Mycoscience (2007) 48:263–265
DOI 10.1007/s10267-007-0354-8

© The Mycological Society of Japan and Springer 2007

NOTE

Shigeru Kaneko · Thu Quang Pham · Yasuyuki Hiratsuka

Notes on some rust fungi in Vietnam

Received: January 22, 2007 / Accepted: March 3, 2007

Abstract Sixteen rust species and two unconnected *Peridermium* collected in Vietnam are enumerated. For all the rust species except *Hemileia vastarix*, *Olivea tectonae*, and *Puccinia thwaitesii*, these are the first records of their occurrence in Vietnam. Some taxonomic and pathological considerations are noted for two economically important pine stem rusts.

Key words Fungal flora · Pine stem rust · Uredinales

Vietnam, which is located on the eastern coast of the Indochinese Peninsula, covers a surface area of 330 000 km^2 from latitude 9° to 23° N and longitude 102° to 110°E. On the mainland, it is 1650 km long from the north to the south. About three-quarters of the area of Vietnam is classified as mountainous and hilly areas; these characteristics support a rich flora and fauna. However, few surveys on fungal flora have been conducted. Only 40 species of rust fungi have been recorded (Trinh et al. 2001).

Kaneko and Pham conducted some surveys of tree diseases during Kaneko's stay for 2 years in Vietnam as a long-term expert for a JICA (Japan International Cooperation Agency)–silviculture technique development project. Hiratsuka visited Da Lat to study Vietnamese pine stem rusts. During these travels, we also were able to collect some rust fungi on herbaceous plants that are not recorded in the list (Trinh et al. 2001). This short article enumerates several rust fungi that we have identified together with some taxonomic or pathological notes for them. All the rust species except *Hemileia vastarix*, *Olivea tectonae* and *Puccinia thwaitesii* are the first record of their occurrences in Vietnam.

All the specimens are deposited in the Herbarium of Forest Mycology and Pathology, Forestry and Forest Products Research Institute (TFM: FPH), Tsukuba, Japan, and a part in the Herbarium of Forest Protection Division, Forest Science Institute of Vietnam, Hanoi, Vietnam.

S. Kaneko (✉)
National Federation of Forest Pests Management Association, COOP Bldg. 1-1-12 Uchikanda, Chiyoda-ku, Tokyo 101-0047, Japan
Tel. +81-3-3294-9719; Fax +81-3-3293-4726
e-mail: skaneko@a.email.ne.jp

T.Q. Pham
Forest Protection Division, Forest Science Institute of Vietnam, Hanoi, Vietnam

Y. Hiratsuka
Northern Forestry Centre, Canadian Forest Service, Edmonton, Canada

Coleosporiaceae

1. *Coleosporium plectranthi* Barclay on *Mosla dianthera* (Hamilt.) Maxim. (II. Ba Vi, Ha Tay Prov., Oct. 28, 2005, TFM: FPH 7895).

Aecial states of *Coleosporium* cause the needle rust of pines. In Vietnam, however, we collected only one sample (no. 2 species of the following list) of the aecial state. When we compared the aecial states with other species (Kaneko 1981), the morphological characteristics of the aecial state we collected differed from those of *C. plectranthi*. In Vietnam, occurrences of aecial states of *Coleosporium* seem to be rare.

2. *Peridermium* sp. 1 on *Pinus kesiya* Royle ex Gord. (0, I. Camly, Da Lat, Lam Dong Prov., March 1, 2006, TFM: FPH 7896).

This *Peridermium* species is believed to be the aecial state of a *Coleosporium* species. Morphological characteristics of the peridia and aeciospores resemble those of *C. tussilaginis* (Pers.) Lév. (Kaneko 1981), but we could not find any uredinial and telial states.

Cronartiaceae

3. *Cronartium orientale* S. Kaneko on *Quercus cambodiensis* Hickel & A. Camus (III. Camly, Da Lat, Lam Dong Prov., July 22, 2005, TFM: FPH 7897; March 4, 2006, TFM:

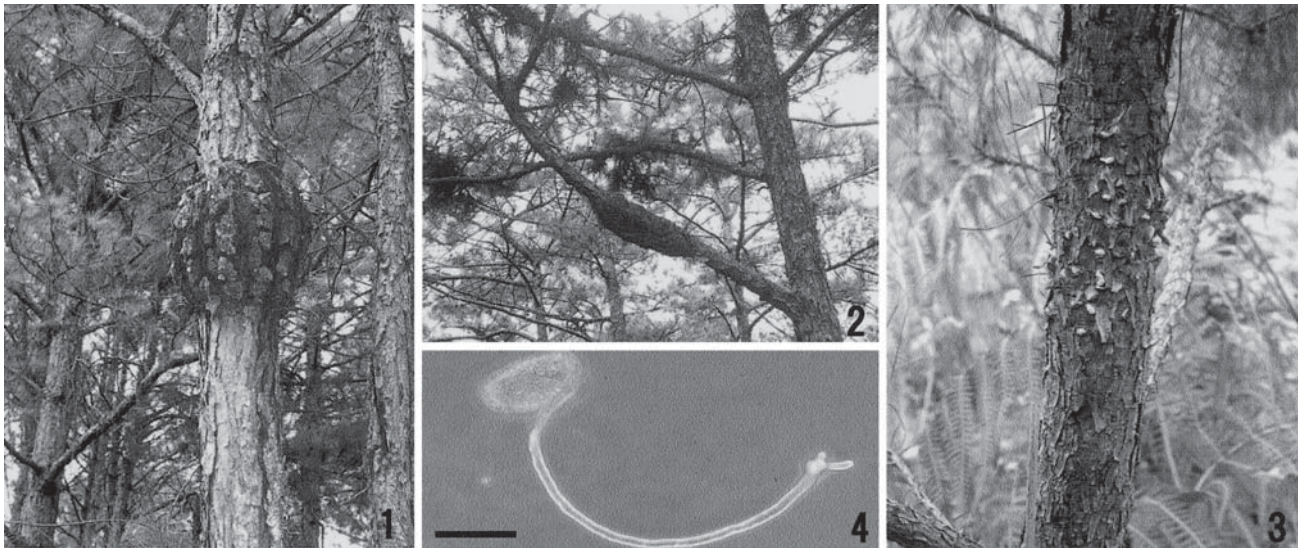

Fig. 1. Globose-type gall of *Peridermium* sp. 2 on *Pinus kesiya*
Fig. 2. Fusiform-type galls of *Peridermium* sp. 2 on *Pinus kesiya*
Fig. 3. Blister-type symptom of *Peridermium* sp. 3 on *Pinus kesiya*
Fig. 4. Germ tube from an aeciospore of blister-type *Peridermium* sp. 3 on *Pinus kesiya*. *Bar* 20 μm

FPH 7898; June 28, 2006, TFM: FPH7 899); on *Q. myrsinaefolia* Blume (III. Mt. Ham Rong, Sapa, Lao Cai Prov., Nov. 6, 2004, TFM:FPH 7900).

We identified this species as *C. orientale* (Kaneko 2000) by confirming globoid (8.5–13.0 μm diameter) basidiospores produced after germination of teliospores of these collections. This is the first record of *C. orientale* in Vietnam.

In the Da Lat area, gall rusts of *Pinus kesiya* and *Pinus merkusii* Jungh. & de Vriese are very common both in plantations and in natural stands (*Peridermium* sp. 2). Their shape is mostly globose (Fig. 1), resembling the typical gall shape of *C. orientale*. The shape of the galls, however, were frequently elongated and changed to a fusiform type (Fig. 2). We supposed that the galls are caused by basidiospore infections of *C. orientale*. To demonstrate the genetic connection between the gall rust and *C. orientale*, we conducted an inoculation experiment with basidiospores from *Q. cambodiensis* onto seedlings of *Pinus kesiya* in June 2006, and we are awaiting the results.

4. *Peridermium* sp. 3 (aecial state of *Cronartium* sp.) on *Pinus kesiya* Royle (I. Camly, Da Lat, Lam Dong Prov., March 1, 2006, TFM: FPH 7901; June 28, 2006, TFM: FPH 7902).

This is a blister-type rust on stems and branches of *Pinus kesiya* (Fig. 3). In young plantations in Camly, Da Lat, the damage by this rust is very severe. In several surveys in the field, no suspected alternate host plants of the rust were found. The period of aeciospore production of the rust is longer than 3 months. Germination type of aeciospores (Fig. 4) is different from *Endocronartium* (Hiratsuka 1969), a genus that has a pine-to-pine life cycle. Morphological characteristics of aeciospores and the symptom of the rust are similar to those of *Cronartium flaccidum* (Alb. & Schwein.) G. Winter. *Cronartium flaccidum* is a host-alternating species. In Europe, however, variations in the life cycle and germination type of aeciospores in *C. flaccidum* have been reported (Hiratsuka 1968; Gibbs et al. 1988). For this *Peridermium* species in Da Lat, the pine-to-pine life cycle was also suspected; therefore, we conducted an inoculation experiment with aeciospores onto seedlings of *Pinus kesiya* in June 2006. However, the seedlings still remain uninfected at the present time (7 months after the inoculation). The damage by this rust on young pines is very severe; therefore, exact identification of the rust species name is needed.

Phakopsoraceae

5. *Crossopsora antidesmae-dioicae* (P. Syd. & Syd.) Arthur & Cummins on *Antidesma acidum* Retz (II. Luc Ngan, Lang Son Prov., Aug. 9, 2005, TFM: FPH 7903).

Chaconiaceae

6. *Hemileia vastarix* Berk. & Broome on *Coffea arabica* L. (II. Klong Klanh, near Da Lat, Lam Dong Prov., March 2, 2006, TFM: FPH 7904).

The damage on coffee trees by the rust is severe in northern Vietnam, but studies on the rust in Vietnam are limited.

7. *Olivea tectonae* (T.S. Ramakr. & Ramakr.) Thirum. on *Tectona grandis* L.f. (II. Dong Ngac, Hanoi, Feb. 4, 2005, TFM: FPH 7905).

Phragmidiaceae

8. ***Gerwasia rubi*** Racib. on *Rubus* sp. (II. Nui Ba, Da Lat, Lam Dong Prov., March 3, 2006, TFM: FPH 7906).

Pucciniaceae

9. ***Endophyllum superficiale*** (P. Karst. & Roum.) F. Stevens & Mendiola on *Clerodendron* sp. (III. Cuc Phuong, Ninh Binh Prov., Oct. 18, 2005, TFM:FPH 7907).
10. ***Puccinia aestivalis*** Dietel on *Eulalia* sp. (II. Ba Vi, Ha Tay Prov., Oct. 28, 2005, TFM: FPH 7910).
11. ***Puccinia congesta*** Berk. & Broome on *Polygonum chinense* L. (III. Ba Vi, Ha Tay Prov., Oct. 28, 2005, TFM: FPH 7908).
12. ***Puccinia diclipterae*** Syd. & P. Syd. on *Strobilanthes cusia* (Nees) O. Kuntze (III. Lao Bai, Hoa Binh Prov., March 30, 2006, TFM: FPH 7909).
13. ***Puccinia horiana*** Henn. on *Chrysanthemum morifolium* Ramat. (III. Camly, Da Lat, Lam Dong Prov., June 28, 2006, TFM:FPH 7911).
14. ***Puccinia polysora*** Underw. on *Zea mays* L. (II. Men village, Da Bac, Hoa Binh Prov., Oct. 21, 2005, TFM: FPH 7912).

On *Zea mays*, *P. sorghi* Schwein. was recorded in the last list (Trinh et al. 2001). However, *P. polysora* is clearly different from *P. sorghi.*

15. ***Puccinia thwaitesii*** Berk. on *Gendarussa vulgaris* Nees. (*Justicia gendarussa* L.) (III. Dong Ngac, Hanoi, June 10, 2006, TFM: FPH 7913); on *Strobilanthes* sp. (III. Ba Vi, Ha Tay Prov., Oct. 28, 2005, TFM: FPH 7914).

This rust species has been reported from Vietnam by Hennings (1895) and Gjaerum (1995). *Gendarussa vulgaris* is frequently planted as an ornamental bush in Vietnam, and the rust is common on these.

16. ***Tranzshelia discolor*** (Fuckel) Tranzschel & Litv. on *Prunus persica* Batsch (II, III. Mt. Ham Rong, Sapa, Lao Cai Prov., Nov. 6, 2004, TFM: FPH 7915).
17. ***Uromyces bidenticola*** Arthur on *Bidens pilosa* L. (II, III. Hoa Binh, Hoa Binh Prov., March 16, 2005, TFM: FPH 7916); (II, III. Camly, Da Lat, Lam Dong Prov., March 1, 2006, TFM: FPH 7919; June 28, 2006, TFM: FPH 7917).
18. ***Zaghouania phillyreae*** Pat. on *Osmanthus fragrans* Lour. (II, III. Mt. Phan Xi Pan, Lao Cai Prov., April 6, 2005, TFM: FPH 7918).

Acknowledgments We thank Dr. Yoshitaka Ono, Ibaraki University, for his kind supply of literature on *Puccinia thwaitesii*.

References

Gibbs JN, England N, Wolstenholme R (1988) Variation in the pine stem rust fungus *Peridermium pini* in the United Kingdom. Plant Pathol 37:45–53
Gjaerum HB (1995) Rust fungi from various countries. Lidia 3:145–170
Hennings P (1895) Neue und interessante Pilze aus dem Königl. botanischen Museum in Berlin. III. Hedwigia 34:10–13
Hiratsuka Y (1968) Morphology and cytology of aeciospores and aeciospore germ tubes of host-alternating and pine-to-pine races of *Cronartium flaccidum* in northern Europe. Can J Bot 46:1119–1122
Hiratsuka Y (1969) *Endocronartium*, a new genus for autoecious pine stem rusts. Can J Bot 47:1493–1495
Kaneko S (1981) The species of *Coleosporium*, the causes of pine needle rusts, in the Japanese Archipelago. Rep Tottori Mycol Inst 19:1–159
Kaneko S (2000) *Cronartium orientale*, sp. nov., segregation of the pine gall rust in eastern Asia from *Cronartium quercuum*. Mycoscience 41:115–122
Trinh TK, Dang VTT, Ha MT (2001) Teliomycetes. Checklist of plant species of Vietnam. Agriculture Publishing House, Hanoi