Cristoforo Alasia De Quesada: a Sardinian mathematician in a transnational network of scholars

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1 Introduction

Cristoforo Alasia de Quesada was born in Sassari (Sardinia) on November 21, 1864. He was of noble origin[1]: his mother, Giovanna Francesca de Quesada Cugia, belonged to the branch line *Marchesi di San Saturnino* of the Sardinian nobilty, while his father, Francesco Alasia Aluffi, was a military officer of Piedmontese origins.

Alasia began his studies at the University of Turin, but he obtained the *licenza* (licence) in mathematics in 1886 at the University of Cagliari.

After the unification of Italy the two universities in Sardinia, namely Cagliari and Sassari, were conformed to those of the peninsula (Polenghi, 1993, 192 ff.). Nevertheless, at the end of the nineteenth century the island was culturally lagging in comparison with the rest of Italy, not only because of its geographic isolation, but above all due to previous policies of Spanish and Piedmontese rule (Scoth, 2016).
Cagliari was the only university offering to students a two-year preparation course in mathematics, awarding a *licenza*, which allowed them to continue their scientific studies in other universities in Italy.

[1]For some biographical notes on Alasia see (Loria, 1919), (Halsted, 1902),(Bozal, 1903). In the latter two, 1869 is incorrectly indicated as the year of birth.

According to (Loria, 1919, 138) and (Halsted, 1902, 182), Alasia enrolled at the School of Engineers of the University of Rome, however his father's death compelled him to stop his studies and return to Sardinia.
Even if he had not completed his studies, Italian legislation allowed him to teach mathematics and natural sciences at lower level of secondary school.[2] Thus, in March 1893, Alasia began his teaching career at the *gymnasium* of Sassari.[3]
In the following years, he continued to teach at the *gymnasiums* of some small towns in central and northern Sardinia: Oristano, Nuoro, Ozieri, and Tempio Pausania.

Of course, living in the north of Sardinia, far from the University of Cagliari and from libraries stocked with mathematical literature, teachers were forced into a great scientific isolation.

During his life Alasia published over 200 papers[4], most of them in scientific journals, on topics of pure mathematics, history, bibliographic news, teaching methods of the exact sciences, astronomy, physics, and philosophy. Many articles were simple notes and mathematical questions posed or resolved[5], others were extensive papers. Almost all of them had the aim of analyzing and spreading the knowledge of known results, always with personal contributions to simplify their understanding.

Disregarding the fact that most of the articles were educational and informative, how is it possible that a *gymnasium* teacher could have written such a quantity of papers, without a great mathematical preparation and confined in the hinterland of a culturally backward island?

Belonging to a wealthy family, Alasia certainly had the economic means to join scientific societies and get periodicals and books for his studies. From some documents we know that he was a member of various astronomical

[2]Law of 13 November 1859 enacted by the minister of education Gabrio Casati, see (Giacardi-Scoth , 2014, 209).

[3]See Bollettino Ufficiale del Ministero dell'Istruzione Pubblica, XX, 13, 1893, p. 525.

[4]We have compiled a detailed bibliography of Alasia's papers

[5]See: Séminaire CIRMATH - La forme Question/Réponse dans la circulation de mathématiques. https://cirmath.hypotheses.org/101-2/, Gispert, Nabonnand, Rollet (dirs.); Base de données des auteurs des *Nouvelles Annales de Mathématiques*, http://nouvelles-annales-poincare.univ.lorraine.fr.

societies (in Italy, France and Belgium), as well as a member of the *Circolo Matematico di Palermo*, the *Società Italiana per l'Avanzamento delle Scienze*, the *Mathesis* (Italian association for secondary school teachers), and a corresponding member of the *Academia das Ciências de Lisboa*
In a letter to the Italian mathematician Roberto Marcolongo[6], dated 21st November 1916, Alasia expressed the desire to give part of his rich personal library, certainly the largest mathematical library ever owned by a Sardinian scientist.

Economic means, curiosity, passion, and study are not enough to justify his extensive scientific production, partly located in the European context. His articles are published in *L'enseignement mathématique, L'Intermédiaire des mathématiciens, Revista Trimestral de Matematicas, Gaceta de Matemáticas Elementales, Annaes Scientificos da Academia Polythecnica do Porto, Anales de la Facultad de Ciencias de Zaragoza, Gazeta Matematica, Giornale di Matematiche, Il Pitagora giornale di matematica per gli alunni delle scuole secondarie, Periodico di matematica per l'insegnamento secondario, Giornale di fisica, matematica e scienze naturali*[7]

After the years of his university studies, Alasia never moved from Sardinia to build or consolidate scientific relationships. However, his great resourcefulness led him to develop these relationships by correspondence. Thanks to these letters, in particular the correspondence with Henri Brocard[8], we know that Alasia became part of a network of scholars from different countries.

One of the main characteristics of this network was that many of the scholars were collaborators or editors of journals qualified as *intermediate* (Ortiz, 1996). Some of these journals were created as an instrument to keep teachers, students, and amateurs up to date on current scientific debates and offer stimuli regarding their research on elementary mathematics topics.[9]

[6]The letter are kept in Marcolongo's Archive, at the library of the Department of Mathematics of the University of Rome "La Sapienza".

[7]For all the quoted journals on this paper, see the database of the CIRMATH project, http://cirmathdata.ahp-numerique.fr/.

[8]The letters are kept in Brocard's Archive, at the library of the Institut Henri Poincaré in Paris.

[9]According to Klein, elementary mathematics was all that could be taught at school;

Some research has shown how *intermediate* journals, also thanks to this network, shared mathematical contents, type of readers, and editorial models.[10]

Therefore *Intermediate* journals were those that best suited Alasia's scientific profile, i.e. where he could carry out his activities competently. In 1901 he himself founded a journal of this type, *Le Matematiche pure ed applicate* (Enea, 2018).

In only two years of publication, *Le Matematiche* had active contributions from 50 mathematicians from twelve different countries, almost all belonging to our network.

Looking at some of Alasia's most important publications and dissemination activities, the aim of this paper is to show how the scholars of this network contributed to the scientific and professional growth of this Sardinian mathematician.

The "Alasia case" will allow us to highlight how, at the beginning of the twentieth century, beside the great mathematicians engaged in the forefront of new mathematical research there were a lot of scholars who, in a transnational network, enable not only the diffusion of important fields of elementary mathematics (even though the questions investigated were often far from elementary), but also the cultural and scientific growth of small communities of often isolated mathematicians.

2 Alasia's first contacts with a network of scholars

The scientific production of Alasia began with the publication of some manuals with educational purposes. These first manuals, on the general theory of equations and on infinitesimal and integral calculus, did not have a great diffusion, both because they dealt with topics already widely covered in the

this did not mean that everything that was elementary mathematics ought to be taught. Klein argued that it was important to make a selection of contents, which ought to be reconsidered from time to time. In fact, the field of elementary mathematics was constantly expanding, thanks to a better representation of mathematics itself. One example of elementary mathematics, according to Klein, was the infinitesimal calculus, with the progress made by Cauchy and Weierstrass. See (Klein, 1904).

[10] See (Ehrhardt, 2018), (Enea, 2018). See also (Nabonnand-Peiffer-Gispert, 2015), (Peiffer-Gispert-Nabonnand, 2018)

manuals of the time and because they had been published by small local publishing houses.

In 1898 Alasia began to publish his manuals with the editor Scipione Lapi, who was well known in Italy for its high level of professional skills. Lapi's press was established in Città di Castello in Umbria, but Lapi must have had international contacts, in fact, his publications were also distributed in France by Gauthier-Villars.

The choice to publish with this editor and to deal with topics of greater interest, allowed Alasia to become known in Italy: his monograph, *Calcolo Grafico ed applicazioni alla Statica Grafica* (1899), was included in the bibliography of a talk by Silvio Canevazzi[11] at the IV International Congress of Mathematicians in Rome in 1908. Alasia referred to the *Statica Grafica* of Carlo Saviotti, professor at the School of Applications for Engineers in Rome and direct pupil of Luigi Cremona.[12] Alasia's manual dealt with the concepts and graphic procedures that are the basis of statics; a result of his studies, which could be useful especially for students.

The breakthrough occurred during the following year when Alasia became interested in the geometry of the triangle.

Even if in the beginning of the 19th century, many mathematicians (Crelle, Feuerbach, Jacobi, Grebe, Lhuilier, Catalan) had repeatedly dealt with properties and remarkable elements of triangles, the beginning of the *new* triangle geometry[13] coincides with the publication of memoires of Émile Lemoine and Henri Brocard in France.[14] A group of geometers gathered around them and gradually the subject grew, mainly through the hands of Joseph Neuberg, Gaston de Longchamps, Maurice d'Ocagne, Émile Vigarié, John Casey, and Robert Tucker.

In (Romera-Lebret, 2014) we learn how we can already talk about a network of scholars, who shared the same research topic, namely the new triangle geometry, and had adopted common practices: referring to each

[11] Professor of Mechanics applied to Construction at the University of Bologna. See (Canevazzi, 1909).

[12] See (Saviotti, 1888), (Palazzi, 2011).

[13] See (Davis, 1888), (Vigarié, 1889), (Berkhan-Meyer, 1914), (Retali-Biggiogero, 1979), (Romera-Lebret, 2014).

[14] See (Lemoine, 1873, 1874), (Brocard, 1881, 1883).

other, publishing bibliographic articles, structuring the papers in the same way recalling the genesis of their research, i.e. Lemoine's work.

Probably Alasia approached the new geometry for his desire for knowledge and for the wide spread given to it by its founders through some *intermediate* journals such as the *Nouvelles Annales de mathématiques*, the *Journal de mathématiques élémentaires et speciales*, the *Mathesis recueil mathématique*.

In 1900 Alasia published a book, *La Recente Geometria del Triangolo*, with the editor Lapi. We now that it was suggested by Eugenio Beltrami[15], who was the president of the *Reale Accademia dei Lincei* at the time. The interest of the great Italian mathematician was not only a recognition of the importance and the educational utility of this area of geometry, but also of Alasia's work, which was becoming more and more known and appreciated.

A letter from Alasia to Brocard, dated December 8, 1899 (only two months after the Beltrami note) allows us to recognize the developments of his work.

Alasia began writing his manual and showed great initiative: without any hesitation he contacted Lemoine, Neuberg, and Brocard to request their papers on the topic. The Sardinian mathematician thus began a long and fruitful collaboration with the community of mathematicians who worked on the new triangle geometry.

Alasia immediately adopts the same practices of this network. *La Recente Geometria del Triangolo* contained a historical introduction with clear references to Lemoine's memoirs; the whole presentation of the topics had a detailed system of notes and contained an updated bibliography of the known results.

Supported by Poulain[16], Alasia did not neglect the algebraic treatment of

[15]Beltrami had followed the development of triangle geometry since 1863 when, in the wake of some works by Steiner, Terquem, Salmon, Casey, Battaglini and Trudi, he had dealt with the properties of the nine point conic. With a note, dated October 15, 1899, he had encouraged Lapi to publish a treatise on the new triangle geometry, suggesting Alasia as an author. Beltrami's note is reported in (Ripert, 1901, 144), and in a letter from Alasia to Brocard, dated November 23, 1900. The first page of the manual contains a dedication to Beltrami and the reproduction of the note sent to Lapi.

[16]Alasia mentioned two letters from Lemoine and Poulain in the preface to his book, in

some results through the introduction of appropriate trilinear, barycentric, tripolar, and angular coordinate systems (Poulain, 1892). The book was completed with a set of 343 exercises[17] and a table of formulas.

In 1902 Alasia had consulted and studied so many texts that he was able to write a bibliography of the new triangle geometry, on Brocard's suggestion, as an updated of (Vigarié, 1895). Still following common practices adopted by the network, Brocard himself presented this bibliography at the Congress of the *Association Franççaise pour l'Avancement des Sciences*, held in Lyon in 1906, published in the *Comptes Rendus* of this Association (Brocard, 1906).

3 The strengthening and growth of Alasia's scientific collaborations

The correspondence with Brocard and some bibliographic records (Alasia, 1911) show how the above mentioned mathematicians guided his scientific and educational publications for several years; they introduced him to a wider network of scholars.

For example, from Alasia's letters to Brocard, we know that they discussed together on the reviews of *La Recente Geometria del triangolo*. In (Alasia, 1911) four reviews were indicated, which were published in *intermediate* journals: the *Nouvelles Annales de Mathématiques*, the *Mathesis*, the *Revista trimestral de Matematicas*, the *Journal de Sciencias Matematicas e Astronomicas*. Also in *L'Enseignement Mathématique*, we find a review by Léon Ripert, who celebrated Alasia's work as the "*premier ouvrage d'ensemble fait sur elle*" [i.e. on the geometry of the triangle] in Italy.[18]

Since Brocard was one of the most active collaborators of all these journals and knew well some of the editors (Charles-Ange Laisant, Zoel Garcìa de Galdeano, Josè Rius y Casas, Francisco Gomes Teixeira)[19], these reviews

which they expressed their appreciation for his work.

[17] These exercises also are now in https://www.esuppa.it/AlasiaWeb/pdf/alasia.pdf

[18] See (Ripert, 1901, 144). In (Berkhan-Meyer, 1914) and in (Biggiogero-Retali, 1979) the Alasia's book is quoted as the "Italian book of the new geometry of the triangle".

[19] For the relationships between Brocard and these mathematicians see: (Auvinet, 2011); Galdeano letters to Brocard kept in Brocard's Archive at the library of the Institut Henri

paved the way for Alasia towards new collaborations with France and Belgium as well as with Spain and Portugal.

We find traces of collaborations between scholars from different countries not only in private correspondences but also in the journals themselves. In a letter to readers of *El Progreso Matemàtico* (III, n. 25, 1893, 3), Galdeano manifested great satisfaction at the results achieved by his journal, as "evidenced by the various memoirs, notes, articles, etc. . . with signatures of great respect and fame such as those of the journal's foreign collaborators Battaglini, Brocard, Cesàro, Teixeira, Guimaraes, Lampe, Lemoine, Longchamps, Peano, Pirondini, Poulain, Retali, Schiappa Monteiro, Schlegel and Vigarié".
Galdeano's letters to Brocard show French mathematicians' support for all Galdeano's publishing activities, so it is not a coincidence if Alasia's first articles were published in *El Progreso*.

Strengthened by the support of this network of scholars, Alasia decided to create a new journal, *Le Matematiche pure ed applicate*, in 1900 (Enea, 2018). It was short-lived, the publications were interrupted in 1903 due to economic difficulties and the premature death of its publisher Lapi. However, those were years of intense work for Alasia.

These scholars provided Alasia with greatest help in terms of articles and reviews, in the spirit of mutual collaboration aimed at promoting the diffusion of these journals and the researches published in them. Brocard was a constant reference point for Alasia; he turned to him for suggestions on direction of the journal, from the editorial model to the choice of articles and questions to be published.
After having obtained the support of Brocard, Lemoine, Ripert, Galdeano, Rius y Casas, Gomes Teixeira, Laisant for his journal, Alasia's resourcefulness led him to contact many other mathematicians. Some of these were international scientists: Henri Poincaréé, Paul Appell, George Bruce Halsted, and Alexander Vassiliev agreed to participate in the editorial board. Charles Hermite sent a brief note (Hermite, 1901)[20], the last written just before his death. We also found letters from Alasia to Gösta Mittag-Leffler, Moritz

Poincaré in Paris; (Kharlamova, 2013).

[20]See also (Hermite, 1917).

Cantor, David Hilbert, Federico Amodeo, Émil Borel, Maurice D'Ocagne. Many of them did not respond to his requests. This fact did not dishearten the Sardinian mathematician, who, for example, wrote again to Hilbert again in autumn of 1902, asking for permission to publish in *Le Matematiche* the translation of his famous lecture's notes, *Sur les problèmes futurs des mathématiques*, presented at the 2th International Congress of Mathematicians held in Paris in 1900.[21]

Keeping true to the editorial project of *Le Matematiche* as a journal that stimulated teachers to research, Alasia published the contributions of many of them. In the editorial enterprise, some Sardinian teachers were also involved, namely Giuseppe Delitala, Giovanni Biasi, and Giuseppe Repetto; mathematicians, who, like Alasia, suffered the cultural isolation of the island and shared the passion for mathematical studies.[22]

Alasia also had scientific and friendly relationships with many Italian scholars, in particular he widely spread the research and initiatives of Giuseppe Peano's school.[23] Some exponents of this school, such as Roberto Marcolongo e Cesare Burali-Forti, also were active collaborators of Alasia's journal.

In the second volume of *Le Matematiche*, Alasia welcomed the proposal to compile and publish a *Dizionario matematico*. The proposal was made by Peano during the second *Mathesis* Congress[24] held in Livorno in August 1901.

In his journal Alasia published [25] a first list of "general terms found in math publications". The terms were presented with their etymology and description (rather than definitions) or examples of their meaning. There were also reported their symbols used for them in the Peano's *Formulario Mathematico*.

[21] Compte Rendus du Deuxième Congrès International des Mathématiciens, Paris, Gauthier-Villars 1902, 58-114. Alasia's letters to Hilbert are kept at the library of the University of Göttingen in Germany. The translation of the lecture's notes was never published, we do not know if this is due to Hilbert's refusal or to the end of the publication of Alasia's journal.

[22] We do not have enough biographical information about them.

[23] See (Luciano-Roero, 2008), (Luciano, 2018).

[24] Atti del Secondo Congresso dei Professori di Matematica delle Scuole Secondarie, Giusti, Livorno, 1902, 9-11.

[25] Parte 1^a, Logica Matematica, Supplement to Volume II.

Again as a contribution to *Dizionario Matematico*, in 1902 Alasia published the *Saggio terminologico-bibliografico della nuova geometria del triangolo* (Bolis, Bergamo). Starting from (Vigarié, 1887), the aim of the *Saggio* was to reduce the enormous bibliography on the triangle geometry to a few fundamental memories, with a consequent reduction in terminology as well. The many terms used to represent the same idea and the multiplicity of meanings, in which the same term was used, were evidently an inconvenience. For each element, Alasia gave a short definition, its fundamental properties and essential bibliographic references. There are also historical notes.

For his *Saggio* Alasia asked Burali-Forti for help, whose researches aimed to give a contribution to the development of the triangle geometry inspired by on Grassmann *Ausdehnungslehre*.[26]

The research tools used by many scholars of triangle geometry were elementary geometry, projective geometry and above all the coordinates of various types (Cartesian, trilinear, barycentric, and angular) as well as the transformations of one coordinate system into another (Poulain, 1892). In his *Saggio*, Alasia used the theory of geometric forms presented in (Peano, 1888) for the representation of points and straight lines, as suggested by Burali-Forti; Peano's approach gave even the barycentric calculation as a particular (Burali-Forti, 1919).

The triangle geometry was the favorite topic of numerous other publications by Alasia. He also tried to spread its foundations in Italy through articles on the *Pitagora* and the *Supplemento al Periodico di Matematica*.

4 Alasia full-fledged member of the network

Alasia always stayed in touch with the members of the network: he sent his demonstrations to some of them for suggestions, inquired about their activities, spread their results and initiatives. Over time our Sardinian mathematician became an appreciated and esteemed interlocutor.

This is confirmed, for example, by his collaboration with *L'Enseignement*

[26] In *Le Matematiche*, Burali-Forti published an article on the applications of the Grassmann method (v. I, 269-278; v. II, 21-30).

Mathématique and its editor Laisant, who was a scholar very involved in the publications of many other *intermediate* journals in France. He was also in the editorial board of *Le Matematiche*. A long article on scientific activity of Giusto Bellavitis (Alasia, 1906) was published by Alasia in *L'Enseignement*. Bellavitis' equipollence method marked a decisive moment in Laisant's scientific path (Auvinet, 2011), and, to celebrate the 25th anniversary of the Italian mathematician's death, Laisant gave the letters exchanged with Bellavits to his "friend" Alasia for publication.

After *Le Matematiche*, Alasia's most significant contribution to a journal was that given to *Rivista di fisica, matematica e scienze naturali*, published in Pavia by the astronomer Cardinal Pietro Maffi[27] and printed by the *Società Cattolica Italiana per gli Studi Scientifici*. The aim of journal was the cultural training and updating of teachers; in fact it was devoted essentially to informing teachers about the progress of science, developing topics only by means of articles and bibliographical sections.[28]
Alasia worked without interruption for the *Rivista* until 1912, when it stopped printing, due to economic and political difficulties. He published numerous informative articles, as well as translations, obituaries, articles and book reviews. In a section, called *Rassegna Matematica*, were given bibliographises, news about national and international congresses of societies and associations of mathematicians, prizes, and courses held in foreign universities. Scientific book catalogs, also offering second-hand books, were suggested. Alasia paid particular attention to the congresses of the *Society for the Advancement of the Sciences* in different countries and to the debate on school programs and training of future teachers.

Alasia's papers reflected his studies, his continuous reading of new publications, his personal thoughts about the covered topics, his information from all over Europe. This can well be seen in his reviews published in the

[27]He taught physics, mathematics and natural sciences at the Seminary of Pavia and was director of the Vatican Specola. As a scientist, his meteorological and shooting star studies were particularly appreciated.

[28]It dealt with many subjects in Astronomy, Biology, Chemistry, Physics, Mathematics, Medicine, Mineralogy, Zoology. For a complete description of the journal see Cirmath seminar–Mathematics journals and teaching publics, Paris, 2016 (https://cirmath.hypotheses.org/740).

Rivista, where he often did not just give the summary but widened with his digressions.

For example[29], in the review of (Cesàro, 1905) on infinitesimal calculus, Alasia crossed the description of the topics of the book with some research in England on the difficulties of engineering students in the applications of mathematics, after the theoretical studies done in the first two years.[30]

In the review of (Campbell, 1903) on Lie's theory of continuous groups, Alasia showed that he knew well the Italian researches on this topic published by Ernesto Pascal, Luigi Bianchi and Giulio Vivanti.[31] In the review of (Halsted, 1904), an elementary geometry book based on Hilbert's Foundations, Alasia told of Giuseppe Veronese's attempts in Italy to harmonize the teaching of geometry at schools with Hilbert's ideas, proposing a logical development of geometry based on intuitive and experimental observations.

Finally we mention the long review (Alasia, 1904) of *L'évolution de la mécanique* (Duhem, 1903). Alasia directly asked Pierre Duhem for a copy of *L'Evolution*, making sure to give it wide dissemination.[32] Alasia big interest in the theme is attested by his many digressions in the review (of which he apologizes to the reader), such as the one on Newton's law of universal gravitation.

Alasia closely continued to follow the researches developed in many *intermediate* journals, publishing abstracts of some of these. He also informed the readers on the closure of the *Rivista Trimestral de Matemàticas* of Rius y Casas, and on the creation of the *Anales de la Facultad de Ciencias de Zaragoza*, also edited by Riusy Casas, and of the *Boletín de Critíca,*

[29]The quoted reviews are contained in *Rivista* (1905, 12, 383-390)

[30]Alasia had deep respect for Cesàro, who was member of the editorial board of *Le Matematiche* and actively collaborated both by publishing articles and proposing and solving questions (see also their correspondence in Fondo Cesàro, http://pzmath.unibas.it/PRIN/STMAT/). In 1907 Alasia wrote two long articles on Cesàro's life and scientific work to commemorate his early death; see *L'ensegnement mathématique* (1907, 9, 4-23), *Rivista* (1907, 15, 23-46).

[31]In the same year Alasia also published a translation, together with his notes, of the Newson article on continuous groups of projective transformations (Alasia, 1905a). This is the only article by Alasia published in Giornale di Matematiche of Battaglini.

[32]Alasia's letters to Duhem are kept in the Archives of the Académie des Sciences in Paris

Enseñanza y Bibliografía mathematica by Galdeano.

Some articles show how Alasia also became able to propose new research topics.

Thanks to *Le Matematiche*, Alasia came into contact with two American mathematicians. The first was George Bruce Halstad, whom we have already mentioned. Alasia was linked to Halsted by a relationship of esteem and friendship, as evidenced by the biographical notes that they dedicated to each other (Halsted, 1902), (Alasia 1903a).[33]

The other American mathematician is George Abram Miller, whom Alasia thanked for the articles sent to him on the group theory and published in *Le Matematiche*.[34]

Between 1903 and 1907 Alasia showed a great interest in these researches, which he disseminated through historical notes and book reviews.[35] A difficult topic, as he wrote himself, that could hardly be introduced in secondary education, but which was fundamental for the development of some fields of mathematics such as geometry and equation theory. In 1908 Alasia published a pioneering and extensive work, *Essai d'une bibliographie sur la théorie des groupes*[36], where he listed all the papers on group theory published from 1771 to 1907. It was divided into three sections: groups of linear substitutions and groups of transformations, continuous groups, and discontinuous groups. Alasia quoted about 4500 titles and 103 journals. He turned to Brocard[37] for some bibliographic reference and for some indication adopted in the *Repertoire Bibliographique des Sciences Mathématiques*[38], which he did not possess.

We point out another article by Alasia, *Sullo stato della teoria delle congruenze binomie avanti il 1852 (note a proposito di una memoria di D. A. da Silva)* (Alasia, 1903c), much appreciated by Gomes Teixeira, with whom

[33]The Halsted biography was published in a supplement to vol. II of *Le Matematiche*. It was printed in Sardinia after the bankruptcy of the publisher Lapi. An English translation was published by Margaret A. Gaffney in (Gaffney, 1905).

[34]See (Miller, 1901), (Miller, 1902).

[35]See, in particular, (Alasia, 1903b; 1905b; 1907a; 1907b).

[36]See (Alasia, 1908-1910).

[37]See Alasia's letters to Brocard dated December 29, 1907 and October 6, 1908.

[38]See (Nabonnand and Rollet, 2002).

Alasia had a long correspondence.[39]

The work was inspired by Alasia's fortuitous finding at a book retailer at Nice, i.e. the volume *Proprietades geraes et resoluçã o directa das Congruencias binomias, por Daniel Augusto da Silva*, published in Lisbon in 1854 and almost certainly owned by Joseph Liouville.

Alasia's curiosity for such a simple and yet so important topic in the field of number theory, together with the surprise of finding an author completely unknown to him, led him to request information from Alfredo Schiappa Monteiro and Teixeira himself. Of course, he obtained full collaboration from the two Portuguese mathematicians. Alasia analyzed the Silva's researches highlighting that some results were already known by Silva, even if historically they were attributed to others: for example the methods of congruence systems resolution that Stieltjes attributed exclusively to Smith [40], were already contained in the Silva's paper.

Alasia's paper was so original and interesting for Portuguese mathematics that it was also published by Gomes Teixeira in his *Annaes* (Alasia, 1909).

5 Conclusions

Cristoforo Alasia lived far away from any academic environment, confined in the hinterland of a culturally backward island, without a deep mathematical preparation and without scientific relationships. Nevertheless, over the years, he succeeded in gaining a place within a network of European scholars, engaged in the spread of important fields of elementary mathematics. A decisive role was played by the scientific and personal relationship with the Frenchman Brocard, but it was the editorial experience of *Le Matematiche* that allowed him to improve and expand relations with the researchers of the network.

As his correspondence and the large number of publications show, Alasia had a great passion for mathematical studies and a huge desire to know, compare and communicate.

[39] Alasia's letters to Gomes Teixeira are kept in the Archive of the University of Coimbra.

[40] See (Smith, 1861)

Loria opinoned[41] that the illusion of being able to embrace the whole immense field of pure and applied mathematics was the cause that prevented Alasia from being more successful. Indeed, Alasia had study skills and spirit of initiative, but Loria seems to forget the cultural reality in which he was trained and lived. No Sardinian mathematician, remaining in Sardinia, had never been able to succeed in working as Alasia had done up to that moment.

Speaking about life and times of Alasia, we also wanted to highlight how, in the second half of the nineteenth century, in Europe there were many scholars engaged in the dissemination of mathematics studies that could reach everyone. It is not only the choice of topics that is important, but also the choice of tools: sharing of papers, exchange of information, support for publications, collaboration with journals that were aimed precisely at teachers, students and amateurs. The network itself is to be considered as one of these tools.

Unfortunately, Alasia's career, which began when he was no longer young, was interrupted by illness and premature death on November 19, 1918.

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[2] Alasia, C. 1903b. L.E. Dickson - I Gruppi lineari, con una esposizione della teoria del campo di Galois. Riv. Fis. Mat. Sci. Nat. 7, 606-616.

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