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INTRODUCTION

IT IS IMPORTANT to know what plants growing in the cultivated areas and on the uncultivated plains and foothills are reservoirs of the beet-mosaic virus. After the pasture vegetation becomes dry on the plains and foothills, enormous flights of aphid vectors fly into the cultivated areas, and are often abundant on favorable weeds, varieties of beets, and other economic plants. Unpublished data indicate that the host range of the virus among economic plants is limited to plants belonging to the families of Azioaceae, Chenopodiaceae, and Papaveraceae.

This paper deals with the weed host range of the beet-mosaic virus. A study was made of the sequence of symptoms of experimentally infected weeds so that naturally infected plants could be recognized in the field. Some reports on weeds susceptible to the virus have been published; these are discussed in connection with our results (pp. 570-571.)

METHODS

Weeds grown from seeds were experimentally infected with the virus by mechanical inoculation using the carborundum method described by Rawlins and Tompkins (1936).⁴ The virus was recovered from each species of weed and transferred to sugar beets by the same method.

WEED HOST RANGE AND SYMPTOMATOLOGY

Six species of weeds in three genera of the family Chenopodiaceae were experimentally infected by mechanical inoculation with the virus extract from mosaic-infected beets. Systemic infection occurred in all of the weeds from which the virus was recovered. The symptoms on the weeds experimentally infected with the virus are as follows.

Bractscale. The symptoms on bractscale, *Atriplex bracteosa*, are cessation of growth and a bending and curling of the apical shoot (plate 1, *B*) on infected plants. The young leaves are dwarfed, cupped outward, occasionally twisted along the midrib (plate 1, *C*) sometimes asymmetrical, mottled with small chlorotic spots; later the leaves become necrotic. Necrosis of the young leaves and death of the apical shoot occur within 3 weeks after inoculation.

Red Orache, or Redscale. The symptoms on red orache, *Atriplex rosea*, develop in essentially the same manner as those described on bractscale. All of the infected plants died within 3 weeks after inoculation.

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⁴ See "Literature Cited" for citations, referred to in the text by author and date.

Spear Orache, or Spearscale. On spear orache, *Atriplex patula* var. *hastata*, small, chlorotic spots appear on the youngest leaves and these gradually enlarge on the somewhat older leaves (plate 2, *D*).

Lamb's-Quarters, or White Pigweed. The onset of mosaic symptoms on lamb's-quarters, *Chenopodium album*, is marked by dwarfed leaves with chlorotic spots and retarded growth of the apical shoots. The apical shoots are bent (plate 1, *F*, *G*), the youngest leaves curled, and cupped outward. Mottling develops on the youngest and older leaves (plate 1, *G*). Some leaves are not mottled but show numerous chlorotic rings surrounding green tissue (plate 1, *E*); later the rings become necrotic. Young leaves on the apical shoots become necrotic and dry (plate 1, *F*, *G*), and eventually the entire plants are killed.

This confirms the findings of Smith (1937), who recorded lamb's-quarters as a host plant of beet mosaic in England and described the symptoms on this weed.

Sowbane, or Nettle-Leaf Goosefoot. The first visible symptom of the disease on sowbane, *Chenopodium murale*, are cleared veins and veinlets (plate 2, *C*, lower row) followed by small, chlorotic areas on young leaves of the apical and axillary shoots (plate 2, *A*, *B*). Growth is retarded and the leaves become twisted, curled outward, and sometimes asymmetrical (plate 2, *A*, *B*). Necrosis of isolated spots or large chlorotic areas results in the death of the young leaves on both apical and axillary shoots, and necrotic streaks extend down the stem in the later stage of the disease (plate 2, *B*). Death of infected plants usually occurs within 4 weeks or less after inoculation.

Russian Thistle. The first reliable symptom on seedlings of Russian thistle, *Salsola kali* var. *tenuifolia*, was stunting of the apical and axillary shoots. Small, necrotic, sunken areas on the needlelike leaves, giving a beaded appearance, soon cause death and blackening of the shoots (plate 2, *E*). Necrotic streaks develop on the stem, and the infected seedlings die within 2 weeks after inoculation.

NONSUSCEPTIBLE WEEDS

The following weeds are nonsusceptible to beet mosaic. All inoculated weeds which failed to show symptoms of the disease were tested for the recovery of the virus.

Compositae, sunflower family: common sow thistle, *Sonchus oleraceus*; prickly sow thistle, *S. asper*

Cruciferae, mustard family: common yellow mustard, *Brassica campestris*

Malvaceae, mallow family: dwarf mallow, *Malva rotundifolia*

Plantaginaceae, plantago family: common plantain, *Plantago major*

Polygonaceae, buckwheat family: curly dock, *Rumex crispus*; fiddle dock, *R. pulcher*; sheep sorrel, *R. acetosella*

Solanaceae, nightshade family: black nightshade, *Solanum nigrum*; stramonium, *Datura stramonium*.

A number of investigators have reported the transmission of the beet-mosaic virus by means of aphids or mechanical inoculation to a number of weeds in many families contrary to the results of the present investigations.

Novinenko (1930) states that *Aphis fabae* Scopoli was able to transmit the

beet-mosaic virus to *Amaranthus retroflexus* (Amaranthaceae), *Chenopodium album* (Chenopodiaceae), and *Sonchus arvensis* (Solanaceae).

Our investigations failed to show that common sow thistle, *Sonchus oleraceus*, and prickly sow thistle, *S. asper* (Solanaceae), were susceptible to beet mosaic, nor could the virus be recovered from these weeds.

Verplancke (1933) reports that forty-five species of weeds in twenty-two families harbored the virus, but his investigations on the weed-host range were discredited by Quanjer and Roland (1936) and Quanjer (1936).

A number of species of aphids have been found in nature in the United States, on weeds susceptible to the virus. Essig (1926) reports that the bur clover or cowpea aphid, *Aphis medicaginus* Koch, was taken on lamb's-quarters, *Chenopodium album*. Gillette and Palmer (1931-1934) collected *A. medicaginus* and the green peach aphid, *Myzus persicae* (Sulzer) on lamb's-quarters and on Russian thistle, *Salsola kali* var. *tenuifolia*. *Aphis medicaginus* and *Myzus persicae* have been demonstrated to be vectors of the beet-mosaic virus to economic plants (unpublished data) and in all probability are vectors of the virus to susceptible weeds under natural conditions.

SUMMARY

Six species of weeds in three genera in the family Chenopodiaceae were experimentally infected by mechanical inoculation with the virus extract from sugar-beet mosaic. Systemic infection resulted in all of the weeds from which the virus was recovered. The species infected were as follows:

- Bractscale, *Atriplex bracteosa*
- Red orache, or redscale, *Atriplex rosea*
- Spear orache, or spearscale, *Atriplex patula* var. *hastata*
- Lamb's-quarters, or white pigweed, *Chenopodium album*
- Sowbane, or nettle-leaf goosefoot, *Chenopodium murale*
- Russian thistle, *Salsola kali* var. *tenuifolia*

Nine species of weeds in the families Compositae, Cruciferae, Malvaceae, Plantaginaceae, Polygonaceae, and Solanaceae were nonsusceptible to the virus.

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PLATES

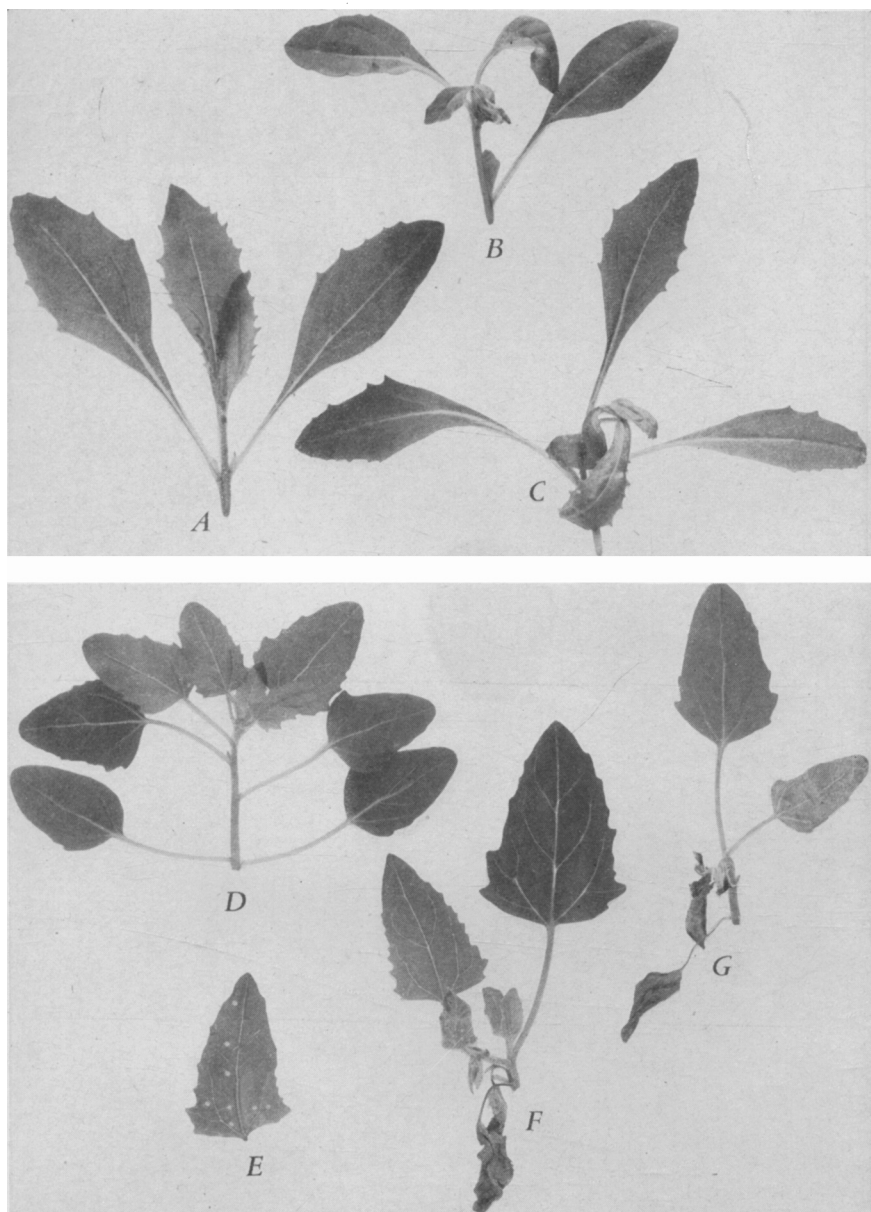


Plate 1.—A—C, Bractscale, *Atriplex bracteosa*: A, apical shoot from healthy check or control plant; B, C, apical shoots from plants experimentally infected with beet-mosaic virus, B showing bending and curling of dwarfed, youngest leaves, and C showing outward-cupped younger leaves and leaf twisted along the midrib. D—G, Lamb's-quarters, or white pigweed, *Chenopodium album*: D, apical shoot from check or control plant; E—G, leaves and shoots from plants experimentally infected with beet-mosaic virus, E showing chlorotic rings surrounding green tissue on young leaf, F showing bending of apical shoot, dwarfed youngest leaves, and dead leaves; and G showing necrotic and dead youngest leaf on apical shoot and mottling of older leaf.



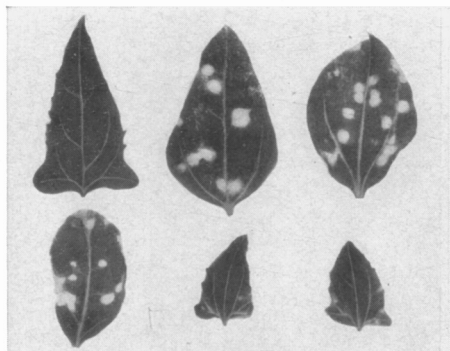
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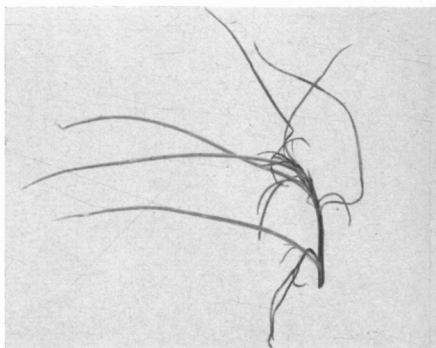
B



C



D



E

Plate 2.—Weeds experimentally infected with beet-mosaic virus: *A–C*, Sowbane, or nettle-leaf goose-foot, *Chenopodium murale*: *A*, left, two leaves showing chlorotic spots; right, bending of apical shoot with outward-cupped and twisted, yellow-spotted leaf; *B*, bending of apical end of branch and axillary shoots with dwarfed, curled, or twisted leaves, chlorotic areas on older leaves, and other leaves necrotic and dead, and with black, necrotic streaks extending along the stems and axillary shoots; *C*, left, leaf from check or control plant, two others showing mottling and chlorotic spots. *D*, Spear orache or spear scale, *Atriplex patula* var. *hasta*: upper row, left, leaf from check or control plant, all others showing chlorotic spots. *E*, Russian thistle, *Salsola kali* var. *tenuifolia*, shoot showing necrotic, black, axillary leaves and necrotic streaks on the stem.

