Holcus mollis L. var. parviflorus Parn. (Poaceae): an erroneous interpretation of abnormal morphology caused by fungi

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Received July 1999; accepted for publication July 2000

During biometric studies it was observed that several specimens of Holcus mollis L. presented a peculiar but constant morphology caused by the presence of Tilletia holci (Westend.) J. Schröt. These changes in morphology were very clear in the spikelet where glumes were shorter and larger and both florets were awned. This morphology closely matches the description of Holcus mollis L. var. parviflorus Parn. The type material was also infected with Tilletia holci. Taxonomic distinction of infected plants is not acceptable.


INTRODUCTION
Gay (1858) reported taxonomic problems caused by Tilletia in Poaceae. The changes in the structure of anthers and ovaries he described for Aira subtriflora Lag. (= Deschampsia caespitosa (L.) P. Beauv. subsp. subtriflora (Lag.) Ehr. Bayer & G. López (Bayer & López, 1994) correspond to our observations in all the infected specimens of Holcus mollis L. Deformations caused by Tilletia are well documented. Viennot-Bourgin (1937) described several deformations on the vegetative and reproductive structures of Triticum; these deformations were also anatomical.

Examples of taxonomic assumptions based on infected specimens include Agrostis pumila L. Linnaeus (1767) described A. pumila based on, among other characters, the large size of the ovaries ("semian majuscula"). Roemer & Schultes (1817) recognized that the morphology described by Linnaeus was caused by fungal infection and they included A. pumila under a varietal category of A. vulgaris Schrad. ("... spiculis ovatis, seminibus conspicuis turgidiculis ustilagine corruptis, stylus persistentibus..." p. 351).

MATERIAL AND METHODS
Studied material came from loans from E (Edinburgh, Scotland), COI (Coimbra, Portugal), RO (Rome, Italy) and MPU (Montpellier, France) herbaria.

SPECIMENS EXAMINED

Macroscopic analysis and photography were undertaken with a binocular microscope Zeiss model SV 11 APO. Microscope slides mounted in PVA (Omar, Bolland & Heather, 1979) were made for all specimens.

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Table 1. Morphological differences between infected (FI, MPU and E) and uninfected specimens of Holcus mollis. All measurements in mm

<table>
<thead>
<tr>
<th></th>
<th>Spikelet</th>
<th>Lower glume</th>
<th>Upper glume</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>FI</td>
<td>MPU</td>
</tr>
<tr>
<td>Length</td>
<td>4.35</td>
<td>3.87</td>
<td>4.16</td>
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<tr>
<td>Width</td>
<td>3.87</td>
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<td>3.68</td>
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<tr>
<td>Height</td>
<td>3.87</td>
<td>3.68</td>
<td>3.68</td>
</tr>
<tr>
<td>(min.) average</td>
<td>(4.26)</td>
<td>(3.68)</td>
<td>(4.11)</td>
</tr>
<tr>
<td>(max.)</td>
<td>(5.54)</td>
<td>(6.58)</td>
<td>(6.58)</td>
</tr>
</tbody>
</table>

Second rachis  
First flower lemma  
First flower palea  
Second flower palea

<table>
<thead>
<tr>
<th></th>
<th>FI</th>
<th>MPU</th>
<th>E</th>
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</thead>
<tbody>
<tr>
<td>Length</td>
<td>0.55</td>
<td>1.79</td>
<td>1.67</td>
</tr>
<tr>
<td>Width</td>
<td>0.52</td>
<td>1.74</td>
<td>1.64</td>
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<tr>
<td>Height</td>
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<td>1.76</td>
<td>1.72</td>
</tr>
<tr>
<td>(min.) average</td>
<td>(0.59)</td>
<td>(1.89)</td>
<td>(1.69)</td>
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<tr>
<td>(max.)</td>
<td>(0.75)</td>
<td>(2.42)</td>
<td>(2.17)</td>
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Fungal spores were observed by light microscopy (Reichert-Jung MicroStar 110), photographed using a SEM after ‘critical point’ drying, and identified following Vanky (1994).

RESULTS AND DISCUSSION

Biometric studies included 64 uninfected and three infected specimens (FI [Adr. Fiori, 24.vii.1884]; MPU [E. Reverchon, 15.vii.1879]; E [E00037488]), and 54 characters. Table 1 summarizes the results obtained for seven key characters.

All infected specimens of Holcus mollis L. studied presented a constant morphology with a general reduction in habit and vegetative characters, and a very clear change in spikelet morphology (Table 1, Figs 1 & 2). This abnormal morphology is consistent with the description of Holcus mollis L. var. parviflorus Parn. and we confirm that the type of Holcus mollis L. var. parviflorus Parn. was also infected with Tilletia holci (Figs 3 & 4). Parnell (1842) refers to Holcus mollis var. parviflorus as “(. . .) a variety from nine to twelve inches high with very small spikelets (. . .), being not more than half the size of those of Holcus mollis.”


CONCLUSIONS

Specimens of Holcus mollis L. infected with Tilletia holci show a constant change in their morphology
corresponding to *Holcus mollis* L. var. *parviflorus* Parn. Taxonomic distinction of infected plants is not acceptable. Several infraspecific taxa have been described for *Holcus mollis* L. In *Flora Europaea* (Tutin, 1980), only *Holcus mollis* L. ssp. *reuteri* (Boiss.) Tutin is accepted. Several of these infraspecific taxa are based on characters resulting from fungal infections. Future investigations will attempt to resolve their position.

**ACKNOWLEDGEMENTS**

*Holcus* taxonomy and biometry are part of the PhD research project of MMS funded by the Fundação Calouste Gulbenkian. TA wishes to thank the Spanish MEC for assistance with the research ‘Estudio biotaxonomico de los Ustilaginales ibéricos’, part of the project *Flora Mycologica Iberica III*, PB95-0129-C03-01.

**REFERENCES**


