



Short note

Arturo Nannizzi (1877-1961): “a singular scientist” in the history of mycology

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Abstract

Arturo Nannizzi was a singular scientist from Siena, who, thanks to a deep commitment and an extraordinary experience linked to uncommon intellectual abilities, was able to make up for the lack of a formal curriculum of studies. Thanks to the availability of the teacher Gino Pollacci, who called him as a collaborator, Nannizzi participated in a scientific project of great importance: the preparation and publication of a work that would become a milestone in the field of applied mycology “I miceti patogeni dell’uomo e degli animali”. Nannizzi also made a fundamental contribution to the taxonomy of dermatophytes, having been the first to demonstrate the complete development of the sexual state of a dermatophyte. Often opposed during his activity for the fact that he did not have a degree, his work was re-evaluated only after his death.

Keywords

History of mycology, medical mycology, history of dermatophytes, Masao Ota, Maurice Langeron

Introduction

Arturo Nannizzi was born in Siena on 29 October 1877 into a simple and modest family. For this reason, once he obtained his upper elementary school diploma, thanks to the prize he received for scholastic merit, he enrolled in technical schools but, due to the family's difficult economic situation, he soon had to abandon his studies. Nannizzi showed a multifaceted personality from the early years of his youth: he combined a love for scientific subjects with a great artistic passion. He composed a small collection of poems entitled “Dai campi” (1902), in which the sensitivity and love he had for nature are evident (Cintorino and Leoncini, 2021). But above all he was gifted with an extraordinary ability in drawing and compiling herbaria, so much so that at just 15 years old he was introduced to Professor Attilio Tassi (1820-1905), director of the Botanical Garden of Siena, and admitted as a volunteer to prepare the herbaria. In 1906, Professor Biagio Longo (1872-1950) became director of



the Sienee Botanical Garden, who was particularly impressed by Nannizzi's ability to draw the details of flowers and plants with extreme precision. So, in 1908, he hired him as caretaker of the garden, not being able to offer a more qualified job as Nannizzi did not have a degree. Thus, it was that at the age of 31 Nannizzi had a paid job within the University for the first time, which allowed him to dedicate himself to the study of plants, in particular medicinal ones, being able to freely access the university library. He soon acquired profound knowledge in this field and also began to publish the results of his studies, first in newspapers and then in scientific journals.

The turning point in his professional life came with the arrival at the direction of the Botanical Garden of Professor Gino Pollacci (1872-1963), who would also become director of the School of Specialization in Pharmacy, as well as professor and rector of the University of Siena in two-year period 1926-1927. In 1922, in fact, Pollacci appointed Nannizzi as technician of the Institute and Botanical Garden and called him to collaborate with him. Nannizzi then dedicated his studies to Mycology, while at the same time studying Dermatophytes. In 1927 he obtained a professorship in Mycology and, starting from the 1937-1938 academic year, he held courses in Pharmaceutical Botany at the University of Siena, until his retirement in 1950. The goal of professorship was achieved with particularly positive reviews (Cintorino and Leoncini, 2021). In addition to that of Professor Gino Pollacci, the opinion of hygienist Achille Sclavo (1861-1930) stands out, praising Nannizzi's vast biological culture, his great technical skill, and his rare expertise in representing the fine structure of microscopic preparations with drawing. Despite Sclavo's requests to have him as a collaborator in his own Serological Institute that he founded in Siena in 1904 (Martini et al., 2022), Nannizzi did not abandon his botanical studies.



Fig. 1 – Arturo Nannizzi (Sienee University Museum System Archive).

From the 1930s Nannizzi assiduously dedicated himself to research on medicinal plants, a sector he had already tackled at the beginning of his career. In 1934 he was appointed director of the Institute and Botanical Garden of the University of Siena, a position he held until 1950. Nannizzi also dedicated his research to *Atropa belladonna*, a plant used to treat patients suffering from encephalitis lethargica (Brigo et al., 2022; Martini et al., 2023, 2024). With his work Nannizzi contributed significantly to the advancement of knowledge on pathogenic fungi of animals but who in life had to suffer acts of marginalization probably because he didn't have a degree.

Mycological studies

Gino Pollacci involved Nannizzi in a scientific project of great importance, the publication of a work that would become a milestone in the field of applied mycology “I miceti patogeni dell’uomo e degli animali, descritti, delineati e preparati per l’osservazione al microscopio con notizie sopra i rimedi per combatterli” (translation: Pathogenic fungi of man and animals, described, outlined and prepared for observation under the microscope with information on remedies to combat them) (Pollacci and Nannizzi, 1922-1930) (Figs 2a,b). This work consists of 10 fascicles, published between 1922 and 1930, with descriptions of 100 micro-fungal species accompanied by 400 mostly original illustrations of Nannizzi. Each fascicle contains 10 preparations for microscopic observation, making a total of 100 slides.

In the preface to the first fascicle, Professor Pollacci wrote: “For this publication I obtained the collaboration of the Technician Mr. Arturo Nannizzi, who is also a renowned draftsman and excellent preparer; thanks to his work, each species described is accompanied by several, mostly original, drawings and by a microscopy preparation fixed dry and sealed in balm, which allows the fungus to be examined directly under the microscope. As the fungi have mycelia with transparent, hardly visible, hyaline hyphae, they have been stained with gentian violet. The preparations are all made from material taken from typical glucose agar cultures” (Pollacci and Nannizzi, 1922-1930). For each mycotic infection, the two scholars provided a morphological description of the pathogen, accompanied by Nannizzi’s original and detailed drawings.

It is interesting to highlight some curiosities treated in the work that are valuable for the History of Medicine, such as the infection with *Beauveria bassiana* (Bals.-Criv.) Vuill. a disease that affects the silkworm, known at popular level as “calcino” (Benham and Jose, 1953). It was named after the Italian naturalist and botanist Agostino Bassi (1773-1856) (Mazzarello and Rovati, 2009), a precursor of modern bacteriology having inspired Louis Pasteur (1822-1895) for the theory of germs (Martini et al., 2019). Bassi clearly noted the nature of this parasitic fungus that caused several damages to the breeding of silkworms. This last argument, particularly innovative for the time, was taken up again in the volume of Pollacci and Nannizzi, deepening Bassi’s intuition that this antagonist fungus could be used in agriculture for some plant diseases in the cultivated countryside.

Thanks to the Pollacci and Nannizzi’s work, the Sienese Mycological School emerges national and international wide and “the concept of mycosis was defined, distinguishing within precise limits the parasitism from commensalism, outlining in a precise picture the parasitic *Mycetes* from those commensals, in line with the knowledge of that historical moment” (Ferri, 1987). In addition to its great scientific value, this publication also had a positive social impact in an era in which fungal infections were particularly common, owing to poor hygiene, an inadequate diet, poor sanitation and

overcrowded living conditions. An interesting testimony to this is the fact that samples of mycotic lesions were sent to the Siena Botanical Institute from various parts of the country, which Nannizzi examined through *in vitro* cultivation of the microorganisms responsible. Through these studies Nannizzi established relationships of scientific collaboration that would last over time, broadened his knowledge of the mycological field, and his name became widely known as a result of the many publications that followed his studies.

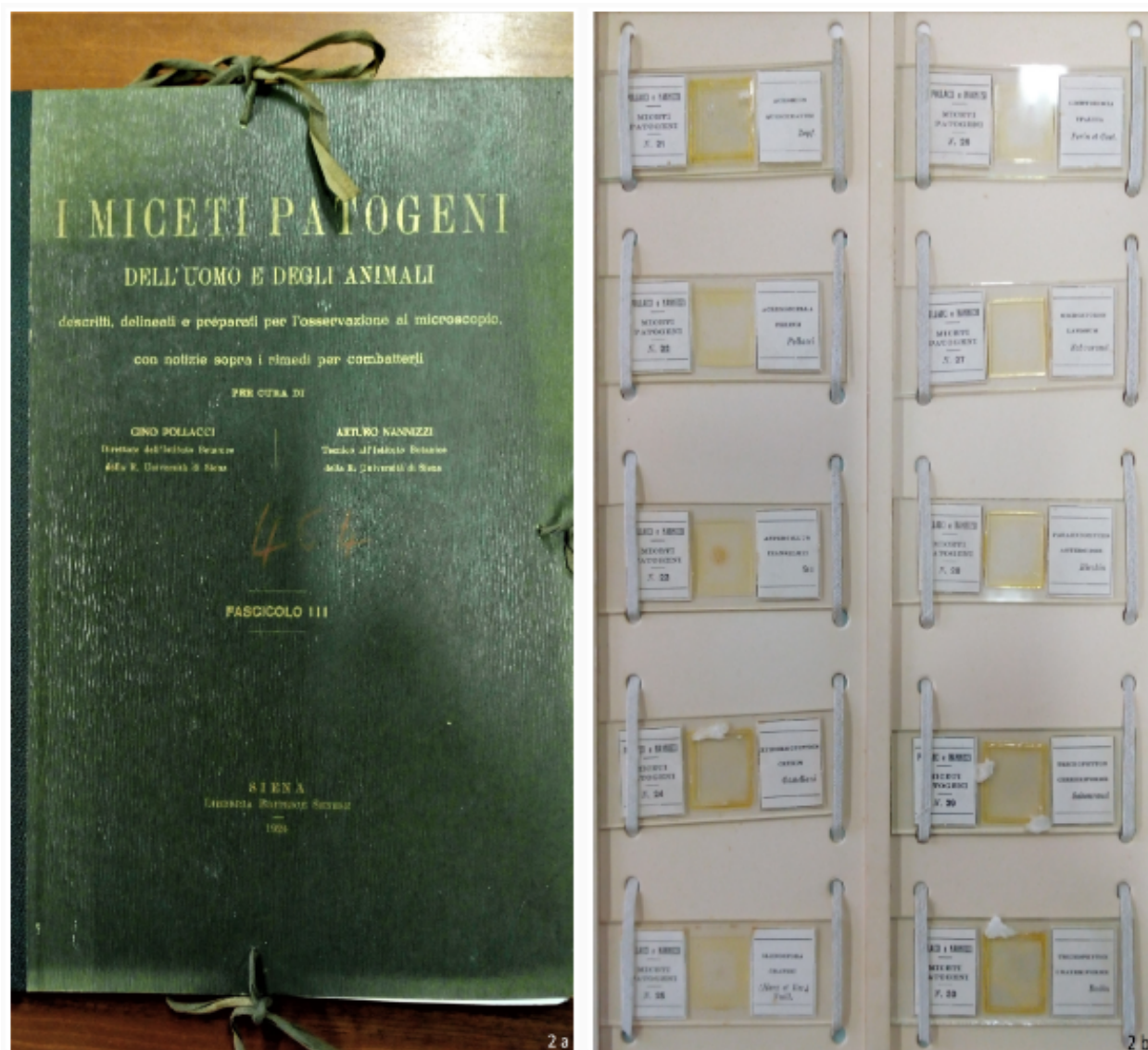


Fig. 2 – a) Cover of the publication “I miceti patogeni dell’uomo e degli animali, descritti, delineati e preparati per l’osservazione al microscopio con notizie sopra i rimedi per combatterli”; b) dossier of the work and the tray of micromycetes slides contained in the collection.

Although Nannizzi never studied at university, he was nevertheless a prolific researcher in the fields of botany and mycology, acquiring a solid reputation in academic circles and qualifying as a free professor in Mycology in 1927. Following his research on fungi, Nannizzi also collaborated with Giuseppe Bianchini (1888-1973), a professor of Forensic Medicine and originator of the concept of “biology of the cadaver” (Bianchini, 1923). As Bianchini considered the study of fungi to be of

particular interest with regard to both the chemistry of the corpse and the chronology of death, he readily exploited Nannizzi's knowledge of mycology (Orsini et al., 2022) (Figs 3a–d).

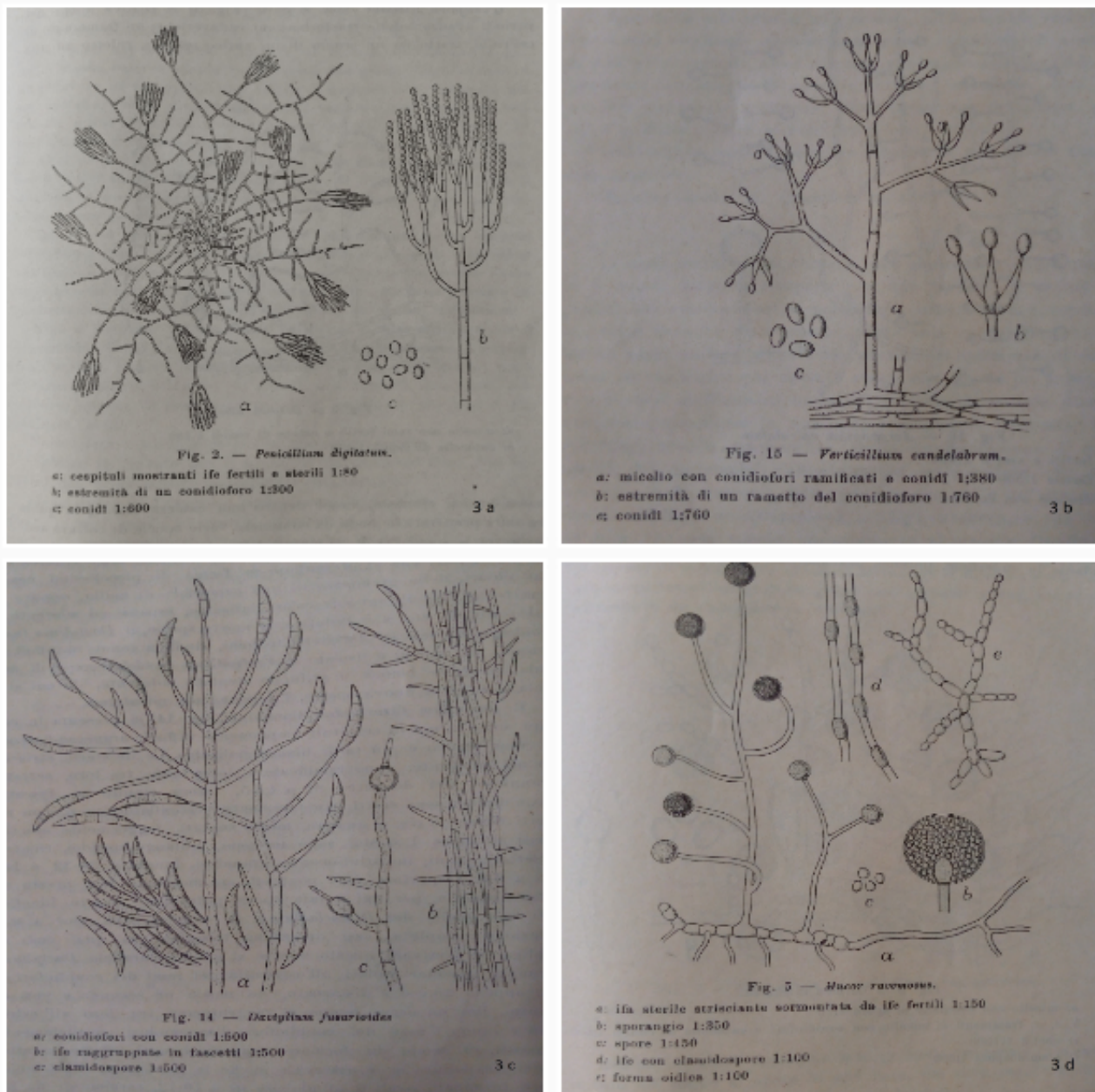


Fig. 3 - Drawings by Arturo Nannizzi, taken from the publication “The fungi of the human corpse” (Bianchini, 1923). a) *Penicillium digitatum* (Pers.) Sacc.; b) *Verticillium candelabrum* Bonord (current name *Sesquicillium candelabrum* (Bonord.) W. Gams); c) *Dactylium fusarioides* Gonz. Frag. & Cif. (current name *Fusarium chlamydosporum* Wollenw. & Reinking); d) *Mucor racemosus* Fresen.

The international clash over dermatophytes

In the same period in which Nannizzi collaborated with Pollacci on the publication of their volume on pathogenic fungi, he also carried out an experimental study on dermatophytes commonly called “ringworm”, filamentous fungi capable of digesting keratin, the main constituent of hair, nails and of the stratum corneum of the epidermis. He managed to demonstrate the complete development of the

sexual state of a dermatophyte, *Microsporium gypseum* (E. Bodin) Guiart & Grigoraki, which caused ringworm in dogs and horses, as well as occasionally in other animal species. *Microsporium gypseum* is a geophilic fungus that has a worldwide distribution and rarely causes disease in humans. This fungus may be found in dogs and cats (which can be asymptomatic carriers), in sick human beings, and especially in contaminated soil (Lopes et al., 1992; Haga and Suzuki, 2002; Metkar et al., 2010; da Silva Souza et al., 2016). Dermatophytosis caused by *M. gypseum* usually manifests as an inflammatory mycosis that typically affects the glabrous skin and scalp, especially in children (Severo et al., 1989). Rarely, it can present as onychomycosis (Romano et al., 2009).

In addition to making a still fundamental contribution to the taxonomy of dermatophytes today, Nannizzi went so far as to state - on the basis of the results of his studies - that “dermatophytes must be definitively included in the *Gymnoascaceae* Baranetz family” (Nannizzi, 1926). Immediately afterwards, he confirmed “the relationship of the *Dermatomyces* with the *Ascomycetes* of the *Gymnoascaceae* family” (Nannizzi, 1927). The results of Nannizzi’s research contradicted those obtained a few years earlier by the Japanese dermatologist Masao Ota and the French mycologist Maurice Langeron. In an article published in 1923 in “*Annales de Parasitologie Humaine et Comparée*”, they wrote about dermatophytes that “On the other hand, it would be premature to classify them among the *Gymnoascea*, because of their pectinate organs, their torsions and their nodular organs, because we certainly do not find the perithecium among them.” (Ota and Langeron, 1923). For this reason, Nannizzi’s precious work not only failed to receive adequate international recognition, but was even discredited by Langeron and Milochevitch, who in an article in 1930 claimed that Nannizzi had used a non-sterile culture medium in his experiments: “Nannizzi (1926 et 1927) a employé une autre série de milieux naturels. Partant de cette hypothèse que les dermatophytes doivent préférer les milieux d’origine animale et que, sur milieux naturels, ils présentent en quelque sorte un aspect tératologique, il a fait ses cultures sur plumes d’oiseaux, poils, cheveux, cuir, peaux de cobayes, etc. Ces substances ont été employées soit stérilisées en tubes, soit à l’air libre. Il a obtenu ainsi, outre la morphologie classique, des organes globuleux qu’il considère comme des pycnides, correspondant au peridium des gymnoascées; ces organes ne renfermaient d’ailleurs que des pycnosporos” (Langeron and Milochevitch, 1930). At the same time, however, the two scholars reached the same conclusions as Nannizzi, attributing the discovery to themselves.

The Nannizzi’s reply came in December of the same year by publishing his essay “On the systematic position of *Dermatomyces*” in the “*Proceedings of the Botanical Institute*” of the University of Pavia. After summarizing the results of his own research, Nannizzi asserted: “To my legitimate amazement, they undoubtedly attribute to themselves priority in definitively assigning *Dermatomyces* to the *Gymnoascaceae* family, claiming that this was ascertained by their research and not by mine; according to them, my research enabled me only to approach the truth without grasping it! [...] As can be seen, Langeron and Milochevitch reach the same conclusions as I set out in my two previous Memoirs. And it could not be otherwise! [...] But since these authors had to find some reason to downgrade my research, they alleged that I had not carried out my experiments in pure cultures” (Nannizzi, 1931). In the face of the established authoritative nature of the two French researchers, Nannizzi could do little and his name was forgotten. In the 1960s, however, some studies by mycologists from various countries confirmed Nannizzi’s supremacy in this discovery, and only a few months before Nannizzi’s death (February 4, 1961) the Australian mycologist Donald M. Griffin again demonstrated, 33 years after Nannizzi, the perfect form of *M. gypseum* (Griffin, 1960).

For this reason, in 1961, the English mycologist Phyllis Margaret Stockdale proposed the new genus *Nannizzia*, to indicate the teleomorphic forms of *Microsporium*, and named the species described by the Sienese researcher *Nannizzia gypsea* (Nann.) Stockdale (Stockdale, 1961). Now, more than 60 years later, the genus *Nannizzia* is confirmed and a recent study, published in 2020, brought the number of species belonging to this genus to 13 (Dukik et al., 2020).

Conclusion

This episode, which he joined some years after the lack of recognition of his role as a teacher, led Nannizzi to close more and more in himself and to isolate himself in his studies of Botany and Mycology. He retired to private life in 1950 due to age limits, spent his last years in solitude, forgotten by all. Only after his death, in 1961, many remembered him and professional recognitions sounded like a belated compensation. It remains the memory of “a singular Sienese scientist” (Mazzarello, 2013), a man with great intelligence and boundless humanity. He was able to make up for the lack of a formal curriculum with constant personal study, reaching high levels in the agricultural sciences but especially in the mycological field: Professor Valerio Giacomini (1914-1981), a botanist and professor in the first Italian chair of Ecology, remembered him with these words, delivering the eulogy at the invitation of the University of Siena (Arturo Nannizzi, 1961). The celebratory speech should have been given by Professor Raffaele Ciferri (1897-1964) of the University of Pavia who, however, declined the invitation. It was yet another episode that characterized Nannizzi's professional life, always poised between recognition of his extraordinary qualities and a certain detachment due to the lack of a degree, which perhaps the University of Siena could have granted for his great merits.

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