DEPARTMENTAL NOTES

TWO WEEVIL PESTS OF MANGO LEAVES

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MANGO trees of various ages ranging from young grafted plants in nurseries to older trees in full-bearing have been attacked recently in different parts of the Island by two small leaf-eating weevils. These insects have hitherto been regarded only as minor pests of mango leaves in Ceylon, but within the last year or so they have rapidly become sufficiently numerous to cause appreciable damage to young leaves and the growth of young plants has been severely checked. Both these weevils were recorded by Fletcher (1914) as being occasional pests of mango leaves in India and brief notes were given of their habits, but in view of their rather sudden increase in Ceylon, due perhaps to the temporary absence of their natural enemies, it has been found necessary to make a preliminary study of their habits with a view to suggesting control measures.

The following notes are given at this stage of the investigation for the guidance of those interested in mango cultivation, and coloured plates illustrating the various stages and type of damage are included so that these pests may be recognised and prompt measures be taken to control them whenever they are noticed. Their small size and great activity in the weevil stage often makes it difficult to connect them with the damage caused, but recent observations in various parts of the Island have indicated that both of these species are far more widely distributed than is generally realised. The leaf-cutting weevil has been prevalent at Peradeniya during the past year or so and has been recorded in a few other localities in the wet zone. The flea-weevil has been very numerous recently in some mango plantations in the northern dry zone and has occurred as a minor pest at Peradeniya and other wet districts.

They have rarely been found attacking the same trees simultaneously, but in cases where they do so, they seem to keep strictly apart, at any rate for the purpose of egg-laying. These two insects, although both belong to the large group of weevils, bear but little superficial resemblance to each other; they have, however, somewhat similar habits of feeding, both in the adult and larval stages.

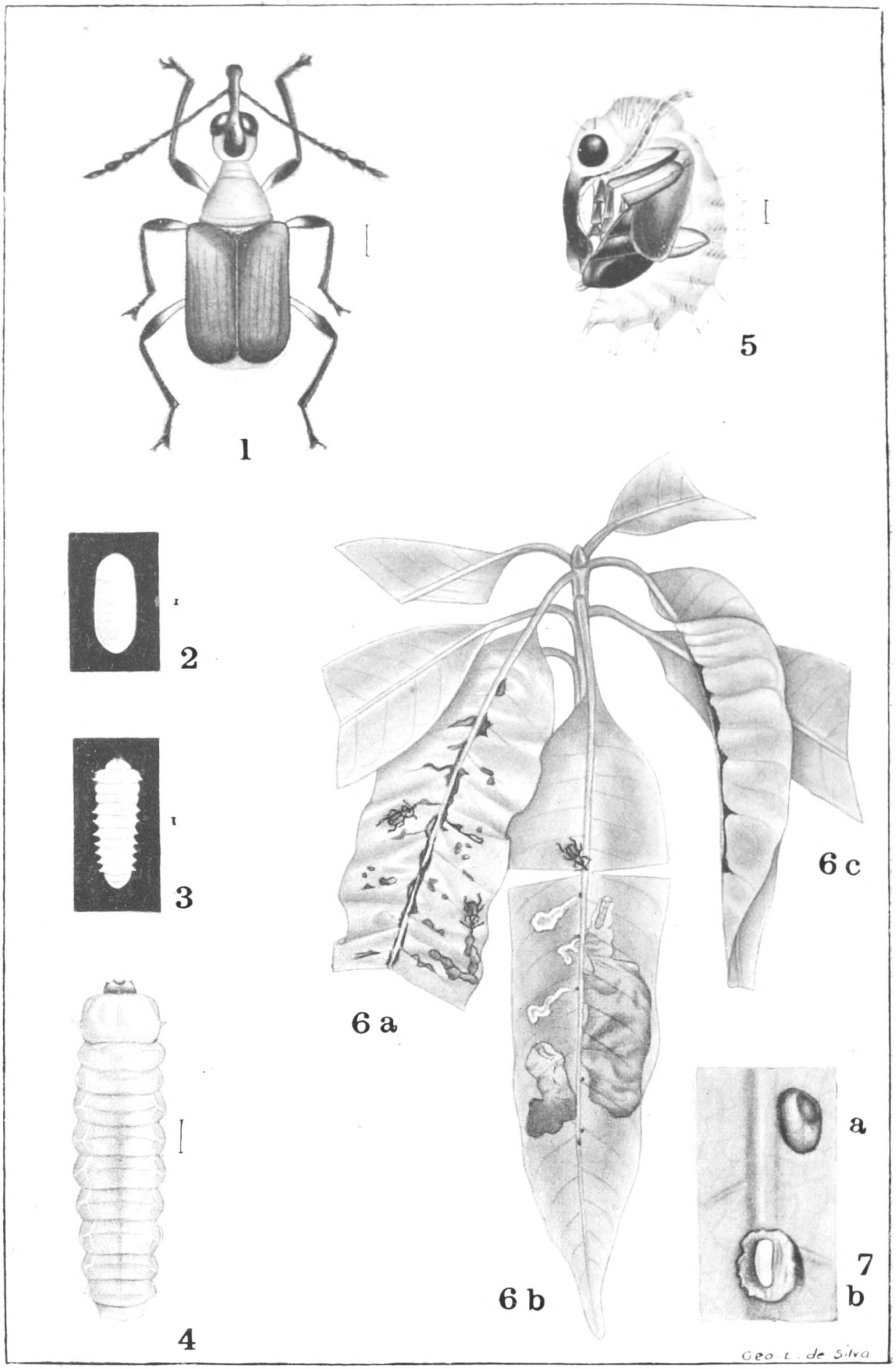

Plate I

The Mango Leaf-cutting Weevil (*Deporaus marginatus* Pasc.)

Fig. 1. Weevil, ×10. Fig. 2. Fully developed egg ×15. Fig. 3. Young larva, ×15. Fig. 4. Full-grown larva, ×10. Fig. 5. Pupa, lateral view, ×10. Fig. 6, Mango shoot, showing damage. Fig. 6a. Feeding damage, two weevils on leaf. Fig. 6b. Weevil cutting leaf. Diagrammatic view of blotches starting from egg spots. Fig. 6c. Mutilated leaf; others at top of shoot. Fig. 7a. Small portion of leaf enlarged, showing egg-spot at *a*, and part of midrib removed to expose egg *in situ* at *b*.

1. THE MANGO LEAF-CUTTING WEEVIL

(*Deporaus marginatus* Pasc.)

Reports have been received from time to time over a period of several years that portions of the young leaves of mango trees were being cut off in the very characteristic manner described elsewhere and it was suspected that this weevil might be responsible for the damage but, in the absence of any specimens or of any definite observations, no investigation could be undertaken. During 1933, however, it was noticed that the young shoots of some young mango trees at Peradeniya were being badly spotted by small weevils which seemed to be identical with the Indian species *Eugnamptus marginatus*. This provisional identification was subsequently confirmed by the Imperial Institute of Entomology under the more recent name *Deporaus marginatus*.

About the same time that the young trees were being attacked it was observed that the ground in the grafted mango nurseries was being strewn with portions of cut leaves. Here and there weevils were actually seen at work and a few were captured and confined in a breeding cage with a young shoot or head of mango leaves. Within three hours every leaf on the shoot had been cut off and a fresh shoot put in with the weevils overnight was similarly mutilated by next morning. In every case a few eggs were found to have been laid in each leaf before it was cut off, as will be indicated below.

Fletcher (1917, p. 219) records this weevil as occurring throughout India, and the same author (1919, p. 197) records the adults as defoliating *Butea frondosa* at Dehra Dun. In Ceylon this weevil has been recorded only from mango leaves.

LIFE-HISTORY AND HABITS

Weevils.—These small slender weevils (Figs. 1 and 6a) feed on the young foliage by eating away small portions of the epidermis and leaf tissues, the injured areas drying up and turning brown, so that the leaves sometimes become badly spotted and then curled up or distorted (Fig. 6a). When the weevils are numerous they seem to concentrate on certain leaves for feeding, so that these leaves eventually shrivel up, and the females go to fresh young leaves for egg-laying. After feeding in this way for about a week after emergence, the weevils mate and the females start laying eggs.

Tender but well-developed uninjured leaves are selected by an egg-laying weevil, which first of all cuts a small semi-circular slit with her proboscis almost invariably close to either side of the midrib (fig. 7a). She then excavates a small pit extending under the midrib and then turns round and inserts an egg into the pit, the egg usually lying inside the fleshy part of the midrib with its long axis parallel with the midrib (fig. 7b); the small upper flap of leaf tissue then shrinks up slightly and seals the mouth of the pit. The egg is thus well protected inside the midrib, and the sealing of the pit prevents it drying up during the subsequent withering of the cut leaf. These egg punctures may be seen as minute dark spots on either side of the midrib (fig. 6b), and are usually to be found on the upper surface of a leaf. Examinations of 500 egg-spots have indicated that only

about 11 per cent. are made on the under surface. Figure 7a shows an egg-spot much enlarged, and figure 7b shows a portion of the midrib cut away to expose the egg *in situ*.

It has been observed that if the mango shoot bears small to medium-size leaves, about 5 to 6 inches long, the weevil usually deposits about 5 or 6 eggs, in the manner indicated above, in the outer three-quarters of a leaf, but not usually in the last inch or so where the leaf gradually tapers to a point. The female after completing her oviposition in the first leaf, then cuts the leaf straight across with her mandibles, usually working in from the edges toward the midrib, which is then cut through so that the outer portion of the leaf falls to the ground, leaving about a quarter of the leaf blade attached to the stalk (Fig. 6b).

In the case of varieties of mango bearing large broad leaves about 10 inches long, the weevil may either lay up to about 12 eggs in the outer portion and then cut off most of the leaf, or she may lay 5 or 6 eggs in the outer 3 or 4 inches and then cut off this portion. Then the same weevil, or possibly another one, finding that there is still more than half of a large and tender leaf still available for oviposition, proceeds to lay a few more eggs in the outer part of the mutilated leaf and cut off another section, leaving 2 or 3 inches attached to the stalk. Occasionally a leaf is found with the sides cut through and hanging by the midrib, as shown in figure 6b.

Observations made on 100 cut portions of leaves indicate that the weevils usually lay nearly 2 eggs for every inch of midrib length, the eggs being generally spaced fairly well apart so as to give the larvae room to develop without interfering with each other. Sometimes two egg-spots may be quite close together on opposite sides of the midrib, but since each leaf-mining larva keeps to its own side of the midrib there is no invasion of each other's "blotch" or feeding area. Figure 6 shows the type of damage done by this weevil. The feeding damage is shown on the left at *6a*, while at *6b* the leaf is being cut through. The galleries of young larvae and blotches of older ones are shown in a diagrammatic form, as though the leaf had not been cut through. Ordinarily however the cut leaf falls to the ground with the eggs in it and the subsequent development takes place away from the tree, as explained below. A cut leaf is shown at *6c* and other cut leaves are shown at the top of the shoot.

Records of only three separate pairs of weevils are available so far, and these indicate the three males lived for about 12, 13 and 7 weeks respectively while the three females lived for about 12½, 12 and 12 weeks, during which periods they laid 218, 74 and 109 eggs respectively. These weevils were kept supplied with fresh young and tender leaves at frequent intervals and the females laid a few eggs almost daily throughout the greater part of their lives. No feeding or egg-laying has been observed on old mature and hard leaves.

Eggs.—These are very small, whitish, somewhat cylindrical and rounded at both ends when freshly laid (Fig. 7b). They turn pale-yellow just before hatching and the body divisions of the grub can be seen through the egg-shell (Fig. 2). The eggs hatch in about 2½ to 3 days.

Larvae.—The newly-hatched larvae (Fig. 3) are very small, whitish, somewhat flattened and apparently legless, with small heads and jaws especially adapted for their mining habits. On hatching they bore into the leaf tissues on either side of, and away, from the midrib, mining between the two leaf surfaces. The mines start as short whitish galleries (Fig. 6b), but soon widen out to form irregular blotches (Fig. 6b) on the withering leaves which gradually become shrivelled up, partly owing to the natural withering after severance from the plant and partly as a result of the larval feeding.

The full-grown larvae are about 5 m.m. long, pale-yellow and slightly flattened (Fig. 4), and are fully developed in about 7 or 8 days. They then bore their way out of the withered leaves and burrow into the soil, where they construct small earthern cells just under the surface. They moult for the last time and change into the pupal stage within their cells in about another 3 or 4 days. The total larval period is about 10 to 12 days, including the pre-pupal period. It has not been possible to ascertain at present how many times the larvae moult during their development.

The larvae seem to be able to complete their development in leaves which are quite shrivelled up, provided that there is sufficient moisture available. In this connexion it may be of interest to note that so far this weevil has been found on mango leaves only in the wetter districts where there is sufficient moisture for most of the year to prevent the cut leaves drying up too rapidly. It seems doubtful, in view of the normal development of the larvae in withering leaves, whether this weevil will ever become established in the dry zone owing to the lack of adequate moisture during long droughts, unless it modifies its habit of cutting off egg-infested portions of the leaves, thus enabling the larvae to develop in growing leaves on the trees, as do the larvae of the flea-weevil mentioned elsewhere. Leefmans (1930 and 1931) records on tea in Sumatra a related species (*Eugnamptus hirsutus*) which does not cut off the leaves and the larvae are able to develop on the plants.

Pupae.—The newly-formed pupae are shining white, but gradually turn pale-yellow. After about a week the pupa undergoes a further change in colour, and the eyes, proboscis, antennae, legs and wings gradually darken until, just before the emergence of the weevil, they are all blackish, with the remainder of the body pale-yellow, as shown in Figure 5. The pupal stage occupies about 11 to 12 days and the newly-emerged weevils soon attain their normal colour (Fig. 1), and start feeding soon after emergence.

Fletcher (1917 p. 79) records that the larvae of *Eugnamptus marginatus* rest in the soil from September to March and April, and the same author (1918, p. 99) mentions that these larvae sometimes remain underground in a resting state for more than a year. This habit has not been observed so far under Ceylon conditions.

LIFE-CYCLE

This ranges from 23½ to 27 days with an average of about 24½ days for 22 individuals in capitivity. It is not known at present whether this weevil can breed continuously throughout the year in Ceylon, but it is apparently

able to breed rapidly during the periods of leaf production, and then the weevils of the last generation may be able to tide over the interval until a sufficient supply of young leaves is available, since they have been found to live for at least 3 months in breeding cages when kept supplied with fresh leaves.

CONTROL

The trees, especially the young foliage, should be sprayed as soon as the first sign of leaf-spotting or cutting of leaves is noticed. For this purpose, lead arsenate at the rate of 1 oz. to 2 gallons of water can be used, the spray being applied mainly to the younger leaves so as to wet them thoroughly. All cut leaves should be collected daily from the ground under the trees and burnt immediately to prevent further development of the immature stages.

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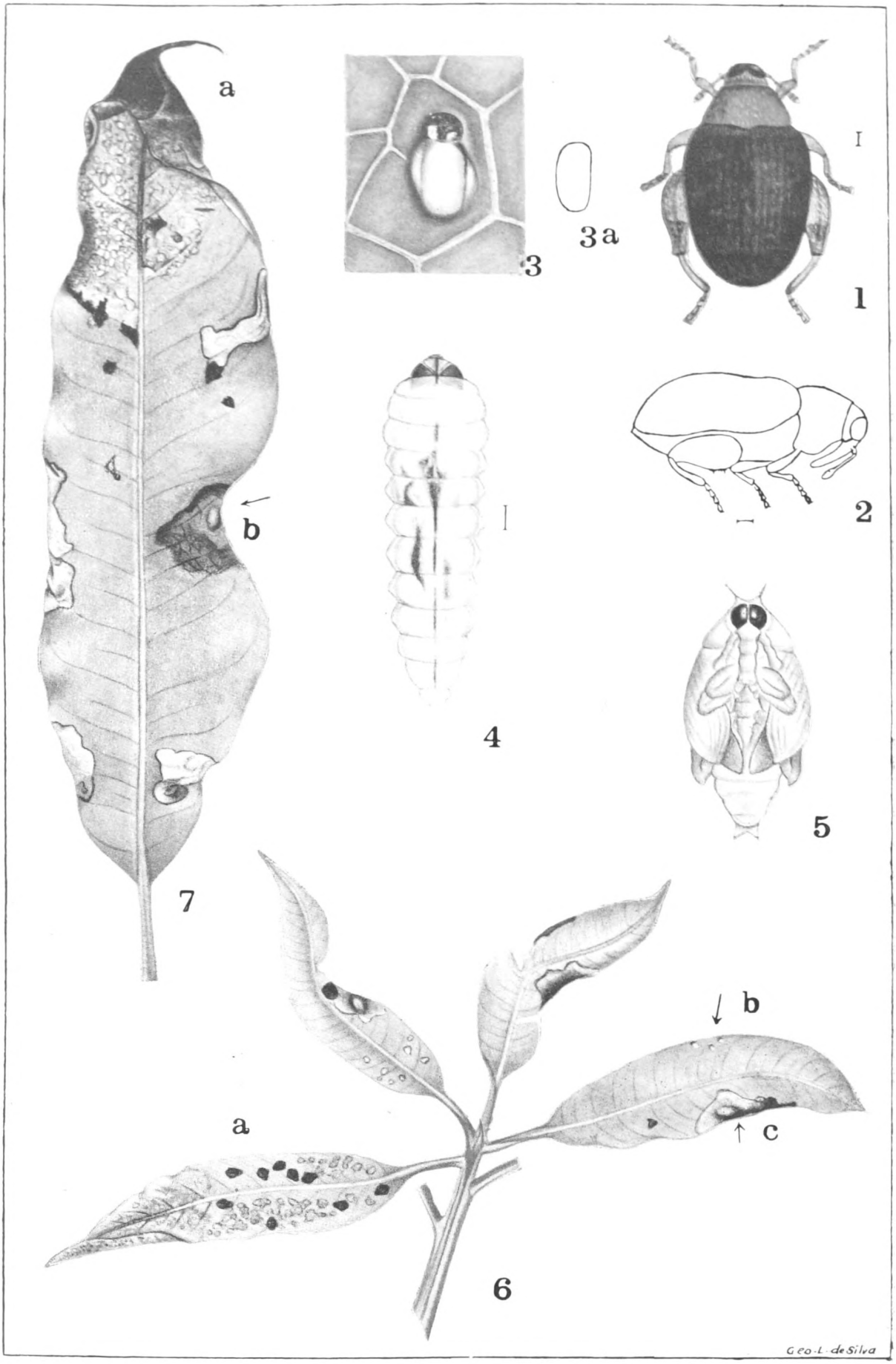

Plate II

The Mango Flea-Weevil (*Rhynchaenus mangiferae* Mshl.)

Fig. 1. Weevil, ×15. Fig. 2. Weevil, side view in outline, showing hind leg. Fig. 3. Egg in leaf tissue, ×20. Fig. 3a. Outline of egg ×20. Fig. 4. Full-grown larva, ×15. Fig. 5. Pupa, ventral view, ×15. Fig. 6. Young mango shoot, showing weevils feeding at *a*, eggs in leaf at *b* and pupal cell in blotch at *c*. Fig. 7. Older leaf, showing withered tip at *a*, old blotch with pupal cell at *b*. Younger blotches are shown at edges of leaf.