A NEMATODE DISEASE OF RICE IN THE CENTRAL PROVINCES.

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The rice plant in the Central Provinces is usually free from serious diseases. The disease which causes at times much damage is the one resembling "Straight Head Disease". It is usually found in certain fields; varieties like Gurmatia and Bhata Gurmatia being particularly susceptible. In the early stages, the growth of the plant is checked and there is at the same time a large increase in the development of coarse roots which are sparingly branched and which have very few root hairs. The affected plants produce poor heads which may be partially sterile. The trouble is due to unfavourable soil conditions which can be remedied by letting out water from the affected fields as soon as the arrest in normal growth of plants is noticed and by allowing the field to get dry till the soil begins to crack when the water can be again turned on, but sparingly.

There are some other diseases of minor importance, such as those caused by Pincularia oryzae Cav., Entyloma oryzae Syd. and Helminthosporium spp.

Besides these diseases, there are two others which are of sporadic occurrence and which have been under investigation for the last few years. In one case, there is the dying of the outer leaves and of tillers, in the other case there is the development of "light" ears and spotting of grains. These diseases are at times very destructive; some varieties are much more susceptible than others; for example, in 1935, at Waraseoni (Balaghat District) early varieties of rice, such as E. B. 17, Pisso and Luchai 21, were very badly affected; their outer leaves and tillers died in large numbers; in 1934 in Chhatisgarh District, the yield of early varieties of rice, such as Ludka, was considerably reduced, as they produced chiefly "light" ears; there was also the dying of outer leaves and of tillers; but in 1935 in Chhatisgarh District the crop was normal.

It is probable that these two diseases may be caused by the same organism.

Symptoms.—Certain varieties of rice, especially early varieties such as Ludka, E.B. 17 and Pisso, show a diseased condition when the plants are
about two to three months old. The first symptom of the disease is the slow
dying of the outer leaves from tip downwards. The tip of the outermost
leaf at first turns brown and dry; the browning and drying slowly extends
downwards along the margin, and later the whole leaf is involved; The
margins more or less curl inwards; the dry leaf stands erect; it does not, at
first, show any marked lesions or signs of rot. The inner leaves also soon
show similar symptoms; the tillers are also affected in the same way and
they die before they put forth a vigorous growth or many leaves. The plant
is ultimately so attenuated that it has only a few inner leaves and a thin
stem bearing a poor head, most of the leaves being dry, and most of the tillers
being dead or dying.

When such a plant, having only a few green leaves, is uprooted, the
roots are found to be healthy and normal. The lower internodes of the
stem are white and do not show any signs of disease except a few stains,
brown or reddish brown, on the short lower internodes. When the outer
leaves of the parent plant are removed the buds in the leaf axils are distinctly
black coloured, wholly or partially, and not white as the healthy buds; when
the leaves of the dead or dying tiller are carefully removed, and the growing
point is exposed, it is found to be black. A microscopic examination of
sections of the blackened growing points of dying tillers, of the partially
black buds in the axils of the outer dying leaves and of the stained lower
internodes does not show the presence of any organism in their tissues; these
tissues are discoloured deep brown or black, but they do not show the pre-
sence of any hyphae or bacteria; these buds, growing points and internodes
remain sterile in a majority of cases, when after sterilizing them in a solution
of corrosive sublimate and washing them in sterilized water they are trans-
ferred to culture media tubes. Leaf-sheaths of the dead leaves of a diseased
plant in a field in which water has been allowed to stand for a long time
have at times within their tissues and on their surfaces, small black minute
sclerotia measuring 47-129 × 54-150 μ, but these sclerotia are not found
on the leaf-blades or in their tissues; they are confined only to those parts
which are usually under water. In some cases, the leaf-sheaths of dying
leaves, which are under water, show distinct lesions, brownish in colour and
elliptical in shape; these lesions may extend to the inner side of the leaf-
sheath; on the parts of the culm which is in contact with these lesions may
be found at times a greyish felt of mycelium; the part of the stem to which
the mycelium is attached shows brownish or blackish lesions, in sections
through these lesions on the stem no mycelium inside the tissues is found
though the epidermical tissues are discoloured; the felt of the mycelium is
entirely superficial.
Diseased specimens of rice, collected last year from Waraseoni (Balaghat District) at first did not show the presence of any sclerotia either on the leaves and stems or inside their tissues; but when these plants were kept in water for a few days, large black sclerotia, about 0.25 mm. in diameter were found in large numbers. They were also present inside the hollow stems; but were confined only to the lower parts of the plants.

When a plant in flower has its inflorescence still enclosed within its enveloping bract, it is hardly possible to say whether the panicle, when it emerges from its boot, will develop into a normal ear or a "light" ear, as the enveloping sheath is usually green and does not usually show lesions on its outside; but when the panicle emerges from the boot the extent to which the ear is diseased can be readily seen even from a distance, as the diseased spikelets stand out very conspicuously amongst the healthy ones.

In normal years, the number of spikelets attacked in a panicle is not great and often it is negligible; but still the diseased spikelets can be readily distinguished from amongst the numerous healthy spikelets of the inflorescence. The flower in a diseased spikelet is either sterile or completely aborted; in the former case the inner glumes, the palea and lemma, are of normal size and shape, but are white coloured and therefore can be readily distinguished from the green glumes of healthy flowers; these diseased flowers have anthers and pollen grains of normal size and shape, but the anthers remain within the white glumes, even though these may have spread apart; the lodicules and the ovary are rudimentary or wilted, but the two stigmas look normal. In those spikelets in which the glumes are distorted and empty, the flower is absent; the palea is papery or membranous, white in colour and crescent shaped; it may be embedded within the lemma, which is also sickle shaped, white in colour and thinner than the lemma of the healthy flower. Both the glumes may be of the same length as those of the healthy flower or may be smaller, but they are much narrower in width than the normal glumes. In some cases, the apical part of the lemma is hook shaped and bends over the palea which is more or less rudimentary. The external glumes may be normal, or very much enlarged, as long as the inner glumes, or may be completely wanting.

When the ear is fully matured and dry its "light" grains having normal sized glumes, which were originally white coloured, slightly turn light brown and so cannot be then easily differentiated from the straw coloured glumes of a ripe normal fruit.

Neither the peduncle, nor the rachis, nor the pedicel shows any rot or decay, though at times the pedicel of an aborted flower may be discoloured dirty brown.
In some cases, the inflorescence does not wholly emerge from the boot-leaf; the basal part remains enclosed within the enveloping sheath; the flowers enclosed within the lower part of the unopened sheath are sterile; their inner glumes are usually of normal shape and size but their colour is wholly white; the boot-leaf may show distinct brownish stains which are not very sharply demarcated. At first the enclosed portion of the inflorescence shows no signs of rot; but at a later stage, especially under wet conditions, it shows a distinct wet rot; the originally white glumes are discoloured brown or black due to the infection of saprophytic organisms like bacteria, *Cladosporum* sp., *Alternaria* sp., *Fusarium* sp., *Phoma* sp., etc. The peduncle, rachis and pedicel do not show any signs of wet rot though they may be discoloured.

When a newly opened inflorescence is carefully examined, it will be found that many of the green glumes of its normal healthy flowers have one or more very minute black circular spots or specks which can easily pass unnoticed; in some cases, the spots are bigger and elliptical in shape; these elongated spots have a dark brown or blackish border with a light brown or whitish centre. The spots do not enlarge; they retain their size and shape even after the flowers have set, and mature fruits are formed; but in the case of the elliptical spots, the central portion becomes whiter and thinner; and it often ruptures, on account of the death of the white central tissues, exposing the healthy kernel underneath. The tiny specks are usually confined to the upper surface of the glumes.

The development of sterile or aborted flowers is chiefly confined to early varieties of rice, like Ludka; late varieties, like Gurmatia, are not usually susceptible to this disease; however, occasionally a few scattered sterile flowers or "light" grains may be found in a well developed ear. But the ears of almost all varieties of rice, late or early, have a number of grains with spotted glumes.

In 1934, when the development of the "light" ears assumed an epidemic form in Chhatisgarh District, certain varieties were more affected than others; Ludka was the most affected, Surmatia was much less affected, and Gurmatia and Chinoor were very little affected. Practically, every field, where Ludka was grown, was diseased and every plant produced "light" ears. A Ludka field in ear could be easily distinguished from fields of other varieties; the large number of sterile flowers with their white glumes gave the panicle a distinctive appearance. The apical spikelets had, in most cases, aborted flowers which had shed before the ear was ripe and so the tips of the pedicels were exposed. The panicles stood erect and did not turn down as do the healthy ones; this was due to the development of "light" apical spikelets.
Cause of the disease.—When the ear is mature, the white aborted inner glumes of a spikelet or its pedicel are often covered with minute black sclerotia which are easily visible with the aid of a hand lens. They are globular or globoid and measure $47.0-129 \times 54.0-150 \mu$. When the aborted glumes or their pedicels are transferred, after sterilizing them with corrosive sublimate and washing them in sterilized water to culture media tubes, pure cultures of a Rhizoctonia are obtained, even in those cases in which sclerotia are not observed on the glumes and pedicels. In sections through the tiny spots on the glumes of healthy flower and fruits, only the epidermal cells and the adjacent cells are seen to be slightly discoloured brown. No hyphæ or bacteria have been found in these discoloured tissues The white central part of the elongated and elliptical spots on the glumes of a ripe grain, has at times on its upper surface minute black sclerotia, similar to those found on rotting leaf-sheaths and aborted glumes; but generally no organism has been found in these spotted tissues, especially when the grain is immature. In no case has the lesion been found to extend from the glumes to the enclosed kernel. The viability of the seed is not in any way affected by the spotting of the glumes. From the "light" grains, when incubated in culture media tubes, Rhizoctonia sp., Helminthosporium spp., Acrothecium sp., Phoma sp., Nigrospora sp. and bacteria were isolated from time to time. When the inner glumes, both of the mature healthy grain and of the "light" grain, are examined under a microscope conidia of Helminthosporium spp., Acrothecium sp., and Nigrospora sp., are found on the outer surface of the glumes; conidia of Nigrospora sp. are particularly found in large numbers.

Rice seedlings at the time of transplantation were inoculated with these fungi and bacteria isolated from diseased plants but except the inoculations with the Rhizoctonia, bearing minute sclerotia, the inoculations were always unsuccessful. When the seedlings were inoculated with this Rhizoctonia, in a few cases, the plants showed some ill-effects of the inoculation. Their growth was at first rather arrested, compared with that of the control plants, and of those inoculated with other fungi; but there was no dying of the outer leaves as found in the fields; and at a later stage there was no difference between the inoculated and control plants; the inoculated plants bore healthy normal ears as did the control plants. When an open inflorescence was inoculated with these fungi, the flowers, which had the inoculum on them did not set; their inner glumes were discoloured black or brown; the typical symptoms found in the naturally diseased flowers were not reproduced, the glumes were neither distorted nor were they white in colour. When the sheath covering the unopened inflorescence was inoculated with these organisms, the inoculations were wholly unsuccessful, except that in a few cases
the enveloping sheaths developed small lesions where the inoculum was placed; the lesions did not grow further. These inoculated boot-leaves and those which served as controls were kept enclosed in glass or celluloid chimneys, the ends being plugged with wet cotton wool; the panicle emerging from these boots often had typical sterile flowers with white inner glumes and spikelets with the typical white aborted glumes, similar to those found in naturally diseased ears; but all attempts to re-isolate the fungus used for the inoculations from these empty grains and aborted glumes gave negative results. These inoculations were made repeatedly during the last three or four years but the results were always the same. Late last season (1935) the unopened ears inoculated with Nigrospora sp. and kept covered in glass chimneys for many days showed typical symptoms of a naturally diseased head; the aborted glumes or the white glumes of sterile flowers did not show any trace of Nigrospora sp. The glumes and their discoloured pedicels in sections showed no presence of fungus hyphae in their tissues. When, however, the glumes of an empty grain were teased out in a drop of water on a slide and examined under the microscope a few live nematodes, belonging to the genus Aphelenchoides, were observed. When other empty grains were similarly examined the same type of nematodes were found. This led to the suspicion that the development of sterile grains may be due to the presence of these nematodes. "Control" ears which were similarly kept enclosed in chimneys had also developed empty grains; and when these were examined, they were also found to contain the same kind of nematodes. Herbarium specimens of Ludka and Surmatia collected in 1934 from Drug and Chandkhuri (Raipur District) were, therefore, re-examined last December, i.e., more than a year after they were collected; the white aborted glumes and the glumes of empty grains were teased out in a drop of water on a slide and in a majority of cases nematodes were observed; each of them was coiled like a watch spring; when kept in water for some time they uncoiled and straightened out; in a few cases, they regained their motility, but in most cases they were dead. These nemas were identical to those found in empty grains last year. At the time this investigation was in progress, specimens of "light" ears were received from Labhandi (Raipur District), Drug and Waraseoni (Balaghat District); from sterile spikelets of these specimens also the identical nemas were found.

When the presence of nematodes in empty grains was noticed, the season had practically ended, the crops in fields were harvested, and so the disease could not be further studied under field conditions; but there were a few potted plants in the experimental area. The main branches of these plants had ripe ears, but there were a few side shoots in bloom; some of the
inflorescences had already, wholly or partially, burst through their boot-leaves and in others they were still enclosed within their sheaths. These heads opened and unopened, were kept under high humid conditions by covering them with glass or celluloid chimneys, the ends of which were plugged with moist cotton wool. Heads, which had opened completely before they were covered, bore a few empty grains but their glumes did not have the typical white colour of the naturally diseased spikelets. In these grains, nematodes were not observed. The heads, which, when they were covered, were either partially opened or wholly unopened, developed typical symptoms of disease; all of them produced a number of empty grains and aborted glumes; in some cases, the inflorescence opened only partially, the basal part remaining within the enveloping sheath. These lower parts of the head bore empty grains, the glumes were either white or had brown lesions on them. The sheath also in some cases showed brown stains, especially above and near the margins; in no case was the main stalk diseased or discoloured. In all these heads, the typical nematode was found. In the spikelet with white glumes of a newly opened inflorescence the stigmas were shining and moist on account of the presence of nemas on them. In some cases, the spikelets had not at all developed, the flower buds had aborted and had turned brown. Nematodes were observed within these aborted flower buds as well (Plate IX, Fig. 10). Some late developed ears were inoculated with nematodes from diseased grains, and were kept covered with chimneys. These inoculated ears also gave typical diseased heads. Since the uninoculated covered heads, kept as "controls," gave the same results as the inoculated covered heads no conclusions can be drawn from these experiments, except that the nema is present on the upper parts of the plant and that it can cause no damage till the unopened or partially opened inflorescence is kept under high humid conditions.

These nematodes were not always found in large numbers in the empty grains; in a majority of cases they were about half a dozen in each grain; individuals of both the sexes were at times found in a grain, but those of the male sex were much fewer in number, and were not found in all the diseased grains that were examined; larvae were found in some of the diseased specimens, but eggs were found very rarely.

The development of typical "light" ears from unopened inflorescences kept artificially under moist conditions at Nagpur, the presence of nemas in "light" spikelets and undeveloped flower buds, and the presence of the same nema in specimens of "light" ears received in 1935 from Drug, Labhandi, Chandkhuri and Waraseoni, confirm the suspicion that this nema is the cause of the disease, at least of the panicle, if not of the basal parts of
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the plants as well; this suspicion is further confirmed by finding the same type of nema from herbarium specimens of diseased Ludka and Surmatia ears collected from Drug and Chandkhuri in 1934.

The soil used for our Nagpur pot experiments was evidently naturally infected with the nematode suspected to be the cause of "light" ears in rice, as is proved by the development of typical diseased inflorescences when kept artificially under high humid conditions; but still there was no dying of tillers or of outer leaves. This may be due to the fact that for the pot experiments Gurnatia variety was used, a variety which under field conditions at Drug and Waraseoni has not been known to be diseased. The dying of tillers and of outer leaves is generally found in certain varieties, like E.B. 17, Pisso, Luchai 21 and Ludka.

Whether the nematode found inside the glumes of sterile flowers is also the cause of the dying of the outer leaves and basal leaf buds and tillers of rice plants it is difficult to say definitely without further study. The absence of hyphae and bacteria within the tissues of the blackened axillary leaf buds and of the growing points of dying tillers, and the failure of reproducing the disease from fungi and bacteria isolated from the lower parts of dead leaves and from diseased ears may be due to the disease not being of fungal or bacterial origin. Before the nematode was found in sterile flowers and grains a nematode belonging to the same genus was occasionally seen in the axils of leaves of fresh specimens received from Drug and Waraseoni, especially from those that were sent with the soil still adhering round the roots; but unfortunately at the time the presence of the nematode was not associated with the disease, and so it was not further studied. Dry herbarium specimens of diseased plants of E.B. 17 collected at Waraseoni in October 1935 were re-examined, a couple of months later; on removing the leaf-sheaths from the basal internodes which had lesions on them, adults, larvae and eggs of nematodes were found in the axils of these leaves. Some of these nema belonged to the genus *Aphelenchoides* and were similar to those found in diseased "light" ears. For these reasons it is suspected that the dying of the tillers and outer leaves may also be due to the same nematode found in the sterile or aborted parts of the head.

No direct evidence has been produced to establish a connection between the presence of the nematode and the spotting of the glumes of fertile flowers. The spotting of the glumes takes place when the inflorescence is still enclosed within the boot; no organism has been found in the tissues of the spotted part of these glumes; the cells are brown coloured or honey coloured; when a spotted glume of a flower which has just emerged from its boot or which is still enclosed within it is transferred to a culture medium tube, after
the glume has been sterilized with corrosive sublimate and washed in sterilized water, it has invariably remained sterile. The lesions on the glumes do not increase in size after the panicle has emerged from the boot and the grains have set; though the central dead parts of a lesion at times turns white and bursts as the fruit matures and ripens. It is therefore suggested that the spotting may be due to the activities of the nema on the outside of the glumes after the flower has well developed and the glumes have begun to get silicified and therefore it is not able to do any damage to the spikelet.

The incidence of "light" ears seems to be dependent on prevailing climatic conditions at the time the plant is heading. With the development of the plant the nemas are able to travel to its apical parts, where they may be active or inactive according as the climatic conditions are humid or dry. If there are frequent showers of rain when the plant is heading, as may happen in the case of early varieties like Ludka, and E.B.17, the nemas become active and attack tender flower buds and immature flowers having unsilicified glumes; therefore the inflorescence, when it opens out of the enveloping boot, has aborted flower buds or spikelets with sterile flowers and distorted empty glumes.

The epidemic of "light" ears in early varieties like Ludka, and Surmatia in Chhatisgarh District in 1934 was very probably due to the frequent showers of rain in the first half of October when the plants were heading.

Nagpur pot experiments have shown that Gurmatia, a late variety, is as susceptible as the early variety Ludka to the development of "light" ears, if its unopened inflorescences are kept under humid conditions; under natural field conditions late varieties, like Gurmatia, Luchai and Chinoor, are more or less immune to this disease. This immunity seems to be connected with their time of flowering. They start heading about the middle of October or later, by which time, the monsoon has practically ended; therefore the critical period when the unopened inflorescence is susceptible to being infested by the nema is normally not sufficiently humid and so these late varieties produce healthy ears, even though the nema may be present on the apical parts of the plants.

The nema disease causing "light" ears in these Provinces is different from "ufra" disease of rice well known in Bengal, and caused by Anguillulina angusta (Butler, 1913). Perhaps in very early stages of the disease, when the leaves die from tip downwards or when the boot-leaf enclosing the immature panicle may have brown stains, there may be some superficial resemblance between these two diseases. "Ufra" disease causes a stunting of the infected plant, and a rotting and shrinking of the peduncle near the node. It does not develop "light" ears with white glumes.
Technique.—A diseased grain was teased up in a drop of water on a slide and examined under a microscope; when nemas were present the pieces of glumes were carefully removed and the drop of water was allowed to evaporate till there was left on the slide just a smear of water; this process was accelerated by keeping the slide on a warm plate or in a dry place. The nemas were then covered with a drop of Amann’s Lactophenol mounting medium (Lee, 1921) which was considerably diluted with water and which was faintly dyed with Cotton Blue. The excess of water from the diluted mounting medium was allowed to evaporate slowly and then a small drop of the uncoloured medium of normal strength was added; it was covered with a coverslip. Permanent preparations were made by ringing the coverslip with Canada Balsam after the water from the medium had completely evaporated.

The nemas in a drop of the diluted mounting medium soon lose their motility and come to rest, a majority of them in a straightened out position. At first there is considerable plasmolysis and so the nemas are very much shrunken and distorted in shape but as they absorb the coloured medium their turgor is restored and they regain their normal size and shape. The blue stain brings out clearly the various organs of the nemas. The spicules stain a much deeper blue than any other part and so stand out very conspicuously.

In this mounting medium the female nema comes to rest more or less straight, from the head to the tip of the tail; but the male nema in the resting position has always its tail curved upwards, almost in a semi-circle, but the remaining part of its body is straight (Figs. 1, 2, 5, 6, and Plate IX, Figs. 11–13).

Morphology of Aphelenchoides sp.—Body is tapering posteriorly and slightly anteriorly; cuticle is transversely finely striated; head is cap-like, offset by a constriction; the anterior part is slightly flattened, sides are convex; head has six longitudinal ridges; labial papillae are present but indistinct; buccal cavity is usually as deep as the head. Stylet is in two parts; the posterior has two well-developed knobs at the base (Figs. 3 and 7). In the head region the wall of the alimentary canal has short thickenings. Oesophagus terminates in a muscular bulb, which is oval or ovoid or broadly elliptical in shape. Oesophagus merges into intestine without any line of demarcation. Oesophageal gland cells with a rounded or pointed posterior are present, but not distinct. Excretory pore is well marked; it is usually a little distance below the posterior end of the oesophagus, but at times level with the posterior end. Rectum and anal opening are prominent.
Female tail is tapering straight and conical; it has three fine stiff minute hairlike appendages, which when they are in close proximity or pressed together make the tail look sharply pointed. Vulva is well marked; the anterior lip is rounded and conspicuous; the opening forms a prominent slit. Vagina is directed inwards and forwards. Posterior uterine sac extends towards rectum about 40–50 μ from the vulva (Figs. 5 and 9). A constriction separates uterus from ovary; uterus is straight. Ovary is anterior, single, and not reflexed, but the apical end is at times slightly curved.

Male tail in fixed specimens is ventrally curved, almost semi-circular. It has two spicules; they are curved, thorn-shaped, and sharply pointed; the dorsal spicule consists of two pieces; the ventral is single and smaller than the dorsal (Figs. 1 and 2). Two caudal papillae are present, one ad-anal which is prominent and the other just behind the median point of the tail which may be indistinct; tail has one or two minute stiff appendages; testis is single, outstretched and not reflexed.

**Dimensions**  
Female:—length 0·4–0·8 mm.; width 0·01–0·035 mm.; stylet 10–15 μ; \( a \) 48–22; \( \beta \) 11–5; \( y \) 20–8; \( \delta \) 4–3; \( V \) 64–80%.

Male:—length 0·5–0·62 mm.; width 0·01–0·02 mm.; \( a \) 45–18; \( \beta \) 12–3; \( y \) 23–12·7; dorsal spicules 13·2–10·2 μ; ventral spicules 7·7–5·1 μ.

Eggs are sausage-shaped; one end is more broadly rounded than the other. They measure 71·0–82·0 × 15·0–20·5 μ. They are found in an unsegmented condition; very few eggs have been observed. They have not been seen inside the female nemas.

Larvae resemble female adults in shape. The tail in the last larval stage has appendages similar to those of an adult female. Oesophageal glands of a larva are more conspicuous than those of an adult. Stylet with two basal swellings (Fig. 4), oesophageal bulb and rectum are prominent.

*Aphelenchoides* sp. on rice is ectoparasitic; on the immature branch of a young inflorescence the nema is found between the membraneous parts of spikelets; in the empty grain with white glumes it lives on the inner side of the glumes, on stigmas and anthers; it has not been found on the outside of the glumes of the sterile flower or within their tissues; *loc. cit.* it is rarely found inside the flowerless distorted papery glumes. It has been found also in the axils of leaves.

**Summary.**

A new disease of rice, considered to be caused by a nematode, belonging to the genus *Aphelenchoides* is described,
Plants infested with the nema produce "light" ears; the inflorescence is attacked while it is still within its boot. A diseased panicle cannot be usually differentiated from a healthy one, till it comes out of the enveloping sheath. Some of the branches of the diseased inflorescence completely fail to develop; a few spikelets on normally developed branches have either sterile flowers with white glumes, which may be distorted, or the spikelets may be aborted; there is no rotting or shrinking of the peduncle of the infested inflorescence, as in the case of "ufra" disease of rice in Bengal. The glumes of healthy flowers may be spotted; the spotting takes place when the flowers are still enclosed within the boot; it does not affect the normal development of the flower.

The nema has been found inside the white glumes of sterile flowers and between the floral parts of undeveloped flower buds. It has been observed in specimens collected in 1935 from various parts of the Central Provinces, and also from herbarium specimens of "light" ears collected in 1934.

If the atmospheric humidity, due to rainfall, is high at the time the inflorescence is still within its enveloping sheath the flower buds are vulnerable to an attack by the nema. Early varieties of rice, like Ludka, are therefore susceptible to this disease if there are occasional showers of rain in October when the plants are heading. This explains why the incidence of "light" ears is sporadic.

Varieties like Ludka, E.B. 17, Pisso and Luchai 21 in certain seasons have a very poor growth due to the dying of outer leaves from tip downwards and of tillers. The various fungi and bacteria isolated from dying leaves and tillers, and sterile spikelets of "light" ears have failed to reproduce the disease. From axils of dying leaves and from dying tillers a nema similar to that present in sterile flowers has at times been found, it is therefore considered that the dying of leaves and of tillers may also be due to the same nema, *Aphelenchoides* sp., which causes "light" ears.

A technical description of the nema, *Aphelenchoides* sp., is given.

**LITERATURE CITED.**


**EXPLANATION OF FIGURES.**

Figs. 1 & 2.—Male tail. Spicules in Fig. 1 are extended \( \times 900 \).

Fig. 3.—Head of an adult \( \times 900 \).

Fig. 4.—Anterior end of a molting larva \( \times 900 \).

Fig. 5.—Female genitalia \( \times 200 \).
Fig. 6.—Female tail ×900.
Fig. 7.—Anterior end of an adult. ×900.
Fig. 8.—Egg. ×900.
Fig. 9.—A part of the female genitals. ×900.
Fig. 10.—Young inflorescence infested with *Aphelenchoides* sp.
Fig. 11.—Female *Aphelenchoides* sp.
Fig. 12.—A male *Aphelenchoides* sp.
Fig. 13.—The posterior end of a male.