

일균일명 체계에 의한 국내 보고 *Aspergillus*, *Penicillium*, *Talaromyces* 속의 종 목록 정리

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Species List of *Aspergillus*, *Penicillium* and *Talaromyces* in Korea, Based on 'One Fungus One Name' System

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ABSTRACT : *Aspergillus*, *Penicillium*, and their teleomorphic genera have a worldwide distribution and large economic impacts on human life. The names of species in the genera that have been reported in Korea are listed in this study. Fourteen species of *Aspergillus*, 4 of *Eurotium*, 8 of *Neosartorya*, 47 of *Penicillium*, and 5 of *Talaromyces* were included in the National List of Species of Korea, Ascomycota in 2015. Based on the taxonomic system of single name nomenclature on ICN (International Code of Nomenclature for algae, fungi, and plants), *Aspergillus* and its teleomorphic genera such as *Neosartorya*, *Eurotium*, and *Emericella* were named as *Aspergillus* and *Penicillium*, and its teleomorphic genera such as *Eupenicillium* and *Talaromyces* were named as *Penicillium* (subgenera *Aspergilloides*, *Furcatum*, and *Penicillium*) and *Talaromyces* (subgenus *Biverticillium*) in this study. In total, 77 species were added and the revised list contains 55 spp. of *Aspergillus*, 82 of *Penicillium*, and 18 of *Talaromyces*.

KEYWORDS : Species list, *Aspergillus*, *Penicillium*, *Talaromyces*

서 론

생물자원을 활용하여 발생하는 이익에 대한 국가 간 분배의 국제적 지침인 나고야 의정서가 2014년 10월 발효되었다. 이에 생물자원을 둘러싼 국가 간의 경쟁이 치열해짐에

따라 우리 주권 영역내의 곰팡이 종을 상세하게 파악하여 국제적으로 인정받을 수 있는 과학적인 자료를 구축해 놓는 것은 매우 중요하다[1]. 또한 곰팡이 명명법의 경우 국제 식물명명규약(International Code of Botanical Nomenclature, ICBN)에 따라 불완전세대명과 완전세대명 모두를 사용하는 이명법을 사용해왔으나 국제조류 · 균류 · 식물명명규약(International Code of Nomenclature for algae, fungi, and plants, ICN)에 따른 일균일명(one fungus : one name)으로 개정되었다[2].

*Aspergillus*와 *Penicillium*은 지구상의 가장 흔한 곰팡이들로서 인간생활과 밀접한 공기, 토양, 식품 등에 발생한다. 이들은 작물과 식품을 오염시키고 다양한 곰팡이독소를 생성하며 심지어 사람에게 곰팡이 병을 발생시키기도 한다. 한편 이들은 식품 발효에 관여하며 페니실린과 같은 항생 물질, 로바스타틴과 같은 의약품, 구연산 같은 유기산 등을 생산하여 산업적으로 매우 유용한 곰팡이다[3, 4]. 이와 같이 *Aspergillus*와 *Penicillium*은 인간 생활에 큰 영향을 끼치기 때문에 다른 어떤 곰팡이 속보다 많은 관심을 받아왔다[5].

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Aspergillus P. Micheli ex Haller (1768)는 분생포자머리(conidial head)의 모양이 가톨릭 의식에 사용되는 성수채(*aspergillum*)와 유사하다고 하여 프랑스의 성직자 Micheli에 의하여 1729년에 *Aspergillus*로 이름 지어진 이래로 Thom과 Raper [6]에 의하여 89종으로 Raper와 Fennell [7]에 의하여 150종으로 정리되었다. 이후 Pitt와 Samson [8]은 현재명 목록(The list of Names in Current use)을 작성하고 불완전세대인 *Aspergillus* 185종과 이와 연관된 완전세대 72종으로 정리하였고 Pitt 등[9]은 이 목록을 불완전세대 *Aspergillus* 184종과 이와 연관된 완전세대종 70종으로 재정리하였다. *Aspergillus*의 완전세대로는 *Eurotium* Link: Fr., *Chaetosartorya* Subram., *Emericella* Berk., *Fennellia* B. J. Wiley & E.G. Simmons, *Neosartorya* Malloch & Cain, *Petromyces* Malloch & Cain, *Stilbothamnium* Henn., *Sclerocleista* Subram., *Hemicarpenetes* A.K. Sarbhoy & Elphick, *Neopetromyces* Frisvad & Samson, *Neocarpenetes* Udagawa & Uchiy. 등이 사용되어 왔으나 최근에 *Sclerocleista*와 *Hemicarpenetes*은 더 이상 *Aspergillus*의 완전세대가 아닌 것으로 밝혀졌다[3]. 곰팡이 명명이 ICN으로 개정됨에 따라[10] *Penicillium*과 *Aspergillus* 국제위원회(International Commission of *Penicillium* and *Aspergillus*)는 완전세대명을 배제하고 모두 *Aspergillus*로 통일하여 339종을 정리 발표하였다[3].

Penicillium Link (1809)은 분생포자경(conidiophore)이 솔(brush) 모양이라고 하여 1809년에 Link에 의하여 명명되었으며[11] 그 이후로 1,000종 이상이 보고되었으나 많은 종들은 표준균주가 남아 있지 않고 기술이 불명확하여 1930년 Thom에 의해 300종으로 정리되었으며[12] 이후 Raper와 Thom [13]은 137종으로 Pitt [14]은 150종으로 Ramírez와 Martinez [15]는 252종으로 정리하였다(완전세대 *Eupenicillium* 종명 포함). 이후 Pitt와 Samson [8]은 *Trichocomaceae*과(科)의 현재명(Names in current use) 목록 작성을 통해 223종으로 정리하였고 Pitt 등[9]은 225종으로 개정하였다. *Penicillium*은 수백 종으로 구성된 거대 속이기 때문에 아속(subgenus)을 두어 구분하였는데 분생포자경의 분지 횡수와 phialide의 모양에 따라 *monoverticillate* (subgenus *Aspergilloides*), *biverticillate* (subg. *Biverticillium*, subg. *Furcatum*), *terverticillate* (subg. *Penicillium*)으로 구분하였다[14]. 이들을 4개의 유전자 염기서열(RPB1, RPB2, Tsr1, Cct8)을 기반으로 하여 유연관계도를 작성하였을 때에 *Biverticillium* 아속과 완전세대 *Talaromyces*는 별도의 그룹을 형성하였고 나머지 3아속(*Aspergilloides*, *Furcatum*, *Penicillium*)과 완전세대들은 모두 단일그룹을 형성하였다[16]. 이에 ICN에서 요구하는 일균일명 체계에 부응하여 *Biverticillium* 아속과 *Talaromyces* 속 종들은 *Talaromyces* C. R. Benj. (1955) 속으로 개정되고[17] 나머지 *Penicillium* 아속과 완전세대 *Eupenicillium*, *Eladia*, *Hemicarpenetes*, *Torulomyces*, *Thysanophora*, *Chromocleista*, *Citromyces*,

Carpenteles 속의 종들은 모두 *Penicillium* Link (1809) 속에 포함되었다[16]. ICN 체계 하의 개정된 *Penicillium* 속에는 354종[4]이, *Talaromyces* 속에는 88종[18]이 기록되었다.

우리나라의 버섯을 제외한 곰팡이의 종 목록 정리는 다른 생물 종에 비하여 늦게 시작되었다. 2003년에 Lee 등[19]은 담자균을 제외한 토양 서식 곰팡이 종을 조사하였는데 *Aspergillus* 16종 그리고 이의 완전세대인 *Emericella* 2종, *Eurotium*과 *Neosartorya* 각 1종을 기록하였고 *Penicillium* 53종과 그의 완전세대인 *Eupenicillium* 2종, *Talaromyces* 9종을 기록하였다. 2015년 한국균학회와 국립생물자원관은 자낭균문 국가생물종 목록집을 발간하였는데 여기에는 *Aspergillus*가 14종, 이의 완전세대인 *Eurotium*이 4종, *Neosartorya*가 8종, 그리고 *Penicillium*이 47종, 이의 완전세대인 *Talaromyces*가 5종으로 정리되었다[1]. 하지만 국가 생물종 목록집의 *Aspergillus*와 *Penicillium*의 종 목록은 MycoBank의 학명 기준을 따르다 보니 ICN의 일균일명의 원칙을 따른 최근의 분류체계를 반영하지 못하였고 또한 국내에 보고된 많은 종들이 누락되었다.

따라서 나고야 의정서가 발효되어 자국에 서식하는 생물 종의 정확한 파악이 필요한 시점에서 본 논문에서는 기존의 *Aspergillus*와 *Penicillium* 및 그 완전세대 속 종들을 최근의 분류체계인 ICN의 일균일명으로 전환된 체계에 따라 *Aspergillus*, *Penicillium*, *Talaromyces* 속으로 재정리하고 또한 기존의 국가 생물종 목록에 누락되어 있던 다수의 종들을 추가하였다.

재료 및 방법

국내에 보고된 *Aspergillus*, *Penicillium*, *Talaromyces* 속의 종명을 재정리하기 위하여 Lee 등[1]을 기준으로 하고 누락된 종을 추가하였다. 먼저 문헌조사는 한국균학회지, Mycobiology, 한국식물병명목록 5판[20], 식물병과 농업, The Plant pathology Journal, Journal of Microbiology, Journal of Microbiology and Biotechnology 등의 저널을 활용하였다. 또한 농업미생물은행(Korean Agricultural Culture Collection, KACC) (<http://www.genebank.go.kr>)에 보존 중인 미생물 자원 중 해당 속의 자원들을 조사하여 국내에서 분리되고 다수염기서열분석 방법을 통하여 신뢰성 있게 동정한 균주들을 선별하여 추가하였다. 참고문헌 없이 KACC 보유를 근거로 기록한 종은 KACC no.를 참고란에 기록하였다[21]. *Aspergillus*와 *Penicillium* 및 그의 완전세대 속명의 분류체계는 *Aspergillus*와 완전세대의 경우 Samson 등[3]의 체계에 따라 관련 완전세대 속 모두를 이명(synonym)으로 하고 *Aspergillus*를 속명으로 사용하였으며, *Penicillium*과 그 완전세대의 경우 *Biverticillium* 아속과 완전세대 *Talaromyces*는 *Talaromyces* 속으로 하고 Yilmaz 등[18]의 체계를 따랐으며, 그 외의 *Penicillium*과 완전세대 속의 경우는 *Penicillium* 속으로 하고 Visagie 등[4]의 체계를 따

랐다. 학명 관련자료는 스프레드시트 파일로 정리하였으며 본문에는 국가 생물종 목록집의 형식에 따라 기술하였다.

결 과

한국산 *Aspergillus*, *Penicillium*, *Talaromyces* 종 목록

Class EUROTIIOMYCETES O.E. Erikss. & Winka

Order EUROTIALES G.W. Martin et al.

Family ASPERGILLACEAE Link

Genus *Aspergillus* P. Micheli ex Haller

Aspergillus aculeatus Iizuka

J. Agric. Chem. Soc. Japan 27: 807. 1953

[Key record] Kim et al., 2013b [22]

Aspergillus assulatus (S.B. Hong, Frisvad & Samson)

Houbraken, Visagie & Samson

Stud. Mycol. 78:154. 2014

[Alter st] *Neosartorya assulata*

[Key record] Hong et al., 2008 [23]

[Note] 국내에서는 *Neosartorya assulata*로 보고됨

Aspergillus aureolus Fennell & Raper

Mycologia 47:71. 1955

[Alter st] *Neosartorya aureola*

[Key record] Adhikari et al., 2015 [24]

[Note] 국내에서는 *Neosartorya aureola*로 보고됨

Aspergillus brunneus Delacr.

Bull. Soc. Mycol. Fr. 9:185. 1893

[Alter st] *Eurotium echinulatum*

[Key record] Hong et al., 2015 [25]

Aspergillus caesiellus Saito

J. Coll. Sci. Imp. Univ. Tokyo 18(5): 49. 1904

[Key record] Kim et al., 2015 [26]

Aspergillus candidus Link

Mag. Ges. Naturf. Freunde Berlin 3(1): 16. 1809

[Key record] Hong et al., 2015 [25]

Aspergillus chevalieri (L. Mangin) Thom & Church

The Aspergilli: 111. 1926

[Alter st] *Eurotium chevalieri*

[Key record] Hong et al., 2011 [27]; Hong et al., 2015 [25]

Aspergillus cibarius S.B. Hong & R.A. Samson

J. Microbiol. 50: 712-714. 2012

[Key record] Hong et al., 2012 [28]

Aspergillus clavatus Desm.

Annls Sci. Nat., Bot., ser. 2:71. 1834

[Key record] Lee et al., 2003 [19]

Aspergillus coreanus S.B. Hong, Frisvad & Samson

Int. J. Syst. Evol. Microbiol. 56 (2): 485. 2006.

[Alter st] *Neosartorya coreana*

[Key record] Hong et al., 2006 [29]

[Note] *Neosartorya coreana*로 처음 보고됨

Aspergillus creber Jurjevic, S. W. Peterson & B. W. Horn

IMA Fungus 3 (1): 69. 2012

[Key record] Kim et al., 2013a [30]

Aspergillus cumulatus D.H. Kim & S.B. Hong

J. Microbiol. Biotechnol. 24: 334-336. 2014

[Key record] Kim et al., 2014 [31]

Aspergillus fennelliae Kwon-Chung & S.J. Kim

Mycologia 66 (4): 629. 1974

[Alter st] *Neosartorya fennelliae*

[Key record] Hong et al., 2010 [32]

[Note] 국내에서는 *Neosartorya fennelliae*로 보고됨

Aspergillus fischeri Wehmer

Zentbl. Bakt. ParasitKde, Abt. II 18: 390. 1907

[Alter st] *Neosartorya fischeri*

[Key record] Hong et al., 2010 [32]

[Note] 국내에서는 *Neosartorya fischeri*로 보고됨

Aspergillus flavipes (Bainier & Sartory) Thom & Church

The Aspergilli: 155. 1926

[Key record] KACC 43789

Aspergillus flavus Link

Mag. Gesell. naturf. Freunde, Berlin 3: 16. 1809

[Key record] Lee et al., 2003 [19]; Kim et al., 2013b [22]

Aspergillus fumigatus Fresen.

Beitr. Mykol. 3: 81. 1863

[Key record] Hong et al., 2005 [33]

Aspergillus giganteus Wehmer

Mem. Soc. Phys. Hist. nat. Geneve 33: 85. 1901

[Key record] Lee et al., 2003 [19]

***Aspergillus glaucus* (L.) Link**

Mag. Ges. Naturf. Freunde Berlin 3: 16. 1809

[Alter st] *Eurotium herbariorum*

[Key record] Hong et al., 2011 [27]; Hong et al., 2015 [25]

***Aspergillus hiratsukae* Udagawa et al.**

Trans. Mycol. Soc. Japan 32 (1): 23. 1991

[Alter st] *Neosartorya hiratsukae*

[Key record] Hong et al., 2010 [32]

[Note] 국내에서는 *Neosartorya hiratsukae*로 보고됨

***Aspergillus japonicus* Saito**

Bot. Mag., Tokyo 20: 61. 1906

[Key record] Lee et al., 2003 [19]

***Aspergillus jensenii* Jurjevic, S.W. Peterson & B.W. Horn**

IMA Fungus 3: 70. 2012

[Key record] Kim et al., 2015 [26]

***Aspergillus laciniosus* S.B. Hong, Frisvad & Samson**

Int. J. Syst. Evol. Microbiol. 56 (2): 484. 2006

[Alter st] *Neosartorya laciniosa*

[Key record] Hong et al., 2006 [29]

[Note] 국내에서는 *Neosartorya laciniosa*로 보고됨

***Aspergillus lentulus* Balajee & K.A. Marr**

Eukaryot. Cell 4: 631. 2005

[Key record] Hong et al., 2005 [33]

***Aspergillus luchuensis* Inui**

J. Coll. Agric. Imp. Univ. Tokyo 13: 469. 1901

[Key record] Hong et al., 2013a [34]

***Aspergillus montevidensis* Talice & J.A. Mackinnon**

C.R. Séanc. Soc. Biol. Argentina 108: 1007. 1931

[Alter st] *Eurotium amstelodami*

[Key record] Hong et al., 2011 [27]; Hong et al., 2015 [25]

***Aspergillus neoglaber* Kozak.**

Mycol. Pap. 161: 56. 1989

[Alter st] *Neosartorya glabra*

[Key record] Hong et al., 2006 [29]

[Note] 국내에서는 *Neosartorya glabra*로 보고됨

***Aspergillus nidulans* (Eidam) G. Winter**

Rabenh. Krypt.-Fl., ed. 2, 1: 62. 1884

[Alter st] *Emericella nidulans*

[Key record] Kim et al., 2013a [30]

***Aspergillus niger* Tiegh.**

Ann. Sci. Nat., Bot. 8: 240. 1867

[Key record] Hong et al., 2013c [35]

***Aspergillus ochraceus* K. Wilh.**

Beitr. Kenntn. Aspergillus: 66. 1877

[Key record] Lee et al., 2003 [19]

***Aspergillus oryzae* (Ahlb.) Cohn**

Jahresber. Schles. Ges. Vaterl. Cult. 61: 226. 1884

[Key record] Hong et al., 2013b [36]

***Aspergillus ostianus* Wehmer**

Bot. Centralbl. 80: 461. 1899

[Key record] Kim et al., 2013a [30]

***Aspergillus parasiticus* Speare**

Bull. Div. Pathol. Physiol., Hawaiian Sugar Planters Assoc.

Exp. Sta. 12: 38. 1912

[Key record] Hong et al., 2015 [25]

***Aspergillus proliferans* G. Sm.**

Trans. Brit. Mycol. Soc. 26: 26. 1943

[Key record] Hong et al., 2011 [27]

***Aspergillus pseudoglaucus* Blochwitz**

Ann. Mycol. 27 (3-4): 207. 1929

[Alter st] *Eurotium repens*

[Key record] Lee et al., 2003 [19]; Hong et al., 2015 [25]

[Note] 국내에서는 *Aspergillus repens*로 보고됨.

***Aspergillus pulverulentus* (McAlpine) Wehmer**

Centralbl. Bakteriolog. 2. Abth. 18: 394. 1907

[Key record] Kwon et al., 2015 [37]

***Aspergillus quadricinctus* E. Yuill**

Trans. Brit. Mycol. Soc. 36: 57. 1953

[Alter st] *Neosartorya quadricincta*

[Key record] Hong et al., 2010 [32]

[Note] 국내에서는 *Neosartorya quadricincta*로 보고됨.

***Aspergillus restrictus* G. Sm.**

J. Textile Inst. 22: 115. 1931

[Key record] Kim et al., 2015 [26]

***Aspergillus ruber* (Jos. König et al.) Thom & Church**

Aspergillus: 112. 1926

[Alter st] *Eurotium rubrum*

[Key record] Hong et al., 2010 [32]; Hong et al., 2015 [25]

***Aspergillus sclerotiorum* G.A. Huber**

Phytopathology 23: 306. 1933

[Key record] Kim et al., 2015 [26]

***Aspergillus spinosus* Kozak.**

Mycol. Pap. 161: 58. 1989

[Alter st] *Neosartorya spinosa*

[Key record] Hong et al., 2006 [29]

[Note] 국내에서는 *Neosartorya spinosa*로 보고됨.

***Aspergillus steynii* Frisvad & Samson**

Stud. Mycol. 50: 39. 2004

[Key record] KACC 47388

***Aspergillus sydowii* (Bainier & Sartory) Thom & Church**

The Aspergilli: 147. 1926

[Key record] Kim et al., 2015 [26]

***Aspergillus tamaris* Kita**

Centralbl. Bakteriöl. 2. Abth. 37: 433. 1913

[Key record] Hong et al., 2015 [25]

***Aspergillus terreus* Thom**

Am. J. Bot. 5: 85. 1918

[Key record] Kim et al., 2013b [22]

***Aspergillus thermomutatus* (Paden) S.W. Peterson**

Mycol. Res. 96 (7): 549. 1992

[Alter st] *Neosartorya pseudofischeri*

[Key record] Hong et al., 2010 [32]

[Note] 국내에서는 *Neosartorya pseudofischeri*로 보고됨.

***Aspergillus tonophilus* Ohtsuki**

Bot. Mag. (Tokyo) 75: 438. 1962

[Alter st] *Eurotium tonophilum*

[Key record] Hong et al., 2011 [27]; Hong et al., 2015 [25]

***Aspergillus tritici* B.S. Mehrotra & M. Basu**

Nova Hedwigia 27: 599. 1976

[Key record] Hong et al., 2015 [25]

***Aspergillus tubingensis* Mosseray**

La Cellule 43: 245. 1934

[Key record] Hong et al., 2013c [35]

***Aspergillus turcosus* S.B. Hong, Frisvad & Samson**

Antonie van Leeuwenhoek 93: 97. 2008

[Key record] Hong et al., 2008 [23]

***Aspergillus udagawae* Y. Horie, Miyaji & Nishim.**

Mycoscience 36: 199. 1995

[Alter st] *Neosartorya udagawae*

[Key record] Hong et al., 2010 [32]

[Note] 국내에서는 *Neosartorya udagawae*로 보고됨.

***Aspergillus versicolor* (Vuill.) Tirab.**

Ann. Bot. (Roma) 7: 9. 1908

[Key record] Lee et al., 2003 [19]

***Aspergillus welwitschiae* (Bres.) Henn. apud Wehmer**

Centrbl. Bakteriöl. ParasitK. 2 18: 294. 1907

[Key record] Hong et al., 2013c [35]

***Aspergillus wentii* Wehmer**

Centralbl. Bakteriöl., 2. Abth., 2: 149. 1896

[Key record] KACC 47393

***Aspergillus westerdijkiae* Frisvad & Samson**

Stud. Mycol. 50: 30. 2004

[Key record] Hong et al., 2015 [25]

Class EUROTOMYCETES O.E. Erikss. & Winka

Order EUROTIALES G.W. Martin et al.

Family ASPERGILLACEAE Link

Genus *Penicillium* Link

***Penicillium adametzioides* S. Abe ex G. Sm.**

Trans. Br. mycol. Soc. 46: 335. 1963

[Key record] Deng et al., 2012 [38]

***Penicillium albocoremium* (Frisvad) Frisvad in Frisvad**

Int. Mod. Tax. Meth. Pen. Asp. Clas. 275. 2000

[Key record] Kim et al., 2006 [39]

***Penicillium antarcticum* A.D. Hocking & C.F. McRae**

Polar Biol. 21: 103. 1999

[Key record] Park et al., 2014a [40]

***Penicillium atramentosum* Thom**

U.S.D.A. Bur. Animal Industr. Bull. 118: 65. 1910
[Key record] Kim et al., 2015 [26]

***Penicillium aurantiogriseum* Dierckx**

Ann. Soc. Sci. Bruxelles 25: 88. 1901
[Key record] Shim et al. 2002 [41]

***Penicillium bialowiezense* K.M. Zalesky**

Bull. Acad. Polon. Sci., Math. et Nat., Sér. B: 450. 1927
[Key record] Kim et al., 2007 [42]

***Penicillium brasilianum* Bat.**

Anais Soc. Biol. Pernambuco 15: 162. 1957
[Key record] Cho et al., 2005 [43]

***Penicillium brevicompactum* Dierckx**

Ann. Soc. Sci. Bruxelles 25: 88. 1901
[Key record] Ahn et al., 2016 [44]

***Penicillium cainii* K.G. Rivera, Malloch & Seifert**

Stud. Mycol. 70: 147. 2011
[Key record] Deng et al., 2013 [45]

***Penicillium carneum* (Frisvad) Frisvad**

Microbiology 142: 546. 1996
[Key record] Kim et al., 2015 [26]

***Penicillium chermesinum* Biourge**

La Cellule 33: 284-288. 1923
[Key record] Kim et al., 2015 [26]

***Penicillium chrysogenum* Thom**

U.S.D.A. Bur. Animal Industr. Bull. 118: 58. 1910
[Key record] Lee et al., 2003 [19]

***Penicillium citrinum* Thom**

U.S.D.A. Bur. Animal Industr. Bull. 118: 61. 1910
[Key record] Kim et al., 2007 [42]

***Penicillium commune* Thom**

U.S.D.A. Bur. Animal Industr. Bull. 118: 56. 1910
[Key record] Lee et al., 2003 [19]

***Penicillium concentricum* Samson, Stolk & Hadlock**

Stud. Mycol. 11: 17. 1976
[Key record] Kim et al., 2014 [46]

***Penicillium coprophilum* (Berk. & M.A. Curtis) Seifert & Samson**

Adv. Penicillium Aspergillus Syst.: 145. 1985
[Key record] KACC 45905, KACC 45976

***Penicillium copticola* Houbraken, Frisvad & Samson**

Stud. Mycol. 70: 88. 2011
[Key record] Kim et al., 2013b [22]

***Penicillium corylophilum* Dierckx**

Ann. Soc. Sci. Bruxelles 25: 86. 1901
[Key record] Jo et al., 1999 [47]

***Penicillium crustosum* Thom**

The Penicillia: 399. 1930
[Key record] Kim et al., 2015 [26]

***Penicillium cyclopium* Westling**

Ark. Bot. 11: 90, 1911
[Key record] Lee et al., 2003 [19]

***Penicillium daejeonium* S.H. Yu & H.K. Sang**

J. Microbiol. 51: 536-539. 2013
[Key record] Sang et al., 2013a [48]

***Penicillium daleae* K.M. Zalesky**

Bull. Acad. Polon. Sci., Math. et Nat., Sér. B: 495. 1927
[Key record] Cho et al., 2005 [43]

***Penicillium decaturense* S.W. Peterson, E.M. Bayer & Wicklow**

Mycologia 96: 1290. 2004
[Key record] KACC 46986

***Penicillium decumbens* Thom**

U.S.D.A. Bur. Animal Industr. Bull. 181: 71. 1910
[Key record] Lee et al., 2003 [19]

***Penicillium dierckxii* Biourge**

La Cellule. 33: 313. 1923
[Synonymy] *Penicillium fellutanum*
[Key record] Kim et al., 2008a [49]
[Note] 국내에서는 *Penicillium fellutanum*으로 보고됨.

***Penicillium digitatum* (Pers:Fr.) Sacc.**

Fung. Ital.: tab. 894. 1881
[Key record] Park et al., 2014b [50]

***Penicillium echinulatum* Raper & Thom ex Fassat.**

Acta Univ. Carol., Biol. 5-6: 326. 1974

[Key record] You et al., 2014a [51]; Kim et al., 2007 [42]

***Penicillium expansum* Link**

Mag. Gesell. naturf. Freunde, Berlin 3: 54. 1809

[Key record] Kim et al., 2002 [52]

***Penicillium fellutanum* Biourge**

La Cellule 33: 262. 1923

[Key record] Oh et al., 2011 [53]

***Penicillium freii* Frisvad & Samson**

Stud. Mycol. 49: 28. 2004

[Key record] Park et al., 2014b [50]

***Penicillium glabrum* (Wehmer) Westling**

Ark. Bot. 11: 131. 1911

[Key record] Kim et al., 2015 [26]

***Penicillium gladioli* L. McCulloch & Thom**

J. Agric. Res., Washington 36: 223. 1928

[Alter st] *Eupenicillium crustaceum*

[Key record] Lee et al., 1989 [54]

***Penicillium glandicola* (Oudem.) Seifert & Samson**

Adv. Penicillium Aspergillus Syst.: 147. 1985

[Synonymy] *Penicillium granulatum*

[Key record] Kim et al., 2015 [26]; Lee et al., 2003 [19]

[Note] 국내에서는 *Penicillium granulatum*로 보고됨.

***Penicillium griseofulvum* Dierckx**

Ann. Soc. Sci. Bruxelles 25: 88. 1901

[Key record] Lee et al., 2003 [19]

***Penicillium griseopurpureum* G. Sm.**

Trans. Brit. Mycol. Soc. 48: 274. 1965

[Key record] KACC 40248

***Penicillium herquei* Bainier & Sartory**

Bull. Soc. Mycol. Fr. 28: 121. 1912

[Key record] Kim et al., 2015 [26]

***Penicillium hirsutum* Dierckx**

Ann. Soc. Sci. Bruxelles 25: 89. 1901

[Key record] Kim et al., 2006 [39]

***Penicillium hispanicum* C. Ramírez, A.T. Martínez & Ferrer**

Mycopathologia 66: 77. 1978

[Key record] Kim et al., 2015 [26]

***Penicillium implicatum* Biourge**

La Cellule 33: 278. 1923

[Key record] Kim et al., 2015 [26]

***Penicillium italicum* Wehmer**

Hedwigia 33: 211. 1894

[Key record] Sang et al., 2010 [55]

***Penicillium janczewskii* K.M. Zalesky**

Bull. Acad. Polon. Sci., Math. et Nat., Sér. B: 488. 1927

[Key record] Kwon et al., 2000 [56]

***Penicillium janthinellum* Biourge**

La Cellule 33: 258. 1923

[Key record] Lee et al., 2003 [19]

***Penicillium javanicum* J.F.H. Beyma**

Verh. K. Akad. Wet., tweede sect. 26: 17. 1929

[Alter st] *Eupenicillium javanicum*

[Key record] Lee et al., 2003 [19]

***Penicillium koreense* S.B. Hong, D.H. Kim & Y.H. You**

J. Microbiol. Biotechnol. 24: 1606. 2014

[Key record] You et al., 2014b [57]

***Penicillium malacaense* C. Ramírez & A.T. Martínez**

Mycopathologia 72: 186. 1980

[Key record] Kim et al., 2015 [26]

***Penicillium malodoratum* (Kwon-Chung & Fennell) Samson et al.**

Stud. Mycol. 78: 355. 2014

[Synonymy] *Aspergillus malodoratus*

[Key record] Kim et al., 2013a [31]

[Note] 국내에서는 *Aspergillus malodoratus*로 보고됨

***Penicillium melanoconidium* (Frisvad) Frisvad & Samson**

Stud. Mycol. 49: 28. 2004

[Key record] KACC 43475

***Penicillium miczynskii* K.M. Zalesky**

Bull. Acad. Polon. Sci., Math. et Nat., Ser. B: 482. 1927

[Key record] Lee et al., 2003 [19]

***Penicillium multicolor* Grig.-Man. & Porad.**

Arch. des Sciences Biol. Leningrad 19: 120. 1915
[Key record] You et al., 2013 [58]

***Penicillium murcianum* C. Ramírez & A.T. Martínez**

Mycopathologia 74: 37. 1981
[Key record] KACC 48070

***Penicillium nordicum* Dragoni & Cantoni ex C. Ramírez**

Adv. Penicillium Aspergillus Syst.: 139. 1985
[Key record] Kim et al., 2015 [26]

***Penicillium ochrochloron* Biourge**

La Cellule 33: 269. 1923
[Key record] Kim et al., 2015 [26]

***Penicillium olsonii* Bainier & Sartory**

Ann. Mycol. 10: 398. 1912
[Key record] Kim et al., 2015 [26]

***Penicillium oxalicum* Currie & Thom**

J. Biol. Chem. 22: 289. 1915
[Key record] Kim et al., 2005 [59]

***Penicillium palitans* Westling**

Ark Bot. 11: 83. 1911
[Key record] Kim et al., 2015 [26]

***Penicillium paneum* Frisvad**

Microbioloy 142: 546. 1996
[Key record] Kim et al., 2015 [26]

***Penicillium paraherquei* S. Abe ex G. Sm.**

Trans. Br. mycol. Soc. 46(3): 335. 1963
[Key record] Kim et al., 2015 [26]

***Penicillium paxilli* Bainier**

Bull. Soc. Mycol. Fr. 23: 95. 1907
[Key record] Kim et al., 2015 [26]

***Penicillium polonicum* K.M., Zalessky**

Bull. Acad. Polon. Sci., Math. et Nat., Sér. B: 445. 1927
[Key record] Kim et al., 2008b [60]

***Penicillium purpurescens* (Sopp) Biourge**

La Cellule 33: 105. 1923
[Key record] Lee et al., 2003 [19]

***Penicillium radicicola* Overy & Frisvad**

Syst. Appl. Microbiol. 26: 633. 2003
[Key record] Park et al., 2016 [61]

***Penicillium raistrickii* G. Sm.**

Trans. Br. mycol. Soc. 18: 90. 1933
[Key record] Lee et al., 2003 [19]

***Penicillium raphiae* Houbraken, Frisvad & Samson**

Stud. Mycol. 70: 114. 2011
[Key record] Paul et al., 2014 [62]

***Penicillium restrictum* J.C. Gilman & E.V. Abbott**

Journal of Iowa State College, Sci. 1: 297. 1927
[Key record] Lee et al., 2003 [19]

***Penicillium roqueforti* Thom**

U.S.D.A. Bur. Animal Industr. Bull. 82: 35. 1906
[Key record] Lee et al., 2003 [19]

***Penicillium sclerotigenum* W. Yamam.**

Sci. Rep. Hyogo Univ. Agric. 2: 69. 1955
[Key record] Kim et al., 2008b [60]

***Penicillium sclerotiorum* J.F.H. Beyma**

Centbl. Bakt. ParasitKde, Abt. II 96: 416. 1937
[Key record] Lee et al., 2003 [19]

***Penicillium simplicissimum* (Oudem.) Thom**

The Penicillia: 335. 1930
[Key record] Kim et al., 2015 [26]

***Penicillium solitum* Westling**

Ark. Bot. 11: 52. 1911
[Key record] Kim et al., 2007 [42]

***Penicillium soppii* K.M. Zalessky**

Bull. Acad. Polon. Sci., Math. et Nat., Ser. B: 476. 1927
[Alter st] *Penicillium meleagrinum* var. *viridiflavum*
[Key record] KACC 45803
[Note] 국내에서는 *Penicillium meleagrinum* var. *viridiflavum*로 보고됨

***Penicillium spinulosum* Thom**

U.S.D.A. Bur. Animal Industr. Bull. 118: 76. 1910
[Synonymy] *Penicillium toxicarium*
[Key record] Kim et al., 2008a [49]
[Note] 국내에서는 *Penicillium toxicarium*로 보고됨.

***Penicillium steckii* K.M. Zalesky**

Bull. Acad. Polon. Sci., Math. et Nat., Sér. B: 469. 1927
[Key record] Lamsal et al., 2013 [63]

***Penicillium swiecickii* K.M. Zalesky**

Bull. Acad. Polon. Sci., Math. et Nat., Sér. B: 474. 1927
[Key record] Min et al., 2014 [64]

***Penicillium spinulosum* Thom**

U.S.D.A. Bur. Animal Industr. Bull. 118: 76. 1910
[Alter st] *Penicillium toxicarium*
[Key record] KACC 43935, KACC 47200
[Note] 국내에서는 *Penicillium toxicarium*으로 보고됨

***Penicillium thomii* Maire**

Bull. Soc. Hist. Nat. Afrique N. 8: 189. 1917
[Key record] Park et al., 2015 [65]

***Penicillium tulipae* Overy & Frisvad**

Syst. Appl. Microbiol. 26 (4): 634. 2003
[Key record] Kim et al., 2006 [39]

***Penicillium velutinum* J.F.H. Beyma**

Zentbl. Bakt. ParasitKde, Abt. II 91: 352. 1935
[Key record] Lee et al., 2003 [19]

***Penicillium verrucosum* Dierckx**

Ann. Soc. Sci. Bruxelles 25: 88. 1901
[Key record] Lee et al., 2003 [19]

***Penicillium viridicatum* Westling**

Ark. Bot. 11: 88. 1911
[Key record] Lee et al., 2003 [19]

***Penicillium vulpinum* (Cooke & Masee) Seifert & Samson**

Advances in *Penicillium* and *Aspergillus* Systematics: 144. 1985
[Key record] Yoon et al., 2007 [66]

***Penicillium waksmanii* K.M. Zalesky**

Bull. Acad. Polon. Sci., Math. et Nat., Ser. B: 468. 1927
[Key record] Lee et al., 2003 [19]

***Penicillium westlingii* K.M. Zalesky**

Bull. Acad. Polon. Sci., Math. et Nat., Sér. B: 473. 1927
[Key record] Kim et al., 2015 [26]

Class EUROTOMYCETES O.E. Erikss. & Winka
Order EUROTIALES G.W. Martin et al.
Family Trichocomaceae E. Fisch.

Genus *Talaromyces* C.R. Benj.

***Talaromyces angelicus* S.H. Yu, T.J. An & H.K. Sang**
J. Microbiol. 51: 704. 2013
[Key record] Sang et al., 2013b [67]

***Talaromyces cecidicola* (Seifert, Hoekstra & Frisvad) Samson, Yilmaz, Frisvad & Seifert**
Stud. Mycol. 70: 175. 2011
[Key record] KACC 47188

***Talaromyces cnidii* S.H. Yu, T.J. An & H.K. Sang**
J. Microbiol. 51: 707. 2013
[Key record] Sang et al., 2013b [67]

***Talaromyces diversus* (Raper & Fennell) Samson, Yilmaz & Frisvad**
Stud. Mycol. 70: 175. 2011
[Alter st] *Penicillium diversum*
[Key record] KACC 45407, KACC 45408

***Talaromyces flavus* (Klöcker) Stolk & Samson**
Stud. Mycol. 2: 10. 1972
[Alter st] *Penicillium vermiculatum*
[Key record] Lee et al., 2003 [19]

***Talaromyces funiculosus* (Thom) Samson, Yilmaz, Frisvad & Seifert**
Stud. Mycol. 70: 176. 2011
[Alter st] *Penicillium funiculosum*
[Key record] KACC 45411, KACC 45412

***Talaromyces islandicus* (Sopp) Samson, Yilmaz, Frisvad & Seifert**
Stud. Mycol. 70: 176. 2011
[Alter st] *Penicillium islandicum*
[Key record] Oh et al., 2008 [68]
[Note] 국내에서는 *Penicillium islandicum*로 보고됨.

***Talaromyces minioluteus* (Dierckx) Samson, Yilmaz, Frisvad & Seifert**
Stud. Mycol. 70: 176. 2011
[Alter st] *Penicillium minioluteum*
[Key record] You et al., 2011 [69]

[Note] 국내에서는 *Penicillium minioluteum*로 보고됨.

***Talaromyces piceus* (Raper & Fennell) Samson, Yilmaz, Frisvad & Seifert**

Stud. Mycol. 70: 176. 2011

[Alter st] *Penicillium piceum*

[Key record] Lee et al., 2003 [19]

[Note] 국내에서는 *Penicillium piceum* 로 보고됨.

***Talaromyces pinophilus* (Hedgc.) Samson, Yilmaz, Frisvad & Seifert**

Stud. Mycol. 70: 176. 2011

[Alter st] *Penicillium pinophilum*

[Key record] Kim et al., 2012 [70]

[Note] 국내에서는 *Penicillium pinophilum*로 보고됨.

***Talaromyces purpurogenus* (Stoll) Samson, Yilmaz, Frisvad & Seifert**

Stud. Mycol. 70: 177. 2011

[Alter st] *Penicillium purpurogenum*

[Key record] Kim et al., 2013a [31]

[Note] 국내에서는 *Penicillium purpurogenum*로 보고됨.

***Talaromyces radicus* (A.D. Hocking & Whitelaw) Samson, Yilmaz, Frisvad & Seifert**

Stud. Mycol. 70: 177. 2011

[Alter st] *Penicillium radicum*

[Key record] Eo et al., 2014 [71]

***Talaromyces ramulosus* (Visagie & K. Jacobs) Samson, Yilmaz, Frisvad & Seifert**

Stud. Mycol. 70: 177. 2011

[Alter st] *Penicillium ramulosum*

[Key record] Kim et al., 2015 [26]

[Note] 국내에서는 *Penicillium ramulosum*으로 보고됨.

***Talaromyces rugulosus* (Thom) Samson, N. Yilmaz, Frisvad & Seifert**

Stud. Mycol. 70: 177. 2011

[Alter st] *Penicillium tardum*

[Key record] Lee et al., 2003 [19]

[Note] 국내에서는 *Penicillium tardum*으로 보고됨.

***Talaromyces stipitatus* (Thom) C.R. Benj.**

Stud. Mycol. 2: 29. 1972

[Alter st] *Penicillium stipitatum*

[Key record] Lee et al., 2003 [19]

[Note] 국내에서는 *Penicillium stipitatum*로 보고됨.

***Talaromyces trachyspermus* (Shear) Stolk & Samson**

Stud. Mycol. 2: 32. 1973

[Key record] Lee et al., 2003 [19]

***Talaromyces ucrainicus* (Panas.) Udagawa**

Trans. Mycol. Soc. Japan 7: 94. 1966

[Alter st] *Penicillium ucrainicum*

[Key record] Lee et al., 2003 [19]

[Note] 국내에서는 *Penicillium ucrainicum*로 보고됨.

***Talaromyces wortmannii* (Klocker) C.R. Benj.**

Mycologia 47: 683. 1955

[Alter st] *Penicillium variabile*

[Key record] Lee et al., 2003 [19]

[Note] 국내에서는 *Penicillium variabile*로 보고됨.

고찰

기존의 국가 생물종 목록집은 *Aspergillus*와 그의 완전세대명인 *Eurotium*, *Neosartorya* 속명을 모두 사용하였으나 본 논문에서는 불완전세대명인 *Aspergillus*를 사용하는 일균 일명의 세계적인 추세를 반영하여 모두 *Aspergillus* 속명으로 정리하였다. 또한 *Penicillium*과 그의 완전세대명도 기존의 *Biverticillium* 아속과 *Talaromyces*는 *Talaromyces*속으로 *Penicillium*의 나머지 3아속(*Aspergilloides*, *Furcatum*, *Penicillium*)과 *Eupenicillium* 등 완전세대 속을 *Penicillium*으로 정리하였다. 기존 보고에서는 *Aspergillus*와 그 완전세대를 합쳐서 26종, *Penicillium*과 그 완전세대를 합쳐서 52종 도합 78종을 기록하였으나 본 논문에서는 *Aspergillus* 55종, *Penicillium* 82종, *Talaromyces* 18종을 기록하여 기존에 비하여 77종을 추가한 155종으로 기록하였다. 나고야 의정서가 발효됨에 따라 생물자원이 국가의 경제적인 부로 직결되는 시점에 생물의 소그룹별로 해당 전문가가 우리 주권 영역 내에 살고 있는 생물종의 명세를 상세히 파악하고 이를 보고하는 것은 국가생물주권 확립에 매우 뜻깊은 일로 생각된다.

적요

인간의 삶에 큰 영향을 끼치는 *Aspergillus*, *Penicillium* 및 그들의 완전세대 속에 속하는 곰팡이의 국내 보고 종 목록을 작성하였다. 기존의 국가 생물종 목록집에는 *Aspergillus* 14종, *Eurotium* 4종, *Neosartorya* 8종, *Penicillium* 47종, *Talaromyces* 5종이 보고되었다. 본 논문에서는 국제조류·균류·식물명명규약(ICN)에 따른 일균일명 체계에 따라 *Eurotium*과 *Neosartorya*은 *Aspergillus* 속으로 합치고 *Penicillium*과 *Talaromyces*도 새로운 속 개념에 따라 정리하였다. 또한 기존의 국가 생물종 목록에 빠져 있던 77종을 추가하

여 *Aspergillus*, *Penicillium* 및 그들의 완전세대에 속하는 곰팡이의 국내 보고 종 목록을 *Aspergillus* 55종, *Penicillium* 82종, *Talaromyces* 18종으로 정리하였다.

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