HIPPEASTRUM STREAK, A VIRUS DISEASE OF HIPPEASTRUM VITTATUM IN PAPUA AND NEW GUINEA.

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ABSTRACT.

The streak condition of Hippeastrum plants in the Territory of Papua and New Guinea is due to a virus which appears to be restricted to this host. Although the leaf symptoms are similar to those induced by tomato spotted wilt virus, the virus is not tomato spotted wilt due to dissimilarity in the host range and physical properties. The virus is readily transmitted by mechanical means to Hippeastrum, but no insect vector was located. Attempts to produce virus-free Hippeastrum bulbs by heat treatment were unsuccessful.

INTRODUCTION.

Hippeastrum vittatum Herb. (syn. *Amaryllis vittata*) is grown throughout the Territory of Papua and New Guinea as an ornamental in house gardens, and the leaves are usually affected by pale and dark green streaks. These streak symptoms are very similar to those described as being induced by tomato spotted wilt virus (Smith 1957). Foliar symptoms induced by viruses on Hippeastrum plants have been reported from the United States of America (Beale 1931), Denmark (Neergaard 1950), the Philippines (Juliano 1951), and the Netherlands (De Bruin-Brink *et al* 1953). To date, the author has not been able to demonstrate the presence of tomato spotted wilt virus in the Territory of Papua and New Guinea, and experimental studies on the streak of *Hippeastrum vittatum* [1] were carried out to determine whether the symptoms are induced by tomato spotted wilt virus and if they are not, what virus is involved. This report gives the experimental details and the results of the investigations carried out on the leaf streak condition of Hippeastrum.

EXPERIMENTAL STUDIES.

Symptoms.

The emerging leaves from infected bulbs of *Hippeastrum vittatum* at first appear to be symptomless, but later three to five dark green irregular shaped areas are observed near the leaf margin. These areas are usually of greater length than width, ranging from 1 to 100 mm. in length and 1 to 10 mm. in width (*Plate* I).

As the leaves mature, the streaks appear over the whole leaf surface and the leaf tip turns a pale green with the darker green streak areas being quite distinct. The streaking is mainly confined to the top two-thirds of the lamina with little streaking near the leaf base. After the leaf reaches senescence, the symptoms become less distinct. The streak symptoms also occur on the flower stalk, but no symptoms are found on the flower parts. The symptoms appear two to three months after the mechanical inoculation of healthy Hippeastrum plants.

Mechanical inoculation.

In the initial mechanical inoculation trials (Anon. 1963) the first two leaves of healthy *Hippeastrum vittatum* plants were dusted with 500 grit carborundum and the sap from infected leaves smeared onto the leaves with a finger.

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[1] The first collection (Accession 2402) of this condition in Papua and New Guinea was made by Dr. D. E. Shaw in 1959 (Shaw 1963).

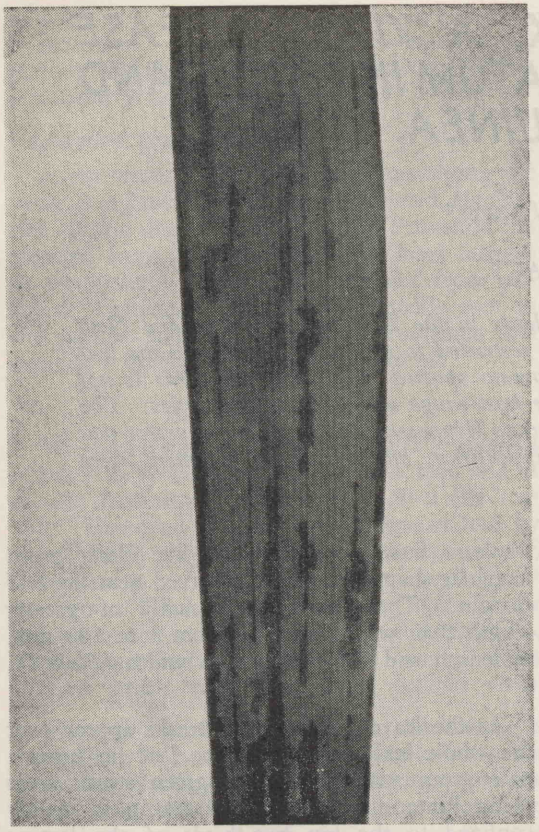

Plate I.—Section of a leaf of *Hippeastrum vittatum* showing the longitudinal streaking induced by Hippeastrum streak virus.

The streak symptoms appeared two to three months after inoculation. *Lycopersicon esculentum* variety ' Grosse Lisse ' was also inoculated in the same manner, but did not become infected.

Best and Samuel (1936) found that a buffer solution of sodium sulphate, potassium phosphate and sodium sulphite increased the infectivity of crude preparations of tomato spotted wilt virus. Sap from infected Hippeastrum leaves was treated with this buffer and healthy plants of *H. vittata* and *L. esculentum* were inoculated with the suspension. There was no increase in infectivity, and further experiments with sodium sulphite solutions of various molarity and pH were carried out, but only Hippeastrum was found to be infected.

Host range.

The host range of Hippeastrum streak is given in *Table* 1. All plants were inoculated with infectious sap treated with the buffer solution of Best and Samuel (1936), sodium sulphite solutions of various molarity and pH and untreated sap. It is evident that the only plant infected was *Hippeastrum vittatum*. Since the virus did not infect any of the other plants susceptible to tomato spotted wilt virus, it is considered that the virus is not tomato spotted wilt.

Table 1.—The host range of Hippeastrum streak virus.

Species.	Proportion of plants infected.
Hippeastrum vittatum Herb.	87/90
Petunia hyrida Vilm. var. 'Rosy Morn'	0/60
Lycopersicon esculentum Mill.	
var. 'Grosse Lisse'	0/300
var. 'Tatula'	0/300
Datura stramonium L.	0/60
Nicotiana tabacum L.	0/60
N. glutinosa L.	0/60
N. rustica L.	0/60
N. clevelandii Gray.	0/60
Hyoscyamus niger L.	0/60
Solanum dulcamara L.	0/60
S. nigrum L.	0/60
Capsicum annuum L.	0/60
Tropaeolum majus L.	0/60
Zinnia elegans Jacq.	0/60
Gloxinia sp.	0/60
Lathyrus odoratus L.	0/60
Pisum sativum L. var. 'Greenfeast'	0/60
Vicia faba L. var. 'Windsor'	0/60
Freesia sp.	0/60
Gladiolus sp.	0/60
Chenopodium amaranticolor Coste et Reyn.	0/60
Allium cepa L.	0/60
Allium sativum L.	0/45

Physical properties.

The dilution end point, thermal inactivation point and longevity in vitro were determined using the methods of Bos *et al,* using Hippeastrum as the test plant. The results were recorded six months after treatment. The dilution end point was found to lie between 1 : 500 and 1 : 600, the thermal inactivation point between 40 and 45 degrees centigrade for an exposure of 10 minutes, and longevity in vitro at 25 degrees centigrade between 120 and 144 hours (*Table* 2).

Table 2.—Physical properties in crude sap of Hippeastrum streak virus using *Hippeastrum vittatum* Herb. as the test plant.

THERMAL INACTIVATION.		DILUTION END POINT.		LONGEVITY.	
Temp. (°C.)	Plants infected/ Plants treated.	Dilution.	Plants infected/ Plants treated.	Hours.	Plants infected/ Plants treated.
Unheated	30/30	Undiluted	30/30	0	30/30
30	30/30	1 : 10	12/30	24	14/30
35	20/30	1 : 100	7/30	48	8/30
40	5/30	1 : 400	3/30	72	6/30
45	0/30	1 : 500	2/30	96	3/30
50	0/60	1 : 600	0/90	120	3/30
55	0/60	1 : 700	0/90	144	0/120
60	0/60	1 : 800	0/60	168	0/60

Attempted transmissions.

No transmission was recorded when healthy Hippeastrum plants were grown in soil collected from around the base of infected field plants. During a period of 12 months, no thrips were collected from Hippeastrum plants growing in the Keravat area. A field planting of healthy and infected Hippeastrum plants was carried out in 1965, in which healthy and infected plants were planted alternately using 50 plants of each. At the end of 12 months, none of the healthy plants was found to be infected. Thus it appears that the main method of dissemination of the virus is by infected planting material.

CONCLUSIONS.

The streak condition of Hippeastrum plants in the Territory of Papua and New Guinea is due to a virus which appears to be restricted to this host. Although the leaf symptoms are similar to those induced by tomato spotted wilt virus, the virus is not tomato spotted wilt due to dissimilarity in the host range and physical properties. The virus is readily transmitted by mechanical means to Hippeastrum, but no insect vector was located. Attempts to produce virus-free Hippeastrum bulbs by heat treatment were unsuccessful. It is considered that the virus has not been previously described and is confined to *Hippeastrum* spp.

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