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**PLEOSPORA STRAMINIS, P. RUBELLOIDES AND
P. RUBICUNDA: THREE FUNGI CAUSING PURPLE-
STAINING OF DECAYING TISSUES**

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(With 3 Text-figures)

Pleospora straminis, previously unrecorded for Britain is described. *P. rubelloides* comb.nov. is described and compared with the related *P. rubicunda* on the host and in culture.

Herbaceous and woody debris decaying in damp situations, frequently shows purple staining. Various fungi such as *Leptosphaeria* spp., *Ophiobolus rubellus* and *Lophiotrema* sp. are sometimes present, but three species of *Pleospora* have been found associated with the purple stain. Since there has been some confusion in the nomenclature of these fungi, they are described below:

PLEOSPORA STRAMINIS Saccardo, *Michelia*, 1, 407, 1879 (Fig. 1)

= *P. obliqua* Wehmeyer, *Mycologia*, 43, 579, 1951.

Several collections of this fungus on grasses, are in the Sheffield Herbarium:

Herb. Sheffield number	Host	Locality	Date
225	Wheat stubble	Londesborough, nr. Market Weighton, Yorks	26. vi. 49
226	Barley stubble	King's Lynn, Norfolk	7. viii. 49
227	Barley stubble	King's Lynn, Norfolk	7. viii. 49
821	<i>Dactylis glomerata</i>	Lindrick Common, nr. Worksop, Notts	15. vii. 50
1046	Wheat stubble	Bolton Percy, York. (coll. W. G. Bramley)	17. iii. 51

The following description is based on specimen 225 (see Fig. 1).

Perithecia, single beneath leaf sheath or stem, associated with a purple coloration; black, thin-walled, globose, surrounded at the base by sparse black hyphae, neck papillate, projecting; 240-390 μ in diameter. *Asci*, broadly club-shaped, rounded at the tip, tapering to a short stalk below, bitunicate, 3-8 spored, 130-192 \times 23-32 μ interspersed by branched filiform 'paraphyses'.

Ascospores, biseriata in the upper portion of the ascus, uniseriate below, oblong-elliptical with rounded ends, the upper half of the spore larger than the lower, with nine to eleven transverse septa, constricted at the septa,

especially at the middle, and with numerous longitudinal septa; golden-yellow in colour, brown with age; $26-34 \times 10-12 \mu$.

Cultures. On potato-dextrose agar the fungus grew slowly (2.5 cm. in 6 weeks at room temperature), producing a pink colour in the medium, the colonies becoming black at the margins. Perithecia were formed in 4 weeks in cultures started from either single ascospores or asci, and were

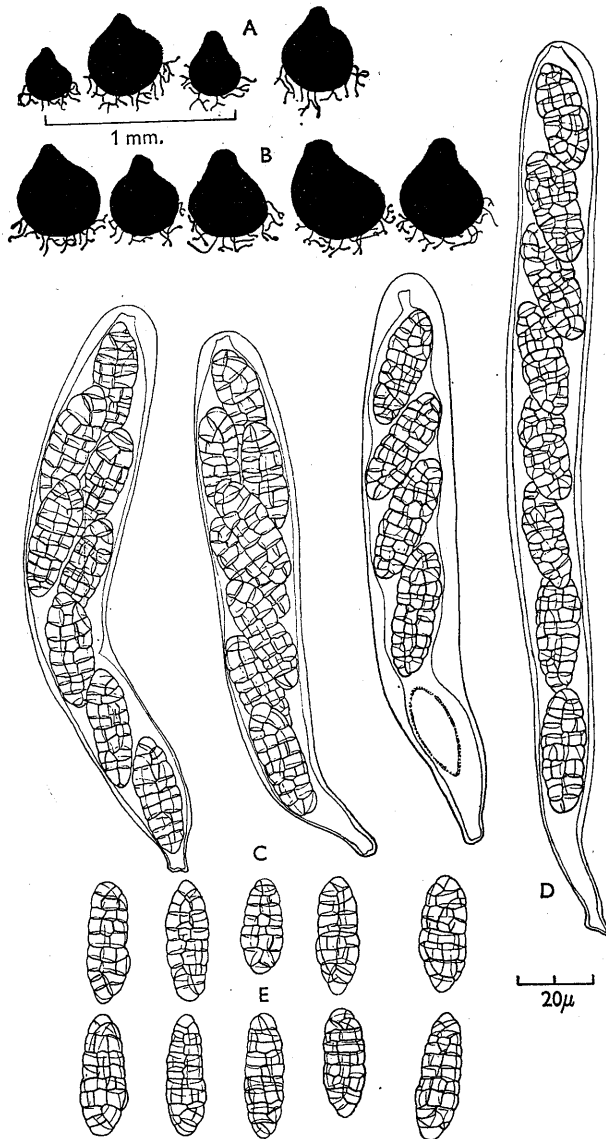


Fig. 1. *Pleospora straminis*. A, outlines of perithecia from stubble; B, outlines of perithecia from culture on P.D.A.; C, asci from the host; D, ascus from culture; E, ascospores from the host (Herb. Sheffield 225.).

frequently larger than those on stubble, measuring 330–450 μ in diameter. The asci were also larger, 155–230 \times 20–27 μ .

For measurements of asci and ascospores from other collections see Table 1.

Wehmeyer (1951) has re-described *P. straminis* as *P. obliqua*. Material from specimen 255 was at first identified by him as *P. obliqua*. Later, having seen authentic material of *P. straminis* (which I had been unable to obtain), he agreed that specimen 255 was identical with *P. straminis*. There is a curious discrepancy in the measurements given for this fungus, however. Saccardo's measurements (see Table 1) are appreciably larger than those given by Berlese from the type, which match more closely those from the present collections.

PLEOSPORA RUBICUNDA Niessl., *Verh. naturforsch. Ver. Brünn*, 14, 1876.
(Fig. 2)

Several collections of this fungus have been made, mainly on various kinds of plant debris near the sea. The following description is based on Herb. Sheffield no. 366 on *Artemisia* (?), Wolferton Marshes, Norfolk, 6 August 1948.

Perithecia, purple to black in colour; seated on purple-stained areas of tissue, developing beneath the surface, later semi-erumpent with about half the perithecium exposed, subglobose or elongated parallel to the long axis of the host, up to 400 μ in diameter; neck papillate, ostiole often slit-like; perithecial wall uneven in thickness, 40–50 μ thick above, about 30 μ thick below. *Asci*, bitunicate, numerous, broadly club-shaped to cylindrical, rounded above, tapering to a stalk below, up to 8-spored, 170–240 \times 16–22 μ ; separated by numerous branched 'paraphyses'. *Ascospores*, biseriate in the broader portion of the ascus, uniseriate below, crescent-shaped when viewed laterally, with 9–13 transverse septa and one or more longitudinal septa in the middle cells, tapering and rounded at the ends, constricted at the septa, especially in the middle; yellow to brown in colour, 30–40 \times 8–12 μ .

Cultures. Ascospores germinated readily on agar media producing germ tubes, apparently from any cell. Cultures started from single ascospores and single asci were transferred to slopes of oat or potato-dextrose agar. The fungus grew slowly, forming colonies about 5 cm. in diameter in 2 months, with a characteristic purple colour in the medium and low pale aerial mycelium. Pycnidia of the *Phoma* type were found in 2-month-old cultures. The pycnidia were up to 500 μ in diameter, subglobose, wall thin (10–15 μ) black, composed of dark interwoven hyphae. The sporophores form a palisade of hyaline skittle-shaped cells lining the wall and abstrict spherical to broadly elliptical hyaline pycnosporos about 2 μ in diameter. Masses of pycnosporos exude as flesh-coloured drops from the ostioles of the pycnidia. Perithecia have been found only once in culture (a multi-ascospore isolate of specimen 1723). When discovered, these perithecia were in poor condition and contained collapsed and distorted ascospores.

Pycnidia. Pycnidia resembling those found in culture have been found associated with perithecia. They are globose, submerged at first, later more

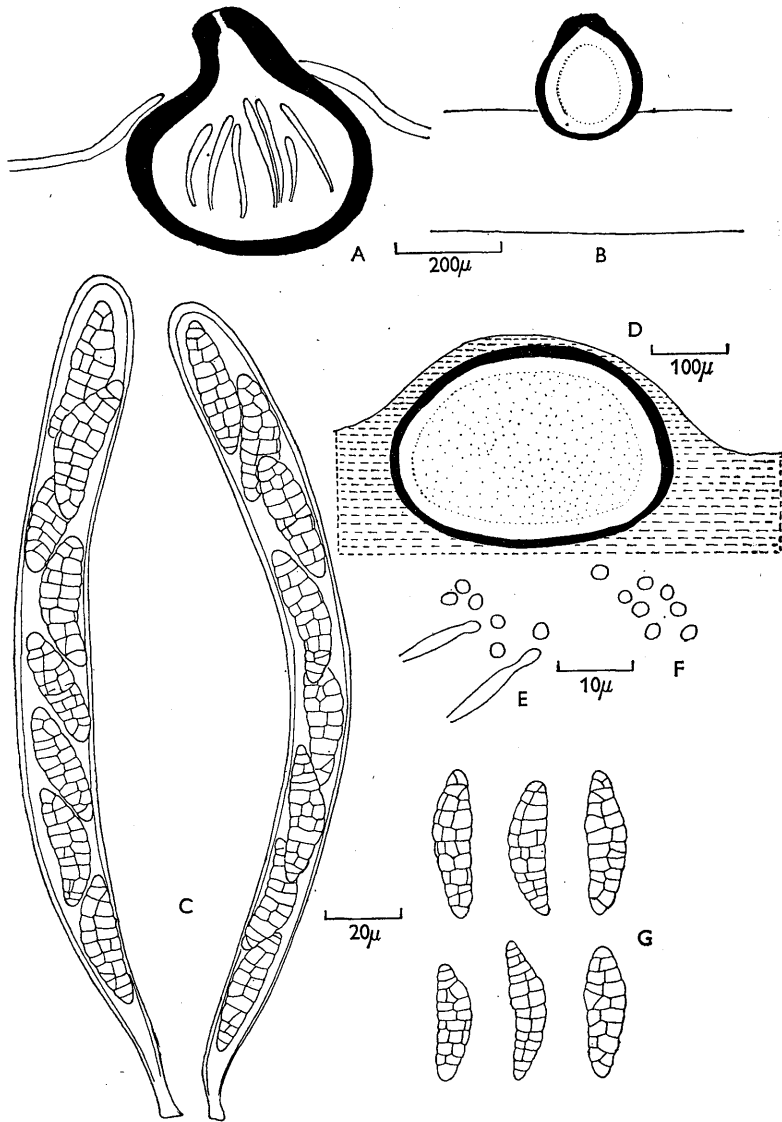


Fig. 2. *Pleospora rubicunda*. A, L.S. host stem and perithecium; B, L.S. host stem and pycnidium; C, asci from the host; D, section of culture showing pycnidium; E, pycnospores and sporophores from the host; F, pycnospores from culture; G, ascospores from the host. (A, C, D, G, from Herb. Sheffield 336; B, E, from Herb. Sheffield 1752 B.)

superficial, up to 200μ in diameter, thin-walled and containing numerous spherical or elliptical pycnospores about 2μ in diameter. When pycnospores from the host are transferred to agar media, they germinate after about 1 week, giving rise to cultures which resemble those derived from ascospores.

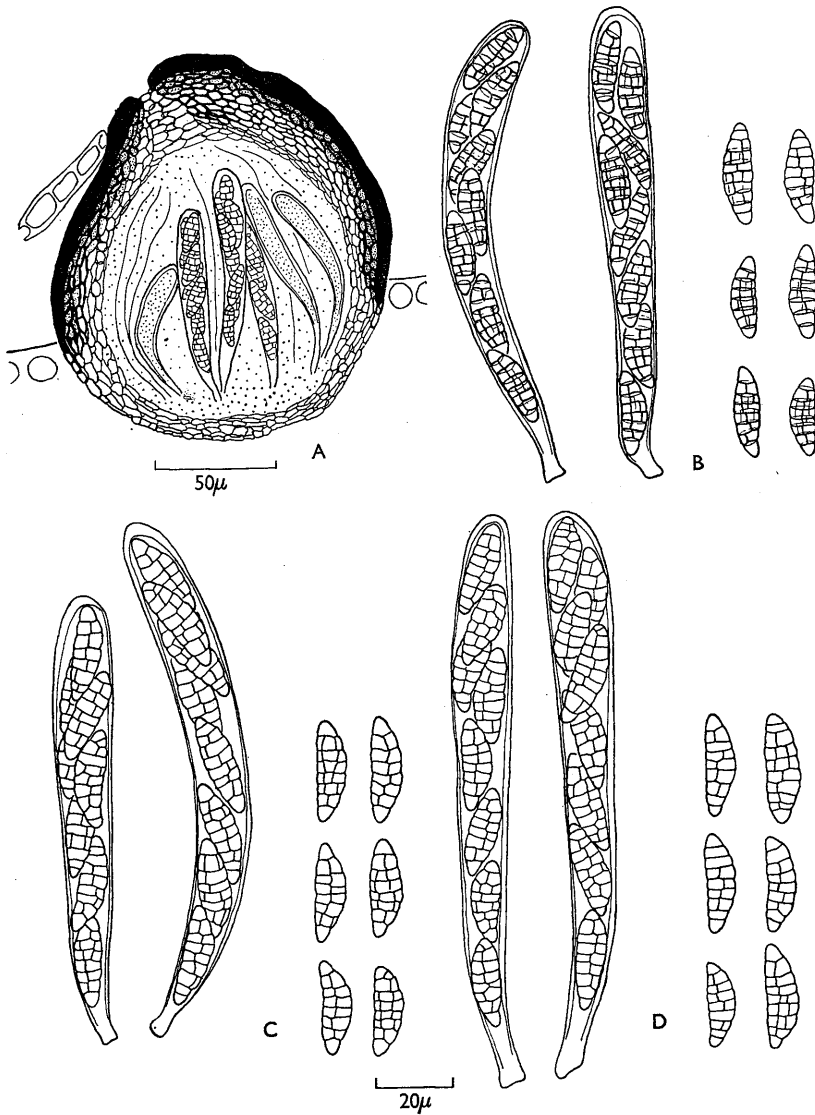


Fig. 3. *Pleospora rubelloides*. A, L.S. wheat stem and perithecium; B, asci and ascospores; C, asci and ascospores from the host; D, asci and ascospores from culture on oat agar. (A, C, D, from Herb. Sheffield 1722; B from the type specimen of *Sphaeria rubelloides*.)

Other collections. I have collected the fungus in Britain, France and Denmark only in maritime habitats, on the following hosts: *Artemisia* (?), *Lepidium latifolium* and *Halimione portulacoides*, and on various fragments of unidentified debris washed up by the sea, including woody plants. Niessl's original collection from Brünn was on *Sambucus ebulus*, but the fate of this specimen is not known. The dimensions of some recent collections and the type are listed in Table 2.

Table 1. Dimensions (in μ) of perithecia, asci and ascospores of *Pleospora straminis*

Specimen or authority	Diameter of perithecia		Dimension of asci		Dimensions of ascospores	
	Host	Culture	Host	Culture	Host	Culture
	Saccardo, 1879	330	—	140-150 × 25-30	—	40-45 × 16-18
Type (Berlese, 1900)	300-350	—	120-130 × 24-28	—	34-38 × 12-14	—
Sheffield 225	240-390	330-450	130-192 × 23-32	155-230 × 20-27	26-34 × 10-12	24-37 × 9-12
Sheffield 226	360-460	—	120-190 × 20-26	—	30-41 × 11-13	—
Sheffield 227	180-250	—	120-170 × 20-24	—	29-37 × 10.5-12.5	—
Sheffield 821	240-260	350-650	104-140 × 20-27	100-190 × 20-26	25-34 × 10-14	30-36 × 11-13

Table 2. Dimensions (in μ) of perithecia, asci and ascospores of *Pleospora rubicunda*

Specimen or authority	Host	Diameter of perithecia	Dimensions of asci	Dimensions of ascospores	Transverse septa
Type (Berlese, 1900)	<i>Sambucus ebulus</i>	250-350	110-130 × 14-18	26-32 × 8-10	12-15
Sheffield 366*	<i>Artemisia?</i>	300-400	170-240 × 16-22	30-40 × 8-12	9-13
Sheffield 855	Unidentified	250-320	130-200 × 18-20	29-36 × 9-11	7-10
Sheffield 856*	Unidentified	250-400	170-200 × 18-20	30-40 × 9-12	9-10
Sheffield 857	Unidentified	300-400	200 × 20-22	30-40 × 9.5-12	9-10
Sheffield 861	Unidentified	300-400	150-180 × 20-22	34-41 × 10-12	9-10
Sheffield 863	<i>Halimione portulacoides</i>	350	150-170 × 18-22	34-40 × 9-11	8-11
Sheffield 1674*	Unidentified	320-400	180-190 × 18-20	28-32 × 9-10	9-10
Sheffield 1723*	<i>Spartina?</i>	400	130-180 × 18-20	35-46 × 10-12	9-11
Sheffield 1727*	Unidentified	320-350	210-270 × 20-24	30-44 × 8-13	9-11
Sheffield 1752*	<i>Lepidium latifolium</i>	290-320	154-166 × 20-24	32-40 × 9-10	9-10

* Produced *Phoma pycnidia* in culture.

Pleospora rubelloides (Plowright ex Cooke) comb.nov. (Fig. 3)

= *Sphaeria rubelloides* Plowright ex M. C. Cooke, *Grevillea*, 5, 120, 1877.

Leptosphaeria rubelloides (Plowright) Sacc., *Sylloge Fungorum*, 2, 77, 1883.

Pleospora minor Wehmeyer, *Amer. J. Bot.* 39, 242, 1952.

Cooke (1877) described this fungus as follows:

'*Sphaeria rubelloides*. Plow. Perithecia scattered, soon exposed, mostly seated on reddish stains; asci lanceolate, sporidia fusiform, multiseptate (about 9) yellow. On putrid culms of *Triticum repens*, King's Lynn (C.B.P.) Sporidia 0.3×0.07 mm.' Examination of Plowright's specimens in Herb. Kew. (on *Triticum repens*, Ap. 1876 Sea Bank, King's Lynn), showed that the fungus is a *Pleospora*. Unfortunately, since the description makes no mention of longitudinal septa, Saccardo (1883) compiled it as a *Leptosphaeria*. Berlese (1894) added support to this transfer by citing it as a synonym of *L. culmiphraga* (Fr.) Ces. & de Not. Wehmeyer (1952) has since redescribed the fungus under the name *Pleospora minor*. Curiously, his description is based on a later collection of Plowright's from King's Lynn, labelled *P. rubicunda* Niessl. Plowright evidently was confused between his *Sphaeria rubelloides* and *Pleospora rubicunda*. In 1877 Phillips & Plowright listed '*Sphaeria* (*Pleospora*) *rubicunda* Niessl. South Wootton. May, 1877. Sporidia 35-10 mk. On *Juncus*. Differing from *Sp. rubelloides*, Plow., *Grevillea*, Vol. v, p. 120, in the larger and muriform sporidia.' This specimen (Plowright Sph. Britt. 3, no. 70), however, matches the type material of *S. rubelloides*. A later specimen (Plowright Sph. Britt. 3, no. 71) labelled '*Sphaeria* (*Pl.*) *rubicunda* Niessl Lynn 1879, *Sp. rubelloides*, Plow. on putrid grass', also matches *S. rubelloides*. Collections by Plowright on rotten wood, Brandon, Norfolk, 1879, in Cooke's Herbarium at Kew are also of *S. rubelloides*, although labelled *Pleospora rubicunda*. *P. rubicunda* and *Sphaeria rubelloides* are, however, distinct, and in view of the confusion, the type specimen of *S. rubelloides* is redescribed.

Perithecia, black, up to 250μ in diameter, globose or somewhat elongated parallel to the stem, subepidermal, piercing the epidermis by a small papillate ostiole, later raising the epidermis and becoming almost superficial; seated on purple-coloured patches on the decaying stems. *Asci*, numerous, club-shaped, tapering at the base to a short stalk, rounded at the apex, bitunicate, usually 8-spored; $94-120 \times 12-16 \mu$. *Ascospores*, uniseriate in the lower portion of the ascus, irregularly biseriate above; yellow to brown in colour, crescent-shaped when viewed laterally, with one face flattened, the other sharply curved, tapering at the ends, with six to nine transverse septa (usually seven) and a variable number of longitudinal septa in all but the end cells; slightly constricted at the transverse septa, especially at the middle; $20-26 \times 6-8 \mu$.

Other collections. Over fifty other collections have been made on various hosts in Britain, France and Denmark. The fungus is common during the summer on old straw and grasses rotting under damp conditions, but is also found on other plant debris, especially in estuaries, salt marshes and sand dunes, along with the related *Pleospora rubicunda*. The fungus has been collected on the following hosts: *Agropyron repens*, *A. junceiforme*, *Ammophila*

arenaria, *Arctium minus*, *Dactylis glomerata*, *Elymus arenarius*, *Festuca arundinacea*, *Melilotus altissima*, *Scirpus maritimus* and on wheat and barley stubble. The range of variation is naturally greater than that found in the type specimen, and the dimensions of perithecia, asci, ascospores on the host and in culture are listed below (Table 3). In certain collections, the size of the ascospores is appreciably greater than in the type collection (e.g. $26-34 \times 7-10 \mu$ in specimen 212, and $26-36 \times 9-11 \mu$ in specimen 1743). The number of transverse septa may also be greater. However, the size of ascospores obtained in cultures from such collections, approximates more closely to that of the type.

Cultures. Ascospores transferred to agar media germinate overnight, producing a germ tube from any cell. The fungus is homothallic and forms perithecia readily within 2 months on oat agar slopes. The characteristic purple coloration is formed in the medium as a secretion of the hyphae, which are colourless. A low-growing felt of white aerial mycelium covers the surface of the medium and the perithecia, which are formed within 2 months, are frequently in contact with the glass of the culture vessel. The perithecia are globose with a short blunt neck, and may be larger than those found on the host, measuring up to 500μ . Similarly, the asci may be longer (up to 180μ in culture, compared with up to 140μ on the host). The dimensions of the ascospores formed in culture show less variation, however, than those on the host. No other type of fructification has been seen in cultures of *P. rubelloides*.

DISCUSSION

The three fungi described above are clearly related to each other. Berlese (1888) pointed out that 'La *Pleospora rubicunda* è affine alla *Pleospora straminis*'. *P. rubicunda* and *P. rubelloides* are, perhaps, more closely similar. Whilst most collections of *P. rubicunda* can generally be separated from the majority of collections of *P. rubelloides* by the larger perithecia, longer and wider asci, and larger ascospores with more numerous transverse septa, none of these characters is completely reliable due to the overlap in the range of dimensions in the two species. Indeed, certain collections here assigned to *P. rubelloides* (e.g. 212 on *Agropyron repens* and 1743 on *Ammophila arenaria*) with rather large spores or wide asci, have been determined only after recourse to cultures. The absence of a *Phoma* stage in culture and the production of perithecia in single ascospore cultures, have been taken as evidence supporting this determination, and this is further supported by the more normal size of ascospores in culture in specimen 212. The existence of such 'intermediate' collections raises the question whether we should consider the two 'species' as a single more variable one. At present the only reliable criterion separating the two species is the production of a 'Phoma' stage in cultures assigned to *P. rubicunda*. Perithecia have been found only once in *P. rubicunda* in a multi-ascospore culture, and have never been observed in cultures derived from single ascospores, whilst in *P. rubelloides* perithecia are formed readily in single ascospore cultures. This may imply that whilst *P. rubelloides* is homothallic, *P. rubicunda* is heterothallic, but the evidence on this point is not completely satisfactory.

Table 3. Dimensions (in μ) of perithecia, asci and ascospores of *Pleospora rubelloides*

Specimen	Host	Diameter of perithecia		Dimensions of asci		Dimensions of spores		Transverse septa	
		Host	Culture	Host	Culture	Host	Culture	Host	Culture
Type	<i>Agropyron repens</i>	250	—	94-120 x 12-16	—	20-26 x 6-8	—	6-9	—
Sph. Britt. III, 71	Putrid grass	250	—	116-130 x 17-21	—	24-33 x 7.5-10	—	8-10	—
Herb. M. C. Cooke	Rotten wood (Brandon)	200-300	—	86-130 x 13-17	—	22-28 x 6-8	—	7-9	—
Sheffield 212	<i>Agropyron repens</i>	200-320	300-350	98-136 x 15-19	130-180 x 12-16	26-34 x 7-10	22-27 x 6.5-8	8-12	7-9
Sheffield 850	<i>A. repens</i>	200-240	300-500	86-168 x 16-17	106-112 x 14-15	23-28 x 7-8	22-28 x 6.5-9	7-9	7-9
Sheffield 853	<i>A. repens</i>	160-200	300-400	80-90 x 14-16	114-120 x 16-18	20-22 x 7	22-30 x 7-10	7	7-9
Sheffield 1722	Wheat straw	200-250	200-350	94-120 x 15-16	120-150 x 13-18	20-26 x 6.5-8	22-30 x 6.5-9	6-8	7-9
Sheffield 1739	<i>Festuca arundinacea</i>	200-240	200-380	120-140 x 15-16	124-170 x 14-17	22-25 x 7.5-8	22-26 x 6.5-8	7-9	7-8
Sheffield 1740	<i>Melilotus alhissima</i>	200-250	250	120-130 x 14-16	130-140 x 13-15	24-28 x 7-9	22-25 x 7-8	7-8	7-9
Sheffield 1743	<i>Ammophila arenaria</i>	250-300	200-290	110-150 x 20-24	120-140 x 20-22	26-36 x 9-11	27-34 x 8.5-11	8-10	8-10
Sheffield 1748	<i>Scirpus maritimus</i>	200-250	250-350	100-120 x 14-16	130-160 x 14-16	22-28 x 7-8	25-30 x 8-10	7-9	7-8
Sheffield 1749	<i>Elymus arenarius</i>	200-250	200-300	100-115 x 15-16	110-150 x 14-18	22-28 x 7-8	27-32 x 8-10	7-9	7-9
Sheffield 1750	<i>Festuca arundinacea</i>	280-350	250-300	100-114 x 14-16	120-160 x 14-16	21-28 x 6.5-7	24-32 x 8-9	7-9	7-9
Sheffield 1751	Barley straw	250-300	200-250	100-110 x 13-16	130-140 x 14-18	20-26 x 7-8	26-32 x 7-9	7-8	7-9

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REFERENCES

- BERLESE, A. N. (1888). Monografia dei generi *Pleospora*, *Clathrospora* and *Pyrenophora*. *Nuovo Giorn. Bot. Ital.* **20**, 5-176.
- BERLESE, A. N. (1894). *Icones fungorum omnium hucusque cognitorum*, **1**.
- BERLESE, A. N. (1900). *Icones fungorum omnium hucusque cognitorum*, **2**.
- COOKE, M. C. (1877). New British Fungi. *Grevillea*, **5**, 118-122.
- NIESSL, G. (1876). Notizen über neue und kritische Pyrenomyceten. *Verh. naturf. ver. Brünn.* **14**, 165-208.
- PHILLIPS, W. & PLOWRIGHT, C. B. (1877). New and rare British fungi. *Grevillea*, **6**, 22-29.
- SACCARDO, P. A. (1879). Fungi veneti novi vel critici vel Mycologiae Veneti addendi. IX. *Michelia*, **1**, 359-445.
- SACCARDO, P. A. (1883). *Sylloge Fungorum omnium hucusque cognitorum*, **2**.
- WEHMEYER, L. E. (1951). Studies in the genus *Pleospora*. IV. *Mycologia*, **43**, 570-589.
- WEHMEYER, L. E. (1952). Studies in the genus *Pleospora*. VI. *Amer. J. Bot.* **39**, 237-243.

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