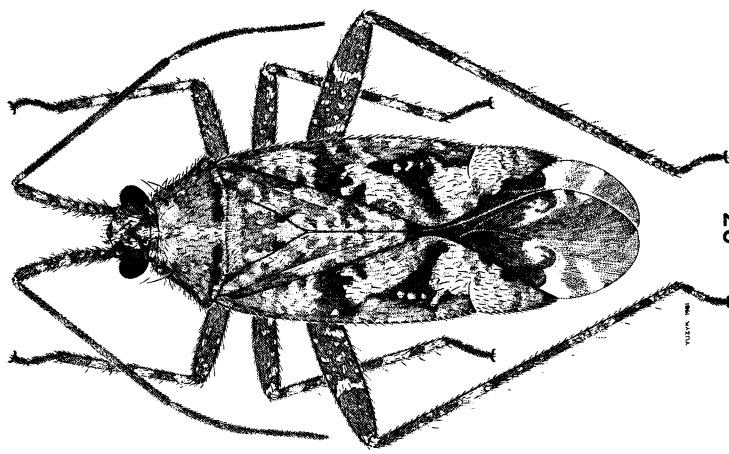

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Figure 27. *Phytocoris husseyi*

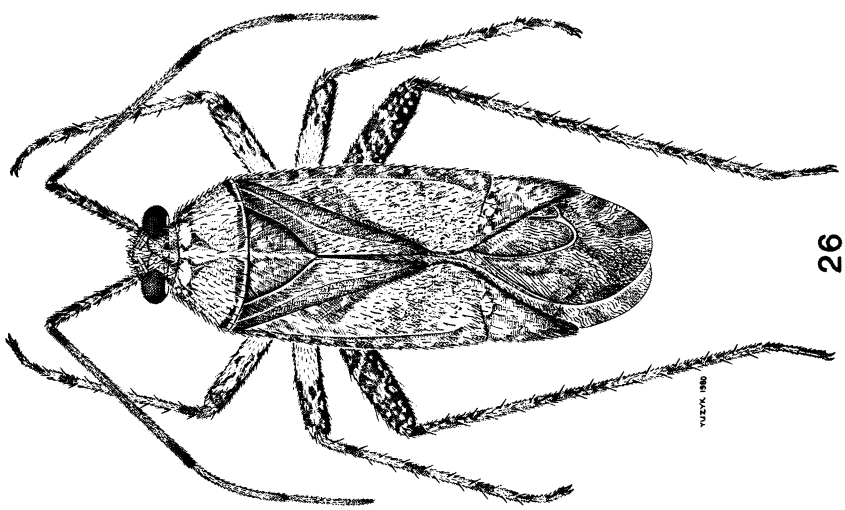

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Figure 26. *Phytocoris salicis*

between them distinct. Pronotum and hemelytra deeply punctate; pubescence simple, long and dense.

One species was collected.

Lygidea mendax Reuter
(Figs. 8, 30)

Lygidea mendax Reuter, 1909 : 47.

Length 6.2-6.5 mm; width 2.1-2.3 mm. Head orange or red. Antennae black. Pronotum orange, coarsely punctate. Hemelytra mostly brown, costal margins red (Fig. 30).

Overwinters in the egg stage. Nymphs appear about mid-May and the adults about mid-June. The adults die out by the end of July. Nymphs and adults feed on leaf buds and fruit. Rivard & Paradis (1978) reported the species as a pest of apple in Québec.

This species is distinguished by the orange or red head and pronotum.

Distribution: north eastern and north central USA; Nova Scotia, New Brunswick, Québec, Ontario.

Genus *Lygus* Hahn

Elongate-oblong, reddish brown species. Eyes large, carina between them distinct. Pronotum and hemelytra coarsely punctate. Pubescence simple.

One species was collected.

Lygus lineolaris (Palisot de Beauvois)
(Figs. 9, 10, 31)

Capsus lineolaris Palisot de Beauvois, 1818 : 187.
Lygus oblineatus Say, 1832 : 21.
Capsus flavonotatus Provancher, 1872 : 103.
Lygus lineolaris : Uhler, 1872 : 413.

Length 4.9-5.9 mm; width 2.3-3.0 mm. Head yellowish brown, frons with red or black submedian oblique bars. Mesoscutum black, lateral areas pale or reddish. Hemelytra yellowish or reddish brown; pubescence yellow, long, dense.

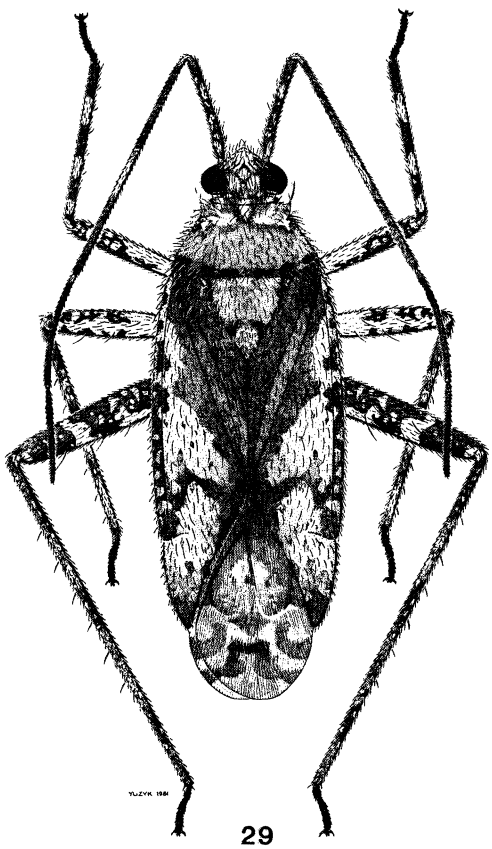

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Figure 29. *Phytocoris canadensis*

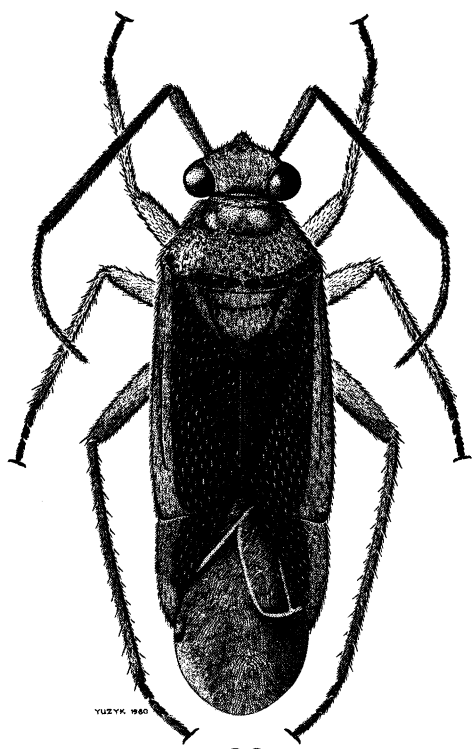

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Figure 30. *Lygidea mendax*

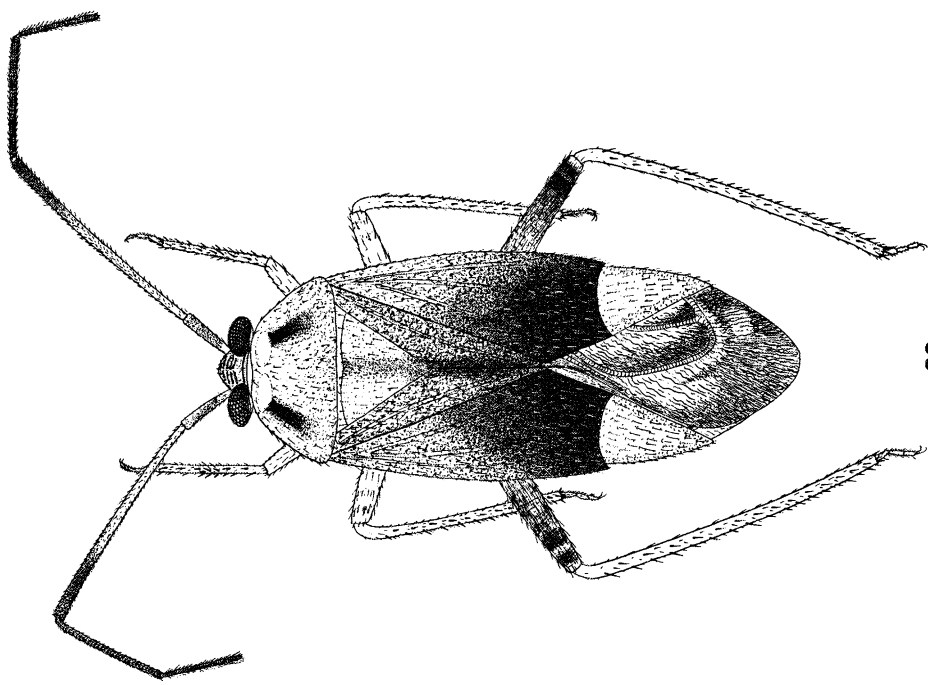

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Figure 32. *Lygocoris communis*

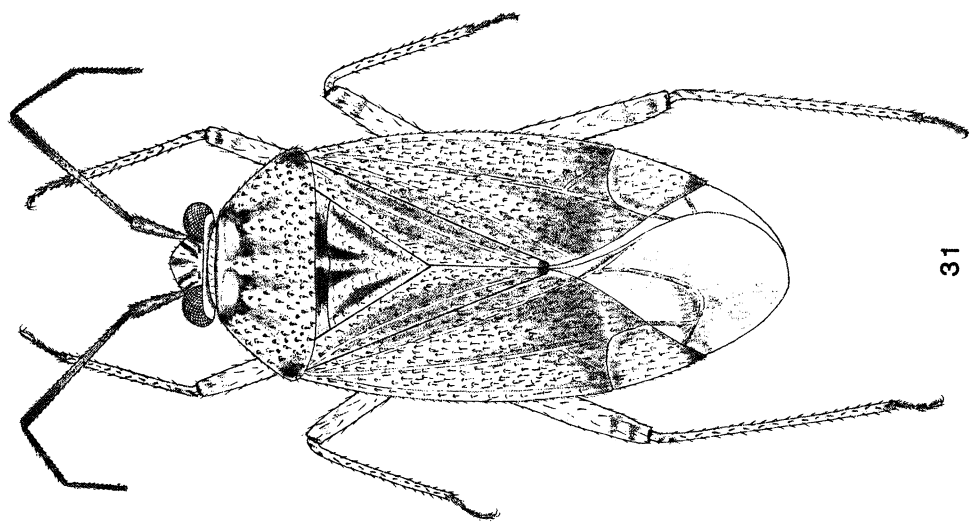

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Figure 31. *Lygus lineolaris*

Adults hibernate under bark or in debris on the ground. Adults emerge in early spring and feed on the buds, mate, and oviposit. The nymphs appear about the end of May or early June, the new generation adults about the end of June or early July. Overwintered adults gradually die out by the end of July, and new generation adults continue to feed until hibernation. Nymphs and adults feed on leaf buds, leaves and fruit.

This is the most common and most omnivorous pest known as the tarnished plant bug. It has been reported to damage all fruit crops, vegetable crops, alfalfa and clover crops, cotton and tobacco crops, and ornamental flower crops.

Distribution: Mexico, widespread in USA and Canada.

Genus *Lygocoris* Reuter

Elongate-oblong, green and brown species. Eyes large, carina between them distinct. Pronotum and hemelytra finely punctate; pubescence simple, long and dense.

One species was collected.

Lygocoris communis Knight (Fig. 32)

Lygus communis Knight, 1916: 346.
Neolygus communis : Knight, 1941 : 159.
Lygocoris communis : Carvalho, 1959 : 141.

Length 5.1-5.9 mm; width 2.2-2.6 mm. Head yellowish with transverse reddish bars. Pronotum yellowish green with reddish or black ray behind each callus. Hemelytra yellowish green on basal half, reddish brown on apical half (Fig. 32).

Overwinters in the egg stage. Nymphs appear in early May and adults in early June. The adults are short lived, and after mating, the females oviposit in the tender new growth and gradually die out by the end of July. Phytophagous, the damage to apples is done by the nymphs in May and by the adults in June and early July.

This species is commonly known as the pear plant bug.

Distribution: transcontinental across central North America.

Subfamily Orthotylinae Van Duzee

This is the second largest subfamily in North America. Species are distinguished by large and free parempodia converging at apices, and by the small and depressed pronotal collar. The subfamily is represented by the tribes Orthotylini and Pilophorini, 5 genera, and 8 species. Four species are new provincial records.

KEY TO TRIBES OF ORTHOTYLINAE

1. Hemelytra without transverse bands of silvery sericeous pubescence .....Orthotylini
   Hemelytra with transverse bands of silvery sericeous pubescence (Fig. 41) ....Pilophorini

Tribe Orthotylini

Four genera are represented by this tribe. Six species are predaceous, one phytophagous.

KEY TO GENERA OF ORTHOTYLINI

1. Antennal segments 3 and 4 nearly as thick as apex of second (Figs. 33-36) .....
   .....*Ceratocapsus* Reuter
   Antennal segments 3 and 4 thinner than apex of second (Fig. 37) 2
2. Hemelytra with two types of pubescence, simple and sericeous (Figs. 37, 38) .....
   .....*Heterocordylus* Fieber
   Hemelytra with simple pubescence only 3
3. Head black (Fig. 39) .....*Paraproba* Distant
   Head green (Fig. 40) .....*Diaphnocoris* Kelton

Genus *Ceratocapsus* Reuter

Elongate or oval dark brown species. Basal margin of head overlaps apical portion of pronotum. Eyes prominent, carina between them distinct. Pronotum and hemelytra smooth or punctate. Pubescence simple or both simple and sericeous.

Four species were collected, all are predaceous, and overwinter in the egg stage. The nymphs appear in early June and adults in early July. The adults are active throughout July and August and gradually die out by September.

KEY TO SPECIES OF *CERATOCAPSUS*

1. Pronotum and hemelytra smooth (Fig. 33) ..... *modestus* Uhler
   Pronotum and hemelytra punctate 2
2. Hind femora pale yellow (Fig. 34) ..... *digitulus* Knight
   Hind femora brown or red 3
3. Species dark brown, cuneus brown (Fig. 35) ..... *pumilus* (Uhler)
   Species reddish brown, cuneus reddish (Fig. 36) ..... *fuscinus* Knight

Ceratocapsus modestus (Uhler) (Fig. 33)

Melina modesta Uhler, 1887: 69.
Ceratocapsus modestus: Smith, 1909: 161.

Length 4.3-4.5 mm; width 1.6-1.8 mm. Head light to dark brown, pronotum and scutellum dark brown; hemelytra light to dark brown; impunctate; pubescence simple with long and short hairs (Fig. 33).

Nymphs and adults prey on mites and aphids.

This species is distinguished by the impunctate pronotum and hemelytra, and by the simple, long and short pubescence (Fig. 33).

Distribution: eastern and central USA; Ontario, Québec, Manitoba, Saskatchewan.

Ceratocapsus digitulus Knight (Fig. 34)

Ceratocapsus digitulus Knight, 1923: 533.

Length 3.5-3.8 mm; width 1.6-1.8 mm. Head, pronotum, scutellum and hemelytra brown. Hemelytra and pronotum punctate. Dorsum with erect simple pubescence intermixed with closely appressed sericeous hairs. Legs pale yellow (Fig. 34).

Nymphs and adults prey on mites and aphids.

This species is distinguished by the pale yellow first and second antennal segments, and by the pale yellow femora.

Distribution: eastern and central USA; Manitoba, Ontario; now known to occur in Québec.

Ceratocapsus pumilus (Uhler) (Fig. 35)

Melina pumila Uhler, 1887: 69.
Ceratocapsus pumilus: Van Duzee, 1909: 182.

Length 3.7-3.9 mm; width 1.5-1.7 mm. Head, pronotum, and hemelytra dark brown. Antennae mostly light brown. Pronotum and hemelytra punctate. Dorsum with erect simple pubescence intermixed with closely appressed sericeous hairs. Legs brown (Fig. 35).

Nymphs and adults prey on mites and aphids.

This is the most abundant species of *Ceratocapsus* in the apple orchards.

Distribution: eastern USA; Ontario, Québec.

Ceratocapsus fuscinus Knight (Fig. 36)

Ceratocapsus fuscinus Knight, 1923: 531.

Length 3.6-3.7 mm; width 1.5-1.6 mm. Head yellow; first and second antennal segments yellow. Pronotum and hemelytra reddish brown, cuneus reddish; punctuate; pubescence similar to that of *pumilus*. Hind femur reddish (Fig. 36).

Nymphs and adults prey on mites and aphids.

This species is similar to *pumilus* in size and appearance but is more reddish.

Distribution: eastern USA; Ontario, now known to occur in Québec.

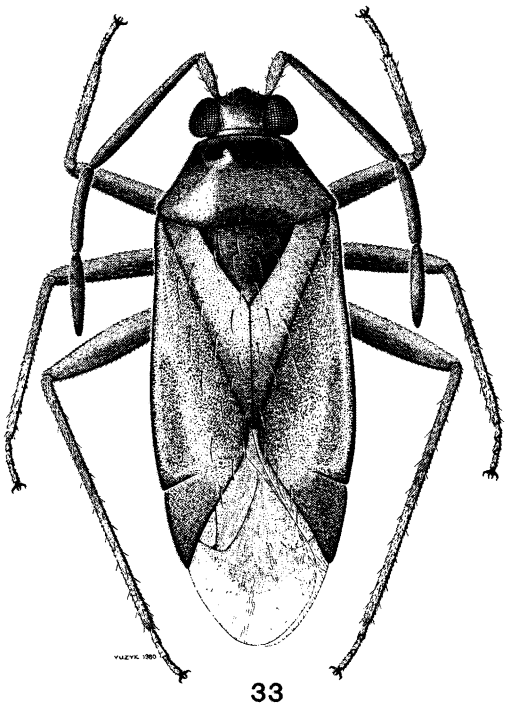

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Figure 33. *Ceratocapsus modestus*

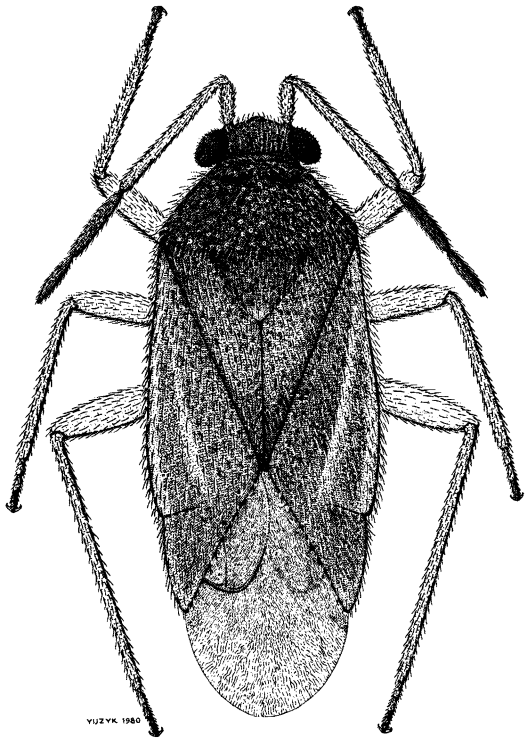

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Figure 34. *Ceratocapsus digitulus*

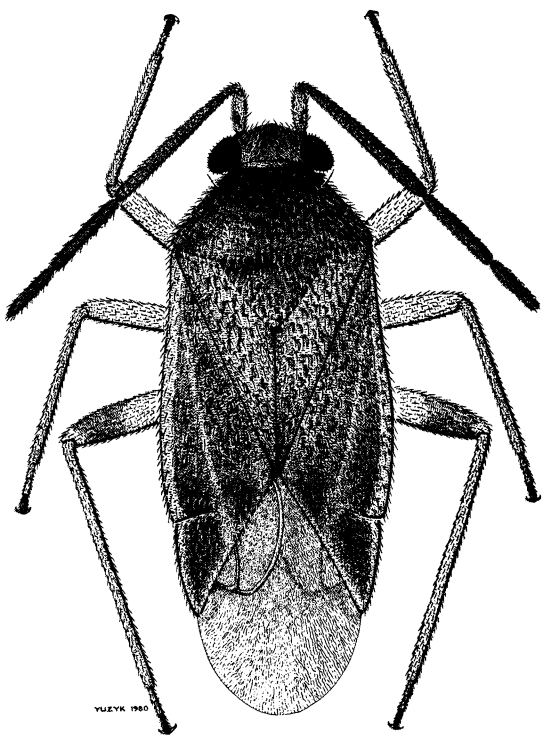

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Figure 35. *Ceratocapsus pumilus*

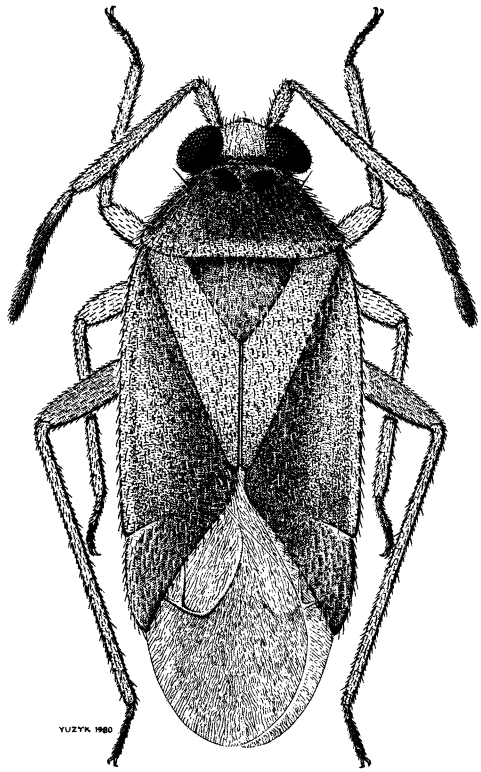

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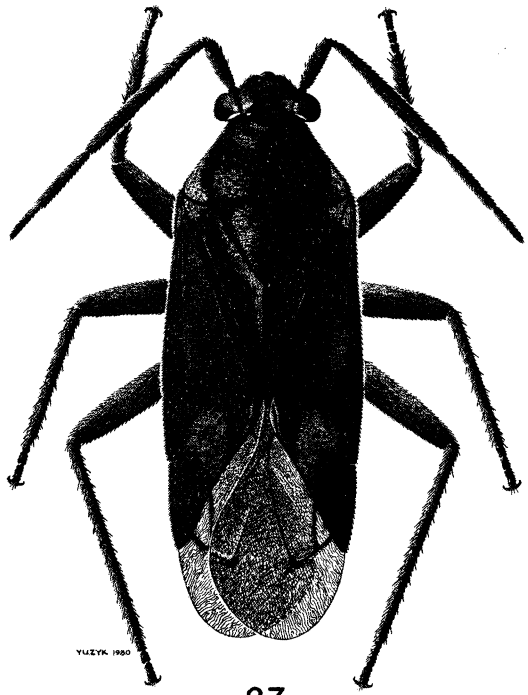
Figure 36. *Ceratocapsus fuscinus*



37

Figure 37. *Heterocordylus malinus*, male

Genus *Heterocordylus* Fieber

Robust, black or black and red species. Base of head sharply truncate. Pronotum rugose, hemelytra impunctate; pubescence simple and scalelike. Legs black.

One species was collected.

Heterocordylus malinus Reuter (Figs. 37, 38)

Heterocordylus malinus Reuter, 1909: 71.

Length 6.3-7.0 mm; width 2.1-2.3 mm. Head and scutellum black. Pronotum and hemelytra black or black and red.

Overwinters in the egg stage. Nymphs appear in early May and adults in early June. The adults gradually die out by the end of July. Nymphs and adults feed on the new shoots and fruit. Also breeds on hawthorn, adults readily migrate to nearby apple.

This species is distinguished by the white scaly pubescence. Males are black (Fig. 37) and females black and red (Fig. 38).

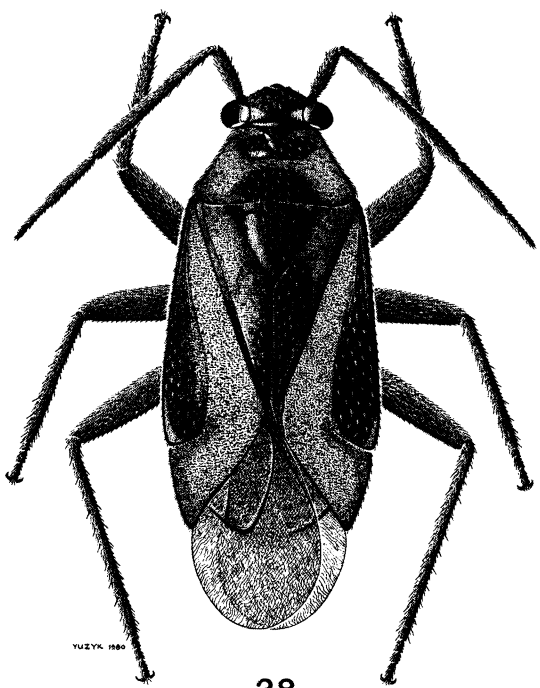


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Figure 38. *Heterocordylus malinus*, female

Distribution: eastern USA; Ontario: now known to occur in Québec.

Genus *Paraproba* Distant

Slender, pale green, delicate species. Head vertical, black, carina between eyes absent. Pronotum and hemelytra pale green with simple pubescence.

One species was collected.

Paraproba capitata (Van Duzee) (Fig. 39)

Diaphnidia capitata Van Duzee, 1912: 490.
Diaphnocoris capitata: Kelton, 1961, 566.
Paraproba capitata: Kelton, 1965: 1028.

Length 3.0-3.5 mm; width 0.9-1.1 mm. Head and first antennal segments black. Pronotum and hemelytra pale green (Fig. 39).

Overwinters in the egg stage. Nymphs appear about the end of May and adults the end of June. Adults are active throughout July and August and gradually die out by early September. Nymphs and adults prey on mites, mite eggs, aphids, immature leafhoppers, and other soft bodies arthropods.

This species is distinguished by the contrastingly black head.

Distribution: northeastern and north central USA; Nova Scotia, Québec, Ontario.

Genus *Diaphnocoris* Kelton

Slender, pale green species. Eyes large, located near middle of head. Head, pronotum and hemelytra pale green; pubescence simple.

One species was collected.

Diaphnocoris provancheri (Burque) (Fig. 40)

Malacoris provancheri Burque *in* Provancher, 1887: 144.
Diaphnidia pellucida in Gillette & Baker, 1895: 44.
Diaphnocoris provancheri: Kelton, 1980a: 343.

Length 4.2-4.7 mm; width 1.4-1.5 mm. General coloration green. Eyes situated forward from posterior margin of head. Second antennal segment and hind tibia often black (Fig. 40).

Overwinters in the egg stage. Nymphs appear about mid-May and adults about mid-June. Adults are active throughout July and August and gradually die out by mid-September. Nymphs and adults prey on mites, mite eggs, aphids and other soft bodied arthropods. Lord (1971) reported two generations on apple.

Distribution: widespread in USA; transcontinental in Canada.

Tribe Pilophorini Reuter

The tribe is represented by one genus and one species.

Genus *Pilophorus* Hahn

Antlike, black or brown species. Base of head convex, overlapping apex of pronotum. Scutellum tumid with clumps of sericeous pubescence. Hemelytra constricted at middle, banded with transverse bars of sericeous pubescence.

One species was collected.

Pilophorus perplexus Douglas & Scott (Fig. 41)

Pilophorus perplexus Douglas & Scott, 1875: 101.

Length 4.2-4.4 mm; width 1.4-1.5 mm. Head, pronotum and scutellum brown to black. Hemelytra brown, pruinose.

Overwinters in the egg stage. Nymphs appear about mid-June and the adults about mid-July. The adults are active throughout July and August, and gradually die out by mid-September. Nymphs and adults prey on aphids, mites, and other soft bodied arthropods.

This species is distinguished by the antlike appearance, and by the transverse silvery lines on the clavus and corium (Fig. 41).

Distribution: eastern USA; Nova Scotia, Ontario; now known to occur in Québec.

Subfamily Phylinae Douglas & Scott

This is the third largest subfamily in North America. Species are distinguished by straight hairlike parempodia between the claws, and by presence of pulvilli.

The subfamily is represented by the tribe Phylini, three genera, and four species. One species is predaceous, three are predaceous and phytophagous. One species is a new provincial record.

KEY TO GENERA OF PHYLINI

1. Dorsum with white scaly pubescence intermixed with simple hairs (Fig. 42) ....*Lepidopsallus* Knight
   Dorsum without scaly pubescence, only simple hairs 2
2. Length over 4.0 mm; head, pronotum and hemelytra mostly black (Figs. 43, 44) ....*Plagiognathus* Fieber
   Length less than 3.0 mm; head pronotum and hemelytra yellowish green (Fig. 45).. .....*Campylomma* Reuter

Genus *Lepidopsallus* Knight

Ovate, black species. Base of head truncate. Pronotum and hemelytra finely rugose; pubescence scaly intermixed with simple black hairs. Legs black.

One species was collected.

Lepidopsallus minisculus Knight (Fig. 42)

Lepidopsallus minisculus Knight, 1923: 472.

Length 2.6-2.8 mm; width 1.3-1.7 mm. Black; scaly pubescence silvery, simple pubescence black (Fig. 42).

Overwinters in the egg stage. Nymphs appear about mid-May and adults about mid-June. Adults are active throughout July and August, and gradually die out by the end of August. Nymphs and adults prey on mites, mite eggs, aphids and other small arthropods.

Distribution: New York; Ontario, now known to occur in Québec.

Genus *Plagiognathus* Fieber

Elongate-oval, black or black and green species. Pubescence simple, dense. Tibiae with black spots.

Two species were collected.

KEY TO SPECIES OF *PLAGIOGNATHUS*

1. Hemelytra black with only base of cuneus pale green (Fig. 43) .....*politus* Uhler
   Hemelytra with pale markings (Fig. 44) .....*obscurus* Uhler

Plagiognathus politus Uhler (Fig. 43)

Plagiognathus politus Uhler *in* Gillette & Baker, 1895: 52.

Length 3.5-3.8 mm; width 1.3-1.5 mm. Head, pronotum and hemelytra black; base of cuneus pale green. Femora black (Fig. 43).

Overwinters in the egg stage. Nymphs appear about mid-May and adults about mid-June. Adults are active throughout July and August and gradually die out by mid-September. Nymphs and adults prey on mites and aphids, and also feed on the fruit.

Distribution: widespread in USA; Ontario, Québec.

Plagiognathus obscurus Uhler (Fig. 44)

Plagiognathus obscurus Uhler, 1872: 418.
Lygus bruneus Provancher, 1872: 104.

Length 4.2-4.6 mm; width 1.5-1.6 mm. Head black; pronotum black, often yellow at middle; hemelytra black with pale markings. Femora pale green.

Life history similar to that of *politus*, but also preys on small caterpillars.

This species is distinguished by the pale green areas on the hemelytra (Fig. 44).

Distribution: widespread in USA; transcontinental in Canada.

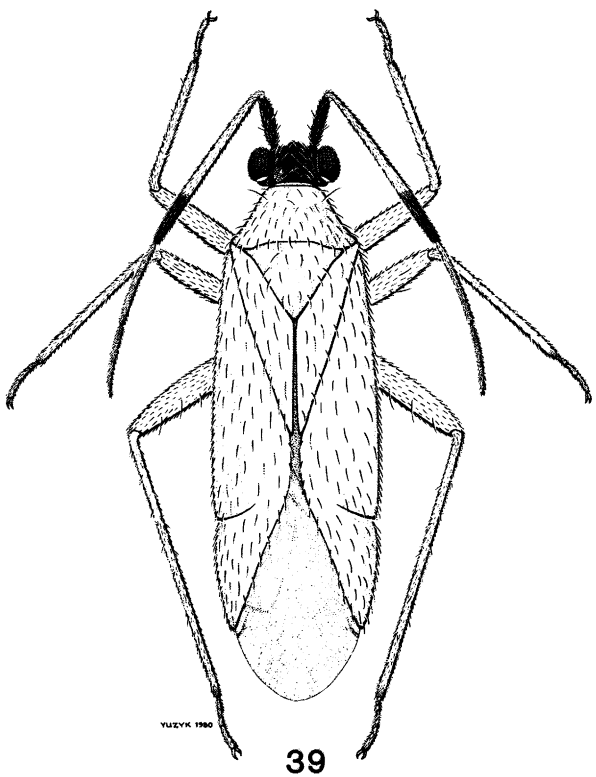

Figure 39. *Paraproba capitata*

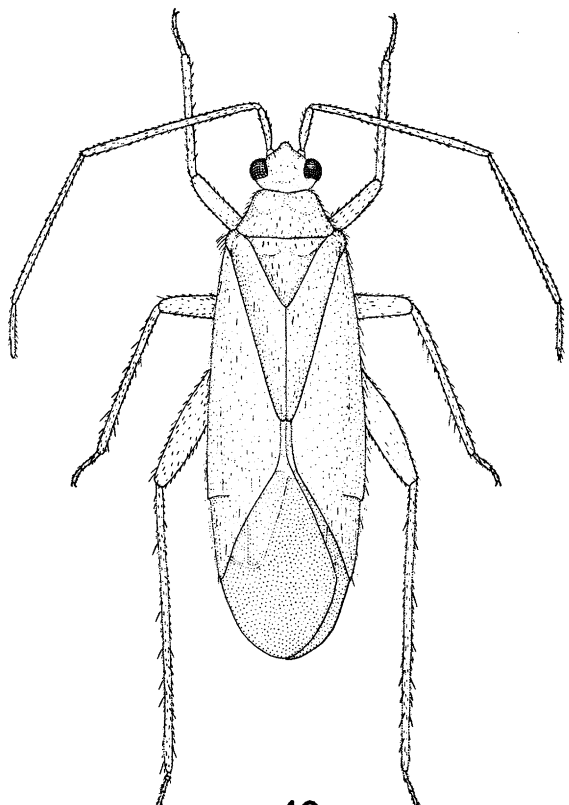

Figure 40. *Diaphnocoris provancheri*

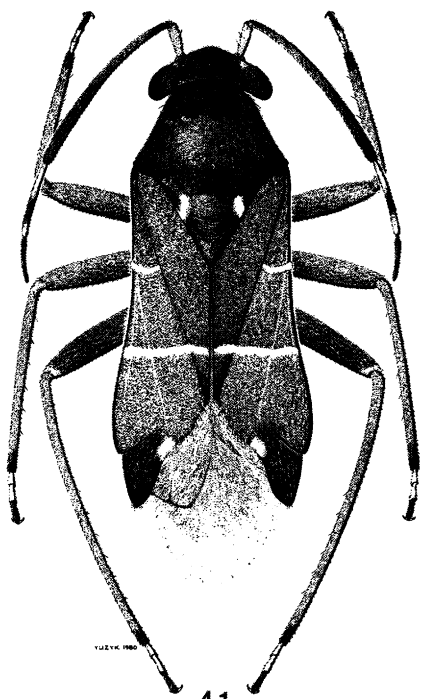

Figure 41. *Pilophorus perplexus*

Genus *Campylomma* Reuter

Small, yellowish green species. Pubescence simple and sericeous. Ventral surface black; legs green spotted with black.

One species, introduced from Europe, was collected.

Campylomma verbasci (Meyer)
(Fig. 45)

Capsus verbasci Meyer, 1843: 70.
Campylomma verbasci: Reuter, 1878: 53.

Length 2.6-2.8 mm; width 1.1-1.3 mm. Head yellow, clypeus often black. Antennae green, apex of first segment and base of second segment black.

Overwinters in the egg stage. Nymphs appear about mid-May and adults about mid-June. Adults are active throughout July and August, and gradually die out in early September. Nymphs and adults prey on mites, aphids and immature leafhoppers; also phytophagous. Gilliatt (1935), and McMullen & Jong (1970), reported two, and three or four generations per year, respectively.

The species is distinguished by the small size and the yellowish green color (Fig. 45).

Distribution: eastern USA; Nova Scotia, Québec, Ontario, British Columbia.

Subfamily Deraeocorinae Douglas & Scott

This subfamily is a relatively small. Species are distinguished by the deeply punctate pronotum, by the prominent pronotal collar, by the hairlike parempodia, and by the deeply cleft claws. The subfamily is represented by the tribes Hyaliodini and Deraeocorini, two genera, and six species. All species are predaceous. One species is a new provincial record.

KEY TO TRIBES OF DERAEOCORINAE

1. Eyes situated forward from posterior margin of head; hemelytra transparent, wing membrane with one cell (Figs. 18, 46, 47) ..... Hyaliodini
   Eyes situated near posterior margin of head; hemelytra opaque, wing membrane with two cells (Figs. 19, 48-51) ..... Deraeocorini

Tribe Hyaliodini

Two species belonging to the genus *Hyaliodes* were collected.

Genus *Hyaliodes* Reuter

Elongate, shiny species. Eyes removed from pronotum, neck distinct. Pronotum deeply punctate. Hemelytra transparent, wing membrane with one cell; pubescence simple.

Two species were collected. Overwinter in the egg stage. Nymphs appear about the first part of June and the adults about the first part of July. Adults are active throughout July and August, and gradually die out by mid-September.

KEY TO SPECIES OF *HYALIODES*

1. Collar and calli pale green; scutellum mostly pale green; apical margin of corium black (Fig. 46) ..... *vitripennis* (Say)
   Collar and calli black; scutellum black at base; apical margin of corium red (Fig. 47) ..... *harti* Knight

Hyaloides vitripennis (Say)
(Fig. 46)

Capsus vitripennis Say, 1832: 24.
Hyaliodes vitripennis: Riley, 1870: 137.

Length 4.6-4.9 mm; width 1.5-1.8 mm. Collar and pronotum pale green, basal area of pronotum adjacent to scutellum often black. Inner margin of clavus and apical margin of corium black (Fig. 46).

Nymphs and adults prey on mites, mite eggs, and aphids.

This species is distinguished by the pale

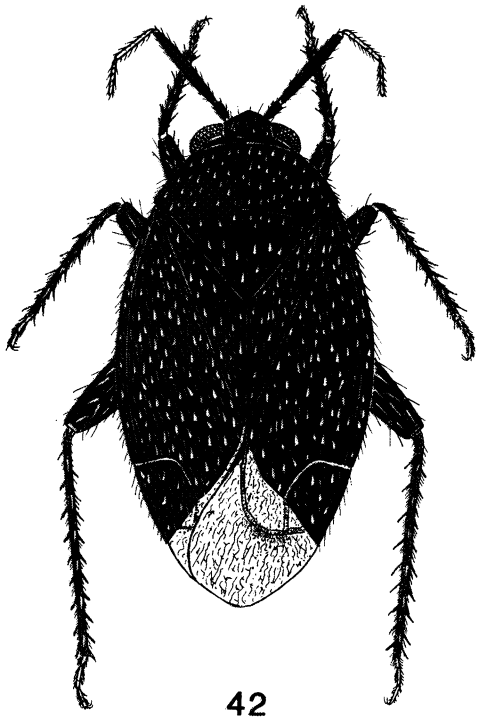

Figure 42. *Lepidopsallus minisculus*

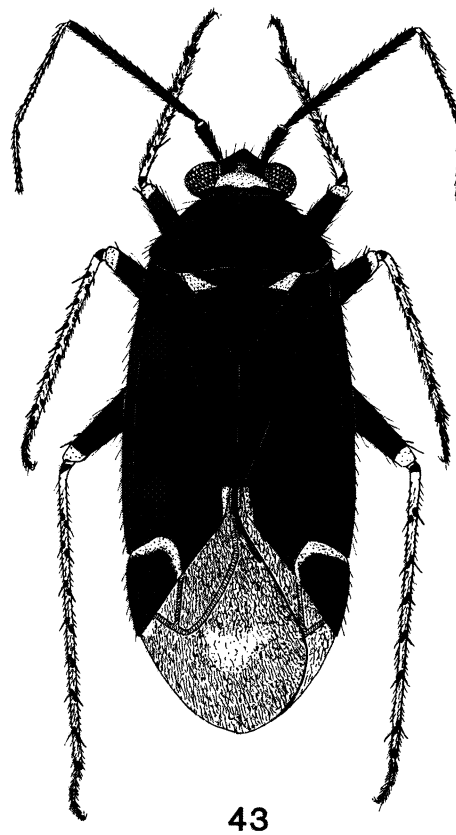

Figure 43. *Plagiognathus politus*

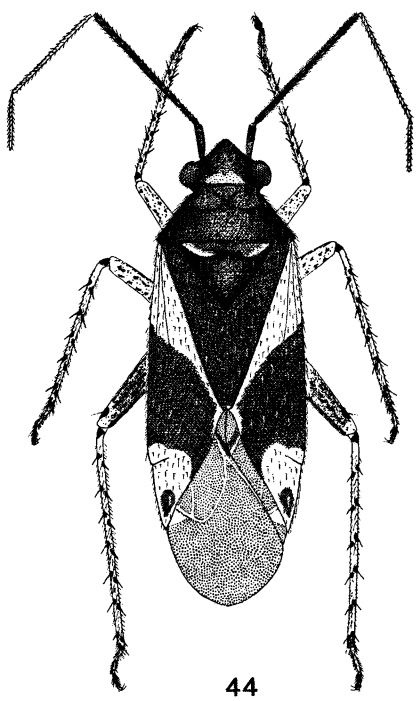

Figure 44. *Plagiognathus obscurus*

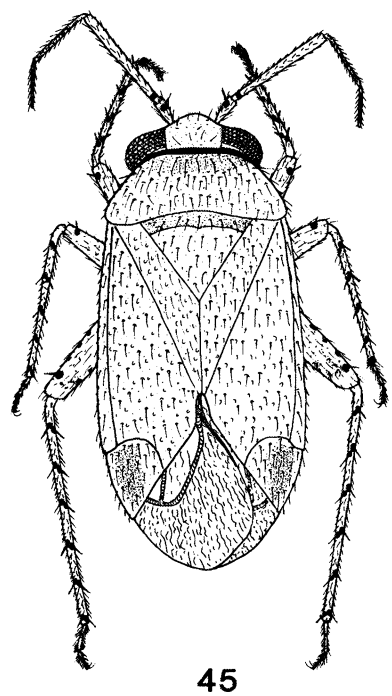

Figure 45. *Campylomma verbasci*

green collar and calli, and by the black apical margin of corium.

Distribution: eastern USA; Ontario, Québec.

Hyaliodes harti Knight
(Fig. 47)

Hyaliodes harti Knight, 1941 : 57.

Length 5.0-5.3 mm; width 1.5-1.8 mm. Head pale green tinged with red. Pronotum pale green, collar and calli black. Apical margin of corium red (Fig. 47).

Nymphs and adults prey on mites, mite eggs, and aphids.

This species is distinguished by the black collar and calli, and by the red apical margin of corium.

Distribution: eastern USA; Nova Scotia, Ontario, Prairie Provinces, British Columbia, now known to occur in Québec.

Tribe Deraeocorini Douglas & Scott

Four species belonging to the genus *Deraeocoris* were collected.

Genus *Deraeocoris* Kirschbaum

Robust, dark species. Eyes large, widely separated; frons smooth. Pronotum and hemelytra strongly punctate; pubescence simple, short. Wing membrane with two cells.

KEY TO SPECIES OF *DERAEOCORIS*

1. Scutellum punctate (Fig. 48) ..... *nebulosus* (Uhler)
   Scutellum impunctate (Figs. 49-51) 2
2. Wing membrane infuscated but without rounded spot at apical half; pronotum and hemelytra grayish (Fig. 49) ..... *aphidiphagus* Knight
   Wing membrane with distinct fuscous spot on apical half; pronotum and hemelytra brown (Figs. 50, 51) 3
3. Pronotum without black rays behind calli (Fig. 50) ..... *fasciolus* Knight
   Pronotum with black rays behind calli (Fig. 51) ..... *borealis* (Van Duzee)

Deraeocoris nebulosus (Uhler)
(Fig. 48)

Camptobrochis nebulosus Uhler, 1872 : 417.
Deraeocoris nebulosus : Knight, 1921 : 91.

Length 3.2-4.0 mm; width 1.4-1.9 mm. Generally light brown marked with black. Calli punctate. Wing membrane mostly clear, spot near outer margin fuscous (Fig. 48).

Adults hibernate. Adults emerge in early spring, mate, oviposit, and gradually die out by the end of July. Nymphs appear in early May and new generation adults in early June; adults are active until hibernation. Nymphs and adults prey on mites, aphids, small caterpillars, and other small arthropods.

This is the smallest species of *Deraeocoris* encountered. It is distinguished by the punctate scutellum.

Distribution: widespread in USA; Nova Scotia, Québec, Ontario.

Deraeocoris aphidiphagus Knight
(Fig. 49)

Deraeocoris aphidiphagus Knight, 1921 : 134.

Length 5.7-6.6 mm; width 2.8-3.2 mm. Generally grayish marked with black. Calli black. Scutellum impunctate.

Overwinters in the egg stage. Nymphs appear in early May and the adults in early June. Adults are active throughout July and August, and gradually die out by September. Nymphs and adults prey on aphids, and are usually found in the leaf curls.

This species is distinguished by the grayish color of the hemelytra.

Distribution: eastern USA; eastern Canada, Prairie Provinces.

Deraeocoris fasciolus Knight
(Fig. 50)

Deraeocoris fasciolus Knight, 1921 : 123.

Length 6.3-7.0 mm. Pronotum light brown with black punctures; calli marked with irregular black bars; scutellum impunctate. Wing membrane with large rounded fuscous spot at apex (Fig. 50).

Life history similar to that of *aphidiphagus*. Nymphs and adults prey on mites, aphids, and small caterpillars.

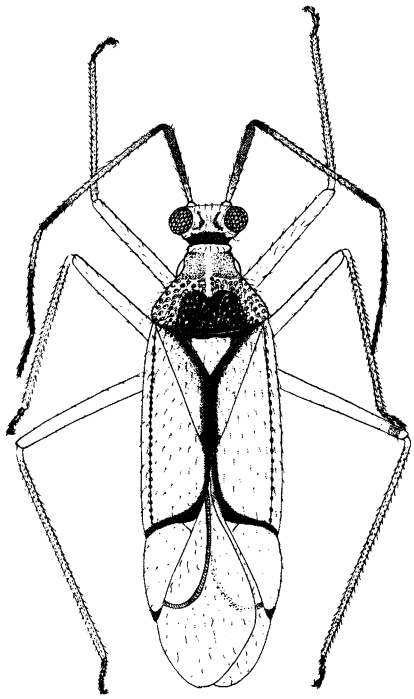

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Figure 46. *Hyaliodes vitripennis*

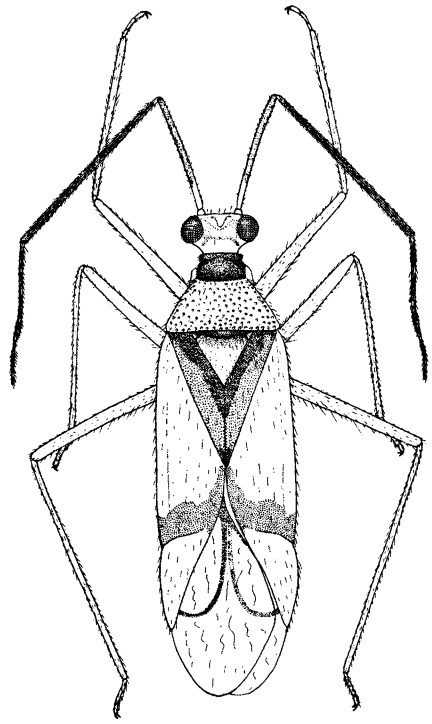

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Figure 47. *Hyaliodes harti*

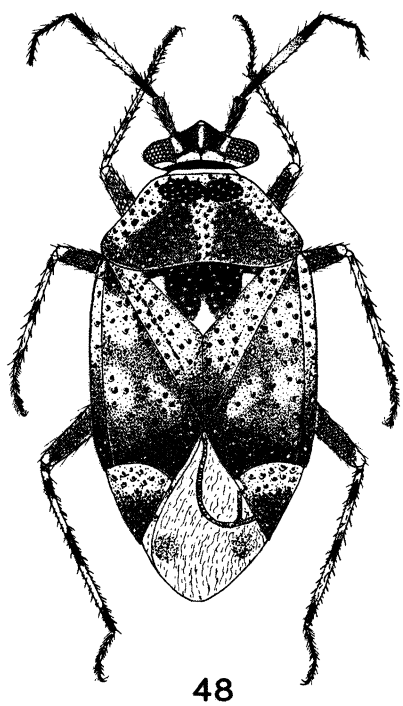

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Figure 48. *Deraeocoris nebulosus*

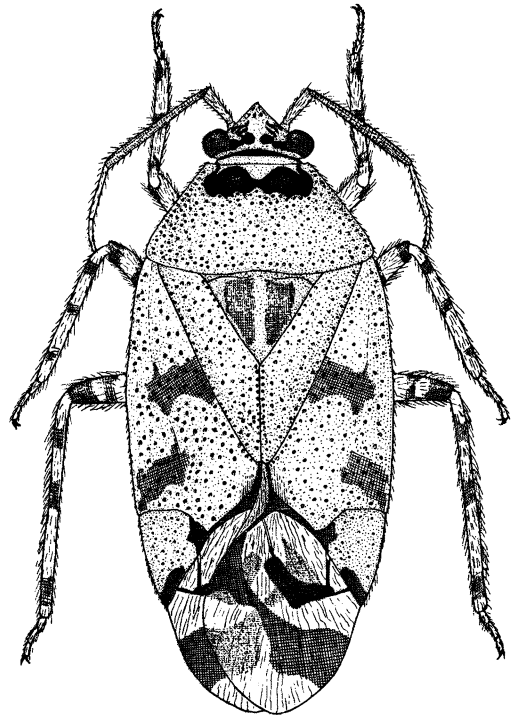

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Figure 49. *Deraeocoris aphidiphagus*

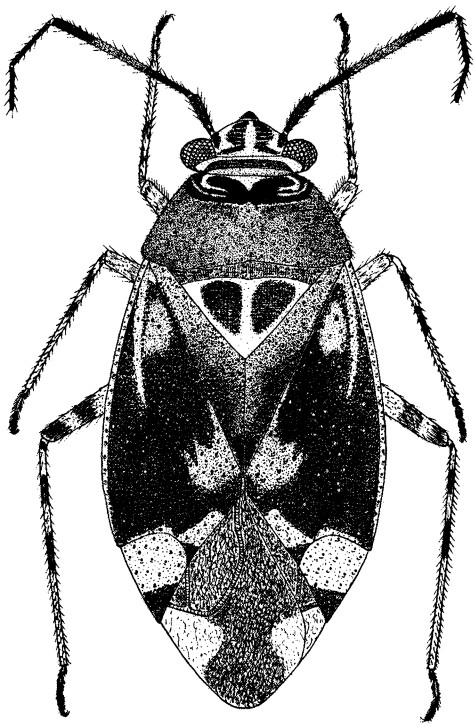

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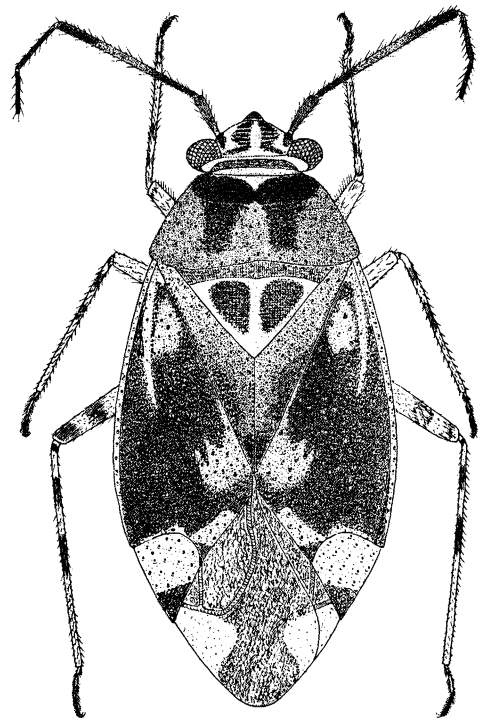
Figure 50. *Deraeocoris fasciolus*



51

Figure 51. *Deraeocoris borealis*

This is the most abundant species of *Deraeocoris* on apple.

Distribution: northeastern and north central USA; Nova Scotia, Québec, Ontario, Prairie Provinces, British Columbia.

Deraeocoris borealis (Van Duzee)
(Fig. 51)

Camptobrochis borealis Van Duzee, 1920: 354.
Deraeocoris borealis: Knight, 1921: 120.

Length 5.7-7.0 mm; width 2.6-2.9 mm. Pronotum light brown with black punctures, calli black with black rays behind. Scutellum impunctate. Wing membrane with large rounded fuscous spot at apex (Fig. 51).

Life history similar to that of *aphidiphagus*. Nymphs and adults prey on aphids.

This species is similar to *fasciolus* in size and appearance. It is separated from *fasciolus* by the completely black calli and by the black rays behind them.

Distribution: northeastern USA: Nova Scotia, Québec, Ontario.

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