

タイに分布する気孔生柱状胞子堆を形成するHemileia属サビキン2種

誌名	日本菌学会会報 = Transactions of the Mycological Society of Japan
ISSN	00290289
著者名	小野,義隆 岡根,泉
発行元	日本菌学会
巻/号	62巻2号
掲載ページ	p. 119-123
発行年月	2021年11月

農林水産省 農林水産技術会議事務局筑波産学連携支援センター
Tsukuba Business-Academia Cooperation Support Center, Agriculture, Forestry and Fisheries Research Council
Secretariat



Note (資料)

Two *Hemileia* species (*Pucciniales*) producing suprastomatal columnar sori in Thailand

Yoshitaka ONO¹⁾*, Izumi OKANE²⁾

1) College of Education, Ibaraki University, Mito, Ibaraki 310–8512, Japan

2) Faculty of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Ibaraki 305–8572, Japan

タイに分布する気孔生柱状胞子堆を形成する *Hemileia* 属サビキン 2 種

小野 義隆¹⁾*・岡根 泉²⁾

1) 茨城大学教育学部, 〒 310–8512 茨城県水戸市文京

2) 筑波大学生命環境系, 〒 305–8572 茨城県つくば市天王台

(Accepted for publication: September 28, 2021)

We report *Hemileia strophanthi* and *H. wrightiae* for the first time from Thailand. Both species produce spores acropetally on columnar sori, that develop from a few emergent hyphae passing through narrow host stoma. *Hemileia strophanthi* occurs on an unidentified apocynaceous tree in Khlong Lan National Park, Kamphaeng Phet Prov. *Hemileia wrightiae* occurs on *Wrightia arborea* (*Apocynaceae*) in Phuket, Phuket Prov. *Hemileia strophanthi* has been recorded on two *Strophanthus* species in Indonesia in Asia and two other *Strophanthus* species in western and southeastern Africa. *Hemileia wrightiae* has been recorded on several *Wrightia* species in tropical and subtropical regions in Asia.

(Japanese Journal of Mycology 62: 119–123, 2021)

Key Words—*Apocynaceae*, Southeast Asia, *Strophanthus*, *Wrightia*, *Zaghouaniaceae*

Hemileia (*Zaghouaniaceae*) is a large genus in *Pucciniales*, being comprised of some 40 named species (Ritschel 2005; Judith & Rossman 2014). However, biological nature is largely unknown in most of the species. Even one-third of fungi named under *Hemileia* are known only from the uredinial anamorph. In Thailand, coffee leaf rust fungus, *H. vastatrix* Berk. & Broome, and Golden gardenia rust fungus, *H. gardeniae-floridiae* Sawada, are the only species published among 11 species known in Southeast Asia (Lorsuwan et al. 1984; Ono et al. 2021b; Farr DF, Rossman AY. Fungal Databases, U.S. National Fungus Collections, ARS, USDA. Retrieved Jun 9, 2021, from <https://nt.ars-grin.gov/fungaldatabases/>). However, numbers of *Hemileia* species, among 1,000 or more rust species, are expected to occur in Thailand, because the land embraces rich flora and vegetations in diverse topo-

graphical and climatical diversity (Ono et al. 2021a). This paper reports two *Hemileia* species, that produce unique suprastomatal sori on *Apocynaceae* trees, from Thailand.

The herbarium specimens examined in this study have been deposited at the Herbarium of Systematic Mycology, the College of Education, Ibaraki University (IBAR). Individual specimens are listed under each species. Microscopic observations and spore measurements followed the method described by Ono et al. (2020a, b). Measurement of dorsoventrally asymmetric or irregular-shaped spores was made in the side view; maximum length in a horizontal and a vertical axes was designated as width and height of individual spores, respectively.

Hemileia strophanthi (Racib.) Racib., in P. Syd. & Syd., Monogr. Ured. 3: 217. 1914 [1915].

Fig. 1

Synonym: *Hemileiopsis strophanthi* Racib., Parasit.

* Corresponding author: yoshitaka.ono.grapes@vc.ibaraki.ac.jp

Alg. Pilze Java's (Batavia) 1: 25. 1900.

On unidentified *Apocynaceae* tree, THAILAND, Kamphaeng Phet Prov., Kamphaeng Phet, Khlong Lan National Park, 11 Dec 1985. M. Kakishima, Y. Ono and P. Lohsomboon (IBAR4055).

Spermogonia and aecia are unknown. Uredinial-telial sori are minute, densely to loosely grouped, or scattered on small yellowish lesions on the abaxial leaf surface. A bulbous hyphal structure differentiates in a substomatal cavity from a stout hypha growing transversely in the host mesophyll (Fig. 1A). A few thin hyphae emerge through a stoma (Fig. 1A) and develop into columnar complex of sporogenous cells (Fig. 1B). Spores differentiate in acropetal order on the columnar complex of sporogenous cells as high as 130 μm (Fig. 1B). The sporulating sori appear as if superficial ball in a surface view (Fig. 1C). Urediniospores are pedicellate, irregular in shape, triangular to 5-lobed, 23–30 μm wide, often wider above and narrower below, and 15–24 μm high in the side view (Fig. 1D). The spore wall is uniformly 1.5–2.5 μm thick, dorsally echinulate, and ventrally or basally smooth (Fig. 1C, E). Germ pores are not observable. Teliospores are pedicellate, irregular in shape, radially 3–7-lobed, and 29–43 μm wide and 14–20 μm high in the side view (Fig. 1F). The pedicels are thin, long, and often persistent. After releasing the spores, the sori look cylindrical brush due to pedicels remaining on the sporogenous cells (Fig. 1B).

Hemileia wrightiae (Racib.) Racib., in P. Syd. & Syd., Monogr. Ured. 3: 218. 1914 [1915].

Fig. 2

Synonym: *Hemileiopsis wrightiae* Racib., Parasit. Alg. Pilze Java's (Batavia) 1: 26. 1900.

On *Wrightia arborea* (Dennst.) Mabb. (= *W. tomentosa* Roem. & Schult.) (*Apocynaceae*), Phuket Prov., Phuket, Kata Beach, 29 Nov 1985. M. Kakishima, Y. Ono and P. Lohsomboon (IBAR4045).

Spermogonia and aecia are unknown. Uredinia are minute, densely to loosely grouped on the abaxial leaf surface without forming appreciable symptoms. Uredinial aggregates look golden yellow or light orange-yellow when fresh. A bulbous hyphal structure differentiates in a substomatal cavity from a stout hypha growing transversely in the host mesophyll (Fig. 2A). A few thin hyphae emerge through a stoma (Fig. 2A) and develop into columnar complex of sporogenous cells as high as 100 μm

(Fig. 2B). The sporulating sori appear as if superficial ball in a surface view (Fig. 2C). Spores differentiate in acropetal order on the columnar complex of sporogenous cells. Urediniospores are pedicellate, obovoid, broadly ellipsoid or reniform, and 23–31 μm wide and 15–20 μm high in the side view (Fig. 2D). The spore wall is 2–2.5 μm thick, apically slightly thickened, dorsally echinulate, and ventrally smooth (Fig. 2D, E). Germ pores are not observable. Teliospores are not observed. After releasing the spores, the sori look cylindrical brush due to pedicels remaining on the sporogenous cells.

Commentary

Hemileia strophanthi and *H. wrightiae* are the species described when the genus *Hemileiopsis* is proposed as distinct from *Hemileia* (Raciborski 1900). The type species, *Hemileiopsis strophanthi*, is characterized by irregularly tetrahedral urediniospores and flattened, prominently 3–7-lobed teliospores produced on suprastomatal sori. Ten to fifty teliospores are adherent each other by mucilaginous material in a ball-like complex. The tightly adherent teliospore balls are reminiscent of teliospore heads of *Ravenelia* (Raciborski 1900, p. 26). Development and morphology of teliospores in *Hemileiopsis wrightiae* are essentially the same as those of *H. strophanthi* (Raciborski 1900; Sydow and Sydow 1914; this study). After examining 22 species then named under *Hemileia*, Sydow and Sydow (1914) concluded that the genus *Hemileiopsis*, which was founded primarily on the basis of the angular teliospores with extended corners, must be united with *Hemileia*. A recent molecular phylogenetic analysis of *Hemileia* species supported this taxonomic conclusion (Bailey et al. 2016).

Hemileia strophanthi occurs on *Strophanthus caudatus* (L.) Kurz [reported as *S. dichotomus* DC.] in Indonesia (Raciborski 1900; Boedijn 1959); *S. hispidus* DC. in Uganda (Wakefield & Hansford 1949); *S. sarmentosus* DC. in Guinea (Ritschel 2005) and Ivory Coast (Resplandy et al. 1954; Ritschel 2005); and *Strophanthus* sp. in Indonesia (Ritschel 2005). *Hemileia wrightiae* occurs on *Wrightia antidysenterica* (L.) R.Br. [reported as *W. zeylanica* (L.) R.Br.] in Sri Lanka (Ritschel 2005); *W. arborea* (Dennst.) Mabb. [reported as *W. mollissima* A. DC., *W. tomentosa* Roem. & Schult.] in China (Tai 1979; Zhuang 2001), India (Ragunathan & Ramakrishnan 1972) and Indonesia

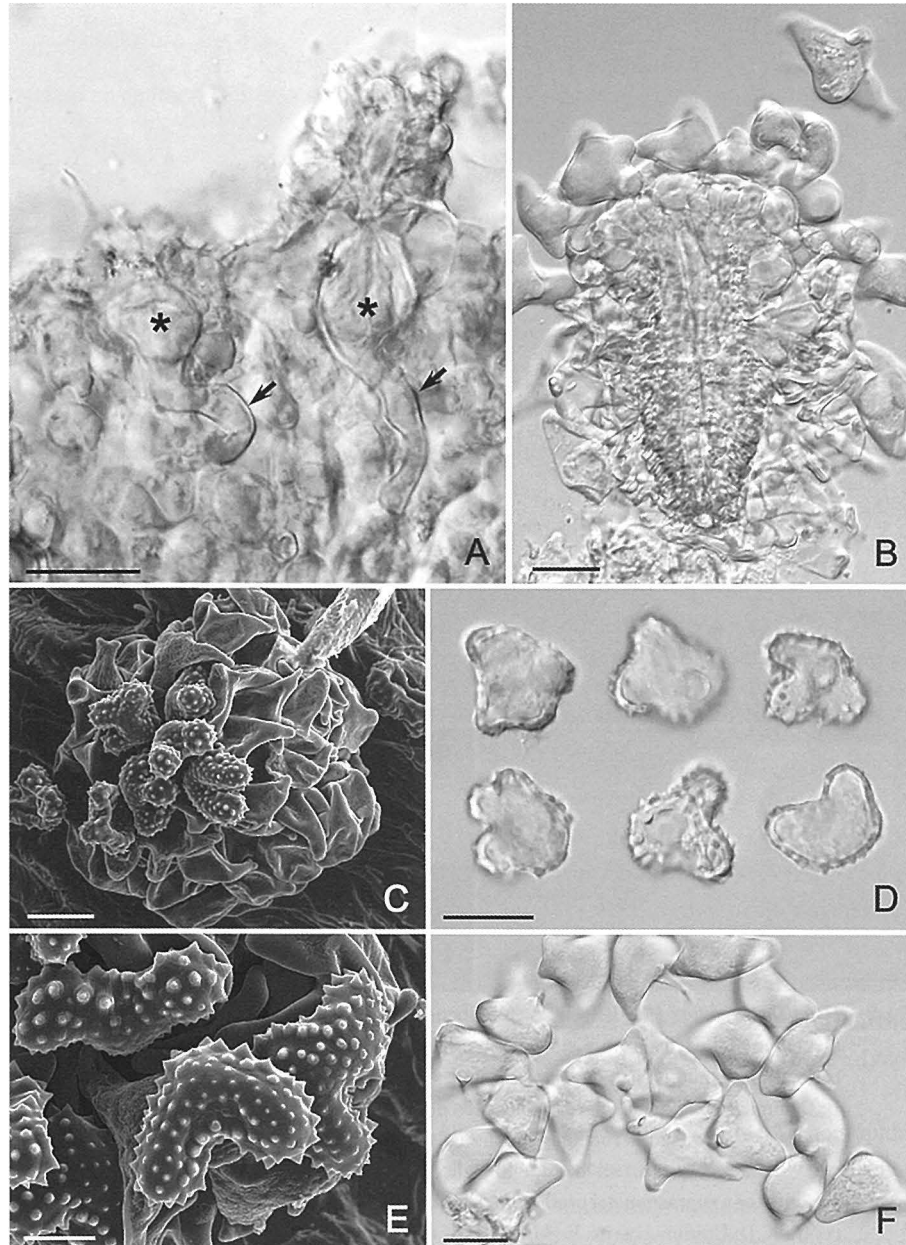


Fig. 1. *Hemileia strophanthi* (IBAR4055). A: Two suprastomatal uredinia produced on the abaxial leaf surface. Bulbous hyphal structures (asterisks) are produced in a substomatal cavity from a stout hypha transversely growing in the host mesophyll (arrows). A few hyphae developed from the bulbous structure emerge through a stoma. B: Columnar complex of sporogenous cells differentiated from a few emergent hyphae. Spores are produced in acropetal order on the columnar sporogenous cells. After releasing the spores, the sori look brush-like due to pedicels remaining on the sporogenous cells. C: Surface view of a suprastomatal sorus producing echinulate urediniospores and smooth teliospores. D: Angular or prominently lobed urediniospores. E: Surface view of urediniospores. F: Prominently lobed teliospores. Bars: A – D, F 20 μ m; E 10 μ m.

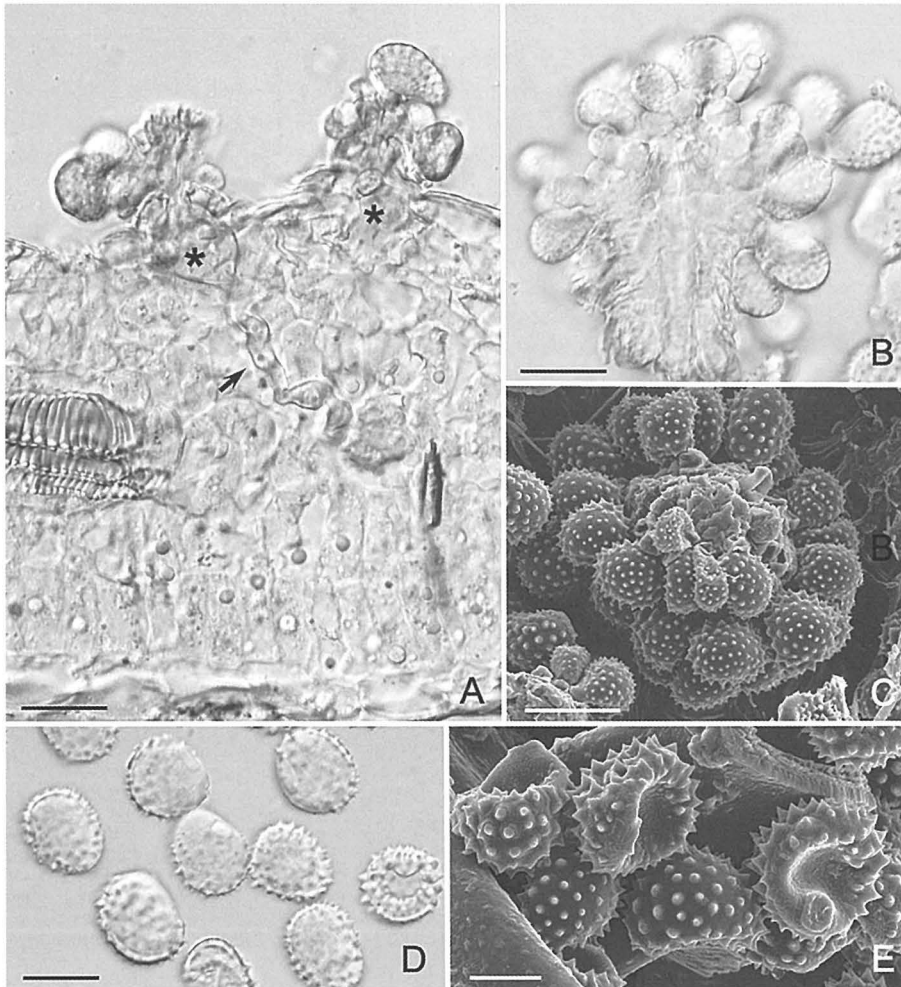


Fig. 2. *Hemileia wrightiae* (IBAR4045). A: A bulbous hyphal structure (asterisks) differentiates in a substomatal cavity from a stout hypha growing transversely in the host mesophyll (arrows). A few thin hyphae developed from the bulbous structure emerges through a stoma. B: Columnar complex of sporogenous cells developed from the emergent hyphae. Urediniospores are produced acropetally on the columnar sporogenous cells. After releasing the spores, the sori look brush-like due to pedicels remaining on the sporogenous cells. C: Surface view of a suprastomatal uredinium. Urediniospore initial and young spores are produced centrally. D: Urediniospores. E: Surface view of urediniospores. Bars: A – D 20 μ m; E 10 μ m.

(Boedijn 1959; Ritschel 2005); *W. javanica* A. DC. in Indonesia (Boedijn 1959; Ritschel 2005); *W. pubescens* R.Br. in Australia (Liberato & Shivas 2011); *W. pubescens* subsp. *laniti* (Blanco) Ngan [reported as *W. laniti* Blanco] in China (Tai 1979), the Philippines (Arthur & Cummins 1936; Teodoro 1937), and Taiwan (Hiratsuka & Chen 1991; Zhuang 2001); *W. saligna* (R.Br.) F. Muell. ex Benth. in Australia (Liberato and Shivas 2011); *W. tinctoria* R. Br. in India (Hosagoudar 1988) and Indonesia (Boedijn 1959; Ritschel 2005); and *Wrightia* sp. in Indonesia (Ritschel 2005) and the Philippines (Teodoro 1937).

Acknowledgments

This study was supported, in part, by the International Joint Research Project (1985), the Japan Society for the Promotion of Sciences. Field works were arranged by Prof. Leka Manoch, Kasetsart University and assisted by Pongvipa Lohsomboon, Kasetsart University, for which we are grateful.

Disclosure

The authors declare no conflict of interests.

摘 要

Hemileia 属サビキン, *H. strophanthi* と *H. wrightiae* がタイで見出された。両種は宿主の狭小な気孔から抜け出した菌糸から分化した柱状の胞子堆に求頂的に胞子を形成する。*Hemileia strophanthi* はカムペーンベツト県で未同定のキョウチクトウ科樹木に寄生していた。*Hemileia wrightiae* はプーケット県でキョウチクトウ科樹木 *Wrightia arborea* に寄生していた。*Hemileia strophanthi* はインドネシアおよびアフリカ南東部と西部地域でも見出されている。*Hemileia wrightiae* はアジア各地域に分布している。

References

- Arthur JC, Cummins GB (1936) Philippine rusts in the Clemens collection 1923–1926, II. Philipp J Sc 61: 463–488
- Bailey J, Aime MC, Castlebury L (2016) Grinding up the coffee rust genus: Molecular phylogenetics for *Hemileia*. 2016 Annual Meeting of the Mycological Society of America, Berkley, California. U.S.A., July 7–11. Inoculum 67: 4–5 (a poster presentation retrieved from doi: 10.13140/RG.2.1.1296.6643, 10 June 2021)
- Boedijn KB (1959) The Uredinales of Indonesia. Nova Hedwigia 1: 463–496
- Hiratsuka N, Chen ZC (1991) A list of Uredinales collected from Taiwan. Trans Mycol Soc Jpn 32: 3–22
- Hosagoudar VB (1988) Uredinales of Kerala. J Econ Taxon Bot 12: 265–272
- Judith C, Rossman A (2014) Revised scientific names of the genus *Hemileia* (Pucciniales) based on the new ICN. Mycokeys 8: 1–10 <https://doi.org/10.3897/mycokeys.8.4040>
- Liberato JR, Shivas RG (2011) First report of *Hemileia wrightiae* on *Wrightia* spp. in Australia. Australas Plant Dis Notes 6: 80–83 <https://doi.org/10.1007/s13314-011-0028-4>
- Lorsuwan C, Tontyaporn S, Visarathanonth N, Manoch L, Kakishima M (1984) Materials for the rust flora in Thailand I. Trans Mycol Soc Jpn 25: 57–65
- Ono Y, Ohmachi K, Unartngam J, Okane I, Ayawong C, Janruang P (2020a) *Milesina thailandica*, a second rust fungus on an early diverged leptosporangiate fern genus, *Lygodium*, found in Thailand. Mycol Prog 19: 147–154 <https://doi.org/10.1007/s11557-019-01549-4>
- Ono Y, Okane I, Chatasiri S, Pota S, Unartngam J, Ayawong C, Nguyen HD, Le CTM (2020b). Taxonomy of Southeast Asian-Australasian grapevine leaf rust fungus and its close relatives. Mycol Prog 19: 905–919 <https://doi.org/10.1007/s11557-020-01607-2>
- Ono Y, Okane I, Unartngam J, Ayawong C (2021a) Discovery of teliospores of a Cape jasmine rust fungus, *Hemileia gardeniae-floridiae* (Pucciniales), and its occurrence in Thailand. Mycoscience 62: 336–340 <https://doi.org/10.47371/mycosci.2021.06.003>
- Ono Y, Unartngam J, Ayawong C, Okane I (2021b) *Puccinia* species (Pucciniales) newly found in Thailand. Bull Coll Educ, Ibaraki Univ (Nat Sci) 70: 67–79 <https://doi.org/10.34405/00019085>
- Raciborski M (1900) Parasitische Algen und Pilze Java's. I. Theil. Staatsdruckerei, Batavia
- Ragunathan AN, Ramakrishnan K (1972). Rust fungi of Madras State - I. Mysore J Agric Sci 6: 285–299
- Resplandy R, Chevaugeron J, Delassus M, Luc M (1954) Première liste annotée de champignons parasites de plantes cultivées en Côte d' Ivoire. Annales des Epiphyties I: 1–61
- Ritschel A (2005) Monograph of the genus *Hemileia* (Uredinales). Bibliotheca Mycologica Vol. 200. J. Cramer, Berlin
- Sydow P, Sydow H (1914) Monographia Uredinearum seu specierum omnium ad hunc usque diem descriptio et adumbratio systematica. Vol. 3. Pucciniaceae (excl. *Puccinia* et *Uromyces*) - Melampsoraceae - Zaghouaniaceae - Coleosporiaceae cum 32 tabulis. Fratres Borntraeger, Leipzig
- Tai FL (1979) Sylloge Fungorum Sinicorum [In Chinese]. Science Press, Academia Sinica, Peking
- Teodoro NG (1937) An enumeration of Philippine fungi. Tech Bull Dept Agric Comm, Manila 4: 1–585
- Wakefield EM, Hansford CG (1949) Contributions towards the fungus flora of Uganda. IX. The Uredinales of Uganda. Proc Linn Soc, London 161: 162–198
- Zhuang WY (ed) (2001) Higher fungi of tropical China. Mycotaxon Ltd, Ithaca