

# **JAMESDICKSONIA IRREGULARIS, NEWLY RECOGNIZED IN POLAND, WITH A NOTE ON THE GENUS JAMESDICKSONIA (USTILAGINOMYCETES)**

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**Abstract.** *Jamesdicksonia irregularis* (Johanson) R. Bauer, Begerow, A. Nagler & Oberw. collected in Poland is described, illustrated and discussed. The grass disease caused by this fungus is also briefly described. This is the first report of *Jamesdicksonia irregularis* in the country. The genus *Jamesdicksonia* Thirum., Pavgi & Payak *emend.* R. Bauer, Begerow, A. Nagler & Oberw. is briefly reviewed and discussed. The sixteen species included in the genus, including two newly added, *J. brizae* (Unamuno & Cif.) M. Piątek & Vánky, *comb. nov.* and *J. parva* (Davis) M. Piątek & Vánky, *comb. nov.*, are enumerated together with their taxonomic synonyms, host plants and geographical distribution.

**Key words:** *Jamesdicksonia*, Georfisferiales, Ustilaginomycetes, blister smut, Poland

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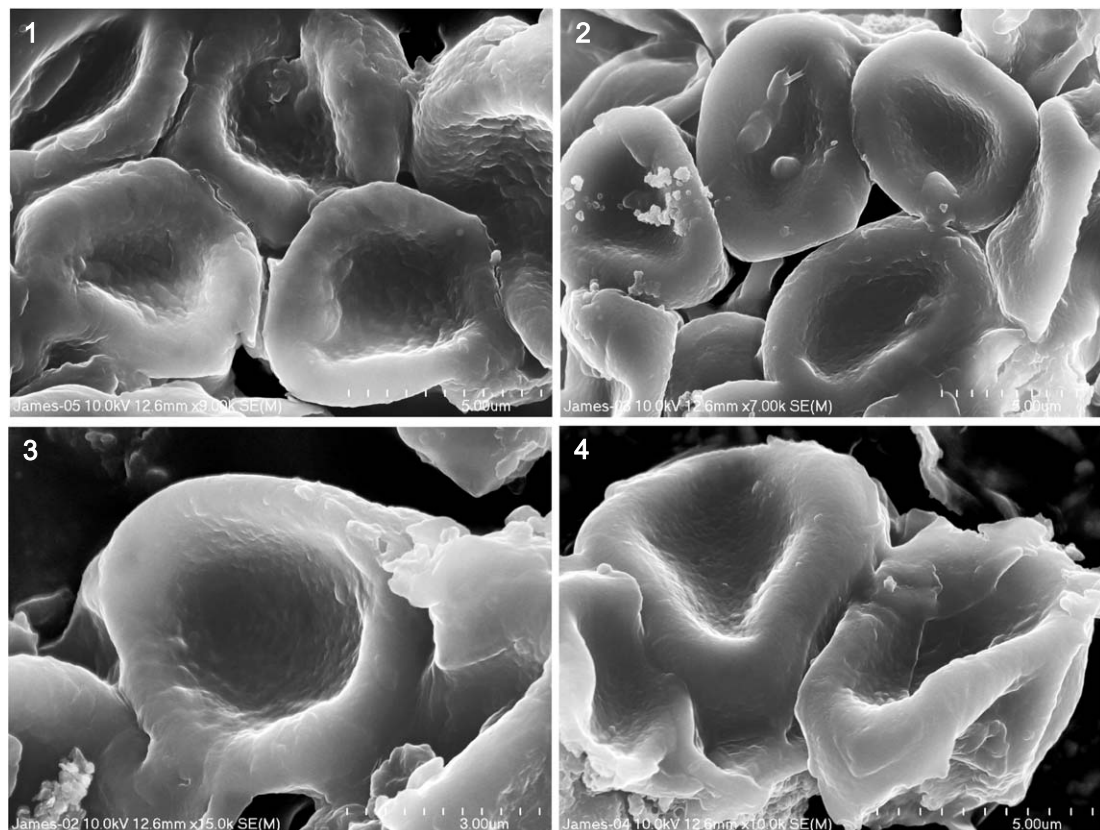
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## INTRODUCTION

Smut fungi on grasses with smooth, darkly pigmented spores when observed by a light microscope, embedded in the host tissues and not exposed by their rupture, were traditionally included in the genera *Entyloma* de Bary or *Melanotaenium* de Bary. However, recent studies of Bauer *et al.* (2001) have shown that they belong to three genera of Georfisferiales, namely: *Eballistra* R. Bauer, Begerow, A. Nagler & Oberw., *Jamesdicksonia* Thirum., Pavgi & Payak *emend.* R. Bauer, Begerow, A. Nagler & Oberw., and *Phragmotaenium* R. Bauer, Begerow, A. Nagler & Oberw. In Europe, '*Entyloma*' *dactylidis* (Pass.) Cif. *s.l.* belongs to this group. This smut fungus is considered to be a collective species differing not only by various hosts, but also by various types of spore germinations on particular host genera (Vánky 1994). Two species from this species complex, '*Entyloma*' *irregularis* Johanson and '*Entyloma*' *brizae* Unamuno & Cif., which were described at the end of 19th and the beginning of 20th centuries, but were later forgotten or considered synonymous with *E. dactylidis*, have recently been reinstated as good

taxa (Vánky 1994). Their appropriate generic name is *Jamesdicksonia* (for arguments see below).

*Jamesdicksonia dactylidis* (Pass.) R. Bauer, Begerow, A. Nagler & Oberw. has been reported from Poland several times on various grasses, including '*Agrostis alba*' (*A. gigantea* Roth or *A. stolonifera* L.), *Cynosurus cristatus* L., *Dactylis glomerata* L., *Festuca rubra* L., *Holcus lanatus* L., *Poa palustris* L. and *Poa pratensis* L. (Mikołajska 1971; Kochman & Majewski 1973; Kućmierz 1976, 1977a, b; Michalski 1982; Danilkiewicz 1987; Mułenko 1989; Prończuk & Prończuk 1997, 2004; Prończuk 2000; Prończuk *et al.* 2003). When these fungus/host combinations were analysed by the first author using the monograph by Vánky (1994), it became obvious that almost all reports indeed belonged to *J. dactylidis*. However, the collection on *Poa pratensis* (Prończuk & Prończuk 1997; Prończuk 2000) was presumed to belong to a different species, viz. *Jamesdicksonia irregularis* (Johanson) R. Bauer, Begerow, A. Nagler & Oberw. The examination of the relevant voucher specimen confirmed this supposition. This is the first report of



**Figs 1–4.** Spores of *Jamesdicksonia irregularis* (Johanson) R. Bauer, Begerow, A. Nagler & Oberw. on *Poa pratensis* L., as seen by SEM (HeMP-5).

*J. irregularis* in Poland. The species is described, illustrated and discussed below, and some remarks on the disease caused by it are given. In addition, a short review of species included in *Jamesdicksonia* is provided, and two new combinations into this genus are proposed.

#### MATERIAL AND METHODS

The leaves of *Poa pratensis* infected by *Jamesdicksonia irregularis* were collected in Radzików (central Poland), taken to the laboratory and examined in LM and SEM. The voucher specimen was deposited in HeMP (= herbarium of the first author). For light microscopy (LM) studies, freehand sections through leaves with sori were mounted in 5% KOH and examined under NIKON Eclipse E600 light microscope. For scanning electron microscopy (SEM) studies, squashed fragments of plant tissue with spores were mounted on clean glass

and fixed to an aluminium stub with double-sided transparent tape. The stubs were sputter-coated with carbon using a CRESSINGTON sputter-coater and viewed with a Hitachi S-4700 scanning electron microscope, with a working distance of ca 12–13 mm. SEM micrographs were taken in the Laboratory of Field Emission Scanning Electron Microscopy and Microanalysis at the Institute of Geological Sciences of the Jagiellonian University, Kraków (Poland).

The review of the known species of *Jamesdicksonia* is based on the data obtained from the literature (most important sources: Vánky 1994, 1996, 2002, 2003a, b, 2004a, b, 2005, 2006; Walker & Shivas 1998; Bauer *et al.* 2001; Vánky & McKenzie 2002; Piepenbring 2003) as well as from the database associated with the Systematic Botany and Mycology Laboratory, U.S. Department of Agriculture, Agricultural Research Service (Farr *et al.* 2005). The nomenclature of host plants mostly follows Capels and Barkworth (2005) and *The International Plant Names Index* (<http://www.ipni.org/index.html>).

## RESULTS AND DISCUSSION

*Jamesdicksonia irregularis* (Johanson) R. Bauer, Begerow, A. Nagler & Oberw. (Figs 1–4)

Sori in the leaves as small, elongate to ovate, slightly pustular black spots, 0.1–2.0 mm long, scattered on the leaves or in small groups. Spores densely packed, closely agglutinated, extremely variable in shape and size, many of them angular to strongly irregular, blackish-brown, 8–10 × 8–15 µm, with thick wall, up to 2 µm wide, surface of spores smooth in LM and SEM. Anamorph often present (but not in our specimen).

**SPECIMEN EXAMINED.** On *Poa pratensis* L. 'Barvictor'. POLAND. NIZINY ŚRODKOWOPOLSKIE LOWLANDS: Radzików, near Warszawa, 15 Mar. 1997, leg. M. Prończuk (HeMP-5).

*Jamesdicksonia irregularis* is a characteristic and distinct species differing from the similar *J. dactylidis* by more irregular, agglutinated spores, and a different type of germination (Vánky 1994). Furthermore, although it was not observed in the present study, it is often accompanied by an anamorph (Johanson 1884; Vánky 1994). It also occurs on different host species and is much rarer than the widespread *J. dactylidis*. The specific distinctiveness of *J. irregularis* is also confirmed by molecular studies (Bauer *et al.* 2001).

*Jamesdicksonia irregularis* parasitizes host plants belonging to the genus *Poa*, namely *Poa annua* L., *P. pratensis* and *P. trivialis* L. in Asia, Europe, North America and New Zealand (Vánky 1994; Vánky & McKenzie 2002). There are also records of this species on *Poa compressa* L., *P. secunda* J. Presl subsp. *juncifolia* (Scribn.) Soreng and *Poa* sp. from the U.S.A. (Anonymous 1960), but these records must be confirmed by examination of herbarium specimens. *Jamesdicksonia dactylidis*, on the other hand, was reported on numerous host genera and species, almost from all the continents, with the exception of Australia and Antarctica. However, as stated in the introduction, *J. dactylidis* is currently considered to be a collective species whose clarification requires extensive combined morphological and molecular studies.

The species of *Jamesdicksonia* are known as the causal agents of grass disease called blister smut. This disease occurs on many grass species grown for forage and turf (Mühle *et al.* 1971; Smiley *et al.* 1992). However, blister smut is more severe on grass grown for turf under intensive management. According to Smiley *et al.* (1992), smut diseases are encouraged by high nitrogen and low phosphorus and potassium fertilization. Excess thatch and acid soil also promote disease development. Blister smut is most apparent in autumn and spring. The species of *Jamesdicksonia* survive winter as spores in soil, thatch or infected foliage. Almost in all phytopathological studies, the causal agent of blister smut was identified as *Jamesdicksonia dactylidis* (usually as *Entyloma dactylidis*). Therefore, there is hardly any information on the susceptibility of grasses to *Jamesdicksonia irregularis* and the economic importance of this species.

The incidence of blister smut on *Poa pratensis* was observed in turf experiments conducted in Radzików in central Poland. Experiments were managed under medium intensive turf maintenance (180 N, 120 K<sub>2</sub>O, 60 P<sub>2</sub>O<sub>5</sub> kg·ha<sup>-1</sup>, and 25 cuts per year). Disease symptoms usually appeared in late autumn and spring. However, the occurrence and prevalence of the disease varied over the years. Severe plant infection by *Jamesdicksonia irregularis* was observed on *Poa pratensis* cultivars in autumn 1996 and spring 1997. Diseased leaves of some cultivars became first chlorotic, then bleached in colour, and had clearly visible black blisters (sori). The examined cultivars showed a considerable range of susceptibility to *J. irregularis* (Prończuk & Prończuk 1997; Prończuk 2000).

A NOTE ON THE GENUS *JAMESDICKSONIA*

The genus *Jamesdicksonia*, which belongs to the Georgefischeriaceae, was described by Thirumalachar *et al.* (1961) to accommodate *Jamesdicksonia obesa* (Syd. & P. Syd.) Thirum., Pavgi & Payak (= *Entyloma obesum* Syd. & P. Syd.) on *Dichanthium annulatum* (Forssk.) Stapf (Poaceae), characterized by unusual dark-coloured, concentrically laminated teliospores. The other smut genera with similar teliospores are *Georgefischeria* Thirum.

& Naras. in the Georfischiaceae, and *Tolyposporella* G. F. Atk. in the Tilletiariaceae within the Georfischiiales. *Jamesdicksonia* had for a long time been a unispesific genus until Walker and Shivas (1998) transferred another species, *Jamesdicksonia brunckii* (Ellis & L. D. Galloway) J. Walker & R. G. Shivas, to it. Bauer *et al.* (2001) included further five dark-spored graminicolous and cypericolous smuts previously placed in *Entyloma* or *Melanotaenium* (they combined one species invalidly) into this genus. While the latter five species do not have such characteristically laminated spores, molecular studies have shown their affinity to *J. brunckii* with the multilamellate spore wall. The emended genus *Jamesdicksonia* is characterized as having holobasidia, ballistic propagules, darkly pigmented spores and sori and occurring on Poaceae and Cyperaceae (Bauer *et al.* 2001).

Other authors (Piepenbring 2003; Vánky 2003b, 2004a, b, 2005) have described or added further species to *Jamesdicksonia*, all but one without the knowledge of their spore germination and/or molecular data that are essential in delimiting the genera of the Georfischiiales. This, however, seems to be a good solution in the case of many of dark-spored species on Poaceae previously assigned to *Entyloma* or *Melanotaenium*, especially when the material is too old to obtain germinated spores or to isolate DNA for molecular analyses. While such an approach makes the genus *Jamesdicksonia* slightly artificial, it is better to include these species in this genus than to keep them in the genera *Entyloma* or *Melanotaenium* as highly discordant elements. After ultrastructural and molecular studies (Bauer *et al.* 1997; Begerow *et al.* 1998), crucial for smut systematics and taxonomy, have been conducted, it is known that the latter two genera are restricted to host plants belonging to dicotyledonous families.

The situation of the species of *Entyloma* on Cyperaceae is more problematic as none of them have been examined by molecular methods. Two cypericolous species were included in *Jamesdicksonia* only on the basis of the type of spore germinations, which are similar to those known in graminicolous species (Bauer *et al.* 2001; Vánky 2004a). It cannot

be ruled out that molecular studies will show that cypericolous species should be accommodated in a separate genus. At this stage, they can be tentatively included in *Jamesdicksonia*.

The following review of the genus *Jamesdicksonia* includes the currently accepted name of each species, its taxonomic and nomenclatural synonyms as well as the information on host plants and the geographic distribution. In addition to 14 species already placed in the genus, further two are added here by proposing appropriate new combinations.

### *Jamesdicksonia* Thirum., Pavgi & Payak

Mycologia **52**(1960): 478. 1961, *emend.* Raghunath, Sydowia **23**: 104. 1969, *emend.* J. Walker & R. G. Shivas, Mycol. Res. **102**(10): 1212. 1998, *emend.* R. Bauer, Begerow, A. Nagler & Oberw., Mycol. Res. **105**(4): 422. 2001.

TYPE OF THE GENUS: *Jamesdicksonia obesa* (Syd. & P. Syd.) Thirum., Pavgi & Payak

1. *Jamesdicksonia brizae* (Unamuno & Cif.) M. Piątek & Vánky, *comb. nov.* [MB 510057]

BASIONYM: *Entyloma brizae* Unamuno & Cif., in Unamuno, Bol. Soc. Esp. Hist. Nat., Biol. **31**: 335. 1931.

HOSTS AND DISTRIBUTION. On Poaceae: *Briza maxima* L., *B. media* L.; Africa (Algeria, Spain: Canary Islands), Europe (Greece, Spain, incl. Balearic Islands), New Zealand, South America (Uruguay).

2. *Jamesdicksonia brunckii* (Ellis & L. D. Galloway) J. Walker & R. G. Shivas

Mycol. Res. **102**(10): 1212. 1998.

*Ustilago brunckii* Ellis & L. D. Galloway, J. Mycol. **6**: 31. March 1890. – *Tolyposporella brunckii* (Ellis & L. D. Galloway) G. P. Clinton, J. Mycol. **8**: 147. 1902. – *Tilletia brunckii* (Ellis & L. D. Galloway) Durán, Canad. J. Bot. **50**: 2570. 1972, *nom. inval.*

*Ustilago apiculata* Ellis & L. D. Galloway, in Jennings, Texas Agricultural Experiment Station Bulletin **9**: 29. May 1890.

HOSTS AND DISTRIBUTION. On Poaceae: *Andropogon gerardii* Vitman, ‘*A. hirtiflorus* (Nees) Kunth var. *pufiflorus* (Nees) Kunth’, *A. ternarius*



Michx. (= *A. argenteus* DC., *A. argyraeus* Schult.), *Bothriochloa barbinodis* (Lag.) Herter (= *Andropogon barbinodis* Lag., *A. perforatus* Trin. ex E. Fourn., *A. saccharoides* Sw. var. *barbinodis* (Lag.) Hack., *A. saccharoides* Sw. var. *leucopogon* Hack.), *B. laguroides* (DC.) Herter subsp. *torreyana* (Steud.) Allred & Gould (= *A. saccharoides* Sw., *A. torreyanus* Steud., *Bothriochloa saccharoides* (Sw.) Rydb.), *Dichanthium sericeum* (R. Br.) A. Camus, *D. sericeum* subsp. *polystachyum* (Benth.) B. K. Simon, *Schizachyrium sanguineum* (Retz.) Alston var. *hirtiflorum* (Nees) S. L. Hatch (= *Andropogon hirtiflorus* (Nees) Kunth); Australia, North America (U.S.A., Mexico).

### 3. *Jamesdicksonia caribensis* M. Piepenbr.

Flora Neotropica Monograph **86**: 220–221. 2003.

HOST AND DISTRIBUTION. On Poaceae: *Andropogon bicornis* L.; Central America (Dominican Republic, Puerto Rico).

### 4. *Jamesdicksonia dactylidis* (Pass.) R. Bauer, Begerow, A. Nagler & Oberw.

Mycol. Res. **105**(4): 422. 2001.

*Thecaphora dactylidis* Pass., in Fischer von Waldheim, Ann. Sci. Nat. Bot., Sér. 6, **4**(1876): 231. 1877. – *Entyloma dactylidis* (Pass.) Cif., Boll. Soc. Bot. Ital. **1924**: 55. 1924.

NOTE. An extensive list of synonyms is given by Vánky (1994), and it is not repeated here, so the reader is referred to this monograph for this information.

HOSTS AND DISTRIBUTION. On Poaceae: numerous genera and species; Africa, Asia, Europe, New Zealand, Central, North and South America.

### 5. *Jamesdicksonia eleocharidis* (Sawada ex L. Ling) Vánky

Mycotaxon **89**(1): 105. 2004.

*Entyloma eleocharidis* Sawada ex L. Ling, Mycologia **41**: 255. 1949. – *Ustilago eleocharidis* Sawada, Rep. Dept. Agric. Gov. Res. Inst. Formosa **85**: 39. 1943, *nom. inval.* – *Jamesdicksonia eleocharidis* (Sawada) R. Bauer, Begerow, A. Nagler & Oberw., Mycol. Res. **105**(4): 422. 2001, *inval. comb.*

*Entyloma eleocharidis* Pavgi & R. A. Singh, Nova Hedwigia **15**(1968): 426. 1969, later homonym.

HOSTS AND DISTRIBUTION. On Cyperaceae: *Eleocharis dulcis* (Burm. f.) Trin. ex Hensch. (= *E. plantaginea* (Retz.) Roem. & Schult.), *Eleocharis* sp.; Asia (China, India, Pakistan, Taiwan).

### 6. *Jamesdicksonia festucae* Vánky

Fungal Diversity **17**: 171. 2004.

HOST AND DISTRIBUTION. On Poaceae: *Festuca toluensis* Kunth; North America (Mexico).

### 7. *Jamesdicksonia irregularis* (Johanson) R. Bauer, Begerow, A. Nagler & Oberw.

Mycol. Res. **105**(4): 422. 2001.

*Entyloma irregulare* Johanson, Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. **41**(9): 159. 1884.

HOSTS AND DISTRIBUTION. On Poaceae: *Poa annua* L., ?*P. compressa* L., ?*P. secunda* J. Presl subsp. *juncifolia* (Scribn.) Soreng (= *P. juncifolia* Scribn.), *P. pratensis* L., *P. trivialis* L., *P. sp.*; Asia (Japan), Europe (Finland, Germany, Iceland, Italy, Norway, Poland, Romania, Spain, Sweden, Switzerland), New Zealand, North America (U.S.A.).

### 8. *Jamesdicksonia ischaemiana* (Thurum. & Pavgi) R. Bauer, Begerow, A. Nagler & Oberw.

Mycol. Res. **105**(4): 422. 2001.

*Melanotaenium ischaemianum* Thurum. & Pavgi, Sydowia **20**(1967): 25. 1968.

HOSTS AND DISTRIBUTION. On Poaceae: *Ischaemum indicum* (Houtt.) Merr., *I. semisagittatum* Roxb.; Asia (India).

### 9. *Jamesdicksonia linearis* (Berk. & Broome) Vánky

Mycotaxon **91**: 259. 2005.

*Gymnosporium lineare* Berk. & Broome, J. Linn. Soc., Bot. **14**: 90. 1875. – *Coniosporium lineare* (Berk. & Broome) Sacc., Sylloge fungorum **4**: 243. 1886. – *Ustilago linearis* (Berk. & Broome) Petch, Ann. Roy. Bot. Gard. (Peradeniya) **9**: 167. 1924. – *Tolyposporella linearis* (Berk. & Broome) L. Ling, Sydowia **3**: 133.

1949. – *Sorosporium lineare* (Berk. & Broome) Thirum., M. D. Whitehead & M. J. O'Brien, *Mycologia* **59**: 394. 1967.

HOST AND DISTRIBUTION. On Poaceae: *Chrysopogon zizanioides* (L.) Roberty (= *Andropogon muricatus* Retz., *Vetiveria zizanioides* (L.) Nash); Asia (Sri Lanka).

10. *Jamesdicksonia major* (Har. & Pat.) M. Piepenbr.

Flora Neotropica Monograph **86**: 221. August 2003.

*Entyloma majus* Har. & Pat., Bull. Mus. Hist. Nat. (Paris) **15**: 197. 1909. – *Melanotaenium majus* (Har. & Pat.) Cif., Atti Ist. Bot. Univ. Pavia, Ser. 3, **1**: 95. 1924. – *Jamesdicksonia major* (Har. & Pat.) Vánky, Fungal Diversity **14**: 206. October 2003, superfl. comb.

HOSTS AND DISTRIBUTION. On Poaceae: *Sporobolus cordofanus* Herincq. ex Coss., *S. ioclados* (Trin.) Nees, *S. marginatus* Hochst. ex A. Rich., *S. pyramidatus* (Lam.) Hitchc., *S. spicatus* (Vahl) Kunth; Africa (Chad, Congo, Kenya, Sudan), Asia (Pakistan), Central America (Dominican Republic, Puerto Rico).

11. *Jamesdicksonia melinidis* (Dennis) Vánky *Mycotaxon* **89**(1): 106. 2004.

*Melanotaenium majus* (Har. & Pat.) Cif. var. *melinidis* Dennis, Trans. Brit. Mycol. Soc. **90**: 471. 1988.

HOST AND DISTRIBUTION. On Poaceae: *Melinis macrochaeta* Stapf & C. E. Hubb.; Africa (Nigeria).

12. *Jamesdicksonia obesa* (Syd. & P. Syd.) Thirum., Pavgi & Payak

*Mycologia* **52**(1960): 478. 1961.

*Entyloma obesum* Syd. & P. Syd., Ann. Mycol. **9**: 145. 1911. – *Tolyposporella obesa* (Syd. & P. Syd.) G. P. Clinton & Zundel, in Zundel, *Mycologia* **22**: 157. 1930.

HOSTS AND DISTRIBUTION. On Poaceae: *Dichanthium annulatum* (Forssk.) Stapf, *Hyparrhenia rufa* (Nees) Stapf; Asia (India), South America (Colombia).

13. *Jamesdicksonia parva* (Davis) M. Piątek & Vánky, *comb. nov.* [MB 510058]

BASIONYM: *Entyloma parvum* Davis, Trans. Wisconsin Acad. Sci. Arts and Letters **19**: 715. 1919.

HOST AND DISTRIBUTION. On Cyperaceae: *Eleocharis acicularis* (L.) Roem. & Schult.; North America (U.S.A.).

14. *Jamesdicksonia scirpicola* (Thirum. & J. G. Dicks.) R. Bauer, Begerow, A. Nagler & Oberw.

*Mycol. Res.* **105**(4): 422. 2001.

*Entyloma scirpicola* Thirum. & J. G. Dicks., Amer. J. Bot. **26**: 404. 1949.

HOST AND DISTRIBUTION. On Cyperaceae: *Schoenoplectiella articulata* (L.) Lye (= *Scirpus articulatus* L.); Asia (India).

15. *Jamesdicksonia sporoboli* (H. S. Jacks.) M. Piepenbr.

Flora Neotropica Monograph **86**: 222. August 2003.

*Tolyposporella sporoboli* H. S. Jacks., in Whetzel & Kern, *Mycologia* **18**: 122. 1926. – *Melanotaenium sporoboli* (H. S. Jacks.) Thirum., M. D. Whitehead & M. J. O'Brien, *Mycologia* **59**: 394. 1967. – *Jamesdicksonia sporoboli* (H. S. Jacks.) Vánky, Fungal Diversity **14**: 209. October 2003, superfl. comb.

HOSTS AND DISTRIBUTION. On Poaceae: *Sporobolus brockmanii* Stapf, *S. indicus* (L.) R. Br., *S. marginatus* Hochst. ex A. Rich.; Africa (Eritrea), Asia (Pakistan), Central America (Puerto Rico).

16. *Jamesdicksonia tremuli* Vánky

*Fungal Diversity* **14**: 209. 2003.

*Melanotaenium sporoboli* Thirum. & M. C. Sriniv., in Srinivasan & Thirumalachar, *Sydowia* **17**: 22. 1963/1964.

HOSTS AND DISTRIBUTION. On Poaceae: *Sporobolus diandrus* (Retz.) P. Beauv., *S. tremulus* (Trin.) Kunth, *S. wallichii* Munro ex Trin.; Asia (India).

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