The Potato Tuber Moth

Gnorimoschema operculella (Zeller). (Order Lepidoptera)
Family Gelechiidae

BY

P. MANICKAVASAGAR

INTRODUCTION

POTATO (Solanum tuberosum L., Arthapal S., Urulai Kilanku T.) has been cultivated in Ceylon on a small scale in garden plots in the Badulla and Nuwara Eliya Districts for the last forty years. During the last two years the cultivation of the crop has been carried out on a larger scale. Consequent upon the recent intensification of potato cultivation more effort has been concentrated on the study of the pests and diseases of potato in Ceylon. A caterpillar attacking potato tubers in storage was first recognised on November 13, 1951, at the Potato Station, Rahangala. The pest was tentatively identified as the potato tuber moth, Gnorimoschema (=Phthorimoea) operculella (Zeller), an identification which has been confirmed by the Commonwealth Institute of Entomology, London.

The potato crop in Ceylon is chiefly cultivated between an elevation of 3,000 and 6,000 feet where the temperature is 70° to 80°F. The crop is also being tried out in various parts of the low country dry zone. Surveys of the potato crops in the Udukinda and Nuwara Eliya ranges during the course of nearly a year since the tuber moth was first recognised indicate from the very rapid build-up of pest populations during this period, that the pest was very recently introduced into Ceylon, probably during the last two years.

DISTRIBUTION

The potato tuber moth has been a serious pest of potatoes in the United States for the last 28 years. It has also been recorded in Australia, Holland and other leading potato growing countries of the world. In Ceylon it is present in almost every plot of the potato crop.

HOST PLANTS

Most cultivated Solanaceae and weeds of this family are attacked by the pest. Among these potato, tobacco, tomato and egg plant are attacked in U. S. A. In Ceylon however the pest has been found attacking only potato

on the field. Artificial infestation of chilli, tomato and tobacco plants with the pest in the laboratory have been carried out and the results have shown that heavy attack is only possible on tobacco. On chillies and tomatoes the attack is restricted to leaf mining and on no occasion did the pest complete its life cycle. On tobacco on the other hand the attack is vicious and appears in the form of leaf mining and stem boring. This point is of special importance and should be seriously considered when tobacco is to be grown in potato growing areas.

NATURE OF DAMAGE

The larvae are responsible for the damage of potato plants and tubers. Healthy growth is retarded by the pest mining between the upper and lower leaf surfaces, causing unsightly grey to brown blotches (Fig. 1 a and b), and thus bringing about low yields. The tunnelling by larvae within tubers render such tubers unfit for human consumption.

DESCRIPTION OF STAGES

Adult

The insect which does the damage to both foliage and tubers is the caterpillar of a very small, narrow winged, brownish grey moth, with dark brown streaks on the fore wings (Fig. 1 g). The fore wings as well as the hind wings are fringed with long hairs. The moths measure $\frac{1}{2}$ inch from tip to tip of the wings. The antenae are simple and filiform. The moths are nocturnal in habit and hide under the leaves of the host plant during day time, and fly out only when disturbed. Their wings are folded tightly along the sides of their body while at rest. The antenae are also held parallel to the body pointing backwards (Fig. 1 h). In captivity the female moths, after mating commence oviposition within 1 to 3 days after emergence. Oviposition lasts for 2 to 4 days. Gravid females lay between 78 and 172 eggs. The gravid females and mated males live for 6 to 10 days after emergence. But the unmated females and males live for 10 to 28 days.

Eggs

Eggs are small pearly white oval and measure about ·25 mm. They are usually laid singly on the undersides (Fig. 1 c) of the leaves along midribs, veins, junctions of veins and eyes of tubers. Generally, the moths prefer to oviposit in small cracks and crevices. The generation of moths emerging a few days prior to harvest tend to lay their eggs on the exposed and discarded tubers in the field. The egg is covered with soft adhesive material on the chorion, which serves to glue it to any surface. At times the eggs are slightly embedded in the epidermis of the plant tissues. The eggs turn yellowish before hatching. The caterpillars emerge in about 4 to 5 days time.

Larva

The freshly emerged larva is about ·5 mm. long (Fig. 1 e) pale, creamish with a well marked black head. In the case of stored potatoes the first instar larvae wander over the tubers for a few hours. They then gradually mine into the tubers first under the skin of the tuber (Fig. 1 d), and later tunnel through the flesh, leaving a compact trail of frass and silken web behind them in the galleries. The first instar larvae can enter very young tubers at any spot, but in the case of mature tubers the points of entry are restricted to the eyes or to bruised spots. On the field the larvae on hatching, mine into the leaves, feeding on the leaf tissues but leaving the upper and lower surface intact. The larvae may also mine through the stems, sometimes reaching the tubers underground. The caterpillar when full grown measures 9 to 10 m.m. in length, having a well chitinised dark brown head, two black plates on the pro-thorax, a pinkish mesothorax while the rest of the body is pinkish dorsally and light greenish on the flanks. Very minute hairs are present on the intersegmental regions. The larval period lasts for 13 to 15 days.

Pupa

The full grown caterpillar before pupation, comes out of the tuber and spins a tough silken cocoon in the frass (Fig. 1 f) pushed out of the galleries, on the surface of the shrivelled up potato. In the case of the caterpillars mining leaves and boring stems, they come out and pupate in the folds of damaged and dead leaves or among trash on the ground. Prior to pupation, the caterpillar shrinks, and the colour changes to greenish blue. The pupa is first pale blue in colour and in about 24 hours become brownish, gradually changing to dark brown. The pupa measures 6.25 to 7.25 m.m. Pupation lasts for 8 to 10 days.

CONDITIONS FAVOURABLE FOR DEVELOPMENT

Warm and dry weather conditions seem favourable for the fast development of the pest. In very warm weather, a healthy crop could be destroyed within two weeks, leaving only the bare stems.

The pest being a leaf miner is not very much affected by the rains. It could complete its life cycle in one leaf alone.

PARASITES

Copidosoma Koehleni, Blanch, a larval parasite of the tuber moth had been recorded in Chili (2).

The larvae of the tuber moth have proved to be ideal insectory hosts for the mass production of Macrocentrus ancylivorms Poh (I) which is used to control the oriental fruit moth (Grapholitha molesh (Busch)) in the

U. S. A. The use of the tuber moth larva as a medium for propagation of Macrocentrus ancylivorms permits production the year around with a minimum of labour and space.

CONTROL

Various insecticides have proved effective in the control of the pest both on the field and in the store. Benzene hexachloride imparts to the harvest of treated potato plants an odour and disagreeable musty flavour (3). In Ceylon, preliminary insecticidal treatments showed a very effective control of the pest by the application of DDT sprays on the field and DDT dusts in the stores. Insecticidal trials have been commenced by the Entomologist to determine the best insecticide and details of its application to effectively control the pest under Ceylon conditions.

REFERENCES

1. Finney, Glenn. L., Stanley E. Flanders and Henry S. Smith. The potato tuber moth as a host for mass production of Macrocentrus ancylivorus. J. Econ. Ento Vol. 37, pp. 61, 1944.
2. Rosenbery (G). (Notes on the despatch of a parasite of the potato moth to California) Agriculture tec. 5, No. 1, pp. 97-98, Santiago, Chile 1943.
3. J. G. Rodriguez and W. A. Gould. Effect of Technical Benzene Hexachloride and Lindane on the flavour of potatoes. J. Econ. Ento. Vol. 43, No. 4, pp. 498-503, 1950.

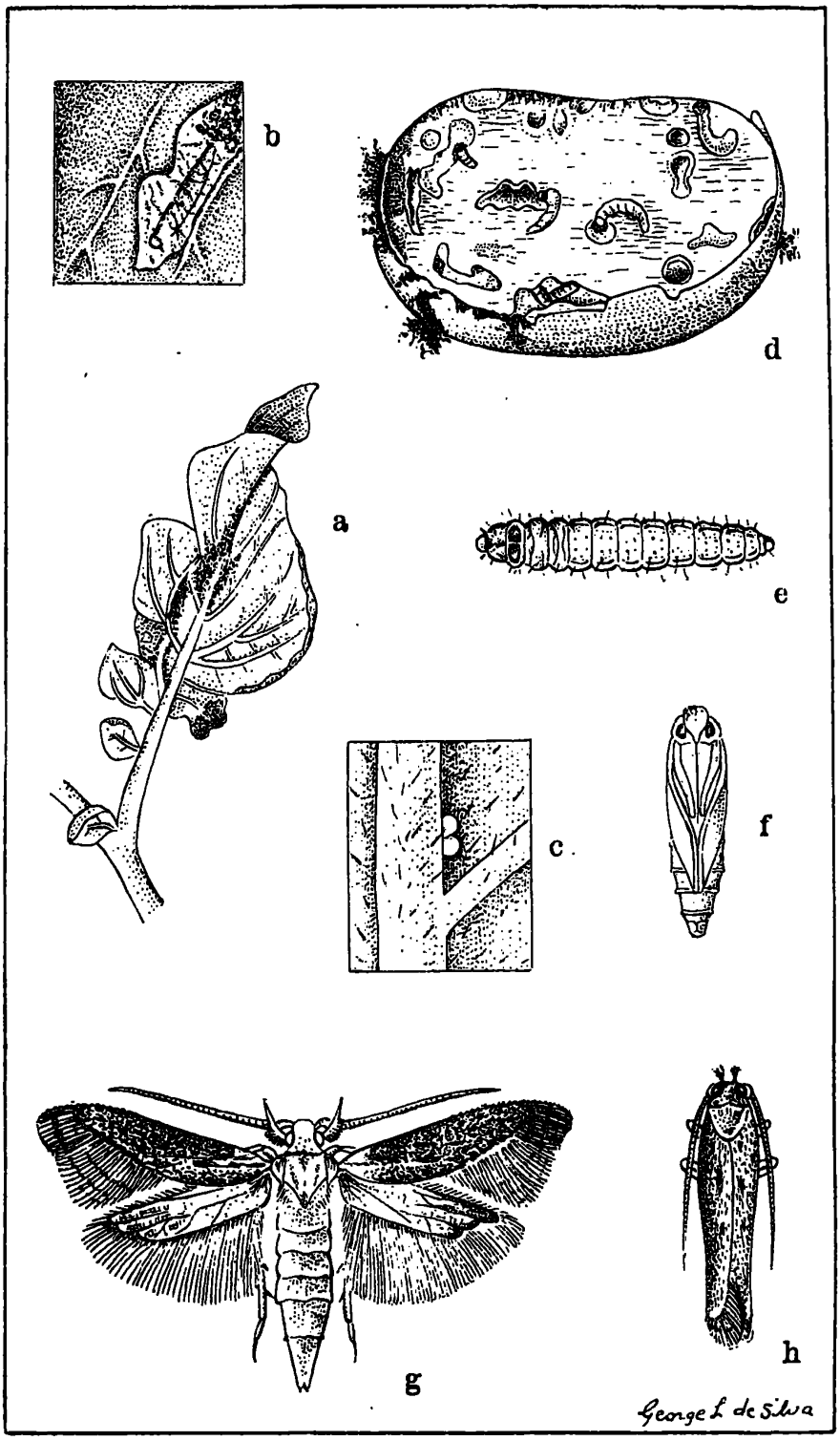

Fig. 1—a, Damage of potato leaves by caterpillar; b, caterpillar mining in potato leaf; c, 2 eggs of tuber moth on under side of potato leaf; d, potato tuber attacked by caterpillars showing larval gallaries, larvae and pupae; e, mature caterpillar; f, pupa; g, tuber moth with wings spread; h, tuber moth in resting position.

(a and d, natural size; b, about twice natural size; c, about 15 times natural size; e, f, g, h. 5 times natural size).