The author is thankful to Dr. A. Johnston, Director, C.M.I., Kew, for identification of the pathogen. Sincere thanks to Dr. S. B. Lal, Head, Division of Plant Pathology, for taking keen interest in the study and also finalising the manuscript. Necessary facilities received from the Director, C.P.R.I., Simla, are sincerely acknowledged.

Division of Plant Pathology,
Central Potato Research Institute,
Simla 171 001, India,
May 18, 1979.

—


—

A NEW VIRUS DISEASE OF RICE IN INDIA

Rice plants (cv. Taichung Native 1) at the maximum tillering stage were found to be severely diseased (50–60%) with an unknown etiology in the Central Rice Research Institute experimental farm. Attempts were made to isolate the pathogen, using conventional procedures, involved therein. Neither a bacterium nor a fungus was found to be associated with the disease. Hence, trials were made to inoculate 20 day old healthy rice seedlings (cv. Taichung Native 1), raised under insect proof condition, with the sap prepared from the affected leaves in sterile distilled water and 0.01 M phosphate buffer (pH 7.8) separately and to transmit the symptom by using the common pests of rice.

Insect transmission done using Nematoditis nigrifictus (Stal), N. viridescens (Distant) and Nilaparvarata lugens (Stal) proved to be negative. Initial symptoms of the pale yellow streaks measuring 0.5–3.0 mm in length appeared on the leaves of plants inoculated with sap prepared in distilled water as well as in buffer 6 days after inoculation. With the advancement of disease, white chlorotic patches developed at the base of leaves together with mosaic mottling of leaves. Long yellow chlorotic streaks parallel to the veins with interveinal chlorosis was noticed on the leaves. Appearance of small brownish (later on necrotic) spots at the base of leaves as well as on leaf sheath and culm were noticed. Development of the disease resulted yellowing of leaves, much less tillering and spreading growth habit of inoculated plants. However, no significant reduction in height of the infected plants could be observed.

Sap transmissible nature and the absence of either a fungus or a bacterium in the tissues provided evidence for the viral nature of the causal organism. Under artificial inoculation, cultivars like IR-8, Karuna and Rattan were also found to be susceptible. Preliminary observations indicated that the virus is also transmissible through soil since seedlings planted in soil used to maintain the diseased plants also exhibited positive symptom development.

Since the symptoms were found to be closely related to rice necrosis mosaic virus attempts were made to detect the presence of X-bodies reported to be present in necrosis mosaic virus infected rice seedlings. The leaf sheath section stained with iodine under microscopic examination revealed the presence of oval-shaped X-bodies measuring 5 0–8 2 × 6 8–15 3 μ in inner epidermal cells.

These observations indicate that the new disorder, was similar to rice necrosis mosaic virus and quite distinct from rice dwarf virus since this virus (a) is not transmitted by N. nigrifictus, (b) is sap transmissible, (c) does not cause significant reduction in plant height and (d) also can be transmitted through soil. This has been observed for the first time in India.

Author is grateful to Dr. H. K. Pande, Director for his keen interest, to Dr. N. K. Chakrabarti, Head, for providing facilities and to Dr. R. Sridhar, Division of Plant Pathology, Central Rice Research Institute, for his useful criticism during the present investigation.

Division of Plant Pathology,
Central Rice Research Institute,
Cutack 753 006, Orissa,

—

3. —, Shokubutsu Bokki (Plant Prot.), 1967, 21, 188.

—

INFLUENCE OF POLLEN ON THE GERMINATION OF CONIDIA OF DRECHSLER Aero TURCICA (PASS.) SUBRAM. AND JAIN

Various physical, chemical or nutritional and biological factors are known to influence spore germination and establishment of infection by pathogenic fungi on different hosts. Among the biological factors, the role of bacteria, fungi and yeasts are well established.
They are known to have either inhibitory or stimulatory effects. The influence of pollen has come to light recently and their stimulatory effects on the germination, growth of germ tubes and lesion development of several facultative pathogens like *Botrytis cinerea*, *Claviceps purpurea*, *Fusarium graminearum*, *Helminthosporium sativum* and *Septoria nodorum* and *Phoma betae* are recorded. The effect of sorghum pollen on *Drechslera turcica* has been established from our laboratory quite recently. While investigating the epidemiology of sorghum leaf blight caused by *D. turcica*, it was found that the incidence of leaf blight reaches the peak, when the plants were in flowering. Similar observations were made by Folkema on rye leaf blight. In nature, plants grow as mixtures of crop plants and weed species. The pollen of non-host plants falling at various places including leaves of host plants may have either a positive or a negative influence on the incidence of the disease. The present study reports the influence of pollens of non-host plants in vitro on the germination of conidia of *D. turcica* compared with that of maize pollen, a susceptible host and distilled water controls.

Pollens of 12 species were selected for study which include maize a host plant, 3 species belonging to grasses and sedges, 3 species classified into weeds and 5 species of common trees at Mysore. Fresh pollen collected from the field were dried at 37°C for 24 hours and stored in deep freeze until further use. In case of *Acacia auriculiformis* anthers with pollen masses were used. Conidia of *D. turcica* harvested from 10 day old pure culture were used and the methods followed were the same as described by Meenakshi and Ramalingam. However, colophane squares used were prepared by boiling for 1 minute in distilled water with chloromycetin and later wet sterilised in distilled water. The effect of different pollen was studied at intervals of 2, 4, 8 and 12 hours and the data were recorded on the criteria established earlier. The results obtained are tabulated in Table I.

The conidia of *D. turcica* germinated within 55 minutes in contact with pollen while it took 100-110 minutes to put forth germ tube in control. All the pollen types tested showed a great influence on the germination of conidia of *D. turcica* and none inhibited germination. The percentage of germination was almost twice compared to control. When the data is examined with the perspective of infectivity, an 8 hour duration seems to be a critical period, by which time maximum number of conidia not only germinated but also produced appressoria and infection hyphae required for successful infection. Almost all conidia were induced to bipolar germination in contact with pollen as compared to the control in which germination is predominantly unipolar. Occasionally conidia produced 1 or 2 extra germ tubes from median cells, 11% with maize pollen and 33% with *Parthenium* and negligible with other pollen types. With increasing incubation, the length of germ tube as well as the number of branches produced showed a great increase as compared to the control. Pollen stimulated germ tube length by 3-4 times than controls and *Cocos* pollen showed the greatest effect (10-12 times) but with reduced number of appressoria and infection hyphae. A similar case is seen with reference to the effect of *Acacia, Delonix* and *Peltophorum* pollen. Appressoria were formed within 4 hours in contact with pollen suspensions of *bajra*, maize and *Mimusops* and took longer time in case of others, the maximum number being produced after 8 hours incubation. At the end of 12 hours they are formed in all treatments.

The pollen of non-host plants studied, stimulated the germination, growth of germ tubes and formation of appressoria of *D. turcica* as recorded with pollen of maize and sorghum, the host plants. Pollen disseminated from non-host plants and depositing on sorghum and maize leaves might play an important role in the establishment of infection and development of leaf blight in the pre-flowering stages. The prevalence of weed and tree pollen in air in considerable amounts during the pre-flowering periods has been recorded at this laboratory (Parswanath and Ramalingam, unpublished). The pollen grains coming from host plants greatly enhance infection and spread in post-flowering stages as already noticed. The pollen of *Cocos* and *Peltophorum* which do not favour the formation of appressoria, which is very critical for establishment of infection, may lead to a reduction in the spread of infection, if not infected area. Although the effect of non-host pollen is identical, the host pollen might have a decided influence as observed in conidia of *Claviceps purpurea*. Since many other organisms, viz., bacteria, actinomycetes and other saprophytic fungi colonising the leaf surface have far reaching effect in infection process no conclusions can be drawn at this stage itself.

The carbon source especially reducing sugars and other carbohydrates in pollen might give a triggering effect on germination of fungal spores. But the aggressiveness of the pathogen seems to depend on the pollen leachates than others. The nutrients exuded by leaves may serve as a source for the saprophytic phylloplane microbes as well as the facultative pathogens which have to compete for them rigorously. While doing so, the latter may be at disadvantage, but the air-borne pollen deposits might provide additional nutrients for the growth and establishment of facultative pathogens including *D. turcica*.
Table I

Data on the germination of conidia of D. turcica as influenced by various pollens (values for 100 spores)

<table>
<thead>
<tr>
<th>Characters</th>
<th>Control</th>
<th>P. tropicaefolium</th>
<th>Zaf. mays</th>
<th>C. eleagnos</th>
<th>S. arcturus</th>
<th>P. heterophyllum</th>
<th>T. procumbens</th>
<th>A. microcarpa</th>
<th>A. auriculiformis</th>
<th>D. regia</th>
<th>C. nucifera</th>
<th>P. porphyropum</th>
<th>M. elongi</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>After 4 hours</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% germination</td>
<td>42</td>
<td>98</td>
<td>96</td>
<td>96</td>
<td>98</td>
<td>97</td>
<td>97</td>
<td>98</td>
<td>98</td>
<td>97</td>
<td>95</td>
<td>93</td>
<td>97</td>
</tr>
<tr>
<td>Length of germ tube (μm)</td>
<td>8</td>
<td>156</td>
<td>124</td>
<td>127</td>
<td>106</td>
<td>98</td>
<td>79</td>
<td>95</td>
<td>105</td>
<td>78</td>
<td>81</td>
<td>32</td>
<td>145</td>
</tr>
<tr>
<td>No. of germ tubes</td>
<td>103</td>
<td>176</td>
<td>175</td>
<td>180</td>
<td>178</td>
<td>187</td>
<td>172</td>
<td>175</td>
<td>171</td>
<td>166</td>
<td>171</td>
<td>158</td>
<td>182</td>
</tr>
<tr>
<td>No. of branches</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>7</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>No. of appressoria</td>
<td>2</td>
<td>11</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>1</td>
<td>.</td>
<td>4</td>
</tr>
<tr>
<td>No. of infection hyphae</td>
<td>.</td>
<td>.</td>
<td>2</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>100</td>
</tr>
<tr>
<td><strong>After 8 hours</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% germination</td>
<td>51</td>
<td>99</td>
<td>97</td>
<td>97</td>
<td>98</td>
<td>98</td>
<td>97</td>
<td>98</td>
<td>99</td>
<td>98</td>
<td>97</td>
<td>98</td>
<td>99</td>
</tr>
<tr>
<td>Length of germ tube (μm)</td>
<td>18</td>
<td>285</td>
<td>237</td>
<td>323</td>
<td>470</td>
<td>229</td>
<td>217</td>
<td>256</td>
<td>313</td>
<td>203</td>
<td>376</td>
<td>162</td>
<td>239</td>
</tr>
<tr>
<td>No. of germ tubes</td>
<td>118</td>
<td>184</td>
<td>181</td>
<td>181</td>
<td>188</td>
<td>201</td>
<td>179</td>
<td>180</td>
<td>172</td>
<td>169</td>
<td>176</td>
<td>179</td>
<td>189</td>
</tr>
<tr>
<td>No. of branches</td>
<td>.</td>
<td>31</td>
<td>41</td>
<td>86</td>
<td>68</td>
<td>65</td>
<td>9</td>
<td>26</td>
<td>169</td>
<td>14</td>
<td>16</td>
<td>9</td>
<td>23</td>
</tr>
<tr>
<td>No. of appressoria</td>
<td>2</td>
<td>34</td>
<td>61</td>
<td>8</td>
<td>7</td>
<td>4</td>
<td>7</td>
<td>51</td>
<td>18</td>
<td>6</td>
<td>.</td>
<td>.</td>
<td>100</td>
</tr>
<tr>
<td>No. of infection hyphae</td>
<td>.</td>
<td>38</td>
<td>32</td>
<td>20</td>
<td>20</td>
<td>5</td>
<td>15</td>
<td>6</td>
<td>23</td>
<td>19</td>
<td>4</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td><strong>After 12 hours</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% germination</td>
<td>52</td>
<td>99</td>
<td>100</td>
<td>98</td>
<td>100</td>
<td>100</td>
<td>98</td>
<td>100</td>
<td>99</td>
<td>100</td>
<td>99</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Length of germ tube (μm)</td>
<td>32</td>
<td>512</td>
<td>598</td>
<td>640</td>
<td>693</td>
<td>670</td>
<td>437</td>
<td>534</td>
<td>662</td>
<td>377</td>
<td>4234</td>
<td>386</td>
<td>782</td>
</tr>
<tr>
<td>No. of germ tubes</td>
<td>124</td>
<td>183</td>
<td>191</td>
<td>193</td>
<td>189</td>
<td>220</td>
<td>184</td>
<td>186</td>
<td>180</td>
<td>190</td>
<td>186</td>
<td>184</td>
<td>189</td>
</tr>
<tr>
<td>No. of branches</td>
<td>.</td>
<td>102</td>
<td>168</td>
<td>261</td>
<td>70</td>
<td>145</td>
<td>142</td>
<td>134</td>
<td>158</td>
<td>46</td>
<td>132</td>
<td>121</td>
<td>273</td>
</tr>
<tr>
<td>No. of appressoria</td>
<td>8</td>
<td>40</td>
<td>23</td>
<td>80</td>
<td>114</td>
<td>20</td>
<td>33</td>
<td>84</td>
<td>8</td>
<td>9</td>
<td>2</td>
<td>16</td>
<td>38</td>
</tr>
<tr>
<td>No. of infection hyphae</td>
<td>.</td>
<td>67</td>
<td>32</td>
<td>80</td>
<td>114</td>
<td>20</td>
<td>44</td>
<td>47</td>
<td>15</td>
<td>8</td>
<td>5</td>
<td>17</td>
<td>42</td>
</tr>
</tbody>
</table>

Our sincere thanks to the University of Mysore for facilities.

P. G. Department of Botany, University of Mysore,
Manasagangotri, Mysore 570 006,