TYLENCHUS Sp. FORMING LEAF-GALLS ON *ANDROPOGON PERTUSUS* WILLD.

BY

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Among the nematodes or eelworms, the most important and the most well known are perhaps the root-knot nematode, *Heterodera radicicola* Muller and the wheat nematode, *Tylenchus tritici* (Stein.) Bastian. A lot of work has been done on *Heterodera*, and even in India it has been found to occur on a very large number of host plants. As regards *Tylenchus* in India, Butler (1 and 2) † has described *Tylenchus angustus* causing a disease on paddy known locally in Bengal as "ufra"; and Milne (8) has noticed the nematode disease of wheat in the Punjab. The wheat nematode is very widely distributed, having been found in all the continents except Africa. No species of Tylenchus has been noticed on any grass in India. So it might perhaps be interesting to record the occurrence of a species of *Tylenchus* on one of the most common grasses in pasture land in South India. Some years back a curious gall formation on the leaves of *Andropogon pertusus* came to my notice. Search in Bangalore lawns revealed it to be a very common pest. In my tours I have come across it in Chikmagalur, Coimbatore and in Palghat. Probably it occurs in other localities as well.

The galls (See Plate I) are to be found on the leaves, leaf-sheaths, the culms, and the axis of the inflorescence, but they have not been noticed on the flowers. Tender portions are very easily affected. The galls when young, are almost colourless, and with age take on a purple colour at the centre, which gradually spreads over the whole gall and sometimes even into the tissue of the leaf. The mature gall is blackish purple in colour. Even a microscopic preparation is very lightly tinted by this purple colour. The galls involve the whole thickness of the leaf, and are more prominent on the under surface than on the upper surface. (See Plate II, Figs. 3 and 4). They may be formed at the margin or anywhere on the surface of the leaf, and sometimes even on the midrib. The galls are globular or oval, varying in size from 0·5 to 1 mm. in diameter. Sometimes, two or more coalesce to form a

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† Reference is made by numbers in brackets to Literature cited.

bigger gall. They occur all along the leaf and may vary in number from one or two to as many as forty. Affected leaves in bad cases are fully covered up by the galls, and sometimes curiously distorted, and as noted by Byars (3) for his wheat nematode, diseased leaves sometimes roll so tightly as to hold firmly the tip of the younger leaves. (See Plate II, Fig. 1 at A). The leaf subtending the inflorescence when severely attacked does not allow the inflorescence to spread out. The leaves finally become yellow and die.

On crushing a few galls in a drop of water on a slide, and observing it under the microscope all stages of development of the nematode from eggs to larvae and adult may be noticed (See Plate II, Fig. 2). The larvae may be seen to wriggle about in their characteristic manner. The females are of the same shape as the males but they are very much bigger. They may be seen to lie coiled up (See Plate II, Fig. 2). The adult male has a bursa at the posterior end. The eelworms seem to belong to the genus *Tylenchus* that is so common on cereals and grasses. From a cursory examination the eelworms appear to be smaller than *Tylenchus tritici* (Stein.) Bastian. More detailed examination and comparative studies on the basis of Cobb's (4) decimal formula are necessary before one can be positive about the identification. The young gall in section may be seen to include four or more veins and the tissues between them (See Plate II, Fig. 3). A lot of sclerenchyma cells are seen surrounding the tissue of the gall, forming a good protection for the inner chamber (See Plate II, Fig. 4). Küster (5) mentions sclerenchyma cells as occurring in the galls of *Perrisia fraxini* (a cecidomyid) on the leaves of *Fraxinus excelsior*, and in some cynipid galls. Even the old galls on dried up leaves contain plenty of eelworm larvae in a quiescent stage. When crushed in water on a slide they become active in about half an hour.

The dispersal of the eelworms in spite of their sluggish movements must be an easy matter, seeing that the host is a common pasture grass. Such being the case the question of control becomes one of great difficulty. Lounsbury (6) says that even the declaration of quarantine is not likely to be of much use in connection with a similar pest on *Cynodon sp.*

Lounsbury (6) in South Africa has found the common lawn grass *Cynodon sp.* (perhaps *incompletus*) to be heavily infested, presumably on the leaves, with *Tylenchus tumefaciens* a gall-forming nematode. Butler (1 and 2) working on the "ufra" of Paddy in India found *Tylenchus angustus* to infect the young ear, the peduncle, the part of the stem just above the upper nodes, the leaf-sheath, and the young

leaf-blades inrolled towards the centre of the bud above the growing point. But this species is an ectoparasite, and has never been known to produce galls. Byars (3) working on the wheat nematode mentions as parts affected, the young and old leaves, and the embryonic fruit, and adds that it may indirectly cause a bending or crooking of the stem. Infected leaves exhibit a wrinkling, twisting and rolling, especially of the younger leaf blades. Galls are sometimes formed on the leaves. But it is in the flower spikes that the disease appears at its best. Some or practically all flowering glumes in infected heads contain, in place of normal kernels, hard light brown to dark coloured galls which are filled with nematodes. Byars (3), however, mentions that a *Tylenchus sp.* morphologically different from *Tylenchus tritici* causes galls on the leaves of *Calamagrostis canadensis*. It is a moot point whether the nematodes which attack other species of grasses are simply strains of the wheat nematode, or whether these are of specific rank. The differences observed may be physiological rather than morphological, and it is only an extended series of cross-inoculation experiments that can give us conclusive evidence on this point. The following list of leaf-galls on gramineae is taken from Marcinowski (7). She surmises that the undetermined species (denoted by asterisks) may most probably be *Tylenchus sp.*

Agropyrum repens	*	Molliard 1904
Agrostis alba	*	Trail (nach Hieronymus 1890)
A. canina	*	Magnus 1876
A. silvatica	*	Kieffer 1892 (nach Houard 1908)
A. stolonifera	*	Schlechtendal 1885
A. vulgaris	*	Karsch 1880, Schlechtendal 1885
Alopecurus geniculatus	*	Hieronymus 1890
Avena pratensis	*	Kieffer 1901
Calamagrostis lanceolata	*	Schlechtendal 1895 (nach Houard 1908)
Festuca dumetorum	*Tylenchus graminis*	Lagerheim 1900
F. ovina	*Tylenchus graminis*	Hardy 1850
F. rubra	*Tylenchus graminis*	Lagerheim 1900
Glyceria maritima	*	Rostrup 1896 (nach Houard 1908)

Poa palustris		Hieronymus 1890
P. nemoralis	*	Schlechtendal 1891
Triticum repens	*	Kieffer 1899

In this list there is no mention of any species of Andropogon. So far as can be made out from available literature there is no mention of any *Tylenchus* on any grass in India.

Summary.

Gall formation, chiefly on the leaves of *Andropogon pertusus* Willd. in South India is described as being due to a nematode, *Tylenchus sp.* This seems to be the first mention of its occurrence on any grass in India.

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Explanation of Plates.

Plate No. I.—*Andropogon pertusus* Willd., showing galls on leaves.

Plate No. II.

Fig. 1. Rolling of leaves of *Andropogon pertusus* Willd. At A the tip of a younger leaf is held tightly between the margins of the older leaf.

Fig. 2. A group of eggs, larvae and adult female of *Tylenchus* sp.

Fig. 3. A photomicrograph of a transverse section of a leaf of *Andropogon pertusus*, showing young stage of gall. Note the elongated vascular bundles.

Fig. 4. A photomicrograph of a transverse section of a leaf of *Andropogon pertusus*, showing structure of gall. Note sclerenchyma surrounding the gall, and group of eggs, larvae and adult female in the cavity.