

Holcus azoricus M. Seq. & Castrov. (Poaceae), a new species from the Azores Islands

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A new species of *Holcus* L. (Poaceae), endemic to the Azores archipelago (Portugal), is described. The vegetative and reproductive structures were studied. The diagnostic characters were compared with those of closely related species. New chromosome counts in *Holcus azoricus* M. Seq. & Castrov. ($2n = 35$) and *H. rigidus* Hochst. ($2n = 28$) are included. A possible hybrid origin is hypothesized; the potential parents are *H. lanatus* L. and *H. rigidus*. © 2007 The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2007, 154, 259–267.

ADDITIONAL KEYWORDS: *Holcus rigidus* – *Holcus lanatus* – hybrids – Gramineae.

INTRODUCTION

In a recent revision of the genus *Holcus* L. (Menezes de Sequeira, 2004), nine species, five subspecies, one hybrid, and one variety are recognized. Five were Iberian Peninsula endemics [*Holcus grandiflorus* Boiss. & Reut., *H. gayanus* Boiss., *H. caespitosus* Boiss., *H. reuteri* Boiss., and *H. annuus* C.A. Mey. ssp. *duriensis* (P. Silva) Franco & Rocha Afonso], one is a South African (Cape Province) endemic (*H. setiger* Nees), and two are Macaronesian endemics (*H. rigidus* and *H. mollis* ssp. *hierrensis* Stierst.), both chamaephytes.

The revision of herbarium plants and fieldwork suggested the presence of a new taxon in the Azores Islands (Menezes de Sequeira, 2004). Some herbarium sheets of this plant included plants with some of the characteristics of *H. mollis*, and some were even determined to be possible hybrids between *H. mollis* and *H. rigidus*. However, the doubtful presence of *H. mollis* on the Azores Islands eliminated this taxon as a possible parent of any recent hybrid.

MATERIAL AND METHODS

The studied material came from plants collected during fieldwork (1999 and 2004), loans from the LISE

herbarium, and plants sent to M.S. by Hanno Schäfer (University of Munich) and included in his personal herbarium. A complete list of the specimens examined is given in the Appendix.

Macroscopic analysis was performed using a binocular microscope (Zeiss model SV 11 APO).

For chromosome counts, the root apices were used. They were obtained from live plants collected during fieldwork in 1999, and after root cutting in order to stimulate root growth. Root tips (0.5–1.5 cm) were cut and maintained in distilled water at 0–4 °C for 24–48 h, after which they were fixed in ethanol : acetic acid (3 : 1). Forty-eight hours before chromosome counting, the root apices were transferred to aceto-carmine solution; they were boiled for a short time in aceto-carmine solution with 1 M HCl (9 : 1). Semi-permanent slides (sealed with nail varnish) were prepared after gentle squashing of the root tips in a drop of acetic acid.

The distribution map is based on the geographical coordinates of the studied specimens plotted using QUIKMAP for Windows, Version 1.02.

RESULTS AND DISCUSSION

This plant was originally cited as *H. mollis*, or as doubtful *H. rigidus*. A brief chronological reference to the citations of *H. mollis* from the Azores is required in order to fully understand how, and where, this ref-

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erence came into the Azores Floras. Seubert (1844) and Drouet (1866) indicated that this plant occurred on the Azores archipelago (Faial) based on C. Watson and C. A. F. A. Heinrich Hartung, respectively. Later, however, Watson (1870: 244) clearly stated that: 'Very likely *Holcus mollis* may not have occurred in the Isles. That name was inadvertently used in my notes for the present quite distinct species. Drouet cites Hartung for a Fayal habitat of *Holcus mollis*, which may be due to a like error.' We studied his voucher at the Webb herbarium (FI-W, Watson 1842 n° 301), and agree that it is not *H. mollis*, but *H. rigidus*.

Drouet (1866: 124) did not collect this plant, and based his reference on Hartung. We could not find any Azorean specimen collected by him, and this citation should be considered as very doubtful.

Tutin (1964) included this name in his list of Azorean plants, but did not mention any specimen. Two years later, Pinto da Silva took this reference and included *H. mollis* in the '*Catálogo das plantas vasculares dos Açores*' (cf. Palhinha, 1966: 160), but with the following comment: 'É digna de nota a citação de Tutin, que vem trazer, após tanto tempo decorrido, a confirmação da existência na mesma ilha, da planta aí colhida por Hartung, indicação depois considerada errónea por Watson que a isso foi levado, afinal por uma má identificação que fez duma colheita sua de *Holcus rigidus* Hochst'.

Hansen (1972: 232) mentioned *H. mollis* in the Azores (São Miguel Island) based on a plant collected by Bruno Carneiro in 1899. We could not find the Bruno Carneiro material, but had occasion to study some other material collected previously (1879 W-25139 and 1881 W-25140), and both belonged to *H. rigidus*.

Pinto da Silva & Pinto da Silva (1974) referred again to *H. mollis* on São Miguel Island: 'Ribeira Grande, Caldeiras, 240 m s.m., in surrounding grassy waste places near the springs, n° 793, plants without flowers presenting retrorse-pubescent nodes'. The study of this specimen (LISE 70612) forced us to correct this view, because this plant corresponds to *H. rigidus*.

Hansen & Sunding (1979) probably used the same reference for 'São Miguel, Terceira, Faial'.

We believe that *H. mollis* either does not grow in the Azores, or if, occasionally, it is found, it should be treated as a neophyte of recent introduction.

In the genus *Holcus*, many levels of ploidy occur, from diploids to heptaploids (Menezes de Sequeira, 2004). *H. mollis* is very variable in chromosome number: tetraploids ($2n = 28$) correspond to autopolyploids (Jones, 1958; Walter, 1977; Lamade *et al.*, 1994; Richard *et al.*, 1995), and the pentaploid ($2n = 35$) is of hybrid origin with *H. lanatus* (Jones, 1958; Richard *et al.*, 1995).

Chromosome counts clearly demonstrate that *H. rigidus* is tetraploid with $2n = 28$ (Appendix; Fig. 1), possibly an autopolyploid with close origin to *H. mollis* (in the herbarium specimen LISE 70337, Danserau & Pinto da Silva refer to a count with no

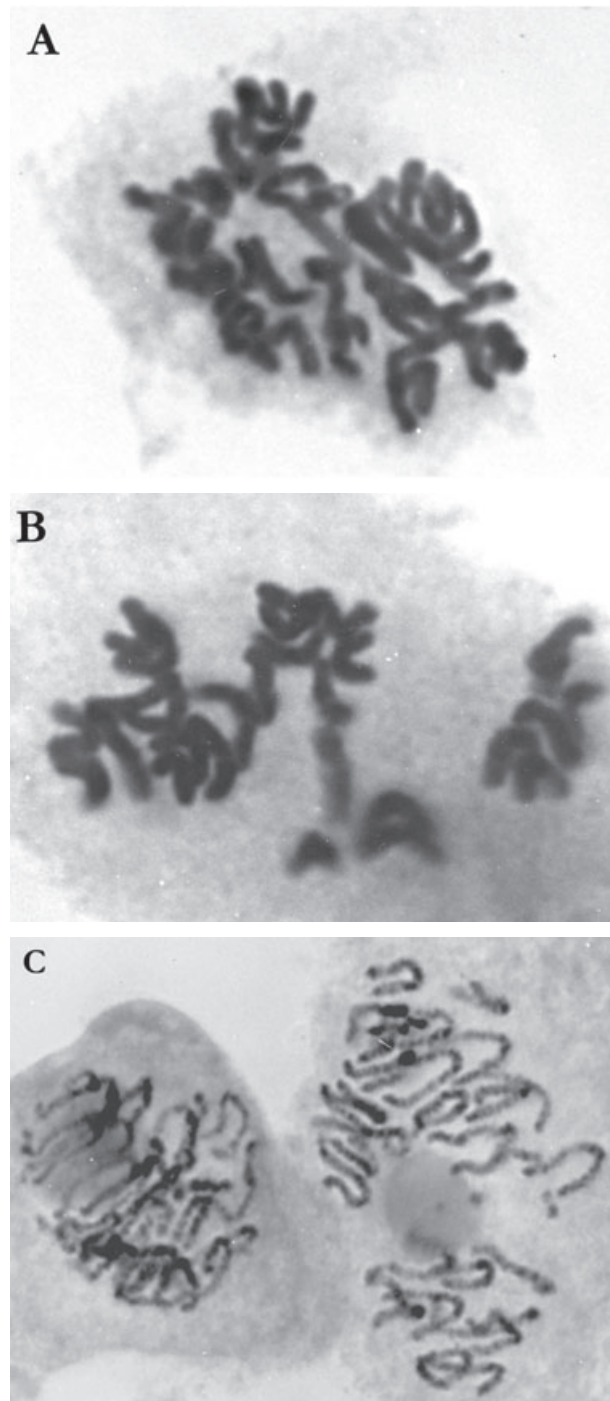


Figure 1. Microsporogenesis in *Holcus rigidus* Hochst. A, metaphase I (MS 3385B, $2n = 28$); B, metaphase I (MS 3385B, $2n = 28$); C, prophase I (MS 3385; $2n = 28$).

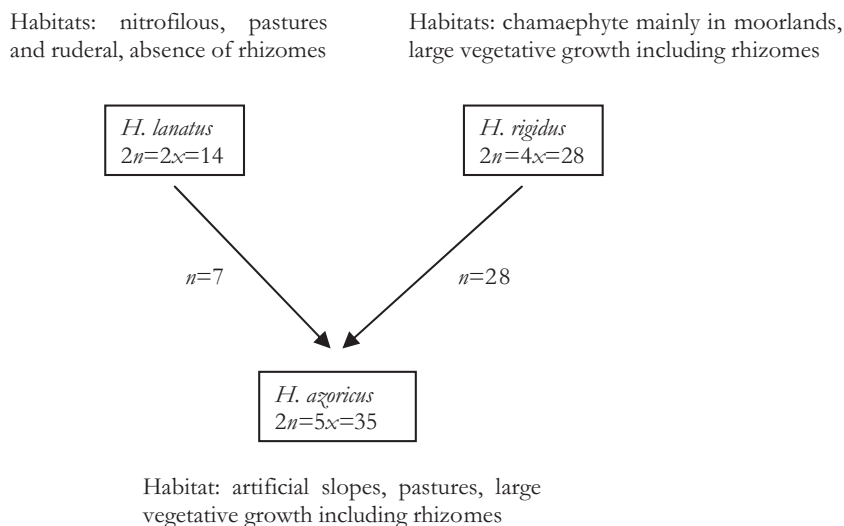


Figure 2. Possible hybrid origin of *Holcus azoricus* M. Seq. & Castrov. from *H. lanatus* L. and *H. rigidus* Hochst.

publication record). There are no previous chromosome counts in *H. rigidus*.

Our chromosome counts on plants collected in Pico Island (MS 3386a, b, e), belonging to *H. azoricus* sp. nov., indicate that it is a pentaploid, $2n = 35$. It can be hypothesized that it originated from the unreduced tetraploid of *H. rigidus* ($2n = 28$) and *H. lanatus* ($n = 7$) (i.e. $28 + 7$; Fig. 2). This potential hybridization could be similar to the process described by Richard *et al.* (1995) for the pentaploids in *H. mollis*, the most common number in France and Britain.

The new plant resembles *H. rigidus*, but the leaves are wider and less pointed, the sheaths and nodes are hairy (pubescent; Fig. 3B), and the ligule is symmetric. It differs from *H. lanatus* by its erect form, with acute glumes, and by having a bent arista on the upper flower. The hairiness of the nodes (Fig. 3) misled some determinations as *H. mollis* L. or as a possible hybrid of *H. rigidus* \times *H. mollis*. Table 1 summarizes the main diagnostic characters of the closely related species of the genus *Holcus*.

HOLCUS AZORICUS M. SEQ. & CASTROV., SP. NOV.

Speciebus *Holcus rigidus* Hochst. et *H. mollis* ssp. *hierrensis* Stierst. *similis* sed planta non suffruticosa, foliis quidem subpungentibus et subdistichis, culmis nodisque pilosis, etsi postremo annulo pilorum retrorsorum vel patentium carentibus, glumis mucronatis pilosis non-numquamve scabridiusculis atque superiore nervis plerumque marginalibus insignitis.

Holotype: ‘São Miguel, Ribeira Grande, Miradouro de Santa Iria. In meadows.’, P. Danserau, A.R. Pinto da Silva & B.V. Rainha, 8.vi.1964 (LISE 70660).

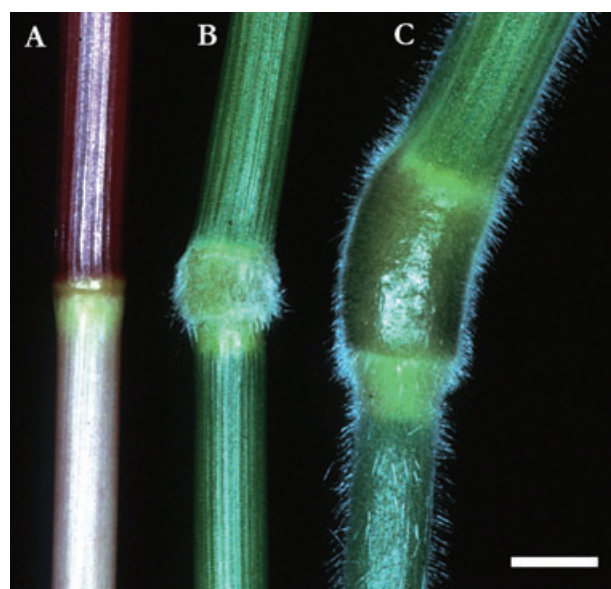


Figure 3. Nodes: A, *Holcus rigidus* Hochst.; B, *Holcus azoricus* M. Seq. & Castrov.; C, *Holcus lanatus* L. Bar corresponds to 2 mm.

The specimen includes a comment by Pinto da Silva that refers to a possible hybrid origin: ‘*Holcus* cf. *rigidus*, atypical: probably an hybrid with *H. mollis*’.

Description: Rhizomatous hemicryptophyte (Fig. 4A), with a short rhizome, not enlarged, scarcely ramified, the inferior nodes rooting. STEMS, 38–110 cm, simple, sometimes branched; nodes dark, pubescent (Fig. 4C). LEAVES rigid, subpungent, spreading; sheath inferiorly pubescent to villose (sometimes the whole sheath; Fig. 4E), median leaves with sheath 4.2–8.8 cm, upper

Table 1. Diagnostic characters of *Holcus azoricus* M. Seg. & Castrov. and related taxa

Character	<i>H. azoricus</i>	<i>H. rigidus</i>	<i>H. mollis</i>	<i>H. mollis</i> ssp. <i>hierrensis</i>	<i>H. mollis</i> ssp. <i>reuteri</i>	<i>H. lanatus</i>
Life form	Rhizomatous hemicyptophyte	Rhizomatous chamaephyte	Rhizomatous hemicyptophyte	Rhizomatous chamaephyte	Rhizomatous hemicyptophyte, with enlarged rhizome	Caespitose hemicyptophyte
Nodes	Dark and pubescent	Dark and glabrous	Sometimes dark, bearded	Sometimes dark, bearded	Sometimes dark, bearded	Not pigmented, pubescent to wholly covered with long hairs
Leaves	Not spreading, subpungent; sheath pubescent to villose	Spreading, pungent; sheath glabrous	Not spreading or pungent; sheath sometimes pubescent towards the base	Not spreading or pungent, sometimes overlapping; sheath sometimes pubescent towards the base	Not spreading or pungent; sheath glabrous, rarely pubescent towards the base	Not spreading or pungent; sheath puberulous to villose
Ligule	Symmetric, puberulous to pubescent	Asymmetric, glabrous to puberulous	Symmetric, glabrous to puberulous	Symmetric, puberulous	Symmetric, pubescent (rarely glabrous)	Symmetric, pubescent to villose
Blade	Scaberulous to pubescent, linear-lanceolate, attenuated in an acuminate and subacuminate apex	Scaberulous, linear-lanceolate, attenuated in an acuminate and rigid apex	Pubescent, linear to oblong-lanceolate, attenuated in an acute apex	Pubescent, linear to oblong-lanceolate, attenuated in an acute apex	Pubescent, linear to oblong-lanceolate, attenuated in an acute apex	Pubescent to villose, linear to oblong-lanceolate, attenuated in an acute apex
Glumes	Equal, usually mucronate	Slightly different, seldom mucronate	Slightly different to unequal, blunt	Slightly different, blunt	Slightly different to unequal, blunt	Unequal, mucronate
Upper glume	Lateral veins usually proximal	Lateral veins usually marginal	Lateral veins proximal	Lateral veins marginal	Lateral veins proximal	Lateral veins marginal
Glume indumentum	Keel, veins, and lamina minutely scabrous to pubescent	Keel, veins, and lamina minutely scabrous	Keel and veins with long hairs, lamina minutely scabrous to pubescent	Keel and veins with long hairs, lamina minutely scabrous to pubescent	Keel and veins with long hairs, lamina minutely scabrous to pubescent	Keel, veins, and lamina minutely scabrous to villose
Median rachilla	Glabrous to pubescent	Puberulous to pubescent	Puberulous to villose-setose	Villose-setose	Puberulous to pubescent	glabrous

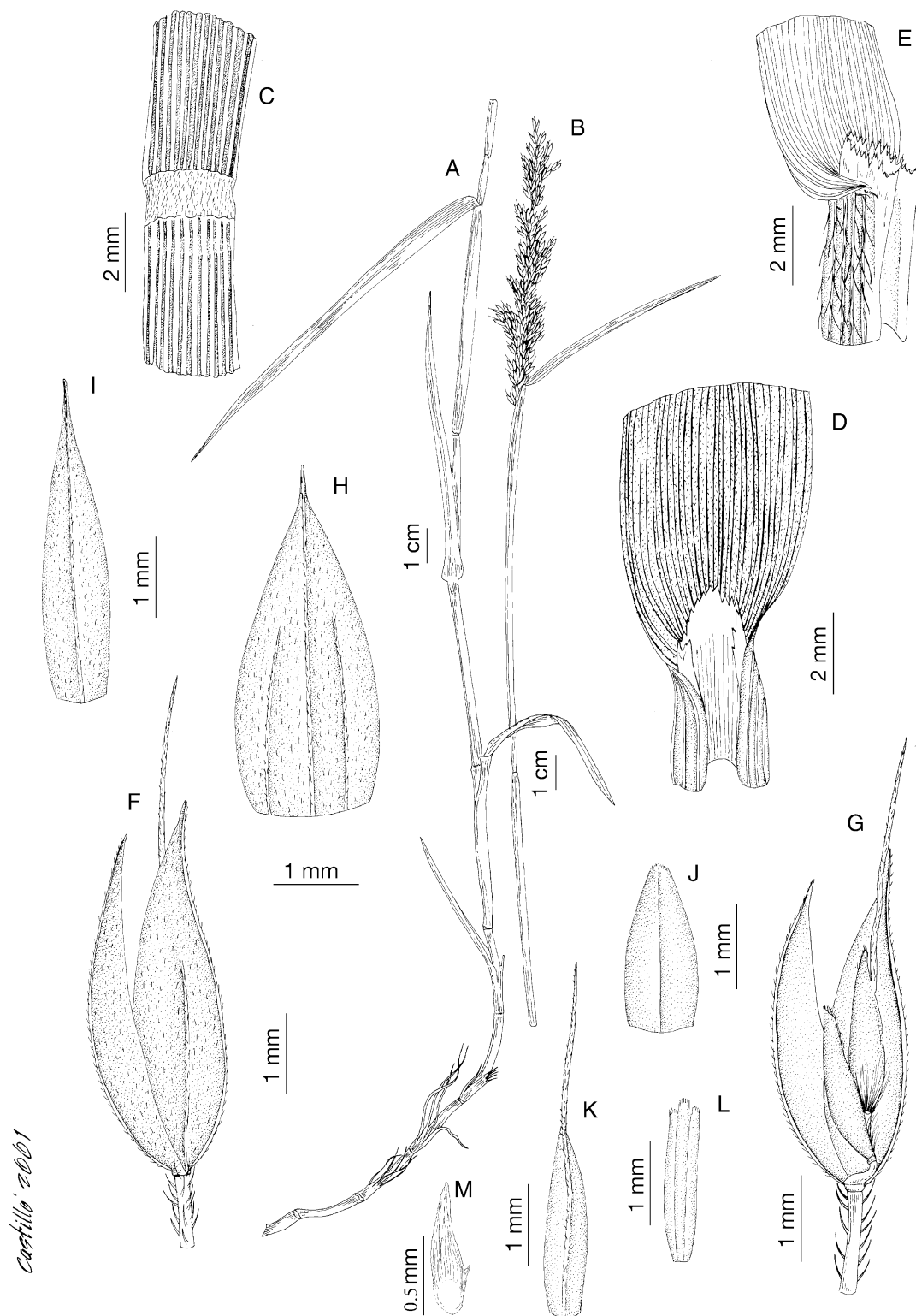


Figure 4. *Holcus azoricus* M. Seq. & Castrov.: A–K, ‘São Miguel, Ribeira Grande, Miradouro de Santa Iria. In meadows’, 8.vi.1964, P. Danserau, A. R. Pinto da Silva & B. V. Rainha, 472, LISE 70660; L, ‘Faial, Cedros near Cancela, in rough pastures’, 8.vi.1964, P. Danserau, A. R. Pinto da Silva & B. V. Rainha, LISE 70337; M, ‘Pico, Lagoa na base do Cabeço da Rocha (Landroal), alt. 785 m’, 23.vii.1997, M. Menezes de Sequeira, 3386A MS. A, rhizome and stem; B, panicle; C, node; D, E, ligule; F, spikelet; G, longitudinal section of the spikelet; H, upper glume; I, lower glume; J, lemma of the lower floret; K, lemma of the upper floret; L, palea of the lower floret; M, lodicule.

leaves with sheath 9.2–17.6 cm; lamina minutely scabrous to pubescent, linear-lanceolate, flat to convolute, persistent, attenuated in a subacuminate apex, median leaves 53.0–115.4 × 2.8–6.6 mm, upper leaves 23.8–66.0 × 1.9–5.1 mm; ligule (Fig. 4D, E) 1.5–2.2 mm, symmetric, membranous, puberulous to pubescent (hairs 0.030–0.326 mm), almost blunt or scarcely toothed to fimbriate. PANICLE (Fig. 4B) 4.5–11.5 cm long, whitish but sometimes purplish, many flowered, loose to somewhat compact (spike-like), sometimes irregular; with scabrous branches with acicular hairs. SPIKELETS (Fig. 4F, G) 3.96–5.71 mm long, falling entire with a well-marked abscission zone at the base of the glumes. GLUMES thinly papery, slightly unequal, enclosing the flowers, emarginated to acuminate, mucronate (rarely blunt), keeled, both keel and lamina minutely scabrous to pubescent; lower glume 3.48–5.08 × 1.37–2.06 mm long, one-nerved (Fig. 4I), puberulous to scaberulous, shortly ciliated on the keel, hairs 0.030–0.622 mm, apex emarginated to acuminate, blunt or mucronate (to 133 µm); upper glume 3.82–5.61 × 2.35–3.63 mm, three-nerved (Fig. 4H), lateral veins usually proximal (seldom marginal), scaberulous-puberulous to pubescent, shortly ciliated on the keel, hairs 0.03–0.712 mm, apex emarginated to acuminate, blunt or mucronate (to 0.370 mm). RHACHILLA extended beyond the last flower, divided into three parts: the first, 0.39–0.62 mm long (between the glumes and the first flower), glabrous, curved; the second (between the flowers) larger, 0.61–0.91 mm long, glabrous to pubescent, straight; the third (above the upper flower) villose-setose. LOWER FLORET hermaphrodite; callus very short, with large hairs (c. 1.47 mm); lemma cartilaginous (Fig. 4J), 1.81–2.54 mm long, puberulous, emarginated, rarely mucronate, shortly ciliated; palea 1.72–2.45 mm long, membranous, trilobed (Fig. 4L), keels (two) pubescent, included in the lemma, adherent to the caryopsis; lodicules 0.80–0.98 mm long, acuminate, with a turgescent base, circular-elliptic, glabrous, adherent and symmetric, with a short lateral tooth (Fig. 4M), 0.038–0.045 mm long, inserted in the lower one-third; stamens three (falling before those of the upper flower), anthers blunt. UPPER FLORET male; callus 118–193 µm long, pear-shaped to rounded, pubescent with hairs 0.25–1.33 mm long; lemma 1.91–2.60 mm long, glabrous to pubescent, emarginated, with a dorsal awn 1.94–3.87 mm long, hooked or bent, inserted on two-thirds to three-quarters of the lemma; palea 1.47–2.35 mm long, two-nerved, shortly trilobed, puberulous to pubescent; anthers blunt.

This new species seems to have a hybrid origin: *H. lanatus* × *H. rigidus*. This origin is much more plausible than that of *H. mollis* × *H. rigidus*, not only because the presence of *H. mollis* in the Azores archipelago is uncertain, but also because *H. azoricus* has

morphological characteristics clearly similar to those of *H. lanatus*. The most relevant are the indumentum (leaves and glumes) and the presence of a mucron in the glumes. Pinto da Silva & Pinto da Silva (1974) also considered this plant as a possible hybrid, but with the parents *H. rigidus* and *H. mollis*: '*Holcus rigidus* Hochst. ex Seub. São Miguel, Ribeira Grande, Caldeiras, 240 m s.m., in surrounding grassy waste places near the springs, n° 794, spikelets longer than in 694; ibid., Miradouro de Santa Iria, 75 m s.m., in meadows, n° 847, atypical: probably a hybrid with *H. mollis*.

Distribution, ecology, and conservation status: *Holcus azoricus* is locally abundant, but is still restricted to the central and eastern islands of the Azores archipelago. According to the studied material, this taxon is an Azores endemic from the islands: Santa Maria, São Miguel, Pico, S. Jorge, and Faial (Fig. 5).

It colonizes pastures (Fig. 6) and road margins, behaving as a ruderal and showing a much broader ecological niche than *H. rigidus*. Plants observed during fieldwork occurred sometimes in mixed populations of *H. rigidus* and *H. lanatus*.

The plants sent by Hanno Schäfer (and also observed in St. Maria by the author) were found in humanized habitats, always at lower altitudes than those preferred by *H. rigidus*.

There is a strong possibility that *H. lanatus* has been introduced in the Azores. In this case, *H. azoricus* may be the result of incomplete isolation between *H. rigidus* and *H. lanatus*. This enables the role of the latter taxon in the evolution and speciation of the genus to be clarified.

The data available are insufficient to attribute an IUCN threat category, and data deficient (DD) should be applied. The data available are also insufficient for the application of the criteria defined by Rabinowitz (1981).

It flowers from June to September.

CONCLUSIONS

A new species, *Holcus azoricus*, is proposed on the basis of clear morphological evidence. The new species belongs to *Holcus* gr. *mollis*, i.e. *H. mollis* ssp. *mollis*, *H. reuteri* Boiss. [= *H. mollis* L. ssp. *reuteri* (Boiss.) Tutin], and *H. mollis* ssp. *hierrensis*. Morphological characters clearly separate this new taxon from closely related species. The chromosome number, $2n = 35$, and the intermediate morphological characters strongly suggest a hybrid origin, possibly from *H. rigidus* and *H. lanatus*.

If *H. lanatus* ssp. *lanatus* is considered as a native species, the hybrid origin of *H. azoricus* would probably be previous to human settlement. Nevertheless, it is clearly taking advantage of habitat change result-

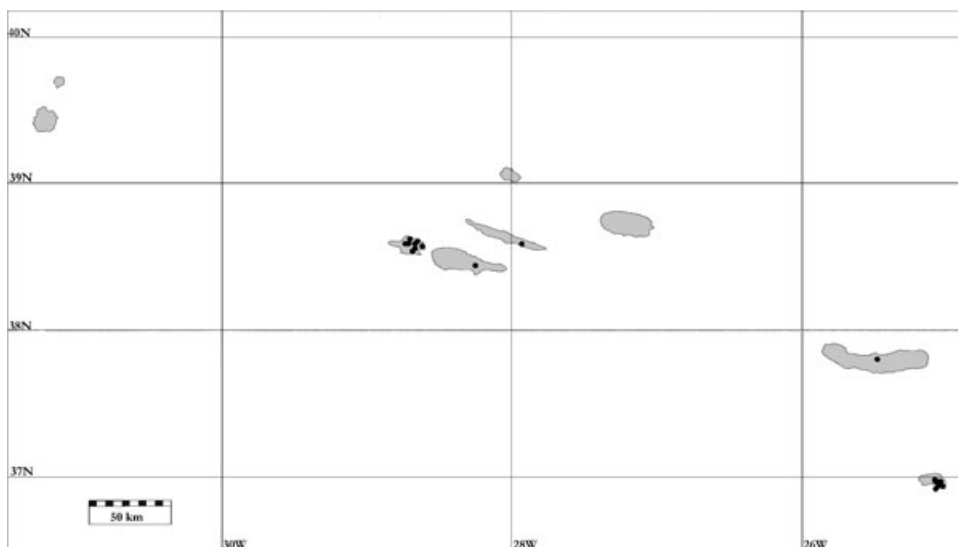


Figure 5. Distribution of *Holcus azoricus* M. Seq. & Castrov. based on the studied material.



Figure 6. Pasture habitat of *Holcus azoricus* M. Seq. & Castrov. near Ribeira dos Capadinhos on S. Jorge Island (Azores).

ing from forest destruction and the development of large pastures, a parallel event to the ecological advantages of the allopolyploid of *H. mollis* × *H. lanatus* (Richard *et al.*, 1995). A detailed study of the distribution and karyological and genetic variability of *H. azoricus* could unveil the ecological vs. genetic evolution of this taxon, and so clarify its possible recent and hybrid origin.

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- plant from Azores (Faial), collected in Faial by Hanno Schäfer, cultivated outdoors in Germany by Ch. Stierstorfer, vi.2001, *Ch. Stierstorfer* MS; Cedros near Canceleda, in rough pastures, 8.vi.1964, *P. Danserau, A. R. Pinto da Silva & B. V. Rainha* 472 LISE 70337; Faial, Fontainhas Westl. Pedro Miguel c. 480 m. Erdweg durch Vichweide, 7354, 10.vii.1999, *Hanno Schäfer*, 920 MS; Kriste nördlich Cedros. Schuttplatz auf den Klippen; auf Haustrüm... c. 100 m, 10.vi.1999, *Hanno Schäfer* 440 MS; Kulturland südl- Cedros. c. 500 m. Kleine Graben in vichweide (intensiv). Rasterfeld 7551, 14.ix.1999, *Hanno Schäfer* 969 MS; Kulturland südlich Cedros c. 500 m [?] Graben in Vichweide (intensiv), 7555, 14.ix.1999, *Hanno Schäfer* 9691/II MS; Lomba Grande westlich Pedro Miguel: c. 300 m. Vichcolide am Fu[?] da Lomba, 7257, 29.vi.1999, *Hanno Schäfer* 661 MS s/n°; Ribeirinha: kulturland an westlichen Ortsrand; c. 200 m. Rasterfeld: 7358, 28.vi.1999, *Hanno Schäfer* 645 MS; Rínquim östl. Praia do Norte. Vichweide c. 500 m, 21.vi.1999, *Hanno Schäfer* 575 MS; Salão, Westliche Ostrand c. 140 m. Vichweide, 7555, 18.vi.1999, *Hanno Schäfer* 5411/III MS; Salão; westlich Ostrand. Vichweide mit *Holcus lanatus*, *Dactylis glomerata*, *Arrhenatherum elatius*; c. 140 m, 18.vi.1999, *Hanno Schäfer* 541 MS; Vichweiden östl. Abegoaria; (Calderia-Horta). Trodiens Hediensaum (*Hydrangea*) am Rand eing Vichweide; c. 380 m, 23.vi.1999, *Hanno Schäfer* 595 MS; Circa Alto do Chão. Nos prados pastados. Alt. 650 m s.m., decl. 0°, exp. N; 16.vii.2004, *M. Menezes de Sequeira* 4431A-C MS. AZORES – PICO: Lagoa na base do Cabeço da Rocha (Landroal), Por entre rochas vulcânicas (muito porosas, com as raízes penetrando nas porosidades, tipo pedra pome). Na borda de um lameiro com *Sphagnum* abundante na borda. Alt. 785 m, 26S 389508 4256224, 23.viii.1997, *M. Menezes de Sequeira* 3386a MS (CAR); Lagoa na base do Cabeço da Rocha (Landroal), Por entre rochas vulcânicas (muito porosas, com as raízes penetrando nas porosidades, tipo pedra pome). Na borda de um lameiro com *Sphagnum* abundante na borda. Alt. 785 m, 26S 389508 4256224, 23.viii.1997, *M. Menezes de Sequeira* 3386b MS. AZORES – SANTA MARIA: Almas N Sto. Espírito c. 250 m [?], 9274, 24.vii.2001, *Hanno Schäfer* 1069/IV MS; Almas N Sto. Espírito c. 300 m [?], 9274, 24.vii.2001, *Hanno Schäfer* 1068 MS; Almas N Sto. Espírito c. 300 m. Rasterfeld 9274, 24.vii.2001, *Hanno Schäfer* 1068/IV MS; Casas Velhas N Malbusca c. 350 m, 9170, 4.vi.2001, *Hanno Schäfer* 842/III MS; E Cruz dos Picos c. 350 m. Manz entlang Erdweg derch[?] vichweiden, 9371, 21.vi.2001, *Hanno Schäfer* 966/III MS; E. Cruz dos Picos, c. 350 m. Manz entlang Erdweg durch Vichweiden. Rasterfeld: 9371, 21.vi.2001, *Hanno Schäfer* 966/I MS; Forno S Arrebentão c. 230 m. *Rubus ulmifolius* – Gebisch an Bóschung, 21.vi.2001, *Hanno Schäfer* 964/I MS; Lagos N St. Bár-

APPENDIX

STUDIED MATERIAL (CAR, PLANT SPECIMENS USED FOR CHROMOSOME COUNT)

Holcus azoricus M. Seq. & Castrov.

PORTUGAL, AZORES – Faial: Alto do Chão. Vichweide, 18.vii.1999, *Hanno Schäfer* 803 MS; Faial, Cabouco, bei Strausee-Baustelle c. 500 m. Wegböschung. rasterfeld 6953, 19.vi.2000, *Hanno Schäfer* MS; cultivated

bara c. 170 m. Arochenes Bachbett. Rasterfeld 9671, 17.vii.2001, *Hanno Schäfer* 1634 MS; Pico do Faleira c. 480 m. Pjad in *Pittosporum* – Gebisch. Rasterfeld: 9569, 13.vii.2001, *Hanno Schäfer* 999 MS; W Cavacas bei Malbusca c. 300 m. Leseteinmanes in Viechweiden, 9170, 4.vi.2001, *Hanno Schäfer* 841 MS; Pico Alto na vereda que corre para Norte, entre *Cryptomeria* e *Hedychium gardenarium*. Alt. 385 m s.m., decl. 0°, exp. N, 11.vii.2004, *M. Menezes de Sequeira* 4389a–d MS; Pico Alto na vereda que corre para Norte, na orla de bosque com *Laurus* e *Rubus*. Alt. 385 m s.m., decl. 0°, exp. N, 11.vii.2004, *M. Menezes de Sequeira* 4392a–e MS; Circa St. Bárbara, numa vereda que sobe ao pico da Faleira. Alt. 250 m s.m., decl. 10°, exp. WNW 282°, 12.vii.2004, *M. Menezes de Sequeira* 4398A–E MS. AZORES – S. MIGUEL: Ribeira Grande, Miradouro de Santa Iria. In meadows, 8.vi.1964, *P. Danserau, A. R. Pinto da Silva & B. V. Rainha* 472 LISE 70660. AZORES – S. JORGE: Estrada para o Topo. Ribeira dos Capadinhos Num prado denso. Alt. 690 m s.m., decl. 0°, exp. SSE 153°, 20.vii.2004, *M. Menezes de Sequeira* 4467A–C MS.

Holcus rigidus Hochst. in Seub.

AZORES – FAIAL: Caldeirão. Na borda cratera para o interior, junto ao miradouro, 19.viii.1997, *M. Menezes de Sequeira, C. Dias Ferreira, T. Salema & M. Menezes de Sequeira* 3384a–e MS (CAR); Cedros, 1 km a sul de Cancela na direcção da Caldeira (limite da estrada), 19.viii.1997, *M. Menezes de Sequeira, C.*

Dias Ferreira, T. Salema & M. Menezes de Sequeira 3383a–e MS (CAR). AZORES – FLORES: Morro Alto, 19.viii.1997, *M. Menezes de Sequeira et al.* 3382a–e MS (CAR); Por cima da Fajã Grande. Estrada para o Morro Alto, 19.viii.1997, *M. Menezes de Sequeira, C. Dias Ferreira, T. Salema & M. Menezes de Sequeira* 3381a–e MS (CAR). AZORES – PICO: Base da subida para o Pico, 25.viii.1997, *M. Menezes de Sequeira, C. Dias Ferreira, T. Salema & M. Menezes de Sequeira* 3387a–e MS (CAR); Lagoa na base do Cabeço da Rocha (Landroal), 23.viii.1997, *M. Menezes de Sequeira, C. Dias Ferreira, T. Salema & M. Menezes de Sequeira* 3385a–e MS (CAR). AZORES – S. JORGE: Face S da Ilha, na estrada da Calheta para o Topo depois da Fajã de S. João, 27.viii.1997, *M. Menezes de Sequeira, C. Dias Ferreira, T. Salema & M. Menezes de Sequeira* 3394a,b,d,e MS (CAR); Face W da Ilha, abaixo do Pico da Velha, na estrada para o farol dos Rosais, 27.viii.1997, *M. Menezes de Sequeira, C. Dias Ferreira, T. Salema & M. Menezes de Sequeira* 3390a–e MS (CAR). AZORES – S. MIGUEL: Empadada, perto da Lagoa do Covão, 30.viii.1997, *M. Menezes de Sequeira et al.* 3414a–e MS (CAR); Lagoa do Fogo, 30.viii.1997, *M. Menezes de Sequeira et al.*, 3412a–e MS (CAR). AZORES – TERCEIRA: Caldeira de St. Bárbara. Perto do topo (Antenas), 16.viii.1997, *M. Menezes de Sequeira et al.*, 3376a–d MS (CAR); Pico da Bagacina, Lagoa do Natal. Num cone vulcânico, 16.viii.1997, *M. Menezes de Sequeira & C. Dias Ferreira* 3377a–e MS (CAR).