

The Genus *Bromus* L. (Poaceae) in Taiwan: A DELTA Database for Generating Key and Descriptions

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ABSTRACT: We examined herbarial specimens of the genus *Bromus* L. (Bromeae, Festucoideae, Poaceae) in Taiwan and recognized four taxa. They were *Bromus catharticus* Vahl, *B. formosanus* Honda, *B. morrisonensis* Honda and *B. rigidus* Roth. Besides, *B. remotiflorus* (Steud.) Ohwi var. *piananensis* Ohwi was treated as an uncertain taxon. The DELTA (Descriptive Language for Taxonomy) database programs were used to generate an identification key and descriptions of the taxa.

KEY WORDS: DELTA, Key, *Bromus*, Festuceae, Festucoideae, Poaceae, Taiwan, Taxonomy.

INTRODUCTION

Bromus L. is the largest genus of the small grass tribe Bromeae and is especially distinct by the hairy apical appendages of the ovary. There are over 120 species of *Bromus* widely distributed in the world. Some of them are important forage grasses (Veldkamp, 1991). Hsu treated three species and one variety of *Bromus* (Poaceae) in the first edition of the *Flora of Taiwan* (Hsu, 1978). They were *Bromus catharticus* Vahl, *B. formosanus* Honda, *B. morrisonensis* Honda and *B. remotiflorus* (Steud.) Ohwi var. *piananensis* Ohwi. In which, *B. catharticus* Vahl is a native of South America and could be introduced into Taiwan as pasture. Now it has been naturalized in the central alpine region of Taiwan. The other three are all endemic taxa (Honda, 1928; Ohwi, 1941). Since then, Kuo (1979) reported a naturalized taxon, *B. rigidus* Roth, which he collected at 43K of Anmasan Forest Trail in 1978.

We reviewed the *Bromus* for volume 5 of the second edition of the *Flora of Taiwan*. The DELTA programs were used to collect data and generate an identification key and descriptions of the taxa. DELTA is a flexible and powerful computer processing tool for taxonomic descriptions (Dallwitz 1974, 1980; Dallwitz *et al.*, 1999a, b). Its data format has been adopted by the Taxonomic Databases Working Group (TDWG), a commission of the International Union of Biological Sciences (IUBS), as a standard for data exchange (Aiken *et al.*, 1996). It has been used previously for treatments of the Poaceae (Aiken *et al.*, 1996; Watson *et al.*, 1989; Watson and Dallwitz, 1994; Xu *et al.*, 1997), including the grasses of *Poa* in Taiwan (Chen and Kuoh, 2000).

This project (1) reviewed the *Bromus* in Taiwan; (2) developed a list of characters for recording data; (3) generated a key for identification of the taxa; (4) produced descriptions of taxa for the treatment of *Bromus* for the second edition of the *Flora of Taiwan*, volume 5.

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MATERIALS AND METHODS

We prepared a list of characters for the genus *Bromus* in Taiwan based on descriptions of the taxa in *Taiwan Grasses* (Hsu, 1975), in *Flora of Taiwan* (Hsu, 1978) and in other publications (Veldkamp, 1991; Watson and Dallwitz, 1994; Aiken *et al.*, 1996). Besides morphological characters, literatures, synonyms, distribution status, specimens cited and notes were also included. All specimens of *Bromus* deposited in the Herbarium of the Department of Botany, Taiwan University (TAI), the Institute of Botany, Academia Sinica, Taipei (HAST) and the Department of Biology, Cheng-Kung University (NCKU) were examined.

The DELTA programs were downloaded from the website <http://biodiversity.uno.edu/delta/www/programs.htm>. We entered the data obtained from the herbarium specimens into DELTA. A data editor program run under Windows 95/98 is available in the most updated version of DELTA programs released in 1999. It was necessary to export the data to three basic files, CHARS, ITEMS and SPECS, from this edition program because all the other functions of DELTA are still run under MS-DOS. Four essential directive files, TOKEY, KEY, TONAT and LAYOUT were edited. The identification key was generated by the program CONFOR with the directive file TOKEY and the program KEY with the directive file KEY. In addition, descriptions of the taxa were generated by the program CONFOR using the directive files TONAT and LAYOUT (Dallwitz *et al.*, 1999a, b).

RESULTS

The final list of 68 characters for the Taiwanese taxa of *Bromus* is presented in Appendix 1. Of the 68 characters, 62 are morphological. After examining specimens at TAI, HAST and NCKU, we recognized *B. catharticus* Vahl, *B. formosanus* Honda, *B. morrisonensis* Honda and *B. rigidus* Roth. *B. remotiflorus* (Steud.) Ohwi var. *piananensis* Ohwi was treated as an uncertain taxon for the time being.

TAXONOMIC TREATMENT

The following key to the Taiwanese taxa of the genus *Bromus* was generated by DELTA. It was a bracketed key originally, but we modified it to an indented key to fit the format of the *Flora of Taiwan*.

1. Spikelets strongly laterally compressed; lemmas awnless; lemmas margins not inrolled 1. *B. catharticus* Vahl
1. Spikelets slightly laterally compressed; lemmas with awn; lemmas margins inrolled..... 2
 2. Lemmas longer than 20 mm; lemmas subcoriaceous; upper glumes subcoriaceous 4. *B. rigidus* Roth
 2. Lemmas shorter than 20 mm; lemmas chartaceous; upper glumes chartaceous 3
 3. Lower glumes 1-nerved; upper glumes shorter than 10 mm; upper glumes 3-nerved; lemmas with a awn longer than half to nearly as long as lemma; lower glumes sharp at apex 3. *B. morrisonensis* Honda
 3. Lower glumes 3-nerved; upper glumes longer than 10 mm; upper glumes 5-nerved; lemmas with a short awn less than the 1/2 length of lemma; lower glumes acute at apex 2. *B. formosanus* Honda

- 1. *Bromus catharticus* Vahl**, Symb. Bot. 2: 22. 1791; Ohwi, Acta Phytotax. Geobot. 10: 107. 1941; Hitchc., Man. Grass. U. S. 34. f. 3. 1951; Keng, Fl. Ill. Pl. Prim. Sinicarum Gram. 277. f. 225. 1959; Hsu, Taiwania 16: 237. 1971; Hsu, Taiwan Grass 295. pl. 42. 1975; Hsu, Fl. Taiwan 5: 429. 1978; Koyama, Grass. Jap. Neighb. Reg. 34. f. 6. 1987; Veldkamp, Blumea 35(2): 487. 1991.

Bromus unioloides Kunth, Nov. Gen. Sp. 1: 151. 1816; Osada, Ill. Grasses Jap. Enl. Ed. 396. 1993.

Annuals, biennials or perennials. Culms ascending, 34-87 cm tall, 3 mm wide. Leaf-blades chartaceous, linear, 21-32 cm long, 5-7 mm wide, sharp at apex, veins conspicuous, puberulous to glabrous above, glabrous beneath. Sheath villous to glabrous. Ligule membranous, tongue- or triangular-shaped, rounded to acute at apex, 3 mm long. Inflorescence an open panicle, 13-31 cm long. Spikelets with 4-9 florets, elliptical, 27-28 mm long, 5-6 mm wide, strongly laterally compressed. Pedicels minutely hispid. Lower glumes subcoriaceous, minutely hispid, lanceolate, sharp at apex, 12-14 mm long, 7-nerved. Upper glumes coriaceous, broadly lanceolate, sharp at apex, 13-15 mm long, 11-nerved, minutely strigose. Florets 19 mm long, with rachilla. Lemmas coriaceous, broadly lanceolate, margins not inrolled, acute at apex, 19 mm long, awnless, 11-nerved, minutely hispid on nerves. Paleas membranous, linear-oblong, acute at apex, 8-10 mm long, 2-nerved, ciliate on nerves. Callus glabrous. Caryopsis linear-oblong, 7 mm long, hilum linear.

Native of South America; introduced to many countries as a forage grass and naturalized in the central alpine region of Taiwan since 1960s.

Specimens examined: TAICHUNG: Lishan, *Chen Y. F. 16881* (NCKU), *Kuoh 80088* (TAI), *Hsu and Kuoh 7102* (TAI); Wuling Farm, *Chang 10891* (NCKU), *Wang 3918* (TAI); Piluhsi, *Wang 2618* (TAI); Chuanhsingshan Nursery Garden, *Wang 1091* (HAST). NANTOU: Tsuifeng, *Chen 1017* (HAST); Mt. Shihmenshan, *Chiu 2981* (HAST); Meifeng, *Tsai 17* (TAI). KAOHSIUNG: Mt. Guanshan, *Kuoh 13128* (NCKU).

2. *Bromus formosanus* Honda, Bot. Mag. Tokyo 42: 136. 1928; Honda, Monogr. Poac. Jap. 38. 1930; Keng, Fl. Ill. Pl. Prim. Sinicarum Gram. 265. f. 215. 1959; Hsu, Taiwania 16: 237. 1971; Hsu, Taiwan Grass 297. pl. 143. 1975; Hsu, Fl. Taiwan 5: 430. pl. 1387. 1978; Koyama, Grass. Jap. Neighb. Reg. 34. 1987.

Perennials. Culms ascending, 30-40 cm tall, 1.5 mm wide. Leaf-blades chartaceous, linear, 15-24 cm long, 3-4 mm wide, sharp at apex, veins conspicuous, glabrous above, glabrous beneath. Sheath glabrous. Ligule membranous or chartaceous, triangular-shaped, rounded or acute at apex, 0.5 mm long. Inflorescence an open panicle, 8-15 cm long. Spikelets with 7-8 florets, lanceolate, 20-24 mm long, 6 mm wide, slightly laterally compressed. Pedicels minutely hispid to glabrous. Lower glumes chartaceous, strigose to glabrous, lanceolate to narrowly lanceolate, acute at apex, 9-11 mm long, 3-nerved. Upper glumes chartaceous, lanceolate to broadly lanceolate, sharp to obtuse at apex, 11-12 mm long, 5-nerved, minutely strigose to glabrous. Florets 14-15 mm long, with rachilla. Lemmas chartaceous, lanceolate to elliptical, margins inrolled, rounded or acute at apex, 14-15 mm long, with a short awn less than the 1/2 length of lemma, 7 to 8-nerved, densely hirsute on marginal region of backside. Paleas membranous, linear-oblong, round, truncate or acute at apex, 9-10 mm long, 2-nerved, ciliate on nerves. Callus glabrous. Anthers 2.5 mm long. Caryopsis oblong to linear-oblong, 8 mm long, hilum linear.

Endemic to the alpine region of Taiwan.

Specimens examined: HSINCHU: Mt. Tapachienshan, *Hsu 12194* (TAI). TAICHUNG: Mt. Hsuehshan, *Shimada 2611* (TAI). ILAN: Mt. Nanhutashan, *Suzuki s. n. Jul. 17, 1937* (TAI); *Fukuyama 4080* (TAI); *Hsu 5966* (TAI); *Lu 23405* (NCKU).

After examining all specimens from herbaria mentioned above, we couldn't recognize any taxon which fit with Honda's description of *B. formosanus* entirely but a distinct and strange taxon. Basically the characters of the taxon tally with the Honda's description of *B. formosanus* except the nerve numbers of lower glumes, upper glumes and lemmas. According to Honda's description, *B. formosanus* had 1-nerved lower glumes, 3-nerved upper glumes and 5-nerved lemmas but the vein numbers of lower glumes, upper glumes and lemmas of the taxon we recognized were three, five and seven. Keng (1959) and Koyama (1987) both followed Honda's description to describe *B. formosanus*. Hsu (1975, 1978) recognized *B. formosanus* and cited several specimens. In his description, *B. formosanus* had 1-nerved lower glumes, 3- or 5-nerved upper glumes and 7-nerved lemmas. Among the specimens Hsu cited, some belonged to the taxon but the others were classified to be *B. morrisonensis* by us. This confusion may be the reason why Hsu described *B. formosanus* as above. Unfortunately we haven't seen type specimen of *B. formosanus* yet thus we can not make sure whether the taxon is *B. formosanus* Honda or not. For the time being we assume that the taxon is *B. formosanus* but modify its description about the vein numbers of lower glumes, upper glumes and lemmas.

3. *Bromus morrisonensis* Honda, Bot. Mag. Tokyo 42: 137. 1928; Honda, Monogr. Poac. Jap. 39. 1930; Hsu, Taiwania 16: 237. 1971; Hsu, Taiwan Grass 299. pl. 44. 1975; Hsu, Fl. Taiwan 5: 430. pl. 1388. 1978; Koyama, Grass. Jap. Neighb. Reg. 35. 1987; Veldkamp, Blumea 35(2): 492. 1991.

Perennials. Culms ascending, 28-100 cm tall, 2 mm wide. Leaf-blades chartaceous, linear, 12-28 cm long, 3-5 mm wide, sharp at apex, veins conspicuous, loosely puberulous to glabrous above, villous to glabrous beneath. Sheath villous to glabrous. Ligule membranous, rounded or acute at apex, 2 mm long. Inflorescence an open or contracted panicle, 9-18 cm long. Spikelets with 5-10 florets, elliptical or lanceolate or linear-lanceolate, 11-25 mm long, 2-4 mm wide, slightly laterally compressed. Pedicels minutely hispid. Lower glumes membranous on margins, glabrous to minutely hispid, lanceolate to linear-lanceolate, sharp at apex, 4-6 mm long, 1-nerved. Upper glumes chartaceous, broadly lanceolate, sharp or acute to obtuse at apex, 5-8 mm long, 3-nerved, minutely strigose to glabrous. Florets 8-9 mm long, with rachilla. Lemmas chartaceous, lanceolate to elliptical, margins inrolled, rounded at apex or acute at apex, 8-9 mm long, with a awn longer than half to nearly as long as lemma, 3-nerved, slightly hairy on the base of nerves or glabrous. Paleas membranous, linear oblong, round or truncate at apex or acute at apex, 6-7 mm long, 2-nerved, ciliate to minutely ciliate on nerves. Callus glabrous. Anthers 2.5 mm long. Caryopsis linear-oblong, 6 mm long, hilum linear.

Distributed in Malesia, the Philippines and Taiwan. Common in the alpine regions.

Specimens examined: HSINCHU: Mt. Itse, *Shimada 509* (TAI). TAICHUNG: Wuling, *Huang 7055* (TAI); Mt. Hsuehshan, *Koyama 23944* (TAI); *Lu 20041* (NCKU). NANTOU: Meifeng, *Tsai 11* (TAI); Mt. Hohuanshan, *Peng 8312* (HAST); en route from Tongpu to Tzuchung, *Hsu 7432* (TAI); Patungkuan, *Huang 8505* (TAI), *Kuoh 14492* (NCKU); en route from Paiyun Hiking Resort to Monroo cliff, *Hsu 6331* (TAI). CHIAYI: Mt. Yushan, *Sasaki s. n. Nov. 1. 1933* (TAI); en route from Tatachia to Paiyun Hiking Resort, *Kuoh 1283* (TAI); en route from Tatachia to Chien-hon-ko, *Chen Y. F. 11339* (NCKU); Nantsuhsienchi, *Kuoh 10246* (NCKU). KAOHSIUNG: *Fukuyama s. n. Jul. 12. 1935* (TAI); en route from Tienchih to Yakou on South Cross Highway, *Huang 8890* (TAI); Mt. Guanshanling, *Kuoh 12471* (NCKU). ILAN: Mt. Nanhutashan, *Kao 5200* (TAI); *Hsu 5907* (TAI); *Suzuki 17627* (TAI). TAITUNG: Mt. Takuanshan, *Peng 11724* (HAST).

This species was thought to be an endemic taxon of Taiwan till 1991. Veldkamp (1991) reported that it was also distributed in Malaysia and the Philippines although it was very rare in the two countries.

4. ***Bromus rigidus*** Roth in Roemer & Ustr., Mag. Bot. 10: 21. 1790; Hitchc., Man. Grass. U. S. 52. f. 36. 1951; Keng, Fl. Ill. Pl. Prim. Sinicarum Gram. 275. f. 223. 1959; Kuo. Taiwania 24: 22. 1979; Koyama, Grass. Jap. Neighb. Reg. 43. 1987; Osada, Ill. Grasses Jap. Enl. Ed. 382. 1993.

Bromus diandrus Roth, Bot. Abh. 44. 1787; Veldkamp, Blumea 35(2): 489. 1991.

Annuals, or biennials. Culms ascending, 30-70 cm tall, 3.5 mm wide. Leaf-blades chartaceous, linear, 5-18 cm long, 2-5.5 mm wide, sharp at apex, veins conspicuous, puberulous above, villous beneath. Sheath loosely villous. Ligule membranous, tongue-shaped, rounded at apex, 3 mm long. Inflorescence an open panicle, 7-20 cm long. Spikelets with 4-8 florets, elliptical, 45 mm long, 4 mm wide, slightly laterally compressed. Pedicels minutely hispid. Lower glumes chartaceous, glabrous or loosely strigose, linear-lanceolate, sharp at apex, 20 mm long, 1-nerved. Upper glumes subcoriaceous, lanceolate, sharp at apex, 15-30 mm long, 3-nerved, minutely strigose. Florets 22-32 mm long, with rachilla. Lemmas subcoriaceous, lanceolate, margins inrolled, shortly bilobed at apex, 22-32 mm long, with a awn longer than lemma, 5 to 7-nerved, densely pubescent on back surface. Paleas membranous, linear-oblong, round or truncate at apex, 12-16 mm long, 2-nerved, ciliate on nerves. Callus glabrous. Anthers 2 mm long. Caryopsis linear-oblong, 10 mm long, hilum linear.

Native to the Mediterranean region of Europe, widely naturalized in North Hemisphere. First collected in Taiwan at Anmashan in 1978.

Specimens examined: TAICHUNG: Anmashan forest trail 43K, Kuo 9611 (TAI).

Kuo (1979) reported this species as a new naturalized record based on only one collection at Anmashan of Taichung county in 1978. Beside Kuo's collection, we haven't seen any other collection of this species in Taiwan. Perhaps it failed to establish its populations here. In most floras *B. rigidus* Roth and *B. diandrus* Roth are distinguishable but Veldkamp (1991) treated *B. rigidus* as a synonym of *B. diandrus*. He thought the two taxa were not so easy to be distinguished. Esnault and Huon (1986 and 1987, cited by Veldkamp, 1991) remarked that the two 'taxa' occur within the same populations and can only be recognized by their chromosome numbers: *B. rigidus* has $2n = 42$, *B. diandrus* $2n = 56$. There is only one collection of the taxon in Taiwan and we have no idea about its chromosome number. More information is needed to make sure what species the taxon of Taiwan is. We retain the collection to be *B. rigidus* for the time being.

UNCERTAIN VARIETY

- Bromus remotiflorus* (Steud.) Ohwi var. *piananensis*** Ohwi in Acta Phytotax. Geobot. 10: 106. 1941; Hsu in Taiwania 16: 237. 1971, Taiwan Grass. 301. pl. 45. 1975, Fl. Taiwan 5: 431. 1978.

The variety was published by Ohwi in 1941 and he gave only a very short description in Latin with notes in Japanese. He noted that this variety looked very similar to *B. morrisonensis* except the more slender culms, sparser trichomes and the appressed hairs at the base of side veins on lemmas. Hsu (1975 and 1978) recognized this variety and cited some specimens. In Hsu's description the variety had 3-nerved lemmas and was almost identical to *B. morrisonensis*. Keng (1959), Koyama (1987) and Veldkamp (1991) all described that *B. remotiflorus* had 7-nerved lemmas. Veldkamp (1991) doubted *B. remotiflorus* var. *piananensis* was part of *B. remotiflorus* and thought it a form of *B. morrisonensis*, hence he treated it as a synonym of *B. morrisonensis*. According to Hsu's key of *Bromus*, he distinguished the two taxa by only the presence of pubescence at base of nerves on lemmas. We found that this is a continuous variation. On the other hand few specimens were almost identical to *B. morrisonensis* except the 7-nerved lemmas. For the time being, we treat the variety as an uncertain taxon.

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Appendix 1. The list of characters

- #1. <literatures>/
- #2. <synonyms>/
- #3. <plant duration>/
 - 1. annuals/
 - 2. biennials/
 - 3. perennials <with remains of old sheaths and/or culms>/
- #4. culms <habit>/
 - 1. ascending/
- #5. culms <height>/
 - cm tall/
- #6. culms <diameter>/
 - mm wide/
- #7. leaf-blades <texture>/
 - 1. chartaceous/
- #8. leaf-blades <shape>/
 - 1. linear/
- #9. leaf-blades <length>/
 - cm long/
- #10. leaf-blades <width>/
 - mm wide/
- #11. leaf-blades <apex>/
 - 1. sharp at apex/
- #12. leaf-blades <veins>/
 - 1. veins conspicuous/
- #13. leaf-blades <indumentum above>/
 - 1. puberulous above/
 - 2. loosely puberulous above/
 - 3. glabrous above/
- #14. leaf-blades <indumentum beneath> /
 - 1. villous beneath/
 - 2. glabrous beneath/

- #15. sheath <indumentum on surface>/
1. villous/
2. loosely villous/
3. glabrous/
- #16. <adaxial> ligule <texture>/
1. membranous/
2. chartaceous/
- #17. <adaxial> ligule <shape>/
1. tongue-shaped/
2. rounded-shaped/
3. triangular-shaped/
- #18. <adaxial> ligule <apex>/
1. rounded at apex/
2. acute at apex/
- #19. <adaxial> ligule <length>/
mm long/
- #20. inflorescence <type>/
1. an open panicle/
2. a contracted panicle/
- #21. inflorescence <length>/
cm long/
- #22. spikelets with <number of florets>/
florets/
- #23. spikelets <shape>/
1. elliptical/
2. lanceolate/
3. linear lanceolate/
- #24. spikelets <length, including the awn>/
mm long/
- #25. spikelets <width>/
mm wide/
- #26. spikelets <compressibility>/
1. strongly laterally compressed/
2. slightly laterally compressed/
- #27. pedicels <vestiture>/
1. minutely hispid/
2. glabrous/
- #28. lower glumes <texture>/
1. chartaceous/
2. subcoriaceous/
3. membranous on margins/

- #29. lower glumes <vestiture on back>/
1. strigose/
2. glabrous/
3. loosely strigose/
4. minutely hispid/
- #30. lower glumes <shape>/
1. lanceolate/
2. narrowly lanceolate/
3. linear-lanceolate/
- #31. lower glumes <apex>/
1. acute at apex/
2. sharp at apex/
- #32. lower glumes <length>/
mm long/
- #33. lower glumes <number of nerves>/
-nerved/
- #34. upper glumes <texture>/
1. chartaceous/
2. subcoriaceous/
3. coriaceous/
- #35. upper glumes <shape>/
1. lanceolate/
2. broadly lanceolate/
- #36. upper glumes <apex>/
1. sharp at apex/
2. acute to obtuse at apex/
- #37. upper glumes <length>/
mm long/
- #38. upper glumes <length 2>/
1. longer than 10 mm/
2. shorter than 10 mm/
- #39. upper glumes <number of nerves>/
-nerved/
- #40. upper glumes <vestiture on nerves>/
1. minutely strigose/
2. glabrous/
- #41. florets <length>/
mm long/
- #42. florets <with or without rachilla>/
1. with rachilla /
2. without rachilla/

- #43. lemmas <texture>/
1. chartaceous/
2. subcoriaceous/
3. coriaceous/
- #44. lemmas <shape>/
1. broadly lanceolate/
2. lanceolate/
3. elliptical/
- #45. lemmas <margins>/
1. margins inrolled/
2. margins not inrolled/
- #46. lemmas <apex>/
1. rounded at apex/
2. acute at apex/
3. shortly bilobed at apex/
- #47. lemmas <length, including awn>/
mm long/
- #48. lemmas <length>/
1. longer than 20 mm/
2. shorter than 20 mm/
- #49. lemmas <awn presence>/
1. with awn/
2. awnless/
- #50. lemmas <awn: ratio of length>/
1. with a short awn less than the 1/2 length of lemma/
2. with a awn longer than half to nearly as long as lemma/
3. with a awn longer than lemma/
- #51. lemmas <number of nerves>/
-nerved/
- #52. lemmas <presence of hairs>/
1. hairy/
2. glabrous/
- #53. lemmas <vestiture>/
1. densely hirsute on marginal region of backside/
2. only slightly hairy on the base of nerves/
3. minutely hispid on nerves/
4. densely pubescent on back surface/
- #54. paleas <texture>/
1. membranous/
- #55. paleas <shape>/
1. linear oblong/

- #56. paleas <apex>/
 - 1. round or truncate at apex/
 - 2. acute at apex/
- #57. paleas <length>/
 - mm long/
- #58. paleas <number of nerves>/
 - nerved/
- #59. paleas <vestiture on nerves>/
 - 1. ciliate on nerves/
 - 2. minutely ciliate on nerves/
- #60. callus/
 - 1. glabrous/
- #61. anthers <length>/
 - mm long/
- #62. caryopsis <shape>/
 - 1. oblong/
 - 2. linear-oblong/
- #63. caryopsis <length>/
 - mm long/
- #64. hilum <shape>/
 - 1. linear/
- #65. <distribution>/
- #66. <note 1>/
- #67. <specimen cited>/
- #68. <note 2>/

台灣的雀麥屬(禾本科)植物：應用 DELTA 電腦資料庫系統
以產生檢索表及分類群描述

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摘 要

本研究重新檢討台灣的禾本科雀麥屬植物的分類，詳細檢視標本館的標本，並蒐集整理相關文獻後，我們確認了 4 個種，及一個疑問變種。此外，並應用 DELTA (分類學的描述性語言)系統，建立各分類群之特徵資料庫，並據以自動化產生分種檢索表及各分類群之描述。DELTA 系統的使用，使得我們在編輯檢索表及描述物種的效率大為提昇，並得到極佳的成果。

關鍵詞：DELTA 系統，檢索表，雀麥屬，雀麥族，羊茅亞科，禾本科，台灣，分類學。

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