

LEAF SPOT DISEASES OF LETTUCE AND ANTIRRHINUM.

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LEAF SPOT OF LETTUCE—*SEPTORIA LACTUCAE* PASS.

THIS disease was observed causing considerable damage to young lettuce plants in the writer's garden* towards the end of May, 1941. It has not previously been recorded in Ceylon (Bertus, *in litt.*)

Symptoms were first noticed on a Cos variety, on plants about a month old, and a few days later a comparable batch of a cut-leaved cabbage type appeared similarly affected (Plate I., Fig. 1). The first sign of the disease is the appearance of irregular, pale-brown or silvery spots on the outer leaves of the plant. The spots later become more distinct, being pale or papery in the centre with a darker margin. Occasionally the centres fall out giving a "shot-hole" effect. The irregular outline is characteristic; it is maintained while the spots increase in size and gradually coalesce to form large, withered areas. At this stage the leaves turn yellow and collapse. As the disease progresses the inner leaves are affected successively until only the heart leaves are left unattacked. The plants may eventually succumb entirely, and are in any case rendered worthless. If attack is postponed or avoided until the plants have made fair growth, its effects would doubtless be less severe.

In the material described, the pycnidia were at no time conspicuous on the spots, and no zonation was seen. The pycnidia occur on both surfaces of the leaf and are immersed in the mesophyll except for a shallow beak which ruptures the epidermis. Exudation of spore tendrils is readily observable in a moist chamber. Under the microscope, in surface view, the pycnidia appear brown in colour with the beak, which is composed of darker, thicker-walled cells forming a well-marked ring about the ostiole. The measurement of 50 pycnidia gave the following results:—

Diameter of pycnidia :—	65 — 145 μ	Mean 106.9 μ \pm 2.72 μ †
Diameter of ostiole :—	15 — 40 μ	Mean 29.4 μ \pm 0.85 μ

These dimensions are not significantly different from those of the pycnidia of *Septoria Drummondii* Ell. & Ev. (1), in which however, there is no dark ring around the ostiole.

* St. Coombs, Talawakelle. Elevation 4,500 feet.

† The standard error of the mean is implied by this expression.

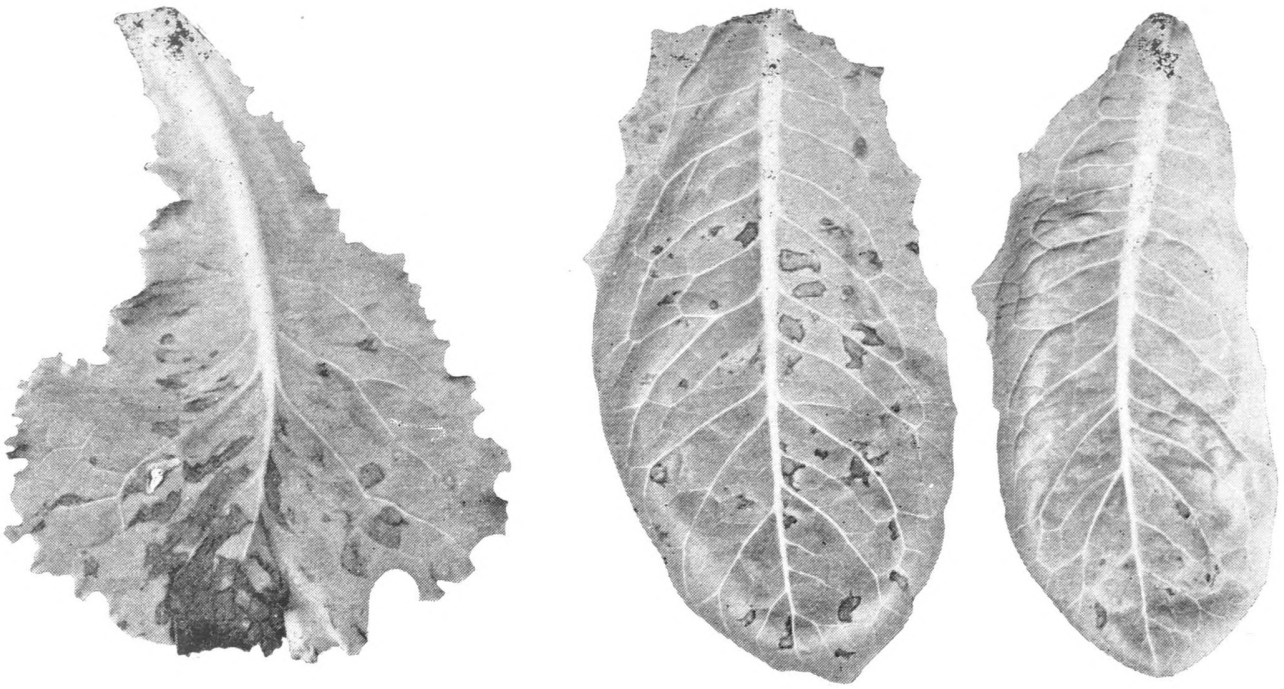


Fig. 1—Leaves of lettuce showing leaf spot symptoms associated with *Septoria lactucae* Pass. (5/8 natural size).

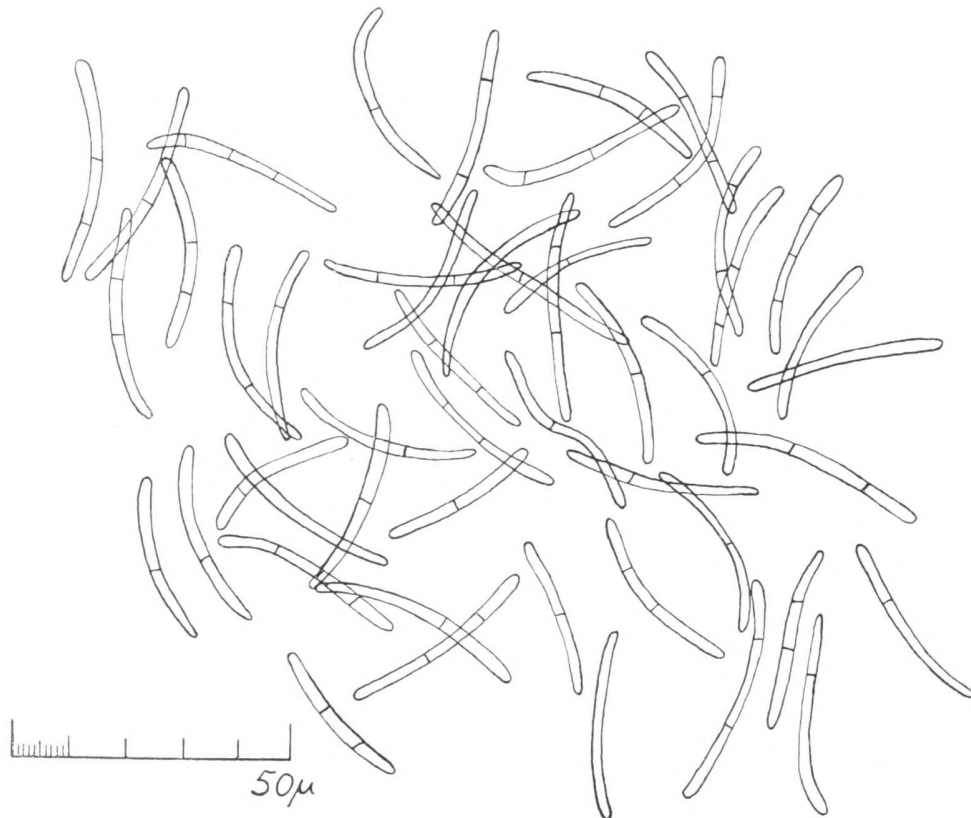


Fig. 2—Fresh spores of *Septoria lactucae* Pass., in water (camera lucida drawing $\times 580$).

The spores (Plate I., Fig. 2) are hyaline, almost invariably curved, mostly 2-to 3-septate or rarely continuous, rounded at the ends. They are irregular in breadth, occasionally tapering from one end. The following measurements give the lengths (measured as the arc) and maximum breadths of 50 freshly exuded spores in water :—

Length :—	29·0 — 43·5 μ	Mean 35·1 μ \pm 0·35 μ
Breadth :—	1·5 — 3·0 μ	Mean 2·3 μ \pm 0·04 μ

Both pycnidia and spores are typical for the genus *Septoria*, and the fungus can be identified as *Septoria lactucae* Pass.

It is interesting to note that Moore (7) has recently recorded the introduction of this fungus into Britain, and in fact the writer discovered the disease on St. Coombs within a few days of reading Moore's paper. Moore (7) gives a full account of the synonymy and distribution of the fungus. Briefly, *S. lactucae* Passerini is the valid name of the species which is based on an Italian specimen published with diagnosis in 1878. *S. lactucae* Peck. is based on N. American material described independently by Peck, in 1879, and is therefore synonymous. *S. consimilis*, Ellis and Martin (1885) appears to be the only other synonym published subsequently.

The fungus as described by Moore (7) has pycnidia from 54 to 120 μ in diameter with mostly two-celled spores measuring 29 to 40 μ \times 2·5 μ . The pycnidia of Moore's specimen appear to be slightly smaller on the average and the spores more frequently uniseptate, but in spore size and other characteristics there is a very close agreement with the Ceylon form.

According to Moore (7), *S. lactucae* is of almost world wide distribution having been reported from the greater part of Europe, from N. America, Argentina, Japan, China, and India (3). It has also recently been reported from Southern Rhodesia (6). The fungus is presumably seed transmissible, since Moore records the presence of pycnidia in four or five per cent. of "seeds" examined by him from among those from which his plants were raised. It is somewhat surprising that the fungus should apparently not have been detected in Britain for more than sixty years after its original discovery in Italy and N. America.

The precise origin of the seed from which the St. Coombs diseased material was obtained cannot be traced. It was not freshly imported and may have been "once-grown" in the Kandapola district. A few seeds from this or a similar batch were available for examination, but no pycnidia were detected. Control measures were not attempted at St Coombs in view of the early approach of monsoon conditions. In addition to strict attention to picking off diseased leaves and the destruction of plant debris, regular spraying with Bordeaux mixture should prove effective.

Control of the disease is obviously of prime importance in those districts in which plants are grown commonly for seed. Experience of the leaf spot disease of celery caused by *Septoria apii* has demonstrated the practical impossibility of preventing seed-borne infection by the usual methods of disinfection, the fungal spores being too well protected within the enclosing pycnidia. The same conditions would presumably apply to *S. lactucae* with the additional difficulty that lettuce seed is known to be relatively intolerant of disinfection (12). Thus, isolation, hygiene and routine spraying methods would have to be relied upon for the production of disease-free seed. It should be noted that isolation can hardly be considered effective if weeds closely related to the lettuce (*i.e.* *Compositae-Cichorieae*) are allowed to flourish since it seems likely that among these a number of susceptible species might exist, which could serve as a reservoir of infection. In the Ceylon indigenous flora, *Lactuca Heyneana* DC (= *L. runcinata* DC) would hardly be important, judging from Trimen's (11) remarks on its distribution, but *Crepis japonica* Benth., which is common upcountry, should be viewed with suspicion. Various introduced species, among which the common sowthistles, *Sonchus oleraceus* L. and *S. arvensis* L. are the best known examples, are perhaps rather more important. The eradication of these weeds from areas of intensive lettuce cultivation would be advisable.

2. LEAF SPOT OF ANTIRRHINUM—*PHYLLOSTICTA ANTIRRHINI* SYD.

This disease occurred in a young planting of dwarf antirrhinums at St. Coombs in April, 1941. This also is a new record for Ceylon (Bertus, *l. c.*).

The earliest symptoms are more or less isolated spots on the leaves (Plate II., Fig. 1). These appeared on both green and red leaved varieties and during the first few weeks were relatively scattered and difficult to find. With the onset of the monsoon the spotting became more abundant and appeared to develop in some cases to a "stem-blight" condition, *i.e.* a water-soaking of the leaves and drooping and rotting of the young stem apex with a certain amount of general wilting. However, the plants were severely affected at the time with the root knot eelworm and the wilting and collapse of the stems may have been due in part to this cause. Finally, when the plants had been flowering for some time, typical spots with abundant pycnidia were seen on certain immature capsules as well as on the dead flower stalks and on the stem at the top of the inflorescence. No pycnidia were observable at any time at the base of the stems. (See below.)

The spots occur typically at the apex and margins of the leaves. They are usually circular, olivaceous to thin, papery

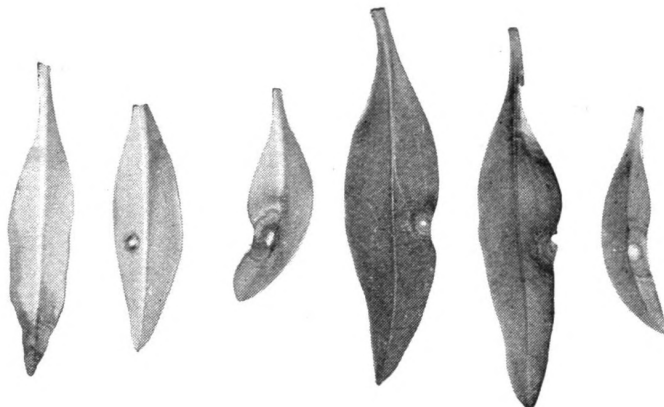


Fig. 1—*Antirrhinum* leaves with leaf spot disease associated with *Phyllosticta antirrhini* Syd. (natural size).

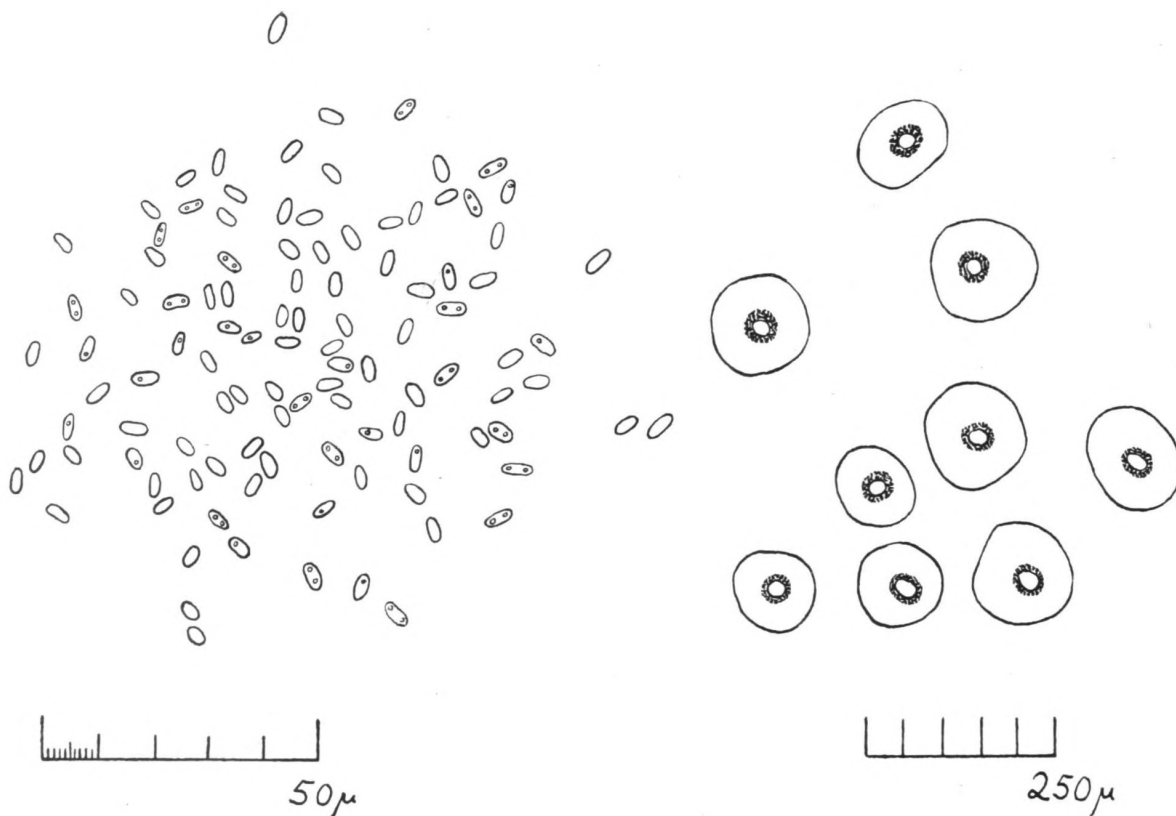


Fig. 2—*Phyllosticta antirrhini* Syd. left, fresh spores in water, $\times 580$; right, pycnidia as seen in surface view of infected leaf, $\times 80$ (camera lucida drawings).

brown in colour and may have a whitish, raised centre. The margin is purplish, or there may be a succession of purple rings round the border.

The pycnidia are abundant, epiphyllous and a few hypophyllous, and may show more or less zonation. Under the microscope they are immersed, clear brown in colour, thin-walled and translucent, with a ring of dark thicker-walled cells around the ostiole, as in *Septoria lactucae*, described above. Twenty pycnidia only were measured, with the following results :—

Diameter of pycnidia :—	90 — 150 μ	Mean	115.5 μ \pm 3.21 μ
Diameter of ostiole :—	20 — 30 μ	Mean	24.8 μ \pm 0.98 μ

The spores were exuded in water only : no spore tendrils were formed in moist air. The spores are hyaline and aseptate, oval to oblong ; one or two minute guttules may be present. Fifty spores were measured in water, as follows :—

Length :—	4.0 — 6.0 μ	Mean	4.7 μ \pm 0.07 μ
Breadth :—	1.5 — 2.5 μ	Mean	1.9 μ \pm 0.04 μ

The characters outlined above serve to identify the fungus as *Phyllosticta antirrhini* Syd. The only essential disagreement with Grove's (5) diagnosis of the species is in the occasional presence of guttules in the spores, these being described as eguttulate by the latter author (Plate II., Fig. 2).

The correct identification of this fungus leads to the old difficulty of distinguishing between the genera *Phyllosticta* and *Phoma*. The original distinction was simple (see 4) : *Phyllosticta* on leaves and *Phoma* on stems. The diagnoses given by Saccardo (9) in 1884 admit that *Phyllosticta* species may occasionally be caulicolous but emphasize differences in habit and in the characters of the pycnidia. Thus, *Phyllosticta* causes spotting of the leaves (or stems), and the pycnidia are thin-walled, with wide pore, whereas *Phoma* pycnidia are not developed on spots, are stouter-walled and with a minute pore. Grove (5) has recently sought a biological interpretation of the differences in habit noted by Saccardo, and considers that *Phyllosticta* is essentially parasitic (holoparasitic) being confined to the "spot" which it kills, whereas *Phoma* is a saprophyte or facultative parasite (generally if not always a wound parasite) growing equally well on dead as on living tissue.

Phyllosticta antirrhini is a useful example for testing the validity of these distinctions. It has long been known to occur on stem tissues and on this account has been described by certain authors as a species of *Phoma*. Grove (5), for instance, mentions the names *Phoma oleracea* Sacc. var. *antirrhini* and *Phoma antirrhini*. Certainly, in Britain and the U. S. A. the stem infection appears to be more severe than that so far

observed in Ceylon by the writer. Two forms of attack have been described in the literature. The commonest and most destructive is a "stem canker" (8), otherwise known as "stem rot" (2) or "stem spot" (10), which involves the formation of spots or lesions bearing pycnidia at the base of the main stems. The stems are eventually girdled completely, so that the parts above the lesion wilt and die. The other type of infection, noted by Smiley (10), is a "branch blight" involving a direct attack on the tips of the young shoots. The latter appears to have more in common with the leaf spot phase of the disease. Possibly also it can be correlated with the symptoms described above from St. Coombs. Buddin and Wakefield (2) were only able to produce the "stem canker" experimentally if the stems were wounded before inoculation, but no wounding was necessary for the infection of the leaves with the production of typical leafspot symptoms. Thus the causal fungus in their experiments (assuming that a single species only was involved) appears to behave both in habit and mode of attack as a *Phoma* and as a *Phyllosticta* simultaneously. Several authors (5, 2) have noted that a second pycnidial fungus, *Diplodina passerinii* All., is frequently associated with the stem canker lesions especially towards the end of the growing season. There seems to be no evidence to suggest that these two fungi are in any way related, nor does anyone appear to have investigated their mutual effect on pathogenicity and symptoms produced.

Both Buddin and Wakefield (2) and Smiley (10) note that *Phyllosticta antirrhini* is a high temperature fungus; the former author considers that the relatively high temperature necessary for optimum infectivity—about 77°F.—accounts for the comparative scarcity of "leaf spot" on antirrhinums grown out of doors in Britain and, by contrast, for the frequency of "stem rot" on young plants grown under glass. Under these favourable conditions the fungus is able to survive in the soil: the wounding of the stems necessary for infection will occur freely during transplanting. If these conclusions hold, one would expect "stem canker" symptoms to be prevalent under up-country conditions in Ceylon, but, as noted above, there is so far no reliable evidence that it occurs here. An experimental investigation of the disease might produce interesting results. A search for *Diplodina passerinii* should also be made.

The disease should be amenable to control by Bordeaux spraying or sulphur dusting (10). The "stem canker" phase, should it appear here, would probably necessitate rigorous uprooting of diseased plants. Buddin and Wakefield (2) have suggested watering the soil with Cheshunt compound at the time of transplanting for the control of soil-borne infection.

The occurrence of pycnidia on the capsules and old flower-stalks points to the possibility of seed infection or to infection from parts of these organs present as impurities in the seed. The St. Coombs specimens were grown from freshly imported seed of which none was available for later examination.

SUMMARY

An account is given of two leaf spot diseases new to Ceylon, viz., a disease of lettuce (*Lactuca sativa* L.) associated with *Septoria lactucae* Pass., and a disease of *Antirrhinum majus* Hort. associated with *Phyllosticta antirrhini* Syd. Brief notes on the naming of the fungus and the control of the disease are given in each case.

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