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AN ANNOTATED LIST OF THE SPITTLEBUGS OF MICHIGAN (HOMOPTERA: CERCOPIDAE)

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Representatives of the family Cercopidae are commonly known as “spittlebugs” because the nymphs cover themselves with saliva-like frothy masses composed of bubbles of air trapped by motions of the abdomen in fluids discharged from the alimentary canal. Spittle protects nymphs from desiccation, but they are able to abandon it for brief periods while migrating to new feeding sites or to other host plants where new masses are produced. Gas exchange by nymphs immersed in spittle is accomplished through spiraculæ situated in a protective chamber formed on the ventral side of the abdomen by extended tergites. Fig. 1 shows a mass of spittle produced by *Aphrophoraalni* nymphs at the base of a plant stem.



Fig. 1. Mass of spittle produced by *Aphrophoraalni* nymphs at the base of a plant stem.

Adult spittlebugs differ from other Homoptera in having hind tibiae armed with two stout lateral spurs and a cluster of terminal spines. Soft sounds produced by vibrating tergal abdominal timbals of a few adult spittlebugs collected in Michigan were analyzed by Moore (1961). Comparison of such sounds provided a basis for recognizing the taxonomic relationships of certain cicadas (Alexander and Moore, 1962). Moore (1956) observed that the family Cercopidae appears closely related to the family Cicadidae; his observations are based on similarity in structure of the abdomen and antennae among nymphs of the two families. He suggested that the higher categories of the Cercopidae evolved along four major lines of specialization represented by the subfamilies Aphrophorinae, Cercopinae, Clastopterinae, and Machaerotinae. The first three subfamilies are represented in Michigan. The subfamily Machaerotinae is not represented in North America, but embraces curious species known as “tube-building” spittlebugs which construct remarkable shelters from



Fig. 2. The counties of the state of Michigan.

hardened spittle.

A few spittlebugs are of economic importance. Plant damage may result from (1) excessive feeding and extraction of plant juices by nymphs in maintaining protective spittle masses, (2) excessive extraction of plant juices by adults to meet metabolic requirements, (3) injection of toxic substances by adult spittlebugs (and nymphs?) while feeding, (4) transmission of virus entities, and (5) feeding punctures which predispose hosts to attack by bacteria and fungi.

Severin (1950) reviewed the importance of spittlebugs as vectors of plant diseases. McDaniel (1937) reported that the pine spittlebug is capable of killing young trees or may reduce the vigor of the host so that the plant succumbs to some other insect or disease. Ewan (1961) described feeding punctures on pine in the Lake States area caused by

Saratoga spittlebug. Large-scale control programs, including aerial spraying, have been directed against Saratoga spittlebug adults in the northern part of the lower peninsula of Michigan during the past eighteen years. The effects of such treatments on non-target organisms are not completely known. Research by Wilson and Kennedy (1968) suggests that control efforts directed at nymphs may prove more acceptable.

The meadow spittlebug is the most abundant and most generally distributed spittlebug in Michigan. Both nymphs and adults feed on a great variety of cultivated plants. It is a good flier and has shown some tendency to migrate. Wilson and Ruppel (1964) reported capturing adults in flight at altitudes of over 1000 feet. Weaver and King (1954) investigated the taxonomy, biology, ecology, and control of the meadow spittlebug.

Doering (1930) published a comprehensive synopsis of the family Cercopidae in North America. Metcalf (1960-62) catalogued the Cercopoidea of the world listing slightly fewer than 4000 species and varieties. Some species which occur in Michigan are dimorphic or polymorphic, but the causes and significance of intraspecific variations are poorly understood. Hanna and Moore (1966) included extensive records on distribution, illustrated keys to genera, and descriptions by which the 21 species known from Michigan can be identified.

Fig. 2 is a map showing the names and locations of the counties in the state of Michigan. Odd numbered figs. 3-47 indicate the counties in which each species has been collected. Only a few species have broad host ranges and occur in a variety of environments. Usually, particular habitats harbor particular compliments of species. Even numbered figs. 4-48 show dorsal and lateral views of adult female specimens collected in Michigan. A line near the bottom margin demonstrates the actual length of the specimen illustrated. The earliest and latest dates that adult specimens have been collected during the season are listed for each species. Most species have one generation per year and winter as eggs, but a few notable exceptions are known.

Order HOMOPTERA

The Spittlebugs

Family Cercopidae

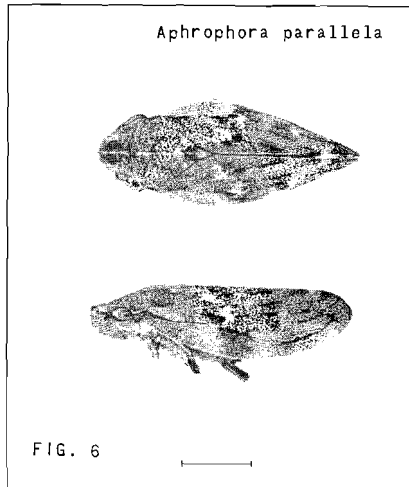
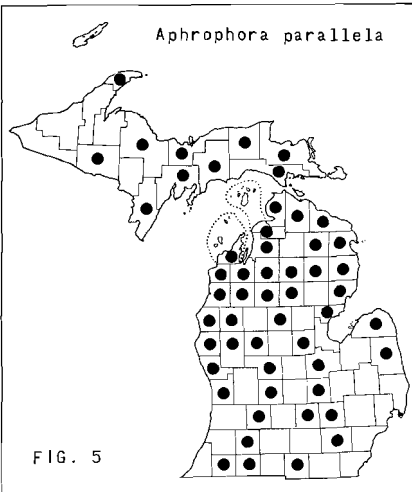
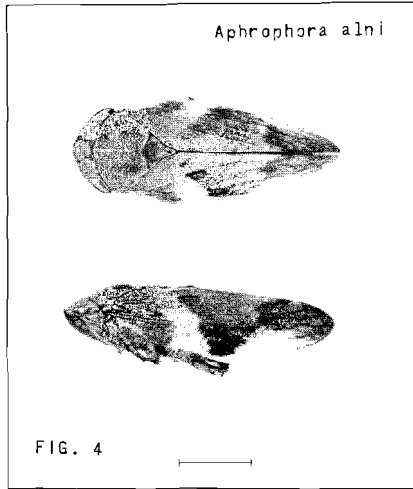
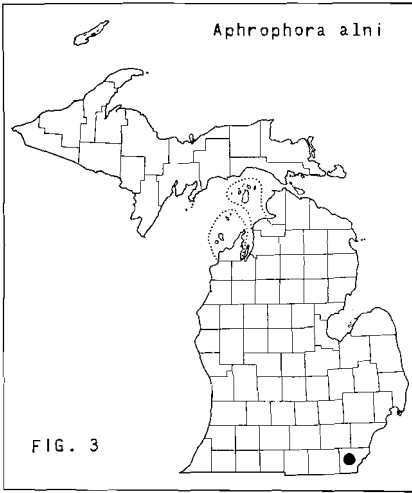
Genus APHROPHORA Germar

alni (Fallen) 1805 (Figs. 3 and 4). Shrubby edges of woods where locally it predominates in association with *Lepyronia quadrangularis*, *Philaenus lineatus*, and *P. spumarius*. Nymphs, June at soil level on stems of *Agrimonia* sp., *Arctium* sp., *Aster* sp., *Cirsium* sp., *Daucus carota*, *Erigeron philadelphicus*, *Geum* sp., *Nepeta hederaceae*, *Rumex crispis*, *Solidago canadensis*, *Sonchus* sp., *Taraxacum* sp., and *Urtica* sp. Adults, on goldenrod and deciduous shrubs; Monroe Co. June 17, 1964 to September 13, 1961, Monroe Co. Probably this Eurasian species was brought to North America from Europe with nursery stock.

parallela (Say) 1824 (Pine Spittlebug). (Figs. 5 and 6). June 4 to October 10. Coniferous trees, especially pine where it often predominates in association with *A. saratogensis*, *A. signoreti*, *Clastoptera testacea*, and *Philaenus spumarius*. Nymphs; May-June. Injury is more apparent in Scotch pine plantations than in native coniferous forests.

quadrinotata Say 1831 (Figs. 7 and 8). June 28 to September 20. Deciduous trees, especially alder, and low vegetation at edges of woods and along stream banks; often in association with *Clastoptera obtusa* and *Lepyronia quadrangularis*. Widespread, but strangely never abundant.

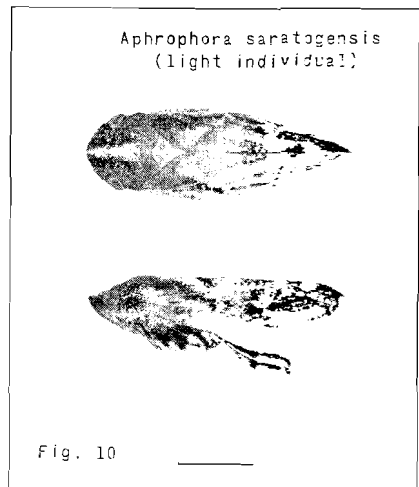
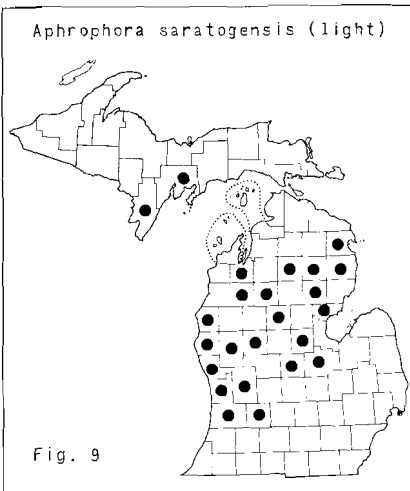
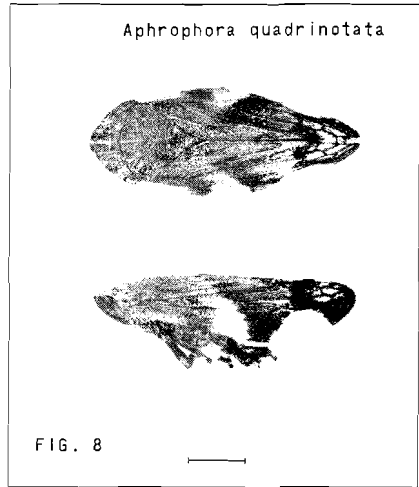
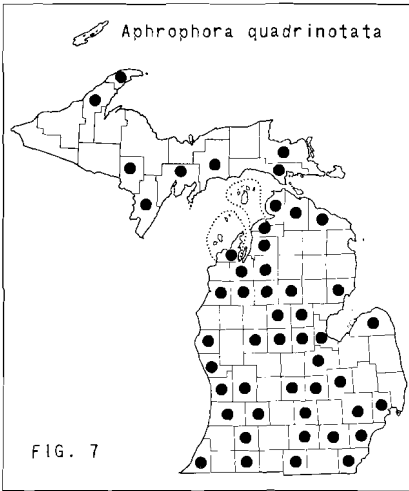
saratogensis (Fitch) 1851 (Saratoga Spittlebug). Two forms occur which occupy separate habitats within a similar geographical range. No significant differences in structure of male



genitalia of the two forms have been observed. However, the postclypeus of the dark form appears more greatly inflated. The two forms are treated separately.

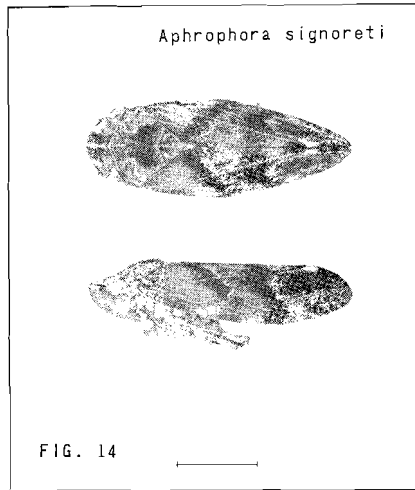
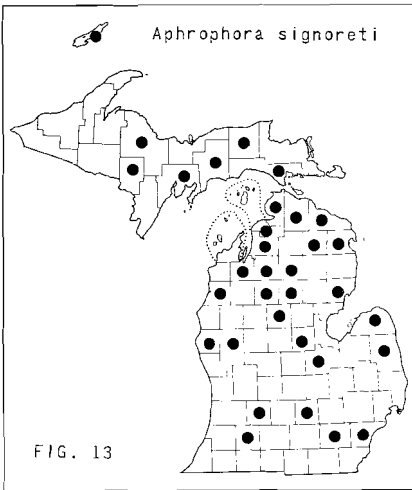
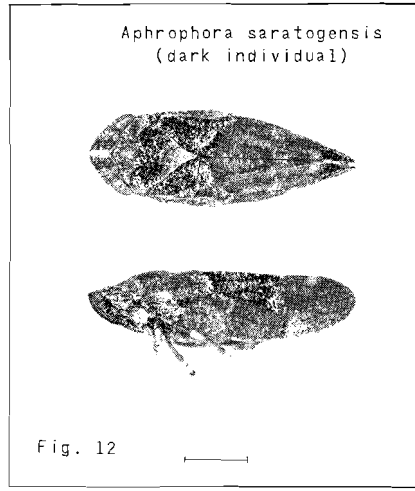
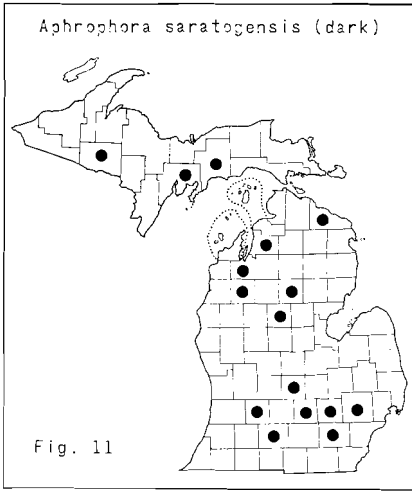
1. Light form (typical Saratoga spittlebug of authors). June 17 to October 9. Individuals with light brown markings; commonly occurring on pine, occasionally on other conifers including tamarack. The specimen illustrated was collected in Clare Co., July 17, 1962 on *Pinus*. (Figs. 9 and 10). Nymphs, May-June, usually near soil line on low vegetation, especially *Rubus* spp. and sweet fern. Because no adult specimens were retained, Fig. 9 does not indicate the occurrence of *A. saratogensis* in Cheboygan, Emmet, Iosco, Kalkaska, Lake, Manistee, and Otsego Counties where Patrick C. Kennedy (personal communication) recently observed characteristic feeding punctures on red pine while making Saratoga spittlebug damage surveys for the U.S. Forest Service.

2. Dark form: Individuals with dark markings (rarely all black) June 28 to September 22. Occurring principally on tamarack, sometimes abundant; specimens have been taken in



northern localities on balsam fir. The specimen illustrated was collected in Ingham Co., July 23, 1964 on *Larix*. (Figs. 11 and 12). Nymphs, May-June near ground level or concealed under moss on low vegetation including *Rubus* spp., seedling tamarack, and numerous herbs. Occasional individuals are parasitized by a dipterous larva which inhabits the abdominal cavity of both sexes.

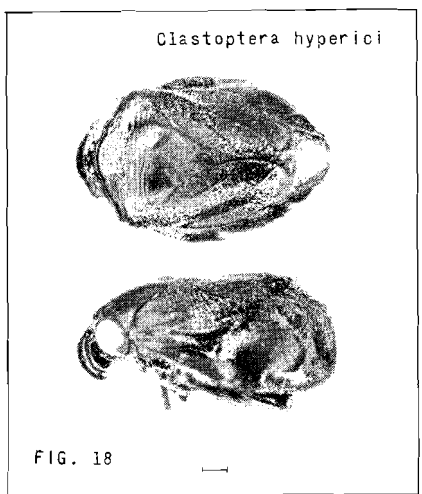
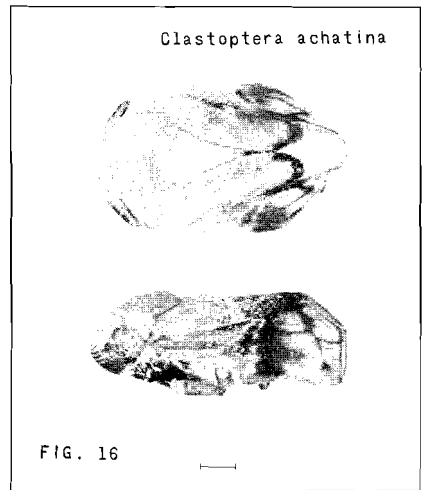
signoreti Fitch 1856 (Figs. 13 and 14). June 19 to September 1. Coniferous trees, especially pine, but seldom abundant. Nymphs, June on stems and foliage of low vegetation. In June 1951 cloth sacks were placed over spittle masses occupied by nymphs of this species on *Daucus*, *Laportea*, *Quercus*, and *Rubus* plants growing near pines at the southwest corner of Baker woodlot on the grounds of Michigan State University, East Lansing. On July 1, 1951 transformation to adults had occurred. Plant succession and growth of the canopy during the intervening interval has rendered the site less suitable for this species, which no longer appears to be present.



Genus CLASTOPTERA Germar

achatina Germar 1839 (Pecan Spittlebug). Figs. 15 and 16. *Carya* groves and solitary trees, especially shagbark hickory; abundant when present. Nymphs, May-September. The Ingham Co. specimen was taken on July 1, 1951 near the transmitter of Michigan State University radio station WKAR, in a woodlot which has since been destroyed. In Genesee Co., numerous individuals were found on October 11 crawling on bee hives in a hickory grove after having been detached from plant hosts by wind and rain. Two generations frequently occur in one season.

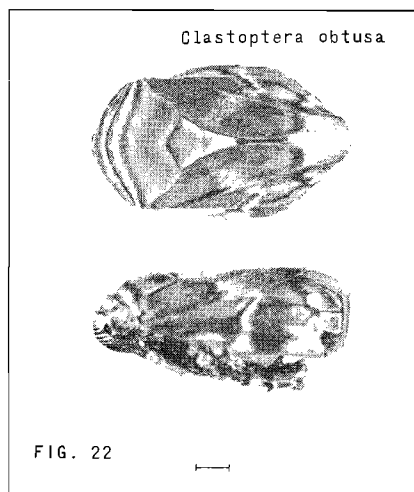
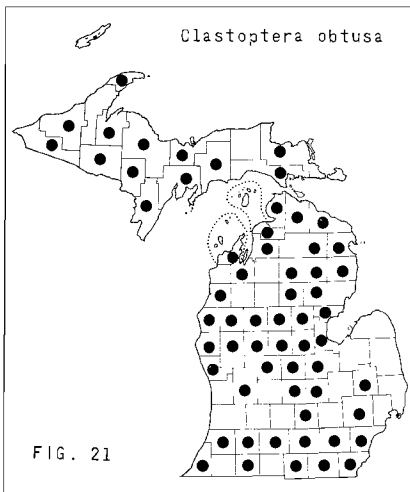
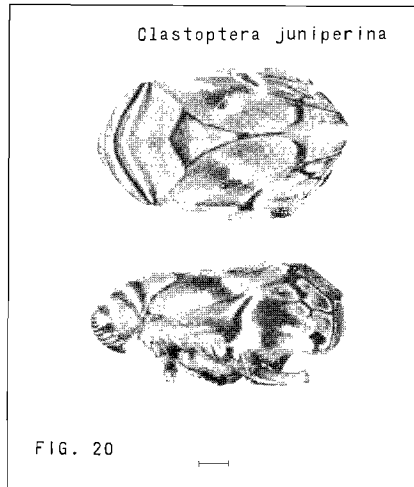
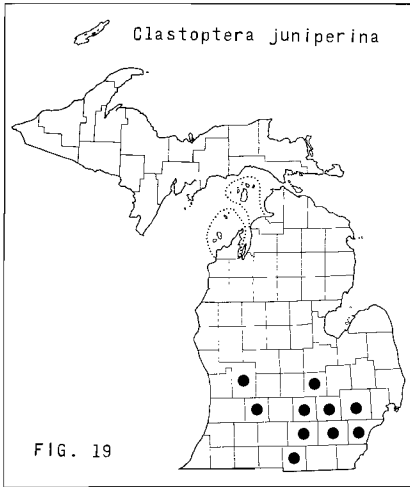
hyperici McAtee 1920 (Figs. 17 and 18). June 30 to September 19. Patches of *Hypericum prolificum* (shrubby St. John's - wort) in open waste; abundant when present (Hanna, 1969). Nymphs, June-July.



juniperina Ball 1919 (Figs. 19 and 20). July 12 to September 24. Occurs infrequently in plantings of ornamental junipers; usually abundant when present, but not known to occur on native red cedar in Michigan. Nymphs, June-July. Probably this western species was introduced into many isolated localities with nursery stock.

obtusa (Say) 1825 (Alder Spittlebug). June 25 to September 22. (Figs. 21 and 22). Deciduous forests, especially representatives of the birch family; predominates in association with *Aphrophora quadrinotata* on alder, but seldom abundant on hickory in association with *C. achatina*. Nymphs, June-July.

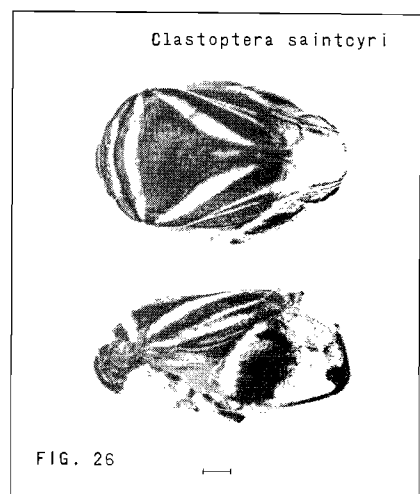
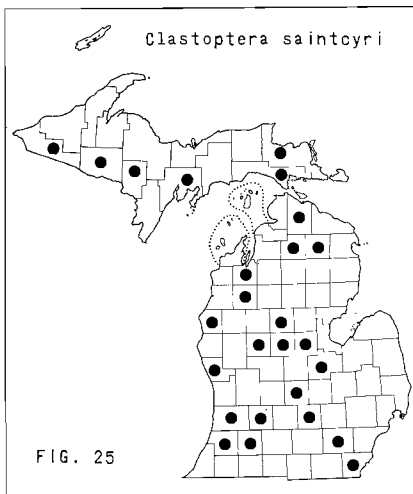
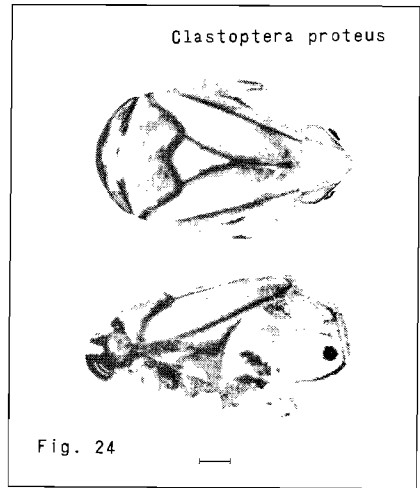
proteus Fitch 1851 (Dogwood Spittlebug). June 22 to August 29. (Figs. 23 and 24). Stream banks and edges of swales on dogwood, sometimes *Vaccinium*; abundant when present. Nymphs, June-July.



saintcyri Provancher 1872 (Heath Spittlebug). June 30 to August 11. (Figs. 25 and 26). Upland blueberry stands, but especially bogs with leatherleaf or *Vaccinium*; abundant when present. Nymphs, June-July. *C. obtusa*, *C. proteus*, and *C. saintcyri* sometimes occur in close association in leatherleaf bogs bordered by alder and dogwood.

testacea Fitch 1851 (Figs. 27 and 28). June 24 to October 5. Occurs on pine and sometimes tamarack, numerous individuals taken at porch lights in a heavily wooded area. In late July 1969, Louis F. Wilson placed cages over spittle masses occupied by nymphs on oak leaves in Alcona County. On July 30, newly transformed adults of both sexes were recovered.

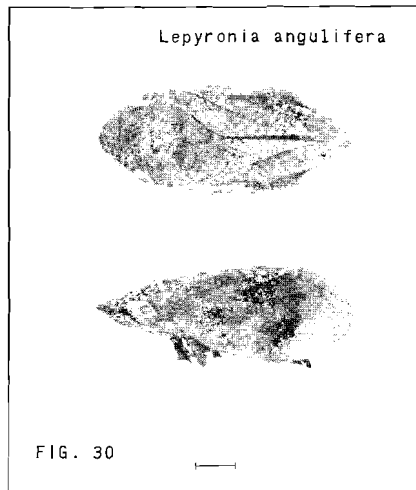
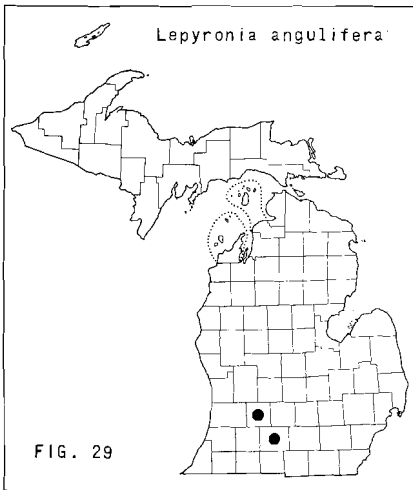
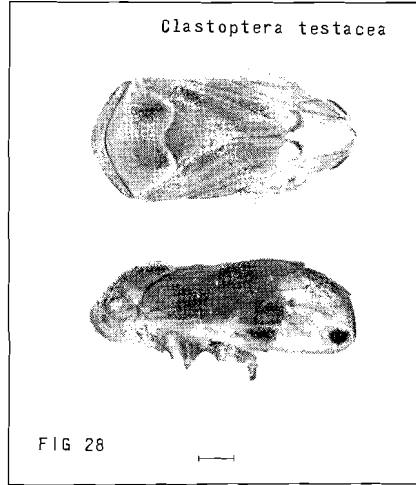
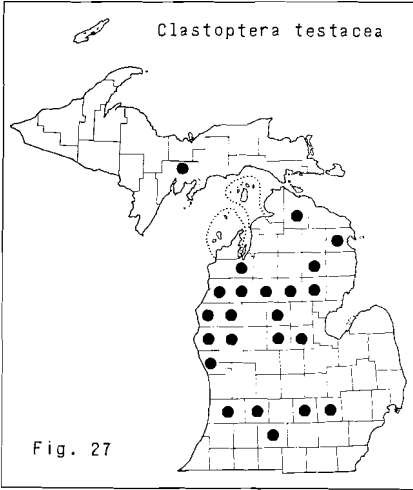
Genus **LEPYRONIA** Amyot and Serville



angulifera Uhler 1876 (Figs. 29 and 30). Males, August 26 to October 18. Females, April 20 to November 4. Occurs on low sedges growing in association with cinquefoil, gentian, and pitcher plants at the edge of small bog-like lakes; abundant when present. Nymphs, August. Transformation from nymph to adult occurs within the spittle. Adult females winter.

gibbosa Ball 1898 (Figs. 31 and 32). July 11 - August 2. Relict prairies: sometimes occurring on low vegetation in open woods which have succeeded prairie. Intense collecting will be necessary to determine accurately when adults first appear and how long they remain. Apparently, this western species is rare in Michigan.

quadrangularis (Say) 1825 (Diamond-backed Spittlebug). (Figs. 33 and 34). Males, July 14 - October 7. Females, May 11 - October 10. Edges of woods on grasses and weeds, especially in seepage and shady areas, sometimes in orchards. Nymphs, June - August.

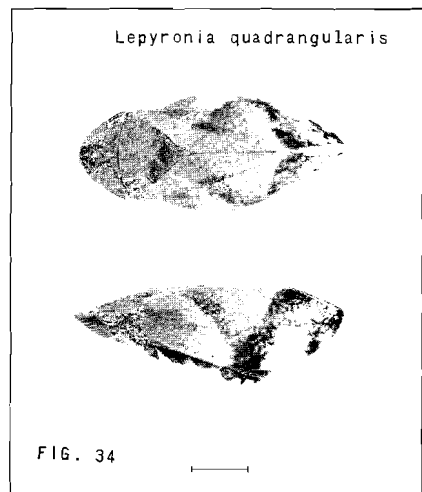
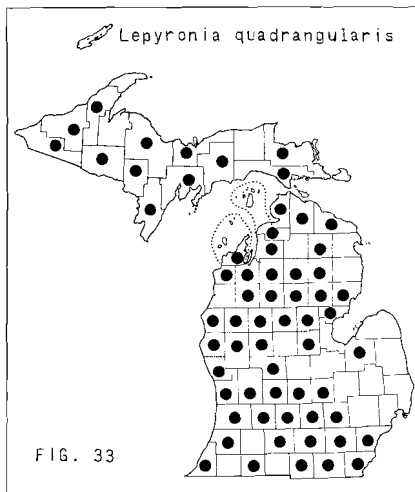
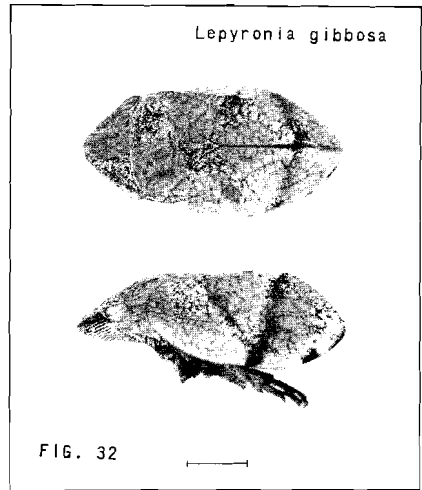
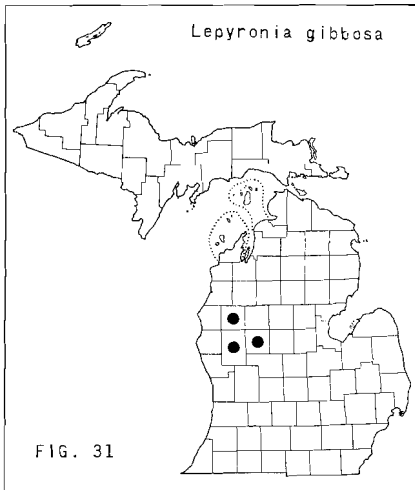


Common; often in association with other spittlebug species, but seldom predominates. Adult females winter.

Genus **PHILAENUS** Stal

abjectus Uhler 1876 (Figs. 35 and 36). May 28 to October 11. Occurs on goldenrod in shady meadows bordering arbor-vitae swamps; abundant when present (Hanna 1967). Nymphs, July-September. Adults of both sexes winter.

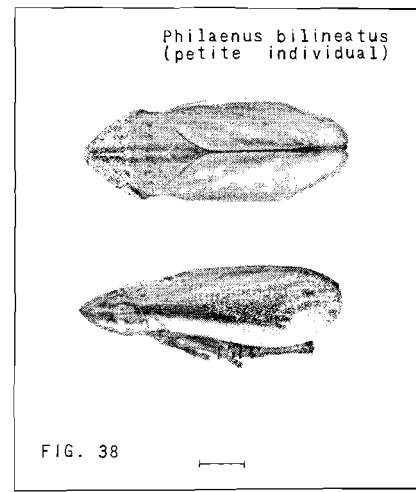
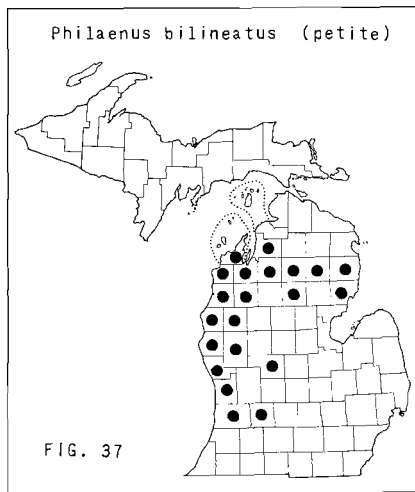
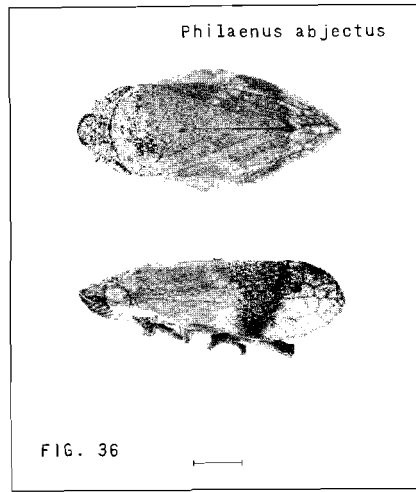
bilineatus (Say) 1831. Two forms occur which occupy similar habitats in separate geographical ranges. Apparently consistent differences in structure of male genitalia of the two forms have been observed. Occasionally, late stage nymphs of both forms produce



spittle masses on broad-leaved herbs which are not usual hosts.

1. Petite form: individuals in the populations occurring in the southernmost counties generally are smaller and exhibit more uniform coloration than individuals in more northern localities. June 24 - September 20. The specimen illustrated was collected July 24, 1962 in Grand Traverse Co. (Figs. 37 and 38). Dry prairies on *Andropogon scoparius* and other grasses; discontinuously distributed, but sometimes locally abundant. Nymphs with dark transverse bands on the thorax and abdomen, June. Predominates in arid plant communities where *P. spumarius* seldom occurs.

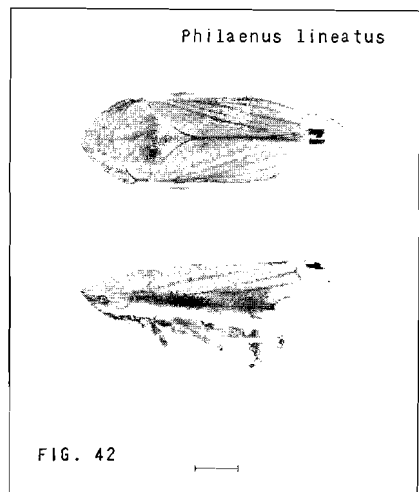
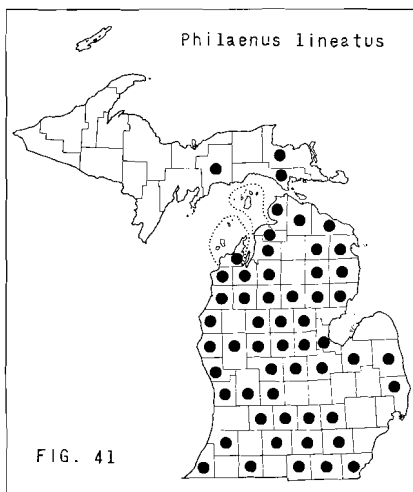
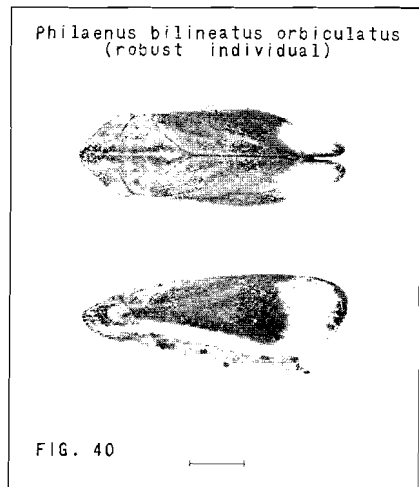
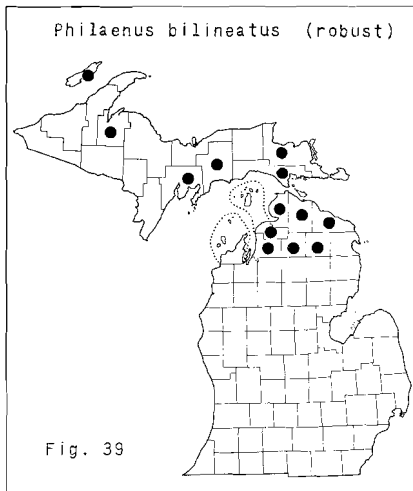
2. Robust form: populations in the northernmost counties include individuals that are larger, more conspicuously marked, and often referable to varieties *nigricans*, *orbiculatus*, or *reticulatus* described by Ball (1919). June 18 to September 4. The specimen illustrated was collected August 16, 1961 in Charlevoix Co. (Figs. 39 and 40). Meadows and abandoned fields on grasses, roadsides; moderately evenly distributed, sometimes abundant.



Nymphs with dark transverse bands on the thorax and abdomen, June. Frequently occurs in association with *P. spumarius*.

lineatus (Linnaeus) 1758 (Figs. 41 and 42). June 15 to October 15. Inhabits Europe and North America. Occurs on grasses, especially in lowlands and marshes. Nymphs, May-June. A usual component of the fauna of lush meadows in Michigan.

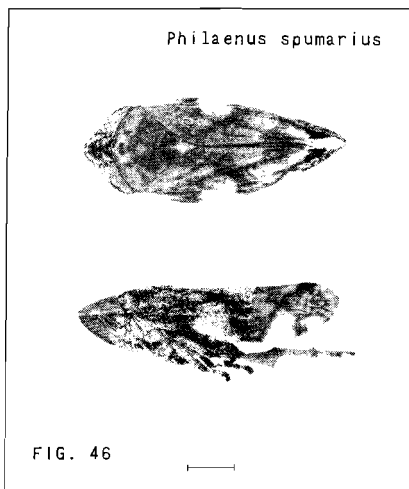
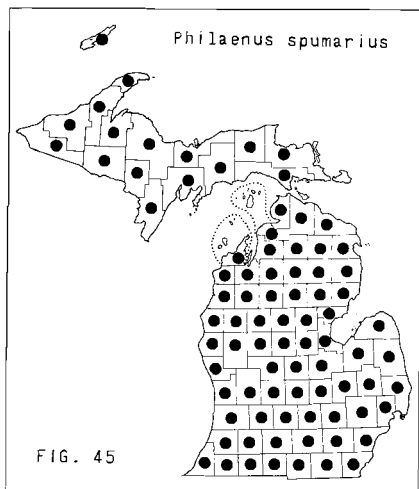
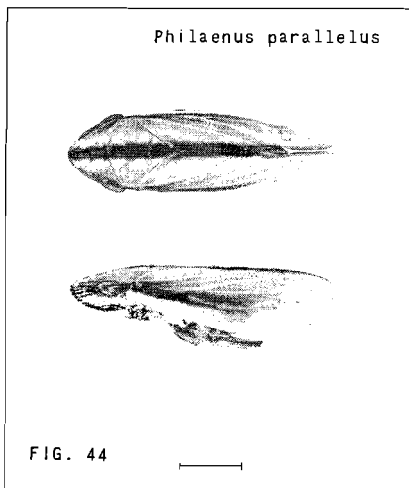
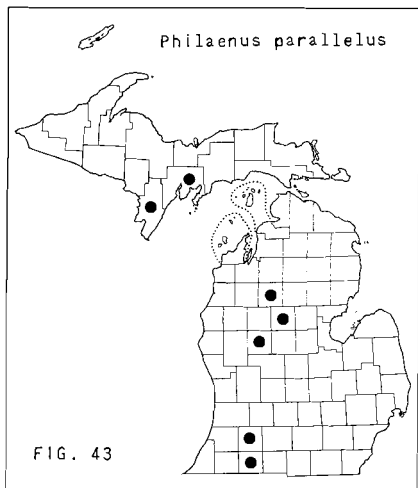
parallelus Stearns 1918 (Figs. 43 and 44). June 29 to September 13. This bog species inhabits tall sedge clumps; not rare when present. Nymphs, June. Transformation from nymph to adult occurs within the spittle. Endemic to the region surrounding Lake Michigan; known westward to Otter Tail Co., Minnesota, August 22, 1922 (H. H. Knight, collector). Specific environmental requirements apparently restrict the occurrence of this species.



spumarius (Linnaeus) 1758 (Meadow Spittlebug). (Figs. 45 and 46). June 9 to November 25. This circumpolar species occurs on native and cultivated grasses, herbs, vines, shrubs, and trees, including stone fruits and pines. Nymphs, May-June. Collected in Calhoun Co. after applications of granular dieldrin at Fort Custer flushed numerous individuals from vegetation onto patches of snow. Polymorphic; colonies in northern localities frequently exhibit a greater diversity of pigmentation than the population studied in Livingston Co. by Owen and Wiegert (1962). By far, the most abundant spittlebug in Michigan.

Genus **PROSAPIA** Fennah

bicincta (Say) 1831. Known in Michigan only from the geographical subspecies *P. bicincta ignipecta* (Fitch) 1856. (Figs. 47 and 48). July 26 to September 10. Abandoned fields and sandy ridges on grasses in association with *Philaenus bilineatus*; occurring in small colonies which occupy diminutive portions of territories available; conspicuous in nature because of



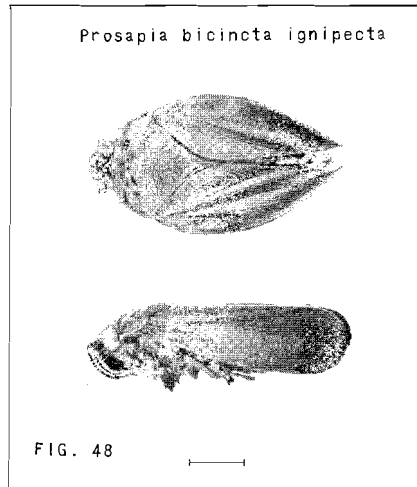
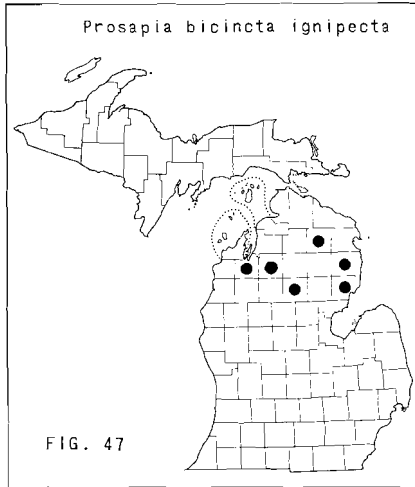
its bold color. Probably, prudent collecting would demonstrate that adults appear much earlier in the season than available records indicate.

ACKNOWLEDGMENTS

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