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First report of *Erysiphe baptisiae* on *Baptisia* in UK with emended description

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Abstract: Cook, R. T. A., Henrici, A. & Braun, U. 2014: First report of *Erysiphe baptisiae* on *Baptisia* in UK with emended description. Schlechtendalia **28**: 41–48.

Erysiphe baptisiae has been found for the first time in UK. Taxonomy and morphology of this species are discussed, and an emended description and illustrations are provided.

Zusammenfassung: Cook, R. T. A., Henrici, A. & Braun, U. 2014: Erstangabe von *Erysiphe baptisiae* auf *Baptisia* in Großbritannien mit emendierter Beschreibung. Schlechtendalia **28**: 41–48.

Erysiphe baptisiae wurde erstmalig in Großbritannien gefunden. Taxonomie und Morphologie dieser Art werden diskutiert, ergänzt durch eine emendierte Beschreibung und Abbildungen.

Key words: powdery mildew, *Baptisia australis*, chasmothecial appendages, *Erysiphe* (*Microsphaera*) *rayssiae*, *Erysiphe baptisiicola*, distribution of conidial widths.

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Introduction

Baptisia (false indigo) is a genus of shrub-like fabaceous perennials, natives of North America with lupin-like flowers used in gardens or landscapes. On 13 August 2014 at the Royal Botanic Garden, Kew, a heavy infection of a powdery mildew was found on a clump of *Baptisia* Purple Smoke, a natural hybrid between *B. australis* and *B. alba* distributed recently by North Carolina Botanical Garden. Greyish white patches of thin mycelium, sometimes covering both leaf surfaces, bore scattered groups of fruiting bodies (chasmothecia). One week later, a survey of the Order Beds at Kew revealed two plants of one of the parents, *B. australis*, about 100 m from the first site. One of these, dated 1969, was entirely healthy. The other, dated 2011, had thin mildew mycelium on a few shaded leaves which by 2 October 2014 bore a few chasmothecia.

Only two powdery mildews are presently recognised on *Baptisia*, viz. *Erysiphe baptisiae* confined to Europe (Germany, Romania, Switzerland) and *E. baptisiicola* U. Braun confined to North America (Braun et al. 2010, Braun & Cook 2012). On first inspection, there appeared to be two types of chasmothecia; one with mainly unbranched, hyaline and aseptate appendages conforming to the description of *E. baptisiae* (Fig. 1) and another with 0–6 times dichotomously branched appendages that were either pale and aseptate (Fig. 2, above) or mid brown and septate at the base (Fig. 2, below). The branching was either more or less symmetrical (Fig. 3, above) or very asymmetrical (Fig 3, below). Appendages are critical in diagnosis, but a mixture of two species is ruled out, because characteristics of conidiophores and conidia (Table 1A-B) consistently conformed to *E. baptisiae*, apart from many foot cells being distinctly 'kinked' at the base (Fig. 4). Conidial width, also critical for identification of a species, showed little variation with a sharp peak at 12 µm (Fig. 5). By contrast, conidial lengths and length/width ratios were both more variable and did not have single peaks (Fig. 6A-B). However, the absence of a second peak in conidial width strongly supported the presence of a single species.

In conclusion it can be said that the British collections on *Baptisia* can be assigned to *E. baptisiae* and represent first records of this species from UK.

This powdery mildew belongs to the *E. trifoliorum* (Wallr.) U. Braun complex in *E.* sect. *Microsphaera* and is distinguished from other species in the group by both anamorph and teleomorph characters. The British collection clearly shows that conidia are narrower, its chasmothecial appendages are not strongly directional and have frequently branched apices that agree well with a Romanian mildew labelled *E. rayssiae* (Mayor) U. Braun & S. Takam. on *B. australis* (Eliade, 1990). Since *E. rayssiae* is restricted to *Spartium junceum*, the Romanian mildew was assigned to *E. baptisiae* by Braun & Cook (2012). However, this material was unavailable for re-examination by Braun et al. (2010) and Braun & Cook (2012) and so details

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of the appendages were not included in the official description of *E. baptisiae*. *E. baptisiicola* (sect. *Erysiphe*), the second species described from *Baptisia*, has much shorter, more geniculate unbranched appendages.

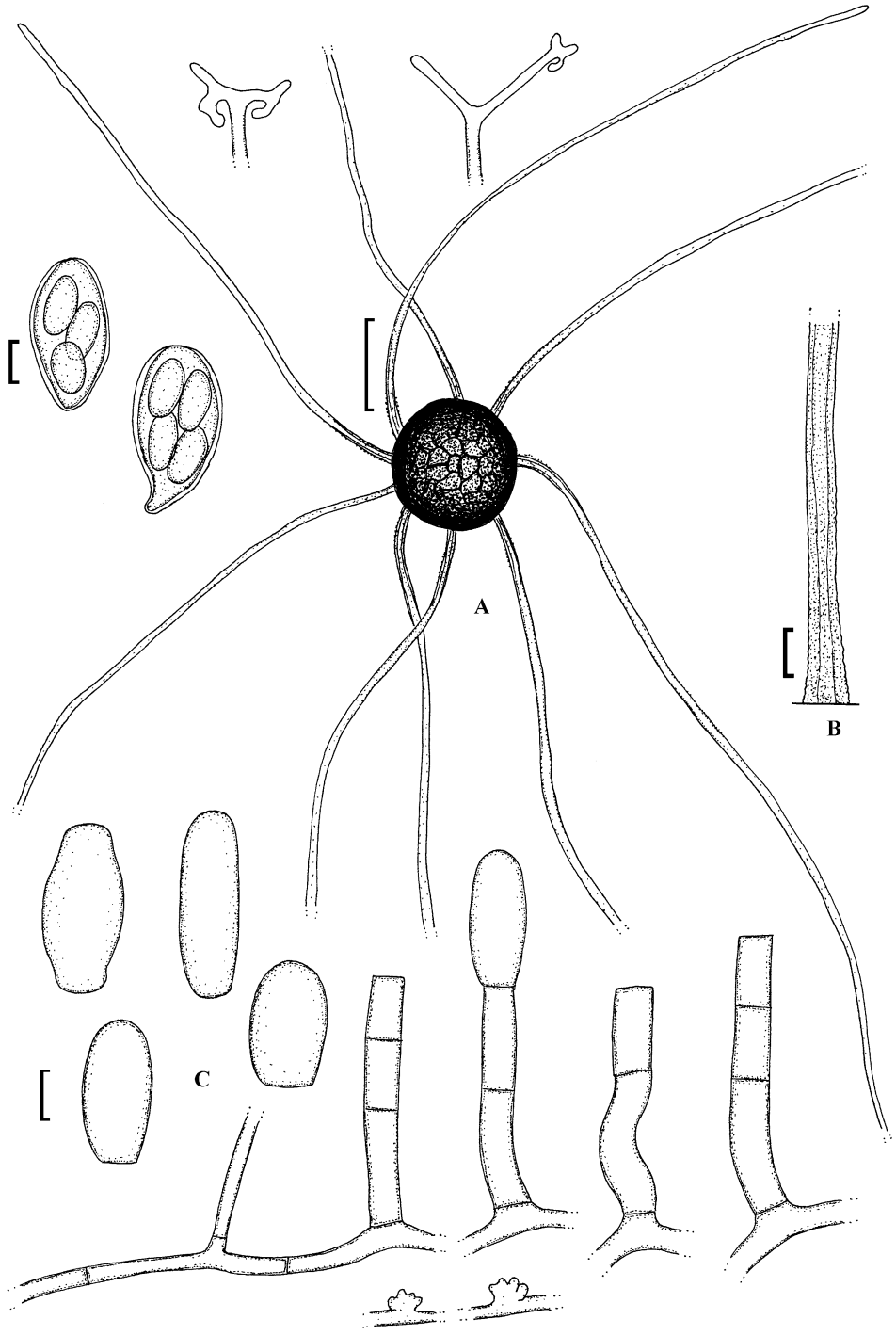


Fig. 1: after Braun et al. (2010). (A) details of teleomorph including (B) detail of appendage base; (C) details of anamorph. Scale bars for chasmothecium = 100 µm, for other features = 10 µm.

Emended description of *Erysiphe baptisiae*

The deviating characters of the chasmothecial appendages of the British collection of *E. baptisiae* require a re-description of this species and the opportunity is also taken to expand the description of the anamorph.

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Erysiphe baptisiae U. Braun & J. Kruse, Mycotaxon **112**: 176 (2010) Figs 1–4

Mycelium amphigenous, in greyish white patches or effuse, often covering the entire leaf surface, thin, persistent; *hyphae* usually straight to somewhat sinuous, 3–7 µm wide, hyaline, walls thin, smooth or almost so; *hyphal appressoria* solitary, 3–7 µm diam., lobed; *conidiophores* arising from the upper surface of the mother cell or laterally, either centrally or towards one end, erect, straight, up to about 100 µm long (without conidia), *foot-cells* (10–)15–39 × 5–8 (mean 27 × 6) µm, cylindrical, straight to mostly somewhat curved and/or kinked at the base, to distinctly sinuous, followed by 1–3 shorter cells, about 10–35 (mean 21) µm long, forming conidia singly; *primary conidia* ellipsoid-ovoid, *secondary conidia* ellipsoid-cylindrical rarely almost doliiform, 22–35(–39) × 8.5–17 (mean 30 × 12) µm, length/width ratio 1.7–3.7 (mean 2.5), ends rounded to truncate. *Chasmothecia* scattered to gregarious, 80–120 µm diam., subglobose; *peridium cells* irregularly polygonal, 10–25(–30) µm diam., cell walls up to about 2 µm thick; *appendages* 6–15(–20), ± equatorial, flexuous, straight, often somewhat geniculate near the base, curved to sinuous, more or less horizontally spread, or somewhat pointing upwards, but not unduly in one direction, length 4–10 times the chasmothecial diam. (up to about 1200 µm), width 3–10 µm, somewhat decreasing from base to top, dimorphic depending on age and degree of maturity, at first aseptate, hyaline, walls thick, up to 3 µm at the base, becoming gradually thinner towards tip, verruculose towards the base, smooth above, *apices* usually unbranched or occasionally only 1–2 times dichotomously branched, appendages later, when fully mature, aseptate and pale or septate and pale to mid brown at the base, tips 0–3(–6) times dichotomously branched, often somewhat asymmetric, branches compact to widely spaced, penultimate branches sometimes strongly recurved, tips straight or curved; *asci* 3–8 per chasmothecium, obovoid to saccate, 45–70 × 25–35 µm, sessile to short-stalked, wall thin, up to 1.5 µm wide, terminal oculus indistinct, 3–5-spored; *ascospores* ellipsoid-ovoid, 14–23 × 10–14 µm, colourless.

Material examined: on *Baptisia australis*, Germany, Niedersachsen, Hannover, Herrenhausen/Leinhausen, Vinnhorster Weg, Schulbiologiezentrum, 5 Oct. 2009, J. Kruse (HAL 2337 F, holotype); on *B. australis* × *B. alba*, UK, Kew, Royal Botanic Garden, Kew, 13 Aug. 2014, A. Henrici (K(M)194214, HAL 2678 F); *B. australis*, UK, Kew, Royal Botanic Garden, Kew, 2 Oct. 2014, A. Henrici (K(M)195557, HAL 2677 F).

Discussion

In Switzerland in 1961, *Baptisia australis*, a plant that had previously been healthy for 5 years developed a powdery mildew bearing chasmothecia with *Microsphaera* type appendages (Mayor 1965) and later identified as *M. rayssiae* (Mayor 1968). The description of the holomorph conforms well to *Erysiphe baptisiae*. Unknown in America (Farr & Rossman 2014), it appeared at first sight that a European or Mediterranean powdery mildew had attacked a recently introduced North American plant. However, an American origin of this species is actually more likely, because this pathogen appeared suddenly in 1961 and is not known on any other host this side of the Atlantic. It would not be the first time a 'new' fungal species has been found outside its natural range in an area with similar climate (synanatropic). In this case, previous records of *Erysiphe* s. lat. (including *Microsphaera*) in N. America have usually been subsumed under several names with extremely broad circumscription and application, as for instance *Erysiphe communis* (Wallr.) Schltdl., *E. pisi* DC. or *E. polygoni* DC. Powdery mildews on legumes in general and the *E. trifoliorum* complex in particular are morphologically intricate and little examined genetically. *E. pisi* and *E. trifoliorum* are, as currently perceived and circumscribed (Braun & Cook 2012), undoubtedly compound, morphologically as well as genetically heterogeneous species in urgent need of phylogenetic re-examination and revision.

The pattern of consistent conidial widths but inconsistent lengths and L/W ratios is also seen with oak mildew caused by *Erysiphe alphitoides* (RTA Cook, unpublished). It seems likely that length depends on extraneous factors such as physiological or environmental conditions at the time of conidial ontogeny, whereas width is a constant genetic trait. It would be interesting to determine whether this pattern is mirrored in a wider range of powdery mildews.

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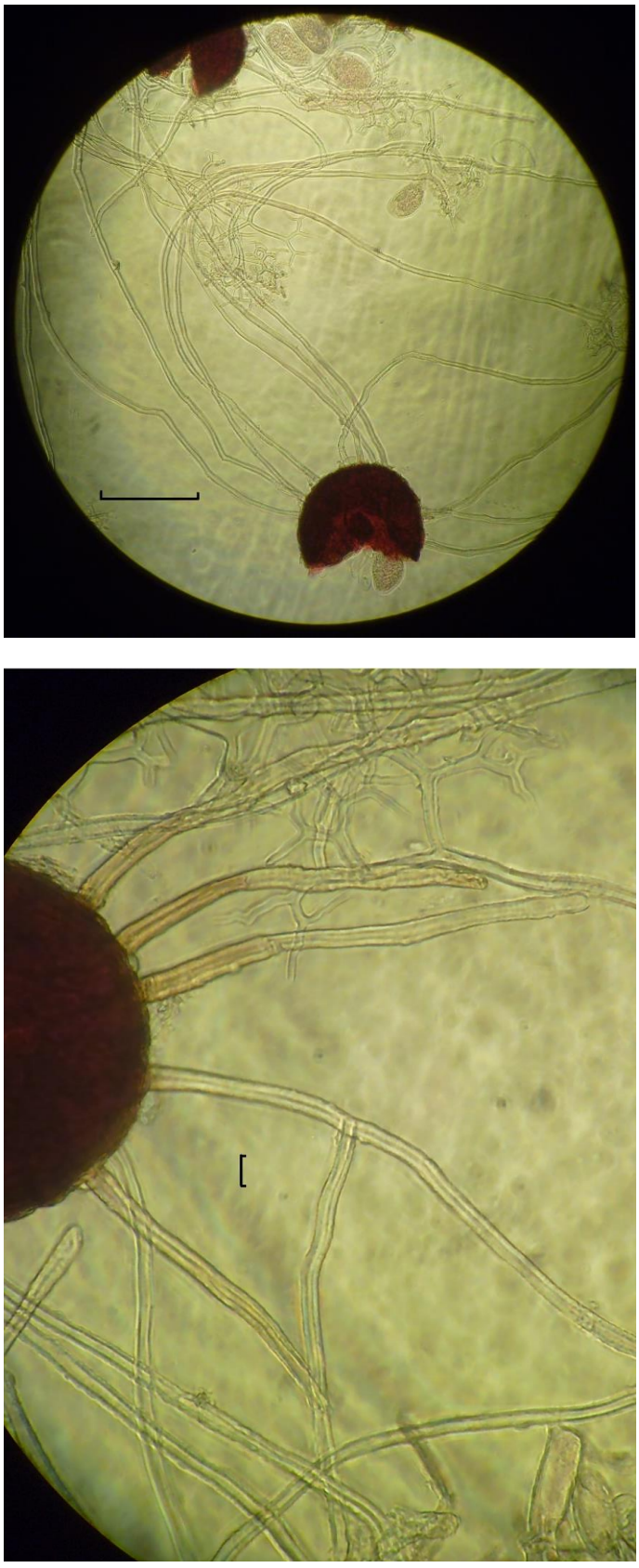


Fig. 2: Photomicrographs of chasmothecial appendages of *Erysiphe baptisiae*. Appendages (above) aseptate and more or less hyaline throughout, (below) septate and brown at bases. Scale bars = 100 µm (above) and 10 µm (below).

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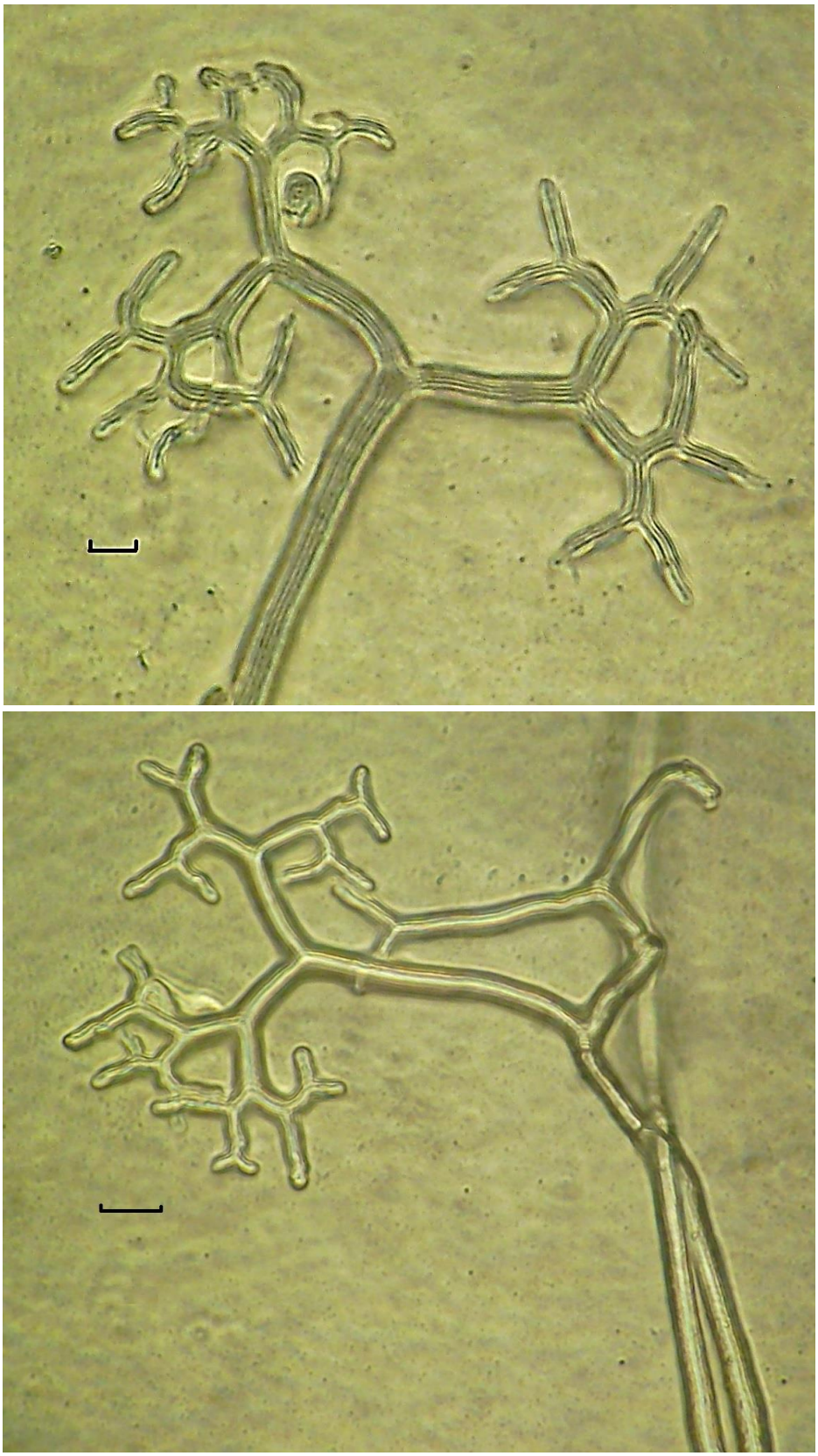


Fig. 3: Photomicrographs of apices of chasmothecial appendages of *Erysiphe baptisiae*. Apex (above) semi-symmetrical, (below) very asymmetrical. Scale bars = 10 µm.

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Fig. 4: Photomicrograph of conidiophore of *Erysiphe baptisiae.* Scale bar = 10 µm

Table 1. Anamorph of *Erysiphe baptisiae*

A) Conidiophore details

Conidiophore			Foot cells		Other cells		
Shape (%)		Length (µm)	Length (µm)	Width (µm)	No. (%)		Length (µm)
Straight 18%	Range	25-99	(9.5)17-39	5-8.5	1, 2, 3	Range	12.5-34
Sinuous 12% Curved 24%	Mean	69.3 ± 3. 21	26.6 ± 1.14	6.3 ± 0.15	(4,46,50)	Mean	21.3 ± 1.05
Kinked at base 47%	N	17	14	17		N	39

B) Conidium details

Shape %		Length		Width		L/W ratio	
Ellipsoid	39	Range	(20.5)24-39	Range	8.5-17	Range	1.7-3.7
Ellipsoid/cylindrical	26	Mean	30 ± 0.5	Mean	12.2 ± 0.26	Mean	2.5 ± 0.06
Cylindrical	33						
Ovoid	2						
Ends truncated	39						

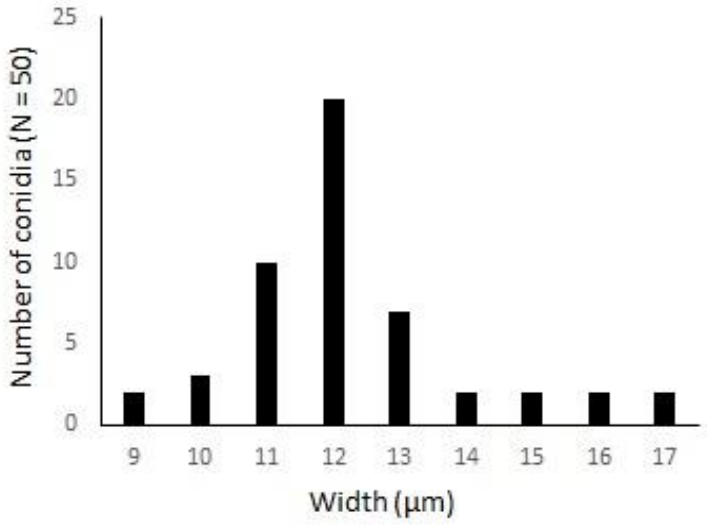


Fig. 5: Distribution of conidial widths of *Erysiphe baptisiae*.

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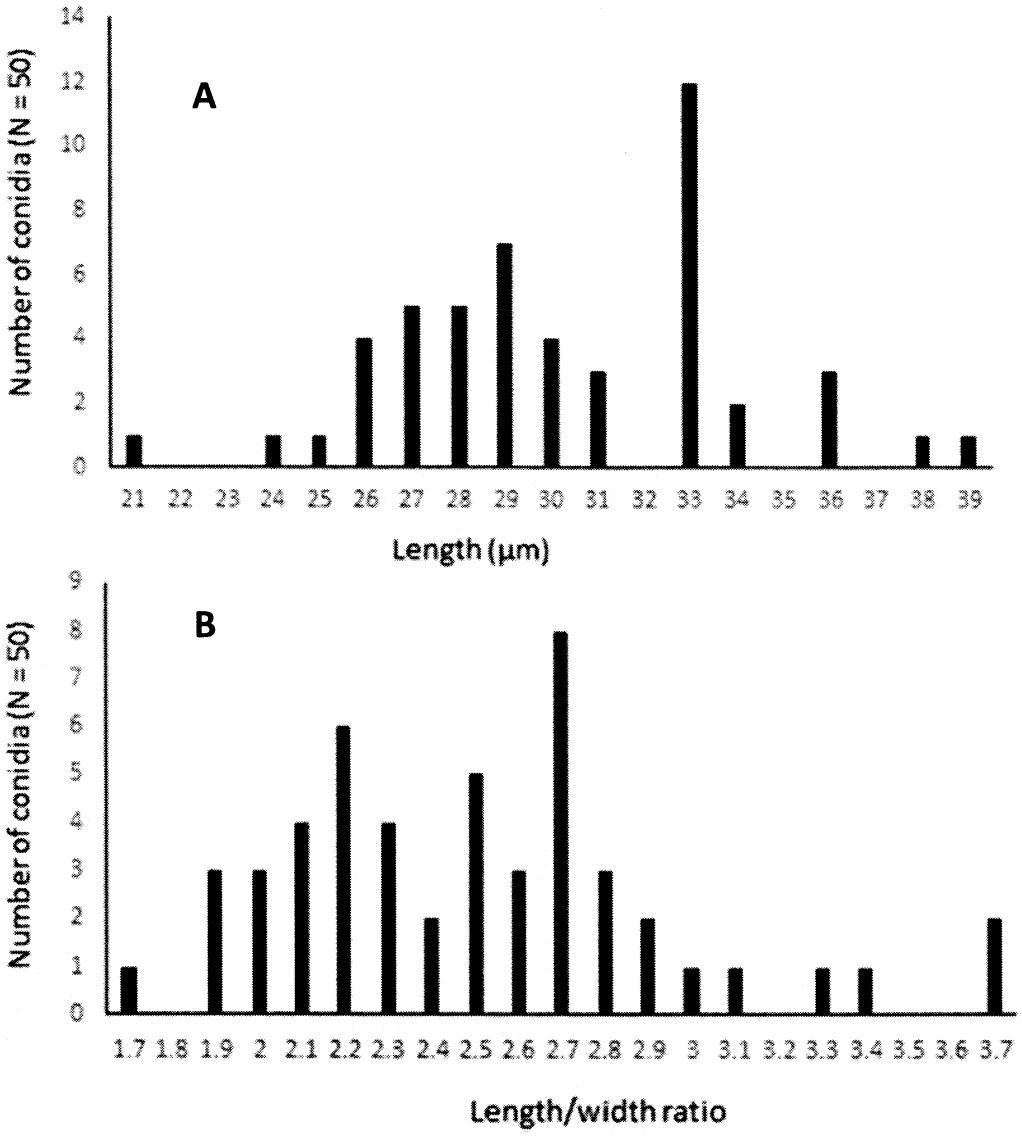


Fig. 6: Distribution of, (A) conidial lengths and (B) conidial length/width ratios of *Erysiphe baptisiae*.

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