Fixing loose ends in downy mildew research – the Peronosporaceae of Kazakhstan by Nina Ivanovia Gaponenko

Marco THINES

Abstract: Thines, M. 2019: Fixing loose ends in downy mildew research – the Peronosporaceae of Kazakhstan by Nina Ivanovia Gaponenko. Schlechtendalia **36**: 133–139.

The Flora of Kazakhstan by Nina Ivanovia Gaponenko is an example of tremendous work, putting together the information available on Central Asian members of the downy mildews, a diverse group of obligate biotrophic oomycetes. Being written in Cold War times and not translated into English, the work has attained little attention, despite being amongst the most complete regional floras of downy mildews. In her book, Gaponenko published several taxonomic novelties. While she obviously tried to adhere to the International Code of Botanical Nomenclature when writing the descriptions – she included a Latin description as well as an indication of type specimens – unfortunately several taxonomic novelties were not validly published due to indicating more than one gathering as the nomenclatural type. A review of the novelties intended to be introduced by her suggests that most species presented by her merit consideration as independent species. Thus, in honour of her outstanding contributions, they are validated here.

Zusammenfassung: Thines, M. 2019: Verknüpfung loser Enden in der Erforschung der Falschen Mehltaue – die Peronosporaceae Kasachstans von Nina Ivanovia Gaponenko. Schlechtendalia **36**: 133–139.

Die Flora von Kasachstan von Nina Ivanovia Gaponenko ist ein Beispiel für eine große Anstrengung, die Zusammenstellung der verfügbaren Informationen über zentralasiatische Mitglieder der Falschen Mehltaue, eine vielfältige Gruppe von obligaten biotrophen Oomyceten. Das Werk, das in Zeiten des Kalten Krieges geschrieben und nicht ins Englische übersetzt wurde, hat wenig Beachtung gefunden, obwohl es zu den vollständigsten regionalen Floren von Falschen Mehltauen gehört. In ihrem Buch veröffentlichte Gaponenko mehrere taxonomische Neuheiten. Obwohl sie offensichtlich versuchte, sich beim Verfassen der Neubeschreibungen an den Internationalen Code of Botanical Nomenclature zu halten – diese enthalten eine lateinische Beschreibung sowie eine Angabe von Typusbelegen, sind leider mehrere taxonomische Neuheiten nicht gültig veröffentlicht, da mehr als eine Aufsammlung als Typus angegeben ist. Eine Überprüfung der Neuheiten, die sie einführen wollte, legt nahe, dass die meisten Arten, die von ihr präsentiert werden, als unabhängige Arten betrachtet werden müssen. Daher werden diese in Würdigung ihrer herausragenden Beiträge hier validiert.

Key words: Oomycetes, neglected taxonomic treatments, systematics, taxonomy.

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Introduction

Language has always been an important barrier to the communication of scientific concepts, including species hypothesis, which is the main reason why a Latin description or diagnosis became a prerequisite (Nicolson 1991) for valid publications of taxonomic novelties. Latin was chosen as both it was the traditional language of science and because it did not have the flavour of national patronisation. From 2012, English is accepted as language for descriptions of taxonomic novelties as well (Turland et al. 2017), as this language has become the de facto language of science with the destruction of the Nazi regime in Germany and the collapsing of the Soviet Union. However, a century ago, until the last quarter of the 20th century, languages used in scientific publications were diverse and scientists often preferred to publish in their native language, as they felt it easier to convey concepts in their mother tongue. This is also reflected by the fact that several highly reputed taxonomic journals, such as Sydowia, allowed the publication of articles in several different main languages (e.g. English, French, German, Italian). In parallel to the rise of the most influential American universities, also the Russian Academy of Science promoted research in a wide field of natural sciences and ran several highly reputed journals, many of which are still domestic publications (Mazov et al. 2015). However, most of the journals were published in Russian and only some had abstracts in English as well. The Cyrillic alphabet used in Russia further complicated the assessment of the literature by researchers on the other side of the iron curtain, in addition to the difficulties in obtaining the literature. This is also true for the many floristic works published in Russia. However, the scientific articles and floristic books often included taxonomic novelties that went unnoticed by the scientific community in the America and Western Europe. The Flora of

Kazakhstan and adjacent territories by Gaponenko (1972) is no exception in this regard. It constitutes one of the most complete accounts of downy mildew of what was the southern Soviet Union, with 18 descriptions of downy mildew taxa, including the descriptions of five species and 13 subspecific taxa. While several of the taxonomic novelties were validly described, some failed to conform with all provisions of the Seattle Code which was valid at that time. In particular, she did not conform with the specific designation of one gathering as the type specimen, a requirement outlined as mandatory from 1958 in the Paris Code. It is the aim of this article to present the species described by Gaponenko (1972) and to validate species-level taxa which, despite full Russian and Latin descriptions, failed to conform with the ICBN.

Materials and methods

All species and subspecific taxa described by Gaponenko (1972) are presented here with a short description. These are discussed based on the monographic work by Constantinescu (1991) and several recent studies (Constantinescu & Fatehi 2002; Göker et al. 2003, 2004; Voglmayr 2003; Voglmayr et al. 2004; García-Blázques et al. 2007; Choi & Thines 2015; Choi et al. 2015). Those species not validly described but highly likely to represent independent taxa are validated here adhering to the rules of the most recent ICNafp (Turland et al. 2017).

Results

Of the 18 taxonomic novelties introduced in Gaponenko (1972), 13 relate to new forms and five to new species. Of these taxonomic novelties seven are not in compliance with Article 40.1 and 40.2 of the current ICNafp (Turland et al. 2018), which warrants that a single gathering is indicated as type. Instead, Gaponenko (1972) mentioned two or more collections, without specifically mentioning the type specimen (merely stating that the type is deposited in the herbarium of her institution).

The following taxa have been validly published in Gaponenko (1972):

On Asteraceae
Peronospora pospelovii, p. 316
Host – *Galatella dahurica*
Comments – This is a curious species as it represents the only known *Peronospora* species on members of the tribe Astereae. Its fully systemic nature and the varying size of conidia render it similar to the *P. violacaea* species complex. However, sequence data will most likely be necessary to test this hypothesis.

On Boraginaceae
Peronospora rocheliae f. *cardiosepalae*, p. 281
Host – *Rochelia cardiosepala*
Comments – Based on the largely divergent shape of the conidia from the type host of the species (almost globose) and those of the form described by Gaponenko (oval), it seems likely that this is rather a distinct species, as the shape of the conidia is usually not strongly variable, even on different hosts (Runge et al. 2012).

On Brassicaceae
Peronospora chorisporae f. *elegantis*, p. 209
Host – *Chorispora subulosa* (as *C. elegans*)
Comments – Based on the host and the morphology, this taxon belongs to the genus *Hyaloperonospora*. Given the high degree of host specificity in the genus *Hyaloeronospora* and the rather divergent morphology when compared to the downy mildew on the type host, it seems likely that it represents a new species.

On Fabaceae
Peronospora medicaginis-minimae, p. 24

Host – *Medicago minima*
Comments – On *Medicago* several species of *Peronospora* seem to exist, but their host range could not yet be investigated in detail (García-Blázques et al. 2007). The conidia in this group range from almost globose to ovate, and various types of oospore ornamentation are present. The whole group is in urgent need of revision. It is noteworthy that in Central Europe pathogens of *Medicago minima* and *M. lupulina* do not seem to be much differentiated (García-Blázques et al. 2007), while in Kazakhstan, the pathogens on the same hosts seem to be quite divergent. A closer morphological and phylogentic investigation of this group will be necessary before any conclusions regarding the status of taxa in this group can be made. Noteworthy are the rather small oospores (~22 µm) reported.

Peronospora medicaginis-orbicularis f. *grossheimii*, p. 245
Host – *Medicago grossheimii*
Peronospora medicaginis-orbicularis f. *schischkinii*, p. 247
Host – *Medicago schischkinii*
Peronospora medicaginis-orbicularis f. *rigidulae*, p. 248
Host – *Medicago rigidula*
Peronospora romanica f. *transoxanae*, p.240
Host – *Medicago transoxana*
Peronospora romanica f. *agropyretori*, p. 244
Host – *Medicago agropyretorum*
Peronospora romanica f. *lavrenkoi*, p. 240
Host – *Medicago lavrenkoi*
Peronospora romanica f. *medicaginis-tianschanicae*, p. 243
Host – *Medicago tianschanica*
Comments – The various *Peronospora* forms described by Gaponenko (1972) differ only in few characteristics, such as minor differences in the shape and size of conidia, a feature that might be influenced by the host matrix (Runge et al. 2012) or environmental conditions (Dudka et al. 2007). For *Peronospora romanica* f. *agropyretori* there are also some issues in the Cyrillic description, as the full range does not include the typical range. However, oospore ornamentation is also reported to differ among some forms and has previously proven to be a useful characteristic to distinguish species or species groups of obligate biotrophic oomycetes (Voglmayr & Riethmüller 2006; Choi et al. 2007, 2008; Ploch et al. 2010; Rost & Thines 2012; Gäumann 1914, 1923). Also the high degree of host specificity of most species of *Peronospora* (Gäumann 1914, 1923; Thines & Choi 2006; García-Blázquez et al. 2007) renders it plausible that at least some of the forms described by Gaponenko (1972) represent distinct species. However, this can likely only be resolved by multigene phylogenies, similar to the situation in *Peronospora* on Amaranthaceae (Choi et al. 2015).

The following taxa were not validly published in Gaponenko (1972) because of designating more than one gathering as the type (Art. 40.1, 40.2).

On Apiaceae
Plasmopara archangelicae, p. 87
Host – *Angelica decurrens* (as *Archangelica decurrens*)
Comments – This species might be the same as the one that occurs on *Angelica archangelica*, which then would be closely related to *Plasmopara pimpinellae* (Voglmayr et al. 2004). However, more investigation into the *Plasmopara* species on Apiaceae is warranted before any conclusions can be drawn.
Plasmopara sii, p. 84
Host – *Sium latifolium*
Comments – This species seems to be distinct from other *Plasmopara* species infecting Apiaceae (Voglmayr et al. 2004) and should thus be recognised as an independent species.

On Caryophyllaceae

Peronospora media f. *neglectae*, p. 157
Host – *Stellaria neglecta*
Comments – This form has rather large conidia. As so far there has not been any detailed study on the *Peronospora* pathogens on Caryophyllaceae, it is unclear, if the morphological differences represent the variation according to the host matrix (Runge et al. 2012) or genetic differentiation on a new host.

Peronospora media f. *stellariae*, p. 155
Host – *Stellaria media*
Comments – This form is characterised by smaller conidia that have a similar shape as compared to the typical form. If this different size is due to different environmental conditions or due genetic differentiation is uncertain. The curious multi-layered structures described as oospores by Gaponenko (1972) are rather reminding of resting spores of fungi and probably do not belong to *Peronospora*. If two parasitic organisms are infesting a plant individual at the same time, it is conceivable that either species will be able to absorb less nutrients, which might also explain the smaller conidia in the newly described form.

On Fabaceae
Peronospora aesivalis f. *lupulinae*, p. 237
Host – *Medicago lupulina*
Comments – In García-Blázques et al. (2007) the causal organisms of *Peronospora* on *Medicago lupulina* and *M. minima* were not showing a strong genetic differentiation and rather seemed to be conspecific. However, the conidia in *Peronospora medicaginis-minimae* seem to be much smaller than in *Peronospora aestivalis* f. *lupulinae*, which, despite the modificatory effect the host matrix can have (Runge et al. 2012), is rather suggesting that they should belong to separate species. However, until more sequence data become available for *Peronospora* on Fabaceae, this assumption must remain highly speculative.

On Plantaginaceae
Peronospora lanceolatae
Host – *Plantago lanceolata*.
Comments: There can be little doubt that this species is distinct from *Peronospora alta* and *P. canescens*, based on its both smaller and more elongate conidia, and from *P. plantaginis* and *P. akatsukae* as these species have much larger elongate lemon-shaped to ellipsoidal conidia. The colour of the down is given as greyish violet, which is similar to the morphologically distinct species *P. alta* and *P. akatsugae*, but differs from the other *Peronospora* species described on the Plantaginaceae. It seems that there is a high diversity of *Peronospora* on Plantaginaceae, so new species are likely to be discovered given the many hosts in Plantaginaceae reported (e.g. Hagedorn 2006). *Peronospora lanceolatae* is nonetheless not validated in this manuscript, because it might be conspecific with a recently discovered downy mildew pathogen on an endemic *Plantago* species in Hawai'i in a manuscript currently in revision (Davis et al., unpublished).

On Ranunculaceae
Plasmopara pygmaea f. *anemones*, p. 70
Host – *Anemone petiolosa* and *A. protracta*
Comments – *Plasmopara pygmaea* has been shown not to be monophyletic with *Plasmopara* species not occurring on Ranunculaceae and has, therefore, been assigned to a genus of its own, *Plasmoverna* (Constantinescu et al. 2005). The species in *Plasmoverna* seem to be highly host specific, and the species on *Anemone nemorosa* and *A. ranunculoides* have already been confirmed as distinct species (Voglmayr et al. 2004). The form described by Gaponenko (1972) seems to be in particular characterised by stouter sporangiophores. If it is also a distinct species, or merely a form incited by environmental conditions (Dudka et al. 2007, Runge et al. 2012) needs to be clarified by detailed morphological comparison and phylogenetic analyses.

Plasmopara pygmaea f. *delphinii*, p. 72
Host – *Delphinium iliensis*
Comments – Given the largely divergent host, it seems likely that this represents an independent species, characterised by rather slender sporangiophores.

Taxonomy

Based on the current knowledge on the specificity of the downy mildews in general and the genus *Peronospora* in particular as well as the morphological characteristics outlined, several taxa described by Gaponenko (1972) should be recognised as independent. In honour of her contributions, two species-level taxa are validated in here.

Plasmopara archangelicae Gapon. ex Thines **sp. nov.**
MycoBank, MB 833645
Latin description: Gaponenko, Semeistvo Peronosporaceae srednei Azii i Yuzhnogo Kazakhstana: 87–88 (1972) [validation of *P. archangelicae* Gapon., nom. inval., Art. 401, 402].
Illustration: Gaponenko (1972: 87, fig. 12).
Holotype: Kazakhstan, Saur Mountains, Kergentas, on *Angelica decurrens* (as *Archangelica decurrens*), 7th of July 1958, leg. M. P. Vassjagina (Herbarium of the Uzbek Academy of Sciences, TASM).

Plasmopara sii Gapon. ex Thines **sp. nov.**
MycoBank, MB 833646
Latin description: Gaponenko, Semeistvo Peronosporaceae srednei Azii i Yuzhnogo Kazakhstana: 84–86 (1972) [validation of *P. sii* Gapon., nom. inval., Art. 401, 402].
Illustration: Gaponenko (1972: 85, fig. 11).
Holotype: Kyrgyzstan, Frunze, on *Sium latifolium*, 2nd of July 1956, leg. A. G. Pospelov (Herbarium of the Uzbek Academy of Sciences, TASM).

Discussion

Due to the dominance of English in the current scientific literature there is the tendency to overlook taxonomic treatments in other languages. Since 2013, this is compensated to a certain degree because it became mandatory to register taxonomic novelties in a recognised repository (Turland et al. 2016). Before that date, as no indexing was required for valid publication, many non-English publications remained little-known and were not considered by subsequent authors. This applies also to some floristic treatments that were not widely distributed. During the cold war time, there were additional complications in obtaining recent literature from the other side of the iron curtain. While some works of well-known mycologists were still recognised, e.g. the work of Novotel'nova on sunflower downy mildew (Novotelnova 1962; Leppik 1966), others not concerning pathogens of economic importance received less attention. In addition, while there are often scanned versions of very old books available through library digitisation efforts, more recent literature from the pre-electronic era is often still protected by copyright and thus not available (Eden & Beaubien 2013). The flora of Kazakhstan by Gaponenko (1972) is an example of a great effort to provide a comprehensive coverage of the downy mildew flora of a large country. However, being written in Cyrillic and not being widely distributed, it was recognised only by few researchers outside the sphere of influence of the Soviet Union (Skaliký 1964; Constantinescu 1991). In her book, Gaponenko (1972) described some taxonomic novelties that were not validly described because the descriptions mentioned several gatherings instead of a single one and, thus, did not designate an unequivocal type specimen. In recognition of the otherwise correct descriptions of high standard, two taxa have been validated in this study, based on her original descriptions (Gaponenko 1972). It seems worthy to screen additional local or regional floras from the realm of the Soviet Union and to bring their taxonomic treatments to the attention of present-day researchers, in order to avoid duplicate descriptions and to pay the due respect to those researchers who did their detailed and skilled work under conditions that would render dissemination around the world difficult.

Acknowledgement

This manuscript is dedicated to the memory of Ovidiu Constantinescu, a jazz drummer and oomycete taxonomist who took an important role in bringing some of the literature of the former East Bloc to the attention of researchers worldwide and who was always emphasising on the need to carefully screen literature not readily available or old (e.g. Constantinescu 1990).

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Address of the author

Marco Thines, Goethe University, Faculty of Biological Sciences, Institute of Ecology, Evolution and Diversity, Max-von-Laue-Str. 13, 60438 Frankfurt am Main, Germany.
Senckenberg Biodiversity and Climate Research Centre, Senckenberganlage 25, 60325 Frankfurt am Main, Germany.
(E-mail: marco.thines@senckenberg.de)