Jour. Agri. Sci., Tokyo Univ. of Agric., 48 (2), 50–58 (2003)
東京農大農学集報, 48 (2), 50–58 (2003)

Renaming of the *Erysiphe* Fungi on Maniok-eibish and Flax, and First Report of an *Oidium* sp. on Kenaf in Japan

By

Seinosuke TANDA* and Tomoji HIROSE*

(Received February 1, 2003/Accepted July 24, 2003)

Summary : Through the reexamination of the powdery mildew fungi on maniok-eibish and flax which have been described as *Erysiphe polygoni* in earlier papers, these fungi were regarded severally as new independent taxa of the *Erysiphe*. From the established fact, the fungus on maniok-eibish was renamed as *E. abelmoschicola* and the fungus on flax as *E. lini*, respectively.

A powdery mildew fungus first found on kenaf in Japan, is treated as an indeterminate species of *Oidium*.

Key Words : maniok-eibish, flax, kenaf, *Erysiphe abelmoschicola*, *Erysiphe lini*

Introduction

A powdery mildew fungus, *Erysiphe polygoni* sens. lato has been recorded on maniok-eibish (*Abelmoschus manihot* (L.) MEDIK. or *Hibiscus manihot* L., family. Malvaceae) and flax (*Linum usitatissimum* L., fam. Linaceae) from Japan (HOMMA, 1927[1], 1928[2], 1937[3]) respectively. According to the current taxonomic conception of the *Erysiphe* fungi (BRAUN, 1987)[4], *E. polygoni* sens. strict. is limitedly applied to the only taxon parasitic of polygonaceous plants. Recently, we found the occurrence of the disease on these plants and examined the causal fungi. The fungi were easily discriminated from the materials of *E. polygoni* which have been observed on *Fagopyrum* and *Polygonum* spp. Their taxonomic treatments are revised in the paper.

Moreover, a powdery mildew was found on kenaf (*Hibiscus cannabinus* L., fam. Malvaceae), on which the disease has not been recorded in this country up to now. The anamorph of the causal fungus was morphologically similar to that of maniok-eibish fungus, but it was unable to infect the *Abelomoschus* plant at all.

Materials and Methods

1. The fungi, their host plants and localities

① Localities and collection dates of the powdery mildew fungus on maniok-eibish : ◎ Tokyo University of Agriculture, Setagaya-ku, Tokyo, 19 Nov. 1996 (anamorph, TUAMH5050) ; ◎ Tokyo Univ. Agric., Atsugi-shi, Kanagawa Pref., 11 Dec. 2001(holomorph, TUAMH6110).

② Locality and collection date of the powdery mildew fungus on kenaf : Tokyo Univ. Agric., Atsugi-shi, Kanagawa Pref., 19 Nov. 2001 (anamorph, TUAMH6104).

③ Locality and collection date of the powdery mildew fungus on flax : Tokyo Univ. Agric., Atsugi-shi, Kanagawa Pref., 11 Nov. 1999 (holomorph, TUAMH5808).

④ Localities and collection dates of *E. polygoni* on polygonaceous plants.

i. The materials on buckwheat (*Fagopyrum esculentum* MOENCH) : Omachi-shi, Nagano Pref., 2 Oct. 1987 (TUAMH3910).

ii. A fungus on blood-wort (*Polygonum aviculare* L.) : Mizusawa-shi, Iwate Pref., 15 Oct. 1975 (TUAMH0316).

iii. A fungus on black-heart (*P. lapathifolium* L.) : Kamimarusawa, Sagamihara-shi, Kanagawa Pref., 23 Oct. 1978 (TUAMH0689).

iv. A fungus on prince feather (*P. orientale* L.) : Yoga, Setagaya-ku, Tokyo, 26 Oct. 1978 (TUAMH 0606).

2. The observations of the causal fungi

The observations of the anamorph of fungi were conducted according to TANDA and SUGA (2002)[5], and their teleomorph were according to TANDA (2003)[6], respectively.

* Department of Agriculture, Faculty of Agriculture, Tokyo University of Agriculture

3. Inoculation experiments

① Inoculation with the *Erysiphe* fungus on maniok-eibish

ⅰ. Plants tested : Maniok-eibish, kenaf, okra (*Hibiscus esculentus* L.), black-heart, buckwheat, flax.

ⅱ. Cultivation of the plants for test : Early in April, the seeds of the six kinds of plants were sown in the soil of pots and they were treated in greenhouse according to the previous study (TANDA and SUGA, 2002)[5].

ⅲ. Inoculations with ascospores and conidia : Ascospores were inoculated to the original host plant, maniok-eibish in the middle of May according to TANDA (2000)[7]. Conidia obtained from the maniok-eibish leaves which were infected artficially with ascospores were inoculated to the six plants above mentioned early in June according to TANDA (1998)[8]. The inoculated plants were kept in a greenhouse, and the observations were followed up in accordance with the previous study (TANDA and SUGA, 2002)[5].

② Inoculation with the flax *Erysiphe* fungus

ⅰ. Plants tested : Flax, maniok-eibish and black-heart.

ⅱ. Cultivation of the plants : The plants were prepared in the same manner as the test with the maniok-eibish fungus.

ⅲ. Inoculation with ascospores and conidia : Ascospores were inoculated to flax. Conidia obtained from flax leaves were inoculated to maniok-eibish, black-heart and flax. Both of the inoculations and the treatments of the test plants were accorded with the test for maniok-eibish fungus.

Results and Discussion

Ⅰ. A new *Erysiphe* fungus on maniok-eibish

An industrial crop, maniok-eibish has been known as a host of *E. polygoni* auct. non DC. sens. HOMMA (1937)[3] in Japan for a long time. HOMMA (1937)[3] had erroneously described the host plants as '*Abelmoschus esculentus* MOENCH. (Tororo-aoi＝Japanese name of maniok-eibish)'. Afterwards, WADA and HIRATA (1977)[9] referred the host under the name of okra (*H. esculentus*), and SATO (1980)[10] did it as maniok-eibish (*H. manihot*) or okra.

In the study, unfortunately it was impossible to confirm a proper host plant first recorded by HOMMA. Recently the holomorph of an *Erysiphe* fungus has been found on maniok-eibish for the second time in Kanagawa Prefecture. The fungus was clearly distinguished from *E. polygoni* sens. strict. or other fungi described on different malvaceous plants in the morphology and pathogenicity. Therefore, it was regarded as a new species of the genus *Erysiphe*.

1. *Erysiphe abelmoschicola* TANDA, sp. nov. (Fig. 1 ; Table 1–2 ; Photo 1・A)

Mycelium amphigenum in foliis, persistens, subrotundas vel irregulariter ad ambiguas efformans, frequenter occupans tota superficiem folii. Cleistothecium sparsa vel gregaria, atro-brunnea, subglobosa vel depresso-globosa, 64–100 μm diametro, cellulis peridii irregulariter polygonalibus, 14–25×11–18 μm. Appendices 3–7, simplices vel perraro dichotome 1 ramosae, mycelioideaeae, tenuitunicatae, hyaline et ad basim pallide brunneae, uni- vel biseptatae, 25–289 μm longae (diametro cleistothecii 0.3–3.5 plo longiore), prope apicem 3.1–5.7 μm et prope basim 5.4–10.4 μm latae. Asci 4 (–5), late ellipsoidei vel ovati, sessiles vel brevistipitati, (36–)43–61(–71)×25–43(–50) μm. Ascosporae 4 vel 5, pallide flavae, ellipsoidei vel ovatae, 18–26×10–16 μm. Conidia singularia, ellipsoidea vel ovati, raro cylindracea, vacuolata, (29–)33–46(–54)×(15–)17–22 μm. Conidiophora recta vel leviter curvata, 1 vel 2, raro 3 septata, 72–110×10–12 μm, cellulis ad basim cylindracea, 32–58×10–12 μm.

Holotypus : in foliis vivis *Abelomoschi manihoti* (L.) MEDIK. (maniok-eibish). Tokyo University of Agriculture, Funako, Atsugi-shi, Kanagawa Prefecture, Japan, 11 Dec. 2001, leg. S.TANDA (TUAMH6110).

Mycelia amphigenous on leaves, conspicuous on upper surface of the leaf, developing subcircular to irregular, white to grayish white, persistent patches, somewhat powdery, often covering the whole surface of the leaves ; conidia solitary, ellipsoidal or ovate, rarely cylindrical, vacuolate, (29–) 33–46 (–54)×(15–) 17–22(av. 37.6±1.1×19.0±0.37) μm, length/width (l/w) ratio 1.6–2.4(–3.0)(av.1.99±0.071) ; conidiophores erect, branching from hyphae on surface of the leaves, straight or often loosely curved, 1– or 2–, rarely 3-septate, 72–110×10-12(av. 77.7±12.4×10.9±0.14) μm, foot-cells cylindric, 32–58×10–12(av. 48.0±3.3×10.4±0.18) μm ; cleistothecia scattered or gregarious, dark brown, subglobose or depressed globose, 64–100 (av. 82.3±1.1) μm in diam, wall cells irregularly polygonal, 14–25×11–18 (av. 18.6 ±1.3×13.1±0.64) μm ; cleistothecial appendages produced 3–7 (av. 4.9±0.32) in number on the lower half part of the cleistothecium, mycelioid, simple or rarely branched 1 time, aseptate, uni- or biseptate, thin-walled throughout, hyaline or light brownish from the middle towards the base, short ones dark brown, 25–289 (av. 121.1±18.1) μm long (0.3–3.5 times as long as the cleistothecial diam), 3.1–5.7 (av. 5.01±0.25) μm wide at the upper part, 5.4–10.4 (av. 7.58±0.42) μm wide near the base ; asci 4(–5) in number, broadly ellipsoid or ovate, sessile or short pedicellate, (36–) 43–61(–71)×25–43 (–50) (av. 52.5±0.94×33.4±0.73) μm ; ascospores 4 or 5 in num-

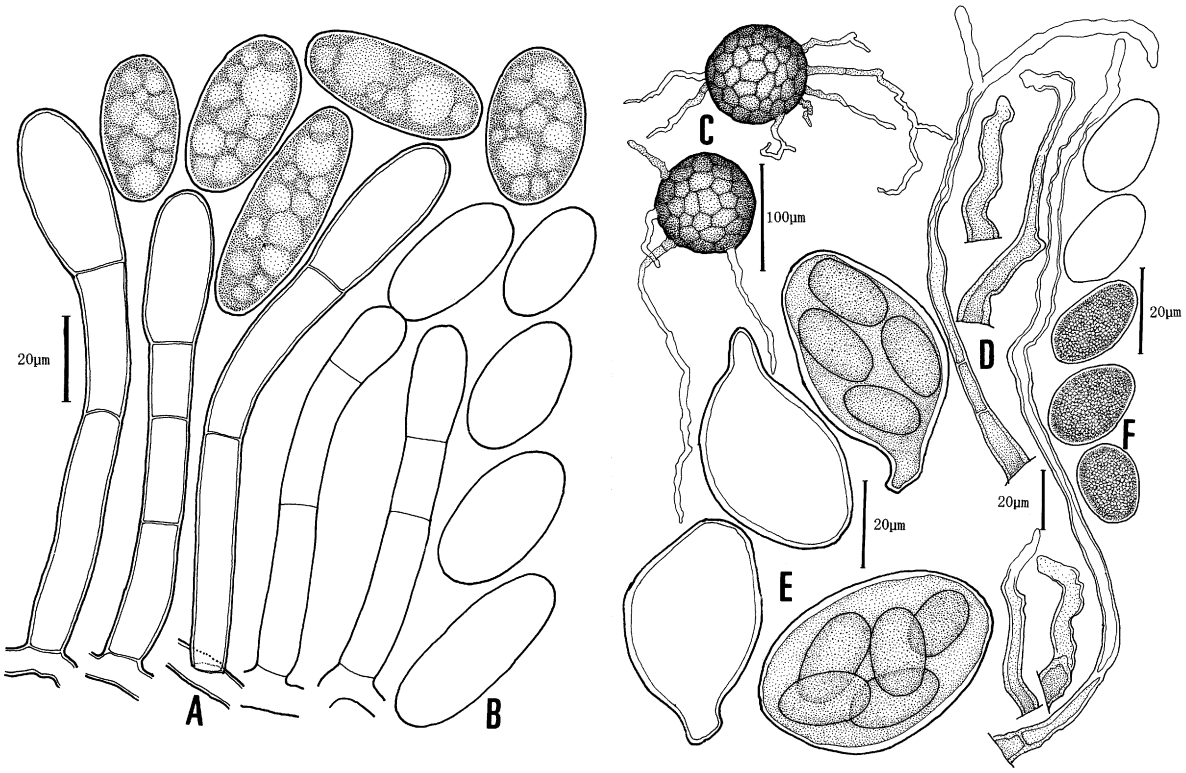

Fig. 1 *Erysiphe abelmoschicola* TANDA on maniok-eibish (A : Conidia and conidiophores ; B : Mature conidia ; C : Cleistothecia ; D : Appendages of cleistothecim ; E : Asci and ascospores ; F : Ascospores).

ber, light yellow, ellipsoid or ovate, granular, 18–26×10–16 (av. 23.2±1.0×12.9±0.55)μm.

2. Taxonomic consideration of the new fungus

Although maniok-eibish has been hitherto known as a host of *Sphaerotheca fuliginea* sens. lato in China and Taiwan (AMANO, 1986)[11], no reliable record of *Erysiphe* fungus on this plant was found in any literatures excepting for a few publications in Japan.

TANDA (1997)[12] has reported an *Oidium* sp. of Pseudoidium type on the related plants, *viz. Hibiscus syriacus* L. and *H. coccineus* WALT, however these foot-cells of conidiophore were evidently slender than those of *E. abelmoschicola* (Table 1).

We have examined the holomorphic materials of *E. polygoni* sens. strict. which were collected from four polygonaceous plants. As compared with them, the size of conidia and conidiophores of the present fungus were distinctly thick ; the asci and ascospores were by far smaller in size, and the cleistothecial appendages were rather long (Table 2).

3. Parasitism of *E. abelmoschicola*

① Parasitism of the ascospores : Two weeks after setting the affected leaves of maniok-eibish to the plant tested, a few arachnoid mycelia appeared on some young leaves. With the lapse of time, the mycelia increased in number and extent. Numerous conidia, which agreed well in the shape with those on the primary materials, were found on these mycelial patches.

② Parasitism of the conidia : Within a week after inoculation with the conidia which were obtained from replicated mycelia, patches similar to the original ones developed on the leaves of maniok-eibish tested.

No sign of infection was found on plants other than maniok-eibish.

Ⅱ. Powdery mildew and its causal fungus on kenaf

A fiber crop, kenaf has been cultivated extensively throughout the tropics to the temperate regions including Japan for a long time. While powdery mildew has been reported on the plant from some countries, no record of the disease is found in any list of Japanese plant diseases.

Recently,we found a slight occurrence of the powdery mildew on a plant which was grown in Kanagawa Prefecture. Though the anamorph of the present fungus resembled closely with that of the aforementioned *E. abelmoschicola* in the morphology (Table 1), it was unable to infect kenaf plant. Therefore, it is sure that the kenaf fungus differs from *E. abelmoschicola* on maniok-eibish.

1. *Oidium* sp. on kenaf (Fig. 2 ; Table 1 ; Photo 1・

Table 1 Dimension of conidia and foot-cells of conidiophore of *Erysiphe abelmoschicola* on *Abelmoschus manihot* and *Oidium* sp. on three *Hibiscus* spp. including *H. cannabinus*

Fungus	Host plant	TUAMH*	Conidium		Size of foot-cell (mean) μm
			Size (mean) μm	Length/Width (mean)	
Erysiphe abelmoschicola	*Abelmoschus manihot*	6110	(29-)33-46(-54)×(15-)17-22 (37.6±1.1×19.0±0.37)	1.6-2.4(-3.0) (1.99±0.071)	32-58×10-12 (48.0±3.3×10.4±0.18)
Oidium sp.	*Hibiscus cannabinus*	6104	(29-)32-41(-52)×16-21 (36.5±0.78×18.7±0.26)	1.5-2.3(-3.1) (1.92±0.067)	31-52×9-10(-12) (37.5±0.78×9.7±0.37)
〃	*H. coccineus*	4661	29-39×17-22 (32.8±0.71×18.6±0.32)	1.2-2.3 (1.77±0.047)	36-64×6-7 (46.4±4.0×6.8±0.15)
〃	*H. syriacus*	4385	31-39×11-18 (35.1±0.63×14.2±0.49)	(1.8-)2.1-2.8(-3.4) (2.53±0.097)	26-38×6-9 (32.9±1.4×7.9±0.31)

TUAMH*: Mycological Herbarium of Tokyo University of Agriculture

Table 2 Dimension of holomorph of *Erysiphe abelmoschicola, E. lini,* and *E. poygoni* sens. str. and sens. lato

Erysiphe fungus	*E. abelmoschicola*	*E. lini*	*E. polygoni* sens. str.				*E. polygoni* sens. lato	
Host (Family)	(Malvaceae) maniok-eibish	(Linaceae) flax	(Polygonaceae) buckwheat	blood-wort	black-heart	prince feather	(Linaceae) flax	(*)
TUAMH	6110	5808	3910	0316	0689	0606		
Conidium (μm)								
〃 ・Size	29-54×15-22	25-43×16-23	35-47×14-19	36-55×13-18	33-52×13-18	35-51×13-19	30-38×19-24	31-42×12-17
〃 (mean)	(37.6×19.0)	(33.2×18.7)	(41.6×16.1)	(45.4×15.2)	(37.5×15.4)	(42.2×15.7)		
〃 (l/w) (mean)	1.6-3.0(1.99)	1.2-2.7(1.81)	2.2-3.3(2.66)	2.3-4.1(3.10)	2.1-3.5(2.46)	2.1-3.3(2.51)		
Conidiophore (μm)								
・Size	72-110×10-12	49-70×8-10	92-103×8-11	50-83×8-11	85-146×7-9	72-110×7-11	up to 62.4	
〃 (mean)	(77.7×10.9)	(59.0×8.9)	(98.5×9.3)	(66.0×9.3)	(115.5×7.8)	(87.2×9.1)		
〃 ・Foot-cell	32-58×10-12	27-45×8-10	33-48×8-9	18-48×9-11	40-98×6-8	34-51×7-9		
〃 (mean)	(48.0×10.4)	(33.4×8.9)	(41.8×8.5)	(31.5×9.0)	(64.3×7.1)	(37.8×8.4)		
Cleistotheium (μm)								
〃 ・Diameter (mean)	64-100(82.3)	68-107(85.5)	88-155(111.7)	96-133(111.6)	89-135(112.7)	103-150(120.5)	91-105	84-140
〃 ・Wall-cell	14-25×11-18	11-18×7-18	11-25×11-14	12-27×12-15	11-26×10-15	11-25×7-14	17-19 diam	10-25×8-17
〃 (mean)	(18.6×13.1)	(16.3×11.5)	(18.0×12.6)	(19.2×14.2)	(19.7×13.2)	(18.2×11.2)		
Appendage								
〃 ・Number (mean)	3-7(4.9)	2-6(3.6)	15-23(18.2)	15-19(17.4)	17-24(19.7)	14-21(17.5)	Ca 8	variable
〃 ・Length (mean) (μm)	25-289(121.1)	47-186(116.1)	67-113(87.4)	59-178(112.4)	20-250(132.5)	20-140(110.2)	168-217	1-5 times diam of cleistothecium
Ascus								
〃 ・Number (mean)	4-5(4.1)	2-5(3.3)	4-6(5.1)	5-7(6.2)	5-7(5.5)	4-8(6.0)	6	4-10
〃 ・Size (μm)	36-71×25-50	32-75×25-50	35-78×25-46	50-68×21-36	46-75×32-46	53-85×28-53	48-55×24-31	38-70×26-48
〃 (mean)	(52.5×33.4)	(54.9×37.2)	(61.9×36.7)	(58.3×32.0)	(62.2×38.1)	(65.1×38.5)		
Ascospore								
〃 ・Number (mean)	4-5(4.2)	3-4(3.3)	3-4(3.5)	3-4(3.7)	3-5(3.9)	3-5(4.0)	1-3	3-6
〃 ・Size (μm)	18-26×10-16	21-27×12-14	24-33×10-13	22-31×11-14	22-31×11-14	20-28×11-14	18-20×10-12	14-29×8-17
〃 (mean)	(23.2×12.9)	(23.8×13.0)	(29.2×11.1)	(27.4×12.1)	(26.8×12.0)	(24.1×13.2)		
Investigator	Present author						Homma (1928)[2]	Homma (1937)[3]

(*) Different families including malvaceous, linaceous and polygonaceous plants

E)

Mycelia amphigenous, developing circular to irregular, white to grayish white, thin patches, the margin obscure, often occupying the whole surface of the leaves ; conidiophores erect, branching from hyphae on the surfaces of the leaves, (1-) 2-3-septate, straight, 68-120×9-10(-12) (av. 89.4±5.6×10.2±0.29)μm, foot-cells cylindric, 31-52×9-10 (-12) (av. 37.5±0.78×9.7±0.37) μm ; conidia solitary, ellipsoid or rarely elongate ellipsoid, vacuolate, (29-) 32-41 (-52)×16-21 (av. 36.5±0.78×

18.7±0.26)μm, l/w ratio 1.5–2.3 (–3.1) (av. 1.92±0.067).

2. Taxonomic consideration of the fungus

Although three powdery mildew fungi belonging to three genera have been reported on kenaf from different countries (AMANO, 1986)[11], their anamorphs differ from Pseudoidium type. The determination of taxonomic position of the present fungus should be deferred to examine its teleomorphic state.

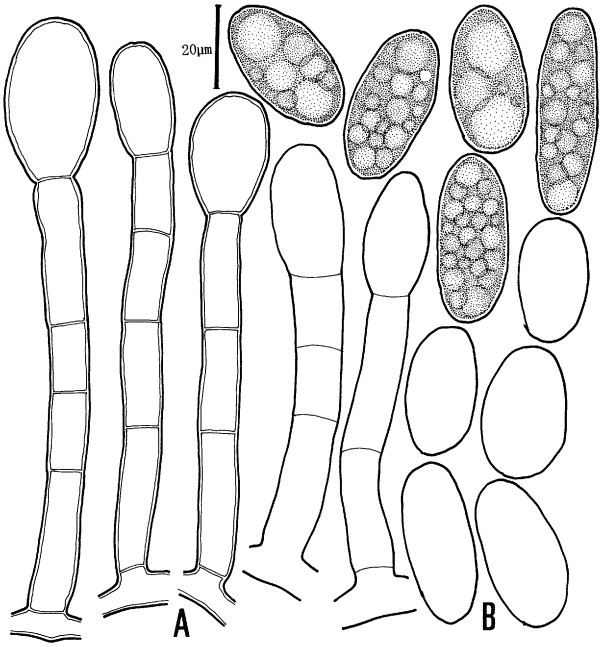

Fig. 2 *Oidium* sp. on kenaf (A : Conidia and conidiophores ; B : Mature conidia).

Ⅲ. A new *Erysiphe* fungus on flax

Flax has been listed as a host of *Erysiphe polygoni* auct. non DC. sens. HOMMA and an anamorph of the genus *Sphaerotheca, Oidium lini* SKORIC in Japan (HOMMA, 1927[1], 1928[2]). Between the above two fungi, however, *E. polygoni* DC. sens. strict. was applied limitedly to the taxon on polygonaceous plants as above-mentioned.

In the autumn 1999, we found the holomorph of an *Erysiphe* fungus on flax grown in the sample garden of the university. In the shape, the fungus resembled closely *E. polygoni* on flax described by HOMMA (1927[1], 1928[2]). As compared with the holomorph of *E. polygoni* on polygonaceous plants, however, that of flax fungus undoubtedly differed from it in the size of conidia and cleistothecia, and the number of appendages and asci (Table 2).

Although four powdery mildew fungi have been reported on flax plant from foreign countries, their anamorphic states are different from Pseudoidium type. Neither *Erysiphe* fungus nor anamorph of Pseudoidium type are recorded in any countries except Japan. The flax fungus is regarded as a new independent *Erysiphe* species.

1. *Erysiphe lini* TANDA, sp. nov. (Fig. 3 ; Table 2 ; Photo 1·F)

Syn. *Erysiphe polygoni* auct. non DC. sens. HOMMA,

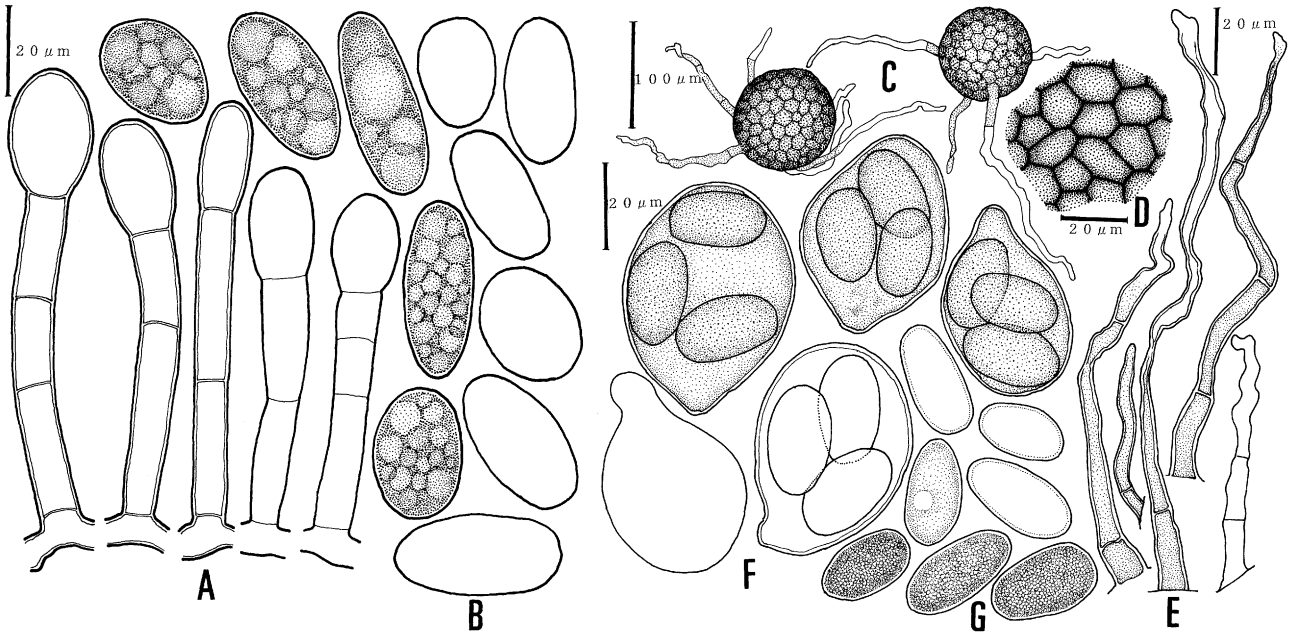

Fig. 3 *Erysiphe lini* TANDA on flax (A : Conidia and conidiophores ; B : Mature conidia ; C : Cleistothecia ; D : Wall cells of cleistothecium ; E : Appendages of cleistothecim ; F : Asci and ascospores ; G : Ascospores).

Hortic., **19**, 13 (1927)[1] ; *Bot. Mag. Tokyo,* **42**, 331 (1928)[2].

Mycelia amphigenum in foliis etiam cauligenum, persistens vel evanescens pelliculas albas rotundas vel irregulariter,frequenter occupans tota superficiem folii et caulis. Cleistothecia sparsa, atro-brunnea, subglobosa vel depresso-globosa, 68–107 μm diametro, cellulis peridii irregulariter polygonalibus, 11–18×7–18 μm. Appendices (2–)3–4(–6), prope aequatorem cleistothecii exorientes, simplices, mycelioideae, tenuitunicatae, curvatae vel flaccidae, brunneae vel apicem versus hyalinae, 1–3 septatae, 47–186 μm longae (diametro cleistothecii 0.5–2.2 plo longiores), prope apicem 3.9–5.2 μm et prope basim 6.5–7.8 μm latae. Asci (2–)3–4(–5), ovati vel late ellipsoidei, sessiles vel brebistipitati, (32–) 43–75×25–50 μm. Ascosporae 3–4, pallide flavae, ellipsoideae vel ovatae, 21–27×12–14 μm. Conidia singularia, ellipsoideae vel late ellipsoidei, raro subglobosa, vacuolata, (25–)28–38(–43)×16–23 μm. Conidiophora recta vel interdum leviter curvata, 1–2 septata, 49–70×8–10 μm, cellulis ad basim cylindracea, 27–45×8–10 μm.

Holotypus : in foliis et caulibus vivis *Lini usitatissimi* L. (flax). Tokyo Univ. Agric., Funako, Atsugi-shi, Kanagawa Pref., Japan, 11 Nov. 1999, leg. S. Tanda (TUAMH 5808).

Loc. Addendum : Hokkaido Univ., Sapporo-shi, Hokkaido, 15 Sep. 1922 (anam.) ; 11 Nov. 1922 (teleom.), leg. Y. Homma.

Mycelia amphigenous, also cauligenous, developing circular or irregular, whitish or grayish patches, margin obscure, often covering the whole surface of leaves and stems, persistent on the upper surface, evanescent on the under surface ; conidia solitary, ellipsoidal, broadly ellipsoidal or rarely subglobose, vacuolate, fibrosin-body absent, (25–)28–38(–43)×16–23 (av. 33.2±0.98×18.7±0.41) μm, l/w ratio 1.2–2.2 (–2.7) (av. 1.81±0.081) ; conidiophores erect, branching from the hyphae creeping on the surfaces of leaves and stems, straight or rarely curved, 1- or 2-septate, 49–70×8–10 (av. 59.0±2.6×8.9±0.26) μm ; foot-cells cylindric, 27–45×8–10 (av. 33.4±2.2×8.9±0.26) μm ; cleistothecia scattered on the under surface of the leaves, dark brown, subglobose or depressed globose, 68–107 (av. 85.5±1.5) μm ; wall cells irregularly polygonal, 11–18×7–18 (av. 16.3±0.87×11.5±1.00) μm ; cleistothecial appendages produced (2–) 3–4 (–6) (av. 3.6±0.38) in number on the lower half part of the cleistothecium, mycelioid, simple, thin-walled throughout, brownish or hyaline upwards, curved or flaccid, 1–3 (av. 1.5±0.25)-septate, 47–186 (av. 116.1±14.0) μm long (0.5–2.2 times as long as the cleistothecial diam), 3.9–5.2 (av. 4.57±0.65) μm wide at the upper part, 6.5–7.8 (av. 7.17±0.65) μm wide near the base ; asci (2–) 3–4 (–5) (av. 3.3±0.17) in number, ovate or broadly ellipsoidal, sessile or short pedicellate, wall thin, (32–)43–75×25–50 (av. 54.9±1.3×37.2±0.86) μm ; ascospores 3–4 (av. 3.3±0.17) in number, light yellow, ellipsoidal or ovoid, granular, 21–27×12–14 (av. 23.8±0.76×13.0±0.39) μm.

2. Taxonomic consideration of the new fungus

The holomorph of the present fungus and *E. polygoni* on flax described by Homma (1927[1], 1928[2]) closely resembled each other in shape except for a few characters (Table 2). Therefore both the fungi were regarded certainly as an identical taxon. On the other hand, the morphology of *E. polygoni* on polygonaceous plants was evidently distinguishable from that of the flax *Erysiphe* fungus. Furthermore, a *Polygonum* plant, black-heart was immune to the flax fungus in inoculation experiment and the fact is later mentioned in the parasitism of the fungus.

Among the reliable fungi hitherto known, five species of *Erysiphe* described on the plants of different families were comparatively similar in shape to the flax fungus (Table 3). The present fungus, however, was distinguished confidently from five fungi owing to the following discrepancies : —① The cleistothecial wall cells of *Erysiphe caucasica* Simon. var. *chorcholi* Tanda on the tiliaceous plant are far larger, the appendages long, and the ascospores small. ② The cleistothecial appendages of *Erysiphe euphorbiae* Peck on the euphorbiaceous plants and ③ *E. coriariicola* Zheng et Chen on the coriariaceous plant are many and long. ④ The appendages of *E. circaeae* Junell on the onagraceous plant bifurcate often irregularly, and its asci and ascospores are small-sized. ⑤ *E. caucasica* var. *caucasica* on the asteraceous plant most allied to the present fungus, but the wall cells are larger, and the asci are rather small.

3. Parasitism of *E. lini*

① Parasitism of the ascospores : In the middle of June, thin, grayish white mycelia developed on a few leaves of flax, and the patches expanded daily. The conidia on the mycelia agreed well with those formed naturally.

② Parasitism of the conidia : On the leaves of flax, the mycelial patches developed in five to six days after inoculations, however, no sign of infection was confirmed at all on the leaves of maniok-eibish and black-heart.

The type materials of the two new species of *Erysiphe* are deposited in the Mycological Herbarium of the Tokyo University of Agriculture (TUAMH, Tokyo Univ. Agric. Museum), Tokyo, Japan.

Table 3 Holomorphic characters of five *Erysiphe* spp. allied morphologicaly with *Erysiphe lini*

Character	*E. caucasica*		*E. circaeae*	*E. euphorbiae*	*E. coriariicola*
	var. *caucasica*	var. *corcholi*			
Host plant (Genus) (Family)	*Aetheopappus* (Asteraceae)	*Corchorus* (Tiliaceae)	*Circaea* (Onagraceae)	*Euphorbia* (Euphorbiaceae)	*Coriaria* (Coriariaceae)
Conidial size (μm)	26–37×13–19	27–37(–40)×16–21	30–46×14–20		30.5–44.5×13–18
Size of foot-cell of conidiophore (μm)	25–35×5.5–9(–11)	22–35×8–10	25–35×6–9		
Cleistothecium (μm)					
Diameter	(55–)75–95(–105)	71–100(–107)	70–105	65–100	(70–)82–90(–100)
Diam of wall cell	8–25(–30)	14–25	10–20	8–20	7.5–21.5
Appendage					
Number	not very numerous	4–12	not very numerous	4–25	5–15
Length	0.5–2.5 times as long as cleistothecial diameter	32–236μm	0.5–3 times, variable	1–6 times	1–4(–5) times
Shape	septate, smooth to rough, mycelioid, usually simple	0–3–septate, often irregularly furcate, curved or flexous, mycelioid	septate, occasionally irregularly branched, rather coarse, simple, smooth	septate, flexous, contorted, smooth to rough, mycelioid, simple	septate, undulate, flexuous, smooth to verruculose, below, simple
Ascus					
Number	3–5	3–5	(2–)3–5(–6)	3–5	3–5
Size (μm)	(40–)50–65×25–45	43–68×25–43	45–65×30–40	35–65×24–45	48–66(–74)×33–51
Ascospore					
Number	(1–)3–4	2–4	3–5	3–4	3–5
Size (μm)	18–26×8.5–15.5	13–24×9–14	18–23×10–12	16–24×10–15	20–28×13–18
Reference	BRAUN (1987)[4]	TANDA (1998)[8]	BRAUN (1987)[4]	BRAUN (1987)[4]	BRAUN (1987)[4]

References

1) HOMMA, Y., 1927. Powdery mildew on the plants in green house. *Engei* (*Horticulture*). **19**, 11–14 (in Japanese).
2) HOMMA, Y., 1928. On the powdery mildew of flax. *Bot. Mag. Tokyo,* **42**, 331–334.
3) HOMMA, Y., 1937. Erysiphaceae of Japan. *J. Fac. Agric. Hokkaido Imp. Univ.,* **38**, 183–461, +pls.v-xi.
4) BRAUN, U., 1987. A monograph of the Erysiphales (powdery mildews). *Nov. Hedw.* (Heft), **83**, 1–700.
5) TANDA, S. and SUGA, R., 2002. Powdery mildews occurred on horse radish and five economic plants, and their causal fungi. *J. Agri. Sci., Tokyo Univ. Agric.,* **47**, 141–152 (in Japanese).
6) TANDA, S., 2003. Powdery mildews newly found on three ornamental trees and one flowering plant, and their causal fungi. *J. Agri. Sci., Tokyo Univ. Agric.,* **47**, 290–297 (in Japanese).
7) TANDA, S., 2000. Two new species of Erysiphaceae from Japan. *Mycoscience,* **41**, 155–160.
8) TANDA, S., 1998. Two powdery mildew fungi found on Jew's marrow (an alias molokhia). *J. Agri. Sci., Tokyo Univ. Agric.,* **43**, 152–158.
9) WADA, K. and HIRATA, K., 1977. The powdery mildew fungi and their host plants recorded up to date in Japan. *Bull. Agr. Niigata Univ.,* **29**, 77–114 (in Japanese).
10) SATO, Y., 1980. Powdery mildew fungi and their host plants in Toyama Prefecture. *Bull. Res. Toyama Coll. Tech.,* **13**, 107–116 (in Japanese).
11) AMANO, K., 1986. Host range and geographical distribution of the powdery mildew fungi. Jpn. Sci. Soc. Press, Tokyo.
12) TANDA, S., 1997. Powdery mildew fungi found on some ornamental plants from Japan. *J. Agri. Sci., Tokyo Univ. Agric.,* **42**, 173–183 (in Japanese).

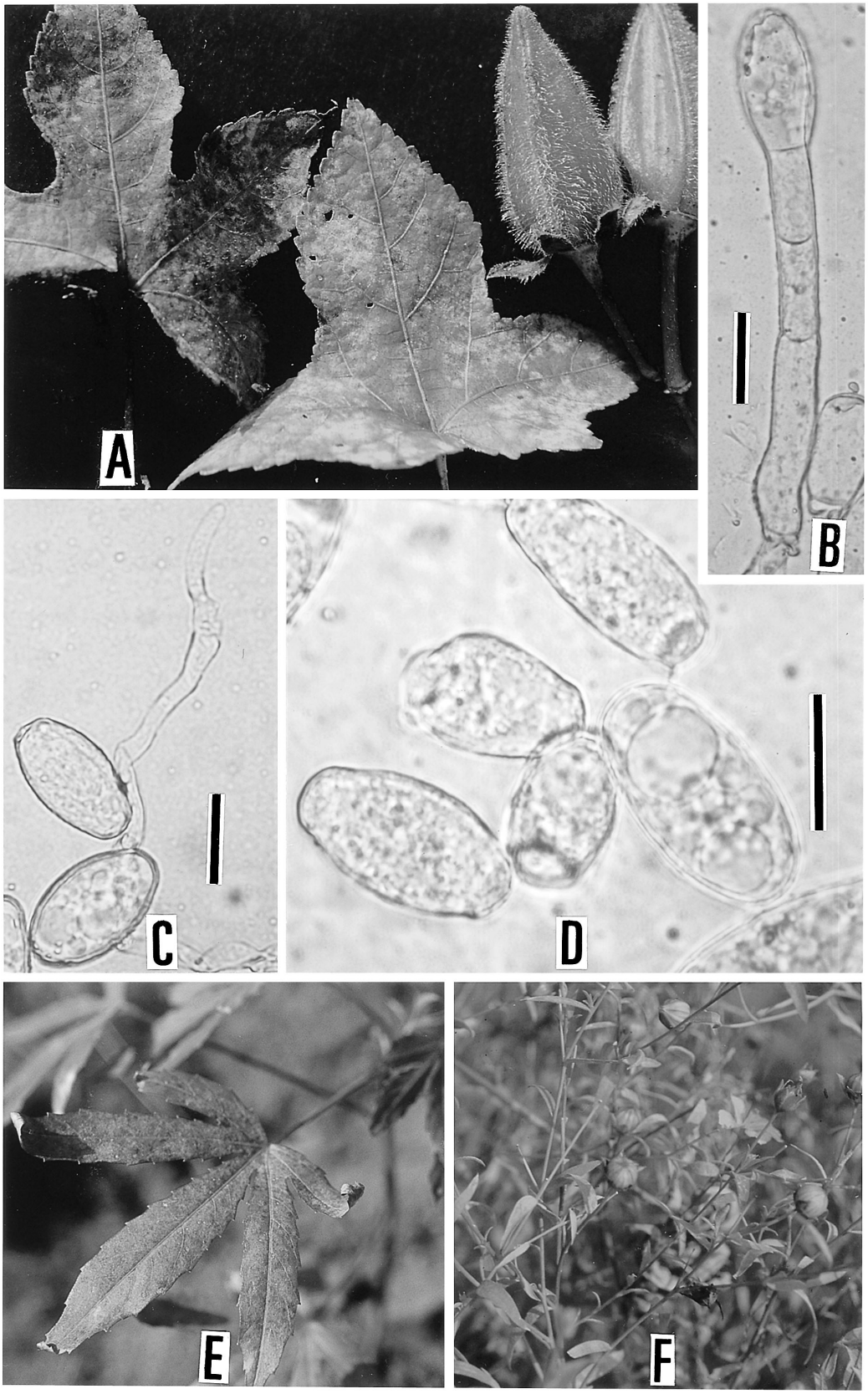

Photo 1 Powdery mildews and their causal fungi on the leaves of three industrial crops (A : Leaves of maniok-eibish affected by *Erysiphe abelmoschicola* ; B : Conidia and conidiophore of *E. abelmoschicola* ; C : Germinating conidium of *E. abelmoschicola* ; D : Mature conidia of *E. abelmoschicola* ; E : Leaves of kenaf affected by an *Oidium* sp. ; F : Leaves of flax by *Erysiphe lini*). Bars B, C, D 20μm

トロロアオイとアマに発生した *Erysiphe* 属菌の改名および日本初発見のケナフ上のうどんこ病菌

丹田誠之助*・広瀬友二*

（平成 15 年 2 月 1 日 受付/平成 15 年 7 月 24 日 受理）

要約：わが国において，これまでに *Erysiphe polygoni* sens. lato の発生が記録されているトロロアオイとアマでうどんこ病の発生が観察された。病原菌のホロモルフを精査した結果，両菌は *Erysiphe* 属の新種と判定され，トロロアオイ菌は *E. abelmoschicola*，アマ菌は *E. lini* と改名された。さらに，わが国でうどんこ病の発生が未記録のケナフでも同病の発生を認め，病原菌の分生子時代を観察したが，その特徴は国外の同植物で記録される菌とは別種と推定された。

キーワード：トロロアオイ，ケナフ，アマ，*Erysiphe abelmoschicola, Erysiphe lini*

* 東京農業大学農学部農学科