Taiwania 63(4): 287-291, 2018
DOI: 10.6165/tai.2018.63.287

Striga crispata sp. nov. (Orobanchaceae), a new hemiparasitic species from Taiwan

Sheng-Zehn YANG[1,*], Zi-Xuan CHEN[1], Chien-Fan CHEN[2], and Po-Hao CHEN[1]

1. National Pingtung University of Science and Technology, 1 Shuefu Rd, Neipu, Pingtung 91201, Taiwan.
2. Division of Botanical Garden, Taiwan Forestry Research Institute, 53, Nanhai Rd., Taipei 10066, Taiwan.
[*]Corresponding author's tel.: 886-8-7703202-7408, fax.: 886-8-7740134, e-mail: yangsz@mail.npust.edu.tw.

(Manuscript received 18 April 2018; accepted 4 September 2018; online published 1 October 2018)

ABSTRACT: A new hemiparasitic species, *Striga crispata* sp. nov., is described and illustrated from Tawu Township, Taitung County, Southern Taiwan. It most closely resembles the Australian species, *S. parviflora* (R. Brown) Benth, but can be differentiated by longer corollas that are pink or pinkish purple in color, corolla-lobes with crispate margins, and ornamented seed surface that is only covered by the primary ridge. A morphological description, line drawings, photographs, and conservation status are provided to aid identification.

KEY WORDS: Hemiparasite, Orobanchaceae, *Striga, Striga parviflora,* Taiwan.

INTRODUCTION

The genus *Striga* Lour. is a genus in the family Orobanchaceae that contains approximately 42 species distributed in Tropical Africa (Fischer *et al*., 2011, Jayanthi *et al*., 2014). Some of the recorded species are from tropical and subtropical Asia and Oceania (Mohamed *et al*., 2001, Jeeva *et al*., 2012, Jayanthi *et al*. 2014, Omalsree *et al.* 2015, 2018), of which two species, *S. asiatica* (L.) Kuntze. (Nail *et al*., 2014) and *S. masuria* (Benth.) Benth., occur in Taiwan (Liu, 1998).

Almost all *Striga* species are obligate root parasites or hemiparasites that require a living host for germination and initial establishment (Jayanthi *et al*., 2014), and which usually cause damage to the host (Sauerborn, 1991, Mohamed *et al*., 2001). The host plants of *Striga* representatives are often from the family Poaceae. Several *Striga* species have already been recognized as cereal pests that are harmful to sorghum and millet in Africa and India (Spallek *et al*., 2013).

In November 2017, an unknown *Striga* species, growing together with some Poaceae members, was detected at the Tawu Township, Taitung County, Taiwan. Examination of the collected materials combined with relevant information from the published literature (Bentham, 1835, 1869; Pennell, 1939, 1943), revealed that the species is related to *Striga parviflora* (R. Brown) Benth., which is a species endemic to Australia; however, the species found in Taiwan has certain distinguishing characteristics. Consequently, it was identified as a new species, which is described here.

TAXONOMIC TREATMENTS

Striga crispata S.-Z. Yang, Z.-X. Chen, C.-F. Chen & P.-H. Chen, ***sp. nov.*** **大武獨腳金 Fig. 1-3**

Similar to *S. parviflora* in having leaf of 15–25 mm long; corolla shortly lobed, lips entire at the margin, violet, but differing from *S. parviflora* with leaves of 7–15 mm long; corolla deeply lobed, lips crispate at the margin, pink or pinkish purple.

Type: TAIWAN: Tawu Township, Taitung County, Alt. ca. 20–30 m, on Tawu 1st cemetery, Nov. 26, 2017, *Z.-X. Chen s.n.* (PPI 78580) (holotype: PPI [fl. & fr., dried]; isotypes: TAIF [fl. & fr., dried]).

An annual erect hemiparasitic herb. ***Stem*** 9–25 cm in height, with 4 ridges, simple or with 2 to 3 branches from below middle, sparsely strigillose. ***Leaves*** simple, sessile, opposite on lower and sub-opposite on upper leaves, linear, 7–15 × 1.0–1.3 mm, truncate at base, acuminate at apex, veins obscure, green or purple in color, strigillose on both surfaces and margins. ***Inflorescence*** spike, 7–7.5 cm long, about 14–40 flowers, lax; bract 1, elliptic, 3–4 × 0.6–1.0 mm, green; bracteoles 2, linear, 5–7 × 0.8–1.1 mm, green; calyx 5-ribbed, 6–8 mm long, tube 4–5 mm long, lobes 5, linear, equal in length, 1–3 mm long, strigillose; corolla salverform, bilabiate, 3.0–3.5 mm in diameter, pink or pinkish purple; tube bend near the top, 8–9 mm long, throat densely bearded, glandular trichomes on outer surface; upper lip 1.0–1.3 mm long, slightly notched in the middle and irregularly crispate at margin, lobes of lower lip fused to < 50% of their length, forming a weakly bilabiate corolla, lower lip ca. 1.3 mm long, deeply 3-lobed, lobe rhombus to ovate, undulate or irregularly crispate; stamens 4, didynamous, included; filament 1 mm long, glabrous; anthers basifixed, longitudinal; ovary hypogynous, oblong, 2 mm long, 0.6 mm in diameter, glabrous; style, 3.5–4.0 mm long; stigma capitate, glabrous. ***Fruit*** capsule, ovate, 2.0 × 1.8 mm, black-brown when mature, calyx persistent, fruit enclosed in calyx lobes, style persistent, loculicidal dehiscence. ***Seeds*** ovoid to oblong or reniform, 0.30–0.35 × 0.1–0.2

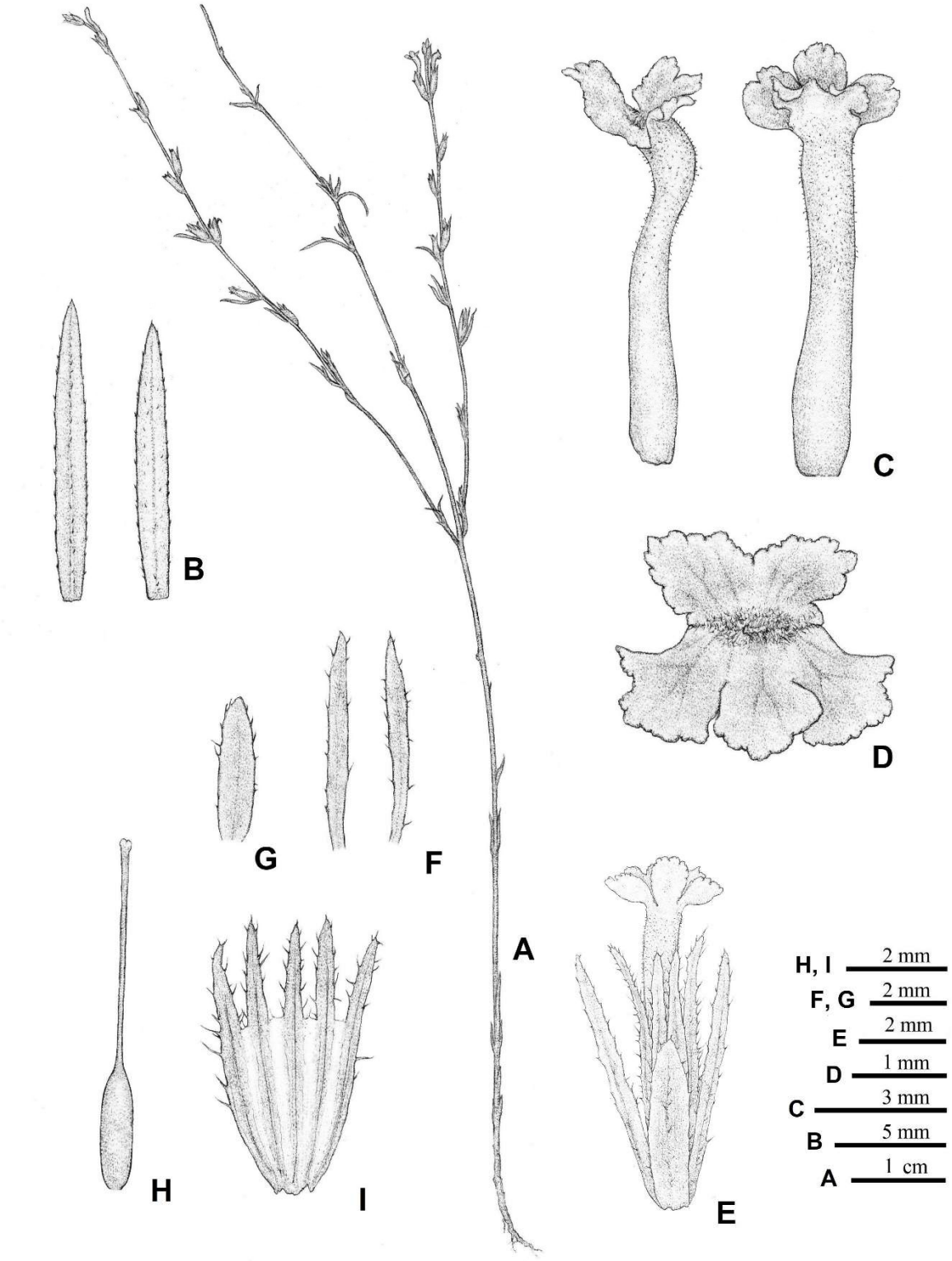

Fig. 1. ***Striga crispata*** (*Z. -X. Chen s. n.*, PPI 78580). **A**: Habit; **B**: Leaves; **C**: Corolla, lateral view (left) and adaxial view (right); **D**: Face view of corolla, showing bilabiate with notched upper lips and 3-deeply lobed lower lips; **E**: Flower, with one bract, two bracteolates, and 5-lobed calyx; **F**: Bracteolate; **G**: Bract; **H**: Pistil, with long style; **I**: Calyx 5-lobed and 5-ribbed.

Fig. 2. ***Striga crispata*** (*Z. -X. Chen s. n.*, PPI 78580). **A**: Habit. **B**: Flower, with 1-bract and 2-bracteolates. **C**: Corolla lobes rhombus to ovate in shape (face view). **D**: Fruit black or brown in color at maturity stage; calyx persistent and longer than the fruit.

mm, prominent reticulates with protuberances on the surface, brown, glabrous.

Ecology: *Striga crispata* sp. nov. is only known from the type locality in Taiwan, found on the edge of streams, at altitudes 20–30 m. The host plant is *Heteropogon contortus* (L.) P. Beauv. *ex* Roem. & Schult (Poaceae) (Fig. 2), and the other congeners *Striga asiatica* (L.) Kuntze (Orobanchaceae) are found near this new taxon. The flowering and fruiting occurs from October to November, with it withering in winter.

***Conservation assessment*:** There is not yet enough information about the distribution, abundance, or threats to this new species; we consider it Data Deficient (DD) at this time (IUCN, 2011).

Additional specimens examined (paratype): TAIWAN: Tawu Township, Taitung County, Alt. ca. 20–30 m, on Tawu 1st cemetery, Sep. 22, 2018, *P.-H. Chen 1696* (TAI [fl. & fr., dried]).

DISCUSSION

When comparing all *Striga* species recorded in the previous report from Mohamed *et al.* (2001), the morphology of *S. crispata* sp. nov. was most similar to that of *S. parviflora* (R. Brown) Benth., which is distributed in tropical Australia (Pennell, 1939, 1943) (Table 1). This new species is a root parasite of the host plant *H. contortus*, but some individuals of this new species grew nearby without parasitizing the host root. Three Poaceae species, i.e., *Eulalia leschenaultiana* (Decne.) Ohwi, *Setaria glauca* (L.) P. Beauv., and *Sorghum nitidum* (Vahl) Persoon., were also found in abundance in this habitat. It was uncertain whether this new species is also a root parasite and harmful to these three species, and should be further investigated in the near future.

The seed surface of each *Striga* species photographed

Table 1. Diagnostic characteristics used to distinguish ***Striga crispata*** and ***S.parviflora.***

Features	***Striga crispata*** (this study)	***Striga parviflora*** (R. Brown) Benth. (reference cited)
Stem cross section	4 ridges	–
Stem branch	2-3-branched	1-little-branched (Bentham, 1835, 1869)
Stem height (cm)	9–25	15–23 (6–9 inch) (Bentham, 1869)
Leaf length (mm)	7–15	15–25 (Pennell, 1939)
Inflorescence	lax spike	interrupted terminal spike (Bentham, 1869)
Inflorescence length (cm)	7–7.5	–
Calyx length (mm)	6–8	1–1.5 lines (Bentham, 1869)
Calyx lobed length	equal	equal (Pennell, 1943)
Corolla shape	salverform	–
Corolla length (mm)	9–10.3	3 lines, 6.4, 7–8 (Bentham, 1869; Pennell, 1939, 1943)
Corolla lobed	deeply-3 lobed	shortly-lobed (Bentham, 1869)
Corolla tube length (mm)	8–9	–
Corolla tube bent	near the top	near the top, strongly decurved (Bentham, 1869; Pennell, 1943)
Corolla color	pink or pinkish purple	blue, violet, reddish purple (Bentham, 1869; Pennell, 1939, 1943)
Upper lips length (mm)	1–1.3	–
Lower lips length (mm)	1.3	–
Lips margin	crispate	entire (Pennell, 1939)
Upper and lower lips length	upper being 2/3 the length of the lower	upper more than half as long as the lower, upper being 1/2 the length of the lower (Bentham, 1869; Pennell, 1939)
Capsule shape	ovate	broad (Bentham, 1869)
Seed surface covered	primary ridges	secondary ridges (Musselman & Parker, 1981)

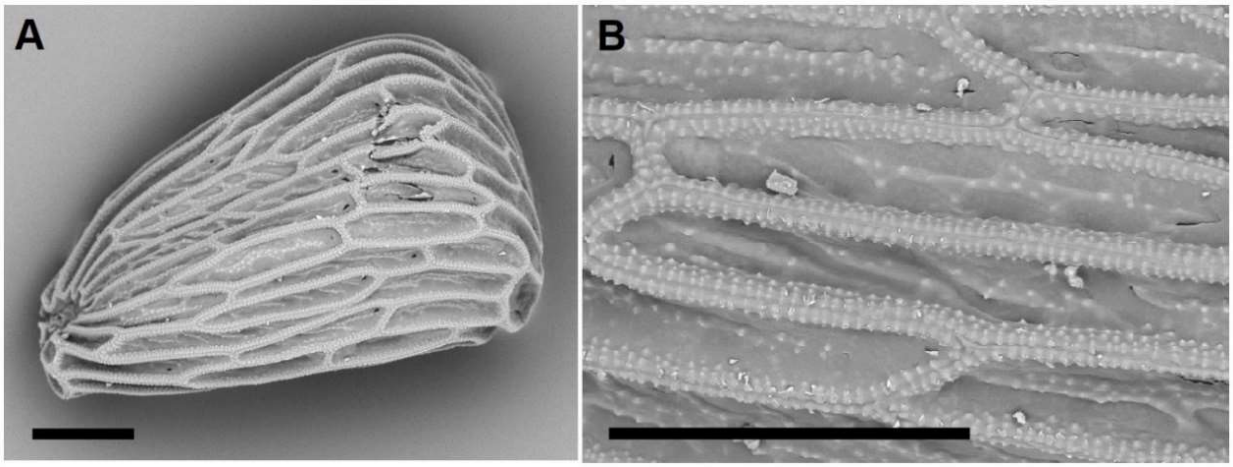

Fig. 3. ***Striga crispata*** (***Z. -X. Chen s. n.***, PPI 78580). **A**: Seed with prominent primary ridges. **B**: Seed surface with only small and short protuberances. Scale bars: A, B = 100 μm.

by scanning electron microscope (SEM) (Krause & Weber, 1990) had a primary and secondary system of ridges, in general. The primary ridges spiral around the seed at different angles (Musselman & Mann, 1976). The pattern of the primary ridges is ornamented with two protuberances on each side of the crest of the ridge. The secondary ridges run either parallel with the primary ridges or at a distinct angle to the primary ridges, and are less prominent and are ornamented with protuberances of different morphology from those of the primary ridges (Musselman & Parker, 1981). However, the seed surface of *S. parviflora* was prominently covered by the secondary ridges (Musselman & Parker, 1981). In this study, the seed surface of *S. crispata* had only the primary ridge (Fig. 3A), covered by 2–4 uniform and sparse protuberances on each side of the crest of the ridge (Fig. 3B).

ACKNOWLEDGEMENTS

We thank Mr. Jia-Jung Lin and Chi-Cheng Tzeng for their kind assistance with the field work, Mr. Che-Wei Lin for his excellent line drawings, and Tsung-Ta Huang for collecting all reports of relevance from Australia.

LITERATURE CITED

Bentham, G. 1835. Synopsis of the Buchnereae, a tribe of the Scrophulariaceae. In: Hooker, W.J. (ed.) *Companion to the botanical magazine.* 1: 362-363. Printed by E. Conchman, London.

Bentham, G. 1869. *Striga parviflora*. Flora Austral. 4: 516-517. Printed by L. Reeve and co., London.

Fischer, E., W. Lobin and J. Mutke. 2011. *Striga barthlottii* (Orobanchaceae), a new parasitic species from Morocco. Willdenowia **41(4)**: 51-56.

IUCN. 2011. Guidelines for Using the IUCN Red List Categories and Criteria. Version 8.0. Prepared by the Standards and Petitions Subcommittee of the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

Jayanthi, P., K.M.P. Kumar, A. Rajendran, B. Thomas, M. Sabu and A.K. Pradeep. 2014. *Striga indica* (Orobanchaceae), a new parasitic species from Southern Western Ghats of India. Feddes Repert. **123(4)**: 283-290.

Jeeva, S., T.S.S. Brintha and L. Rasingam. 2012. *Striga scottiana* (Scrophulariaceae), a new species from southern Western Ghats of Tamilnadu, India. J. Basic Appl. Biol. **6**: 79-82.

Krause, D. and H.C. Weber. 1990. SEM observations on seeds of *Striga* spp. and *Buchnera americana* (Scrophulariaceae). Plant Syst. Evol. **170(3-4)**: 257-263.

Liu, H.-Y.1998. Scrophulariaceae. In: Huang, T.-C. *et al.* (eds), Flora of Taiwan, 2nd ed. **4**: 582-646. Editorial Committee, Dept. Bot., NTU, Taipei, Taiwan.

Mohamed, K.I., L.J. Musselman and C.R. Riches. 2001. The genus *Striga* (Scrophulariaceae) in Africa. Ann. Missouri Bot. Gard. **88(1)**: 60-103.

Musselman, L.J. and C. Parker. 1981. Surface features of *Striga* seeds (Scrophulariaceae). Adansonia **20(4)**: 431-437.

Musselman L.J. and W.F. Mann, Jr. 1976. A survey of surface characteristics of seeds of Scrophulariaceae and Orobanchaceae using scanning electron microscopy. Photomorphology **26**: 370-378.

Nail, K., D.J. Kriticos, J.K. Scott, T. Yonow and N. Ota. 2014. *Striga asiatica.* HarvestChoice Pest Geography. St. Paul, MN: InSTePP-HarvestChoice.

Omalsree, M., K.M. Prabhu Kumar, M. Sabu, P. Sunojkumar, B. Thomas, A. Rajendran and V.K. Sreenivas. 2015. A new species of *Striga* section Polypleurae (Orobanchaceae) from southern Western Ghats of India. Phytotaxa **212(2)**: 163-168.

Omalsree, M., P. Vivek, Sojan Jose, V.K. Suresh and V.K. Sreenivas. 2018. *Striga masuria* (Orobanchaceae) - A new record to the flora of Kerala, India. Annals of Plant Sciences **7(6)**: 2361-2362.

Pennell, F.W. 1939. Botanical results of the Archbold expeditions: new and noteworthy Papuan, Scrophulariaceae. J. Arnold Arbor. **20**: 75-84.

Pennell, F.W. 1943. A second summary of the Scrophulariaceae of New Guinea. J. Arnold Arbor. **24(3)**: 264-267.

Sauerborn, J. 1991. Parasitic flowering plants. Ecology and management. Verlag Josef Margraf, Weikersheim.

Spallek, T., J.M. Mutuku and K. Shirasu. 2013. The genus *Striga*: a witch profile. Mol. Plant Pathol. **14(9)**: 861-869.