THESIS

on

TINGIDS OF ECONOMIC IMPORTANCE IN OREGON

WITH SPECIAL REFERENCE TO THE WESTERN WILLOW TINGID

CORYTHUCA SALICATA GIBSON

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Kwan Lun Wong

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APPROVED:

Assistant Entomologist, Agricultural Experiment Station

Professor of Entomology

In Charge of Major

Chairman of Committee on Graduate Study
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TINGIDS OF ECONOMIC IMPORTANCE IN OREGON

WITH SPECIAL REFERENCE TO THE WESTERN WILLOW TINGID

CORYTHUCHA SALICATA GIBSON*

Kwan Lun Wong

INTRODUCTORY NOTES

Tingids commonly known as lace-bugs are small, flat, oval or oblong insects with reticulated upper surface often lace-like in appearance, hence the common name. They are often regarded as an unimportant pest on account of their infestation mostly on the uncultivated plants and their occurrence in small numbers. However, when they change from the uncultivated or non-economic plant hosts to the cultivated ones and become adapted to the new hosts, they may multiply at a tremendous rate and be present in sufficient numbers to warrant control measures.

In several Oregon orchards during the last few years, the Western Willow Tingid, Corythucha salicata Gibson, occurs abundantly on apple and sparingly on willow, which is supposed to be its chief host, even though the latter plant is found in the same orchard. Infestation has increased each year. Damage of rhododendron by Leptobyrsa rhododendri (Horvath) has been reported from Clackamas county. Other important species such as Piesma cinerea (Say), Corythucha contaminata Gibson, Corythucha pura Gibson, Corythucha juglandis Fitch, Corythucha incurvata Uhler and Corythucha obliqua Osborn and Drake have been recorded from time to time. Around Stayton,

*Order Hemiptera, family Tingidae
Corythucha padi Drake has been found scatteringly on the hazelnut and, according to Drake, it is a new host record for this species. With the damage already being done by the Western Willow Tingid and the possibility of infesting economic plants by the above mentioned species, together with the little knowledge on this group of insects in Oregon, the writer made some special studies on the Western Willow Tingid, Corythucha salicata Gibson, with the hope of stimulating further interest on other members of the family.

**REVIEW OF THE ECONOMIC HISTORY**

All the members of this superfamily are plant feeders, living in all stages on the under sides of leaves where they suck the sap, causing the upper surface to become whitened and the lower one spotted and discolored by their excrement. Later the leaves turn brown and dry up. Species of Copium Thumb are known to form galls on Teucrium and, according to Houard, castration of the floral generative organs results (25). Tingids infest native plants as well as cultivated crops and ornamental shrubs and trees. When present in sufficient numbers they do a considerable amount of damage. Stephanitis (Tingis) pyri F. attacks pear and apple in Europe (25) and Froggattia olivina Horv. damages olive trees in Australia (39). In the United States, especially in the East, much work has been done on this family. Several species of them are restricted to but one or a very few kinds of food plants. A knowledge of their hosts will help in the process of collecting them. The following list of food plants is given merely as a guide to the identification of the
more or less economically important species.

Alder, common black (*Alnus rugosa*)

*Corythucha pergandei* Heidemann (17) (33)

Apple (*Pyrus malus*)

*Corythucha caelata* Uhler (11) (14) (40)

*Corythucha mali* Gibson (14)

*Corythucha salicata* Gibson (8) (11) (14)

Ash, white (*Fraxinus americana*)

*Leptophya mutica* Say (2) (7) (24)

Basswood (*Tilia pubescens*)

*Corythucha contracta* Osborn and Drake (8)

*Gargaphia tiliae* Walsh (15) (31)

*Baptisia tinctoria*

*Gelchossa heidemanni* Osborn and Drake (1) (26) (44)

Beans

*Gargaphia angulata* Heidemann (3) (15) (16)

Birch, yellow (*Betula lutea*)

*Corythucha pallipes* Parshley (10)

*Corythucha betulae* Drake (14) Synonyms of *pallipes*

Bladder nut, American (*Stathylea trifolia*)

*Corythucha bulbosa* Osborn and Drake (31) (33)

Buckeye (*Aescula glabra*)

*Corythucha aesculi* Osborn and Drake (15) (31)

Cherry, choke (*Prunus demissa*)

*Corythucha padi* Drake (33)
Cherry, wild (*Prunus serotina*)

*Corythucha associata* Osborn and Drake (14)
*Corythucha pruni* Osborn and Drake (14)

Christmas berry, California (*Heteromeles arbutifolia*)

*Corythucha incurvata* Uhler (11) (38)

Chrysanthemums

*Corythucha marmorata* (Uhler) (2) (43)

Currant (*Ribes* sp.)

*Corythucha salicis* Osborn and Drake (3)

Egg plant (*Solanum melongena*)

*Gargaphia solani* Heidemann (13) (14) (22)

*Gargaphia opacula* Uhler (15)

Fringe tree (*Chionanthus virginia*)

*Leptoypha mutica* Say (2) (5)

Grapes

*Piesma cinerea* Say (2) (32)

Grease-wood (*Ceanothus sauguineus*)

*Corythucha obliqua* Osborn and Drake (14) (11) (32)

Hawthorn

*Corythucha crataegi* (Heidemann (30) (31)

Hazelnut (*Corylus americana*)

*Corythucha coryli* Osborn and Drake (2) (33)
*Corythucha padi* Drake (14)
*Corythucha pergandi* Heidemann (14)

Linden (*Silia americana*)
Corythucha pallida Osborn and Drake (33)
Corythucha juglandis Fitch (14)

Mulberry (Morus rubra)
Corythucha pallida Osborn and Drake (33)

Oaks (Quercus alba, Q. prinus, Q. sp.)
Corythucha arcuata Say (30)
Corythucha floridana Heidemann (14)
Corythucha piercei Gibson (14)
Corythucha bellula Gibson (14)

Red root (Ceanothus cardulatus)
Corythucha obliqua O. and D. (14) (11) (32)
Corythucha contaminata Gibson (14)

Rhododendron
Leptobyrsa rhododendri (Horvath) (2) (4) (36)

Sunflower, Prairie (Palsamorhiza sagittata)
Corythucha para Gib. (14)

Sycamore (Platanus occidentalis)
Corythucha ciliata Say (30)
Corythucha confraterna Gibson (14)

Walnut (Juglans sp.)
Corythucha contracta Osborn and Drake (8)
Corythucha juglandis Fitch (14)

Willow (Salix sp.)
Corythucha elegans Drake (9)
Corythucha salicata Gibson (14)

Corythucha salicis O. and D. (14) (33)

REVIEW OF THE SYSTEMATIC WORK

The family Tingidae was established by L. de Laporte in 1832. In 1843 Amyot and Serville grouped the members of this family into two subfamilies, Piesminae and Tingidinae. In 1910 O. M. Reuter founded the superfamily Tingidoidea to which belong only two families, Piesmidea and Tingididae.

Family Piesmidea is represented by only a single genus (Piesma) and has in the past often been classed as a subfamily either of Lygaeidae or the Tingididae, but is in reality a connecting link between the two. The North American species have been treated by McAtee (28). In his paper eight new species were described. Formerly the family had been supposed to be represented in North America by only a single species, Piesma cinerea Say.

Family Tingididae is represented throughout the world, about 350 species. More than 120 species of the family are now recognized from North America, 50 or more of which occur in the Western States. These are divided among twenty-two genera and separated into three tribes, all belonging to the subfamily Tinginae. The following key to the tribes is adapted from Blatchley's "Heteroptera of Eastern North America" (2).
Key to the Tribes of the Subfamily Tinginae

a. Front parts of pronotum elevated into a more or less inflated or bulbous hood; paranota and costal margin of elytra expanded and projected much beyond the sides of the body.

b. Elytra for the most part widely reticulate and membranous, the cells usually hyaline; discoidal area of elytra confined to the basal half; osteolar openings (metasternal orifice) distinct, rarely (Galeatus and Dictyonota) wanting.

Tribe I. Galeatini

bb. Elytra closely reticulate, the cells, except those of the costal area, small and mostly subopaque; discoidal area reaching apical third or fourth; osteolar openings absent.

Tribe II. Acalyptini

aa. Front part of pronotum without an inflated hood, its median carina often slightly elevated to form a small hood-like elevation; elytra closely reticulate and for the most part coriaceous and opaque; paranotum and costal margins of elytra much less expanded, but little projecting beyond the sides of body.

Tribe III. Physatocheilini

POSITION OF THE SPECIES CORYTHUCHA SALICATA GIBSON

The Western Willow Tingid was first described by Gibson and named Corythucha salicata (14). The type is taken from Hood River, Oregon. In the same paper he described another tingid as a new species called Corythucha drakei, which is taken from apple tree in
Portland, Oregon. He distinguished *salicata* from *drakei* by the less arched median carina, which is slightly shorter, and by the angulate tumid elevations of elytra. Drake, 1921 (8), reports that it is impossible to separate *Corythucha drakei* from *Corythucha salicata*, and considered *drakei* as a synonym of *salicata* according to the law of priority. It belongs to the superfamily Tingidoideae, family Tingididae and genus *Corythucha*.

A. Characters of the Superfamily Tingidoideae:

Members of Tingidoideae are characterized by having the upper surface of the body, especially the elytra, more or less finely reticulated or lace-like, which justified the application of the name lace-bugs to them. There is very rarely any distinction between the corium and membrane. The four-segmented antennae are usually much longer than the head; segments one and two short and subequal in length; three longest, and four fusiform with apex sometimes attenuate. Rostrum consists of four segments. Bucculae are raised to form a sulcus for the reception of the beak. Pronotum is usually more or less prolonged backward to cover the scutellum. Legs are rather slender and the tarsi are two-jointed. The two families of this superfamily can be easily classified by the following key, which is adapted from Osborn and Drake in their "Tingitoidea of Ohio" (31).

**Key to the Families of the Tingitoidea**

Pronotum produced posteriorly, forming a triangular process;
ocelli wanting; elytra of a uniform texture throughout, densely areolated, membranous between the areolae.

Family Tingitidae
Pronotum not produced posteriorly; ocelli present; hemelytra with a distinct membrane, the rest reticulately punctate.

Family Piesmidae

B. Characters of the Family Tingididae

This family consists of small, oval or oblong insects with the upper surface reticulated, giving the lace-like appearance. Head is small and triangular. Juges are not prominent and not longer than the stylus. Ocelli are wanting. Antennae consist of four segments with the third segment the longest. Beak is four-jointed and the sulcus is rather deep with the sides raised. Pronotum, in front, with a hood or only tumid; lateral margins foliaceous, reticulately projecting or closely lapped over on the pronotum; disc with one or three carinae; posterior triangular process usually long. Elytra are more or less reticulated throughout, without distinct corium or membrane, and membranous between the reticulations. Tarsi consist of two segments.

The key to the genera of Ohio Tingididae (31) contains the twelve common ones and is cited below, for it is quite convenient to use for classification of the tingids, including those genera which are now represented in Oregon. For those genera which are not mentioned in the key, it is recommended to refer to Blatchley's "Heteroptera of Eastern North America" (2).
Key to the Genera of Tingididae

1. Membranous pronotal margins not expanded; or reflected vertically; or reflected more or less against the dorsal surface of the pronotum ................. 8

   Membranous pronotal margins more or less reflected, but at an obtuse angle ............................................. 2

2. Pronotum with a pronotal and discal hood, the latter divided behind; areolae very large ........ Genus Galeatus Curtis

   Pronotum with only a pronotal hood; areolae very much smaller ................................................................. 3

3. Rostral sulcus interrupted between the meso- and meta-
   sternum by a prominent, sinuose, transverse carina ........ Genus Gargaphia Stal

   Rostral sulcus uninterrupted by a transverse carina ........ 4

4. Outer edge of membranous pronotal margins and elytra, except distal third, armed with short, acute spines; elytra with a tumid elevation near the antero-inner margin ................................................................. Genus Corythucha Stal

   Outer edge of membranous pronotal margins and elytra un-armed (in the genus Leptobyrsa closely beset with fine hairs) ................................................................. 5

5. Pronotum with a single median carina ........ Genus Fenestrella n.gen.

   Pronotum tricarinate ......................................................... 6

6. Discoidal area reaching beyond the middle of the elytra .......... Genus Acalypta Westwood

   Discoidal area not reaching the middle of the elytra .......... 7
7. Elytra very broad, extending about one-half beyond the apex of the abdomen, the outer margin broadly rounded and beset with numerous, fine hairs. Genus *Leptobyrsa* Stal. Slender insects; elytra narrow, shorter, the outer margin more or less constricted about the middle, hairs on outer margin wanting. Genus *Leptostyla* Stal.


Membranous pronotal margins reflected vertically; or reflected more or less against the dorsal surface of the pronotum.

9. Reflected pronotal margins very broad, broadly rounded, touching or nearly touching the outer carinae. Genus *Physatochila* Fieber.

Reflected pronotal margins very narrow, subquadrate.

10. Subcostal, discoidal, and sutural areas undifferentiated; body very thick; antenniferous tubercles very large. Genus *Alveotingis* n. gen.

Subcostal, discoidal, and sutural areas distinct; antenniferous tubercles much smaller.

11. Antennae contiguous at the base; elytra broadly rounded at the apex. Genus *Taleonemia* Costa. Antennae not contiguous at the base; elytra greatly narrowed or obliquely rounded at the apex. Genus *Melanorhopala* Stal.
C. Characters of the Genus Corythucha

Corythucha belongs to the tribe Galeatini, the characteristics of which have been mentioned in the key to the tribes of the family. The genus is characterized by having the outer edge of the membranous pronotal margins and elytra, except distal third, armed with short, acute spines and the elytra with a tumid elevation near the antero-inner margin. The head is entirely concealed by the hood the apex of which reaches in front of the tyllus. Rostral sulcus is not interrupted by a transverse carina. Bucculae united in front. Antennae slender, beset with long bristly hairs; front segment twice or more the length of the second; third segment longer than first and second united, and fourth segment shorter and stouter than the third. Elytra subquadrate and narrowed at the base. The nervures of the upper surface often bear a few scattered erect spines. Blatchley separated his genus into three groups and gave keys to 24 Eastern species (3). Gibson in 1918 redescribed nearly all the species and described several new ones with a key to 57 species in his "The Genus Corythucha Stal" (15).

DESCRIPTION OF THE VARIOUS STAGES

A. Adult (Plate I, fig. 1)

Size of female is 3.55 by 2 mm. Male is little smaller, being 3.45 by 1.9 mm. (Average of 50 specimens). Color in general is above white or creamy with a brown band near the apex and a faint brown one across the base of the elytra. A brown
spot at center of costal margin and brown tumid elevations of elytra are usually very prominent. There is comparatively few spines on the membranous margins and nervures. Pronotal hood is slightly higher than median carina and height of hood is about one-half its own length (Plate I, fig. 2). Median carina is of normal height. Lateral carinae are long and terminate a short distance from base of hood. Reticulations of globose portion of hood are about the same size as those of paranota. It is well to note that the general size and color may vary to a certain extent and the comparative measurements of the pronotal hood and median and lateral carinae are more reliable and stable characters.

The male and female can be easily distinguished with the naked eyes. The regularly rounded abdomen of the female (Plate II, fig. 2) distinguishes it readily from the tapering, bluntly-pointed abdomen of the male (Plate II, fig. 1). On the under side at the posterior tip of the male abdomen there is a pair of forcep-like claspers (Plate II, fig. 3). The ovipositor of the female is overlapped by the sides of the eighth abdominal segment almost concealing it (Plate II, fig. 2). The ovipositor consists of a basal pair of plates joined along their inner edges forming a sheath for the two cutting blades which are serrated on the outer edges (Plate II, figs. 4 and 5).

B. Egg (Plate III)

Egg is small, light brown and semitransparent in basal half, subelliptical in outline and slightly curved. The basal end is
rather bluntly pointed and the apical end capped with a narrow cylindrical collar surmounted by a low pyramid with ridges extending from the base to the apex. The pyramidal portion of the apical end is grayish white in color. Below the collar the exposed portion of the egg is covered with a black, sticky substance which hardens soon after oviposition. The length of the egg averages .47 mm. with its width .19 mm. (Average of 50 eggs).

C. Nymphs (Plates IV and V)

First Nymphal Stage (Plate IV, Fig. 1) - General form is more cylindrical elongate and thicker than the other instars. Length varying from .52 mm. to .63 mm; the greatest width from .23 mm. to .28 mm. At the time of hatching the nymph is pale in color. Fully matured specimens are dirty yellow. Antennae are composed of three segments; the first two segments of which are short and subequal in size; the second one bears a very few slender spines; the terminal segment is longer than the first two together, clavate and is provided with long spines. The rostrum is four-segmented and about three-fifths as long as the entire body, reaching when bent backwards to the middle of the fourth abdominal segment. Legs are long and stout; coxae as long as broad; trochanters indistinct; tibiae as long as femora and more slender; tarsus consists of two segments, the basal segment indistinct and the last segment bearing a pair of claws at its tip. A few slender spines occur on the various segments of the legs. The rostrum, except the tip which is brown, the antennae and the
legs are all pale yellowish in color. Head bears five
tubercles, the anterior pair with a single spine on each, the
median and the posterior pair with two spines on each. Thorax
is about as long as head, being slightly wider. Prothorax is a
little larger than mesothorax and the mesothorax is a little
larger than the metathorax. Both pro and mesothorax are armed
with a spine on each side. Mesothorax also with a dorsal pair of
tubercles, each bearing a pair of spines. Abdomen consists of ten
segments. Abdominal segments two, three, four, five, six, seven,
eight and nine with a small tubercle, bearing a slender spine, on
each side. Abdominal segment two bears a pair of small dorsal
tubercles with a spine on each; segments five and six with large
and prominent dorsal tubercles, each tubercle bearing three
spines; segment eight with small tubercles each bearing a pair of
spines.

Second Nymphal Stage (Plate IV, Fig. 2) - The change which
occurs in the first moult is not great. Body is broader in pro-
portion to its length than the preceding instar. Length varies
from .85 mm. to .95 mm; the greatest width from .41 mm. to .45
mm. Color is darker yellow. Rostrum reaches to about the
posterior margin of the second abdominal segment. The spines
along the margins of the abdomen and thorax are stronger and
larger and a small secondary spine has appeared at the base of
each marginal tubercle. The additional spines are as follows:
In the head region, a small spine has been added to the median
tubercle and two spines have appeared at each base of the posterior pair of tubercles; on the mesothorax, two spines are added to each base of the dorsal tubercles.

**Third Nymphal Stage (Plate IV, Fig. 3)** - This instar does not differ greatly in structure from the preceding one. Length varies from 1.07 mm. to 1.12 mm; the greatest width from .50 mm. to .58 mm. The terminal segment of the antenna is now indistinctly divided into two segments, the outer one being shorter but slightly broader than the inner one. The rostrum reaches the caudal margin of the first abdominal segment. The legs are slender and shorter in proportion to the length of the body than before. A few tubercles appear on the lateral margins of the pro and mesothorax. Spines have been added to the tubercles of the head, varying in numbers, usually one to the median and one to each of the posterior tubercles.

**Fourth Nymphal Stage (Plate V, Fig. 1)** - The most noticeable change which takes place in the third moult is the first appearance of the wing pads, which arise as curved, backward growths of the sides of the mesothorax. The wing pads extend back on each side to the middle of the second abdominal segment. The prothorax is proportionally longer than before and bears two pairs of tubercles. The two terminal segments of the antenna are more distinct than those of the preceding instar. Rostrum reaches to the posterior margin of the metathorax. Tubercles are prominent and a small one is added at the base.
of each marginal tubercles from the fourth to the ninth abdominal segments. General color is yellow with wing pads embrowned. Length varying from 1.35 mm. to 1.50 mm; the greatest width from .81 mm. to .87 mm.

Fifth Nymphal Stage (Plate V, Fig. 2) - The most noticeable changes which occur at the fourth moult are the increased length of the prothorax in proportion to the length of the body, and the increase in length of the wing pads. The wing pads now extend back on each side to the middle of the fifth abdominal segment. Prothorax is very prominent, the median anterior portion being considerably raised and inflated. Rostrum reaches to about the middle of the metathorax. Spines and tubercles on lateral margins of abdominal segments covered by the wing pads are wanting. General color is yellow with tips of the wing pads embrowned and with two prominent brown spots near the base of the dorsal tubercles on the wing pads. Length varying from 2 mm. to 2.25 mm.; the greatest width from 1.12 mm. to 1.25 mm.

LIFE HISTORY AND HABITS

A. Eggs

The eggs are deposited on the under surface of the leaf usually along both sides of the ribs, especially the midrib (Plate III, Fig. 1). Preparatory to the deposition of the eggs, the female punctures the leaf tissue with the serrated cutting blades of the ovipositor (Plate II, Fig. 5). About
three-fifths of the egg is inserted into the tissue leaving the two-fifths protruding from the leaf (Plate III, Fig. 2). The exposed portion of the egg is covered with a black sticky substance which is secreted by the female after deposition. They are generally placed singly and in no definite order. Occasionally two eggs are inserted in the same egg puncture.

The eggs are deposited during the latter part of April (first observation in field was on April 28, 1932) until beginning of July. The eggs are quite large in proportion to the size of the abdomen. The size of the ovaries can contain only a few fully formed ova at one time. This probably accounts for the long period of egg deposition. Adults were collected from the field to the laboratory but failed to lay eggs, and in case eggs were observed they failed to hatch on account of the desiccation of the leaves. Judging by the first field observation of eggs (April 28) and the first field observation of newly hatched nymphs (May 20), it takes about three weeks for the incubation period. The number of eggs found in a single leaf varies from 50 to 528 in a leaf 6 cm. long and 3.5 cm. in diameter.

B. Nymphs

The cap of the egg is pushed off when the nymph emerges from the egg (Plate III, Fig. 1). It took 50 minutes for the young to emerge from the egg case in an instance under
observation by the writer in the laboratory. The gregarious habit of the nymph is more pronounced in the first two instars. They gradually scatter during the older stages. Newly hatched nymphs are not so active and are found moving not far away from the empty egg cases. Molting skins of the first instar nymphs are found on the leaves where eggs are laid. Nymphs of all instars are fed on the under side of the leaves where they suck the sap of the tissue and cause the leaves to dry. Discoloration caused by their feeding is very conspicuous on both sides of the leaves. In addition to these discolored areas, there are small black spots on the undersides of the leaves where the excrements have been deposited.

The nymphal stages are represented by five instars. All stages are found in the field from the middle of June to the end of July. The length of different instars is as follows:

1st instar - - - - - - - - 3 to 6 days
2nd instar - - - - - - - - 3 to 5 days
3rd instar - - - - - - - - 3 to 5 days
4th instar - - - - - - - - 5 to 9 days
5th instar - - - - - - - - 4 to 8 days

The following tables show the molting stages and the duration of each stage of the nymphs which were observed in the laboratory.
Table I. Moulting Stages of Nymphs of Corythucha salicata Gibson, Corvallis, Oregon, 1932

<table>
<thead>
<tr>
<th>Rearing Number</th>
<th>Date Hatched</th>
<th>First Moult</th>
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<th>Third Moult</th>
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*Nymphs collected from field
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### Table II. Duration of Different Instars (Number in Days)

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</table>
C. Adults

Newly moulted adults can be distinguished by the white appearance of the dorsal surfaces which become creamy and dotted brown within one or two days. Adults, like the nymphs, feed on the undersides of leaves and injure them in the same manner. It is interesting to note that the feeding habits of adults, as well as nymphs, would be changed from the under to the upper surface of the leaf if direct sunlight was on the under surface. It seems that the insect is negatively phototropic to a certain extent. However, when the adults were released in a room they were attracted to the window. Their reaction to light is not well known and offers an interesting further study. Adults are also gregarious in habit. Hundreds of them may be found clustering in a single leaf. They are not actively flying insects, being spread gradually in the orchard.

Winter is passed in the adult stage and hibernation begins early in September. Wilson and Lovett (45) report that hibernation takes place in the rubbish on the ground. Under field observation it is found that most adults hibernated among the moss on standing trees in or near the orchard and sparingly in rubbish on the ground or under bark of trees. There were 711 hibernating adults found in a 1000 cc. beaker full of moss from the standing trees near the orchard. The overwintering adults come out some warm days in the spring (first field observation of 1932 was on April 9, and of this year on April 4).
Lebanon, where the most serious infestation has occurred, it was found averaging ten insects per bud soon after they left their hibernating quarters (average of 100 buds). With the lack of control measures the number has increased to 22 insects per bud this year. In one severe case 112 tingids were found in a single bud. The adults first appear on the trees near the hibernation quarters and keep on spreading in the orchard. Feeding and mating were observed soon after emergence. Eggs were laid about three weeks later and brood rearing of the season started.

D. Seasonal History

There is apparently only one generation a year. Overwintering adults come out in early April. Egg deposition covered rather a long period starting late in April (first field observation was on April 28) until the beginning of July. Eggs began to hatch the latter part of May (first field observation was on May 20) and took from 19 to 29 days for the development of the five instars. All nymphal stages may be found in the field from about the middle of June to the latter part of July. The first generation adults were observed about the middle of June (first field observation was on June 12) until the beginning of August. Early in September they began to hibernate and come out until the next spring. The chart illustrates the seasonal history of the insect which was observed in Lebanon, Oregon, 1932.
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DISTRIBUTION

The Western Willow Tingid, Corythucha salicata Gibson, has been reported from Oregon, Washington, Manitoba and British Columbia (8) (11). In Oregon it has been found doing damage on apple in Lebanon, Salem and Dallas, and has been recorded from Portland, Hood River and Corvallis.

ECONOMIC IMPORTANCE

Since adults as well as nymphs procure their food by sucking the juice in the leaf tissue, the injury resulting to the plant is indicated by the brown and sun-burnt appearance of the leaves. The black excrement and moulted skins of the nymphs on the undersurfaces of the leaves give a good identification of the presence of the pest. The tissue surrounding the eggs is somewhat hard and corky and distortion of the ribs may happen where many eggs are deposited on a leaf. An infested orchard can be recognized by a brown unhealthy color instead of a rich green appearance.

By the middle of July most of the injured leaves turn brown and dry up and the orchard resembles the winter condition (Plate VI). A heavily infested orchard was so damaged by the tingid that practically 100 per cent of the crop was lost.

APPLIED CONTROL

In spraying, it is essential to have timely application of the insecticide and to direct the spray at the underside of the leaves so that the insect will be thoroughly covered by the spray. Control
experiments were carried on by Mr. B. C. Thompson, Assistant Entomologist of the Oregon Experiment Station, assisted by the writer. The first application was made on April 27, about two weeks after the tingid had emerged from hibernation, for the purpose of killing the adults.

The following insecticides were used:

1. Oil No. 6, 3%
2. Oil No. 6, 3%, plus Black Leaf-40, 1 to 800
3. Oil No. 6, 1/2% plus Black Leaf-40, 1 to 600
4. Black Leaf-40, 1 to 600
5. Pyrocide No. 40, 1 to 800
6. Pyrocide No. 40, 1 to 400
7. Pyrocide No. 40, 1 to 400 plus oil No. 6, 3%

None of the sprays gave control with the first application. The experiment was repeated on June 17 on the nymphs, and almost 100 percent control was obtained with all the sprays used.

Winter cleaning of the moss in the woods in or near the orchard is recommended as a remedy, as evidence has shown that those favorable hibernating quarters are contiguous to the orchard.

NOTES ON OTHER SPECIES

Several other species of tingids occur in Oregon which are more or less of economic importance. As there was not time to make a detailed study of these species, a brief review of their life habits and distribution follows.
A. Rhododendron Lace-bug, *Leptobyrsa rhododendri* (Horvath)

This insect has a more or less wide distribution, being reported from Maine, Massachusetts, New York, New Jersey, Pennsylvania, Maryland, District of Columbia, West Virginia, North Carolina, Florida, and Ohio.

Specimens and infested rhododendron leaves have been received from Clackamas county, Oregon, which locality is not included in the distribution given in Van Duzee's "Catalogue of the Hemiptera of America North of Mexico", and apparently is a new locality record for this species. It has been found also from Portland and Corvallis, Oregon.

Injury is caused by the nymphs and adults feeding on the undersurface of the leaf. They suck the sap, causing discolored areas on the upper surfaces, often with consequent drying and shriveling of the leaf. The underside of the leaf, due to the excrement left there by the insect, shows an unsightly appearance.

The life history has been studied by Crosby and Hadley (4) of Cornell University. The winter is passed in the egg stage. The eggs hatch in late May or early June. The nymphal stages are represented by four instars. The length of the different instars has been found to be as follows:

1st instar -- 6 to 7 days
2nd instar -- 4 to 6 days
3rd instar -- 3 to 6 days
4th instar -- 12 to 15 days
Crosby and Hadley (4) report that it is not difficult to control this insect by a soap and water spray at the rate of one pound soap to ten gallons of water. The spray should be directed at the underside of the leaves and applied as soon as the nymphs are observed. Care should be taken not to spray the plant while the hot sun is shining, otherwise the leaves will be scorched. A series of sprays were tested for the control of this insect by Felt and Broinley (12) with results indicating the value of the spray when there was a thorough wetting of the insect. The following contact sprays were used and gave a very satisfactory control:

1. Sodium oleate (So-Fyne) 1 - 50 plus nicotine sulfate (Black Leaf-40) 1 - 800.
2. Potassium oleate (Crystal) (0.5%) plus nicotine sulfate (Black Leaf-40) 1 - 800.
3. Pyrethrum soap (Pyrethrol) 1 - 80.

Following is a description of the adult by Blatchley (2):

Broadly oval, strongly dilated behind. Head, under surface and disk of pronotum black, shining; nervures of upper surface straw-yellow, the cells hyaline; an oblique spot on median pronotal carina and some of the nervures at basal third of elytra fuscous-brown, the latter forming a vague brownish cross-bar; antennae, bucculae and legs pale dull yellow, the tarsal claws and apical half of fourth antennal darker. Para-nota semi-elliptical, strongly reflexed. Elytra widening from
the base, their areolae large. Length, 3.5 - 3.8 mm.

The *Leptobyrsa explanata* Heidemann is a synonym (36) of *L. rhododendri* Horvath.

**B. Ash-Gray Leaf Bug, *Piesma cinerea* Say**

*Piesma cinerea* Say belongs to the family Piesmidae and genus *Piesma*, which is the only genus represented in this family. Piesmidae can be distinguished from Tingididae by the pronotum which is not produced posteriorly, the hemelytra which have a distinct non-reticulate membrane, and the presence of ocelli.

It is a species of wide distribution, ranging from Ontario and New England westward to the Pacific and southwest to Florida, Texas and Mexico (2). In Oregon it has been found from Narrows, Warm Spring Valley and near Corvallis. Specimens from these localities are represented in the collection of the Department of Entomology, Oregon State College.

It has been recorded by Summers as injuring the leaves and flowers of grapes (31). Weiss and Lott (45) state that in New Jersey it feeds by hundreds on the flower heads and foliage of the dark green bulrush, *Scirpus atrovirens* Muhl., and the rough pig-weed, *Amareanthus retroflexus* L., causing the upper surface of the leaves to become mottled or spotted with white.

Following is a description of the adult by Blatchley:

Oblong-oval. Dull gray or straw-yellow, more or less mottled with brown or fuscous, the elevated hind lobe of pronotum often almost wholly brown; costal margin of elytra
alternated with pale and dark; antennae and legs dull yellow, the fourth antennal and claws darker. Pronotum narrower in front than behind, side margins broadly shallowly emarginate near middle; disk densely rather coarsely punctate, the carinae distinct. Length, 2.7 - 3.2 mm.

C. Walnut Tingid, *Corythucha juglandis* (Fitch)

This species ranges from New England west to Kansas and southwest to Texas (2). It feeds on walnut, butternut, basswood and linden, and is recorded from British Columbia, Washington, Oregon and Idaho in the West (11).

Gibson, 1918, (14 p. 81), redescribes the species as follows:

Pronotal hood at least twice as high as median carina with its height fully two-thirds its own width. Length of hood not noticeably longer than median carina, sometimes slightly so. Reticulations of hood very large, more than twice the size of those of the paranota. Spines normal, rather short. Costal margin of elytra nearly straight. Size 3.3 mm. to 3.8 mm. long, 2 to 2.3 mm. wide.

General aspect above yellow or light brown. A light spot on paranota, sometimes a faint second one. Brown band across base of elytra and another across elytra near apex. Anterior border of apical band straight, not slanting from inner margin of elytra to costal margin.
D. Corythucha contaminata Gibson

This species is recorded from Idaho, Oregon and California. Osborn and Drake place it synonymous with distincta. Gibson, 1918, (14), separates this species from distincta by the comparatively low hood and shorter lateral carinae, and concludes that this is a distinct species. It was taken from red root, Ceanothus cardulatus.

The original description of the species by Gibson (14) is given:

Pronotal hood slightly higher and shorter than median carina, its height is at least one-half its own length. Lateral carinae long with distinct areoles. Reticulations of hood not over twice the size of those of the membranous pronotal margins. Spines on membranous margins small. Size, 3.5 mm. long, 2.3 mm. wide. Nervures of hood embrowned.

Two brown spots on paranota. Brown bands at base and apex of elytra, apical band narrow with several hyaline areoles. Tumid elevations embrowned and a small brown spot at center of costal margin of elytra.

E. Ceanothus Tingid, Corythucha obliqua Osborn and Drake

This species occurs in California, Oregon and Idaho. In Oregon specimens have been taken from Hood River and near Corvallis. It is common on ceanothus in the Sierra foothills of California as reported by Essig (11). Near Corvallis numerous specimens have been taken from greasewood, Ceanothus sanguineus.
It is first described by Osborn and Drake as follows:

(32 p. 11)

Antennae beset with a few long, stiff hairs; first segment moderately swollen, about twice the length of the second; second segment less swollen, shortest; third segment very long, cylindrical; fourth segment considerably swollen towards the apex. Rostral groove rather broad; rostrum reaching the intermediate coxae. Pronotum coarsely and regularly punctured; membranous margins broad, kidney-shaped, quite closely reticulated, strongly bullate about the middle, slightly reflected behind, the dorsal surface armed with a few erect spines; posterior, triangular portion reticulated at the apex, the sides raised anteriorly, with five or six distinct areolae; median carina considerably raised, with one complete row and two divided areolae about the middle forming double cells. Hood moderately raised, rather closely reticulated, armed with a few short spines on the sides, quite abruptly constricted about the middle, globose behind. Wings a little longer than the abdomen. Elytra broadly rounded at the apex, outer margin slightly sinuate; costal area with three complete series and a partial row of areolae near the base. Length, 3.45 mm.; width, 1.44 mm.

and raised sides of triangular process yellowish. Expanded margins of pronotum mostly dark-fuscous; centers of areolae hyaline. Elytra yellowish, a rather broad band near the base, a slightly narrower, oblique band near the apex, a few transverse nervures of costal area, and more or less of sutural areolae dark-fuscous; areolae of costal area hyaline. Nervures of apical areolae dark-fuscous; areolae hyaline, a few slightly infuscated.

F. Choke Cherry Tingid, Corythucha padi Drake

It is recorded from Montana, Oregon, Washington and British Columbia. Its host plant is western choke cherry, Prunus demissa. Around Stayton, Oregon, it has been found scatteringly on the hazelnut, Corylus americana, and, according to Drake, it is a new host record for this species.

Winter is passed in the adult stage among the moss on the standing trees near the host plant. The adults appear from May to September. Eggs are deposited in circular masses. The nymphs were observed late in June and apparently there is only one generation a year.

Following is a description of the adult by Gibson (14):

Hood twice as high as median carina, with height about two-thirds its length, noticeably longer than median carina. Height of hood not greater than length of median carina. Reticulations of hood large. Spines on membranous margins and nervures rather small, not numerous. Costal margins of elytra nearly
straight. Size, 4 mm. long, 2.4 mm. wide.


G. California Christmas-berry Tingid, Corythucha incurvata Uhler

The distribution of this species includes California, Oregon and Arizona in Van Duzee’s "Catalogue of Hemiptera of America North of Mexico." In Pemberton’s paper (38) it was wrongly determined as Corythucha arcuata.

It is a pest on the Christmas-berry, Heteromeles arbutifolia, and its presence can easily be detected by the brown, sun-burned appearance of the undersides of the leaves. In a heavy infestation the entire foliage of the bush is given a brown unhealthy color, very different from the live green of the uninjured plants.

Life history of the insect has been studied by Pemberton (38). There are several broods in a year, though it has not been determined whether the number is definite or whether it varies, according to climatic conditions. Under normal conditions in the Santa Clara Valley of California the average life cycle is passed in about seventy-eight days. The period of activity lasts about eight months and there are probably three broods a year. Winter is passed in the adult stage. Adults appear from March until December. Nymphal stages are represented
by five instars.

Following is a description of the insect by Gibson (14):

Pronotal hood very large, twice as high as median carina, and its height equal to two-thirds the length of the hood. Length of hood considerably greater than length of median carina. Hood abruptly constricted at the middle, globose portion wider than long, not flattened on top or posteriorly. Reticulations of hood large. Median carina arched before. Lateral carinae of medium height, short, terminating a considerable distance from base of hood. Costal margins of elytra distinctly concave. Spines on membranous borders short. Length 3.3 mm., width 2.9 mm.

General aspect above yellowish brown. Membranous portions hyaline with nervures yellow. Crest of hood more or less embrowned. Pronotum proper, brown. Inner border of elytra more or less embrowned. Faint brown band across apex of elytra, tumid elevations more or less brown and a slight brown spot in each anterior-lateral angle of elytra.
BIBLIOGRAPHY

   1922 - The Lace Bugs of New Jersey. Bur. Statistics and

2. Blatchley, W. S.

3. Chittendon, F. H.
   1900 - A New Tingitid on Bean (Garaphia angulata Heid.)

   1915 - The Rhododendron Lace-Bug, Leptobyrsa explanata Heid.
   Jour. Econ. Ent. 8:409-414.

5. Dickerson, E. L. and Weiss, H. B.
   1916 - Notes on Leptopypha mutica Say (Hemiptera) Ent. News
   27:308-310.

6. Drake, C. J.
   1918 - Description of Six New Species of Corythucha in

7. Drake, C. J.

8. Drake, C. J.
   1921 - Notes on Some American Tingidae, with Description of
   New Species. Florida Ent. 4:49-54.

9. Drake, C. J.
   1922 - Heteroptera of the Cranberry Lake Region. New York
10. Drake, C. J.

11. Essig, E. O.
1926 - Insects of Western North America, p. 351-354.

12. Felt, E. P. and Bromley, S. W.

13. Fink, D. E.
1915 - The Eggplant Lace-bug. U.S.D.A. Bul. 239.

14. Gibson, E. H.

15. Gibson, E. H.

16. Heidemann, Otto

17. Heidemann, Otto

18. Heidemann, Otto

19. Heidemann, Otto
20. Heidemann, Otto


21. Heidemann, Otto


22. Heidemann, Otto


23. Heidemann, Otto


24. Hussey, R. F.


25. Imms, A. D.


26. McAtee, W. L.


27. McAtee, W. L.


28. McAtee, W. L.

29. McAtee, W. L.

30. Morrill, A. W.

31. Osborn, H. and Drake, C. J.

32. Osborn, H. and Drake, C. J.

33. Osborn, H. and Drake, C. J.

34. Osborn, H. and Drake, C. J.

35. Parshley, H. M.

36. Parshley, H. M.

37. Parshley, H. M.
38. Pemberton, C.

39. Tillyard, R. J.
   1926 - The Insects of Australia and New Zealand.

40. Uhler, F. R.

41. Van Duzee, E. F.
   1917 - Catalogue of the Hemiptera of America North of Mexico.

42. Weiss, H. B. and Lott, R. B.

43. Weiss, H. B. and Lott, R. B.

44. Weiss, H. B. and West, E.

45. Wilson, H. F., and Lovett, A. L.
   1912 - Miscellaneous Insect Pests of Orchard and Garden. O. A. C. Experiment Station Biennial Crop Pest and Horticultural Report, p. 152.
Plate I

Figure 1. Dorsal View of Adult *Corythucha salicata* Gibson 30x

Figure 2. Lateral View of Hood and Median Carina, *Corythucha salicata* Gibson, 40x
Plate I

Figure 1

Figure 2
Plate II

Figure 1. Dorsal View of Last Three Abdominal Segments of Adult Male, *C. salicata* Gibson, 40x

Figure 2. Dorsal View of Last Three Abdominal Segments of Adult Female, *C. salicata* Gibson, 40x

Figure 3. Last Segment of Male Abdominal Segment Showing a Pair of Forcep-like Claspers Extended, 68x

Figure 4. Ovipositor of *C. salicata* Gibson (dissected out) 68x

Figure 5. Ovipositor with Plates Removed Showing the Serrated Cutting Blades Adapted for Piercing the Leaf Tissue, 100x
Plate III

Figure 1. Eggs of *Corythucha salicata* Gibson Protruding from Underside of Leaf, 80x

Figure 2. Cross Section of Leaf Showing the Insertion of Egg, 80x

Figure 3. Egg Removed from Leaf Showing its Shape, 80x
Plate IV

Figure 1. First Nymphal Stage, Corythucha salicata Gibson, 40x
Figure 2. Second Nymphal Stage, C. salicata Gibson, 40x
Figure 3. Third Nymphal Stage, C. salicata Gibson, 40x
Plate IV

Figure 1

Figure 2

Figure 3
Plate V

Figure 1. Fourth Nymphal Stage, *C. salicata* Gibson, 40x

Figure 2. Fifth Nymphal Stage, *C. salicata* Gibson, 40x
Plate V

Figure 1

Figure 2
Plate VI

Figure 1. Picture of Orchard Taken at Middle of July
   Showing Infested Area of Orchard in Foreground

Figure 2. A Healthy Normal Leaf

Figure 3. Infested Leaf Showing Sunburnt Appearance,
   Black Excrement and Moulty Skins of
   Corythucha salicata Gibson