STUDIES ON SOYBEAN MOSAIC VIRUS

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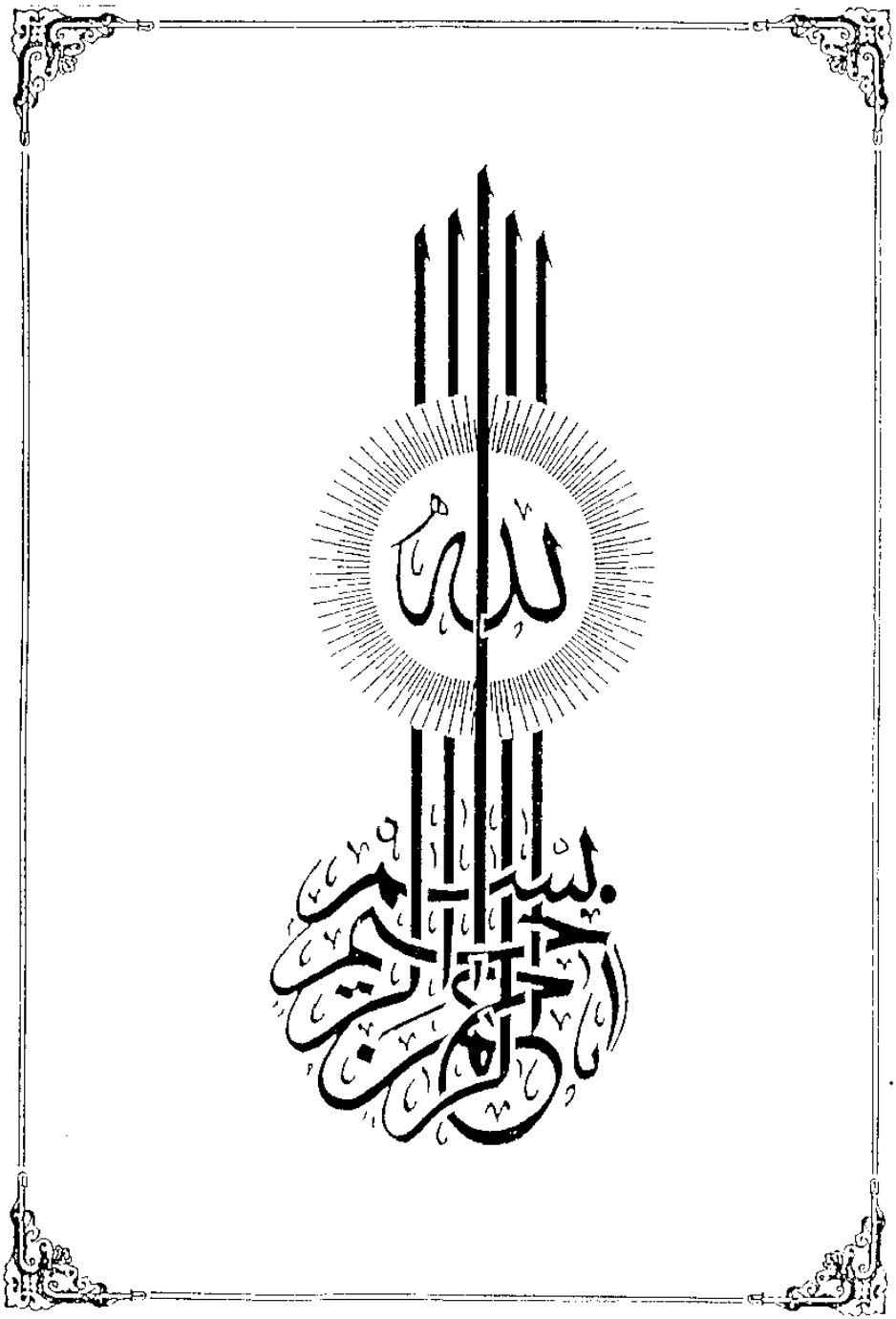

A C K N O W L E D G E M E N T

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CONTENTS (Cont.)

I N T R O D U C T I O N

Severe losses in the yield of Soybean (Glycine max Merr.) had been attributed to virus infection (Kendrick and Gardner, 1924 and Ross, 1963).

Since 1940 practically the production of soybean has grown from relative insignificance to first place among the oil seed crops of so many countries. This legume has been responsible for the creation of new industries and the expansion of many long-established ones, and its drived products are consumed in a notable diversity of food, feeds, and industrial products, and processes.

As experiments have been conducted with the soybeans in Egypt, this investigation was carried out to study some of the viruses that naturally infect the soybean (G. max Merr.) in A.R.E. and to determine their effect on the yield and the morphology of infected plants.

REVIEW OF LITERATURE

I. Host Range and Physical Properties of Soybean Mosaic Virus :

Differences in the host range and physical properties of a virus might be attributed to source of inoculation, virus strain, and environmental conditions (Ross, 1964).

Kendrick and Gardner (1924) observed that soybean (Glycine max Merr.) varieties differed in their susceptability to virus infection, while, Midwest variety was very susceptible, Soysota and Virginia varieties were resistant. They failed to transmit soybean mosaic virus to garden bean (Phaseolus vulgaris L.), seven other species of phaseolus, two species of Dolichos, field pea (Pisum sativum L.), and cowpea (Vigna sinensis Savi.).

Lavroff (1932) reported a virus disease of oats (Avena sativa L.) that was not seed transmitted. He also noticed that the virus might be transmitted through the soil to other hosts such as soybean (G. max Merr.); wheat Triticum vulgare Vill.); barley (Hordeum vulgare L.); and maize (Zea mays L.).

Pierce and Walker (1933) observed that the Robust or the yellow strain of bean mosaic virus was capable of infecting

(Pisum sativum L.) vars. Alaska, Perfection, Wisconsin early sweet, Garden Admiral, Surprise, Progress, Alderman, Dwarf Telephone, and Horal.

Soybean virus 1 was inactivated by heating at 58°C., and lost its infectivity by keeping at room temperature for three days.

Savulescu et al. (1935) observed soybean mosaic virus on the soybean plants (Soja max Piper.) in Rumania.

Savulescu et al. (1937) stated that symptoms of virus disease of soybean (G. max Merr.) characterized by curling of the leaves and brown or yellow mosaic.

Stubbs (1937) reported that soybean (G. max Merr.) var. Midwest was used as differential host between pea virus 1 (enation mosaic virus) and other three mosaic viruses on pea. The first-named infected Midwest soybean, but the other three did not.

Zaumeyer (1938) used soybean (G. max Merr.) and other hosts to separate pea streak virus 1 from three strains of lucerne mosaic virus, designated as virus 1, 1 A, 1 B. He found that soybean (G. max Merr.) was susceptible to the first three viruses, but resistant to the fourth.

[illegible] (1[illegible]) [illegible] that soybean (G. max Kerr.) [illegible] of leguminosae and cucurbitaceae [illegible] to [illegible] virus (Pisum virus 3).

[illegible] (1935) [illegible] soybean mosaic virus on soybean plant (G. max Merr.) in China.

Heinz and Köhler (1940) isolated a mosaic disease from growing soybean plants in Germany. Sap transmission of the virus, using carborundum powder was successful, a dilution of 1 to 10,000 still causing infection, but not of 1 to 100,000. The virus lost its infectivity at 61°C. In unpurified sap, the virus remained viable for three to four days when kept at room temperature of 21° to 23°C. The virus was transmissible by the rubbing method to bean (P. vulgaris L.) and vetch (V. sativa L.), but did not seem to progress from the inoculated leaves into the other parts of the plants; attempts to transmit it to sweet pea (Lathyrus odoratus L.); field pea (P. sativum L.); and hair vetch(Vicia villosa Roth.) were negative. The symptoms showed rather striking differences, indicating that the virus had several strains.

Dale (1943) pointed out that soybean appeared to be attacked by common cowpea mosaic, and when experimently

Conover (1948) pointed out that soja virus 1 (soybean mosaic virus) produced systemic infection only on soybean (G. max Merr.), however, it was recovered from the symptomless, inoculated, primary leaves of garden bean (P. vulgaris L.) vars. Burpee's stringless, stringless green pod, and stringless green refugee, after twenty three to twenty seven days from inoculation. The thermal inactivation point of Soja virus 1 was free 64° to 66°C; longevity In Vitro was 4-5 days.

Kreitlow and Price (1949) recorded a disease of Ladino clover (T. repens L.) known as yellow patch. The causal organism was at that time unknown strain of the lucerne mosaic virus. In greenhouse experiments, soybean (G. max Merr.), garden zinnia (Zinnia elegans Jacq.), six varieties of bean (P. vulgaris L.), and four varieties of pea (P. sativum L.) and several other clovers, were found to be hosts to that virus.

Hagedorn (1950) isolated a new strain cucumber virus 1 from diseased pea plants (P. sativum L.). Host range experiments, indicated that soybean (Soja max Piper.) might be infected by this strain.

Thomas and Zaumeyer (1950) reported the red node virus might mechanically be transmitted with carborandum to soybean (G. max Merr.).

Ross (1967) observed that symptoms of SMV included mosaic, rolling, and puckering of foliage, chlorosis of older leaves in certain varieties, and a significant increase in seed mottling. Unifoliate leaves of guar(Cyamopsis tetragonoloba (L.) Taub.) var. Brechler; and common bean (P. vulgaris L.) var. Kentucky Wonder wax pole, were used as local lesions hosts.

Murav'eva (1968) reported that soybean (G. max Merr.) could be infected by soybean mosaic virus, bean yellow mosaic virus, tobacco ring spot virus, lucerne mosaic virus, pea mosaic, cowpea mosaic virus, and bean (pod) mottle virus.

Akhatova (1969) stated that the most resistant varieties to soybean mosaic virus were Výsokostebel maya 2, and lincoln.

Ross (1969) reported that soybean mosaic virus (SMV) isolates varied significantly in their pathogenicity to twenty four soybean selections. Host reactions depended on the soybean genotype and SMV strain and included no symptoms, systemic mottling, necrotic lesions on inoculated leaves, systemic necrotic lesions, and general necrosis. New introduced plants Pl's 96,983 and 170,893, and variety Ogdon were resistant to the seven SMV isolates. These isolates

[illegible] varieties [illegible] with [illegible] [illegible], [illegible] symptoms of dwarfing, [illegible] [illegible] leaves, [illegible] necrosis, while [illegible] no symptoms. All [illegible] induced local lesions on [illegible] (P. vulgaris L.). When [illegible] SMV-resistant soybean varieties were tested, [illegible] of them were susceptible to all SMV isolates. Variety Tokyo was resistant to SMV-1, -3, -4, -5, -7 and either was resistant or became necrotic when inoculated with SMV-2 [illegible] SMV-[illegible].

Quiniones and Dunleavy (1970) reported that two isolates of soybean mosaic virus were distinguished, SMV-NC from J.P. Ross, North Carolina and SMV-M from a single plant developed from virus infected soybean seed of variety Hood.

Twenty two plant species were inoculated with each of the two isolates. Distinct local lesions developed on leaves of the following inoculated plant species: guar (Cyamopsis tetragonoloba (L.) Taub.); chenopodium (Chenopodium quinoa L.); hyacinth bean (Dolichos lablab L.); horse gram (D. biflorus L.); and bean (P. vulgaris L.) var. Kentucky Wonder Wax Pole. The following plant species were inoculated with the SMV-M virus but the virus was not recovered ; beet (Beta vulgaris L.); chenopodium (Chenopodium amaranticolar Costel & Reyn.); globe amaranth (Gompherena globosa L.); tomato

(*Lycopersicon esculentum* Mill.); [illegible] (*Petunia hybrida* Vilm.); [illegible] *Phaseolus lunatus* L.); bean (*G. soja* L.) var. White Purple, and Black seed; bean (*P. vulgaris* L.) var. Beautiful, Red Mexican, Scarlet runner, and Striped purple; broad bean (*Vicia faba* L.); and maize (*Zea mays* L.).

Kahn *et al.* (1971) reported that soybean (*G. max* Merr.) was infected by peanut mottle virus. Small chlorotic areas appeared on the first two trifoliates in six to nine days when primary leaves of Bragg or Lee soybean (ten days old) were mechanically inoculated.

II. Effect of Virus Infection on the Chemical Composition of the Host :

Brewer *et al.* (1926) stated that tomato plants (*L. esculentum* Mill.) infected with mosaic, showed a considerable reduction in fresh weight.

Allam (1965) recorded that infection with squash mosaic virus caused a reduction in fresh weight of virus infected squash (*C. pepo* L.).

Bilyk (1966) found that infection of soya with soja virus 1, and Phaseolus virus 2, lowered the quantity of vegetative mass.

virus than in healthy plants. Stanley (1937), Best and Gallus (1953), and Commoner et al. (1953) reported that tobacco plants infected with the same virus had a greater amount of protein than healthy ones.

Elbertzhagen (1938), Pyrikic and Mullen (1952), John (1963), and Said (1967) found that leaves of tobacco plants (N. tabacum L.) infected with tobacco mosaic virus, contained more nitrogen and protein nitrogen than non-infected leaves.

Doring and Wartenberg (1963), and Ouf et al. (1969) reported a raise in the amount of total nitrogen in tubers from leaf roll infected potato (Solanum tuberosum L.) plants.

Krayev (1965) pointed out that infection of broad bean (Vicia faba L.) with pisum virus 1 and pea enation mosaic virus decreased the protein content of the green organs.

Allam and Abo-El-Ghar (1970) indicated that infection with watermelon mosaic virus and cucumber mosaic virus significantly increased the total nitrogen content of squash (C. pepo L.); and melon (C. melo L.).

Allam et al. (1971) concluded that tobacco plants (N. tabacum L.) infected with tobacco mosaic virus contained