



## Aristotle - Ἀριστοτέλης (ARISTOTÉLĒS, 384/3- 322/1 BCE) The revelation of tuberculosis in his zoological works

M. Cilione<sup>a</sup>, M. Martini<sup>b</sup>, F. Zampieri<sup>c</sup>, N. Riccardi<sup>d</sup>, F. Brigo<sup>e</sup> and V. Gazzaniga<sup>f</sup>

<sup>a</sup>Department of Biomedical, Metabolic and Neural Sciences - University of Modena and Reggio Emilia, Modena, Italy; <sup>b</sup>Department of Health Sciences, University of Genoa, Genoa, Italy; <sup>c</sup>Department of Cardiac, Thoracic, Vascular Sciences, and Public Health - Unit of Medical Humanities, University of Padua, Padua, Italy; <sup>d</sup>Infectious Diseases Clinic, Azienda Ospedaliero Universitaria Pisana, Pisa, Italy; <sup>e</sup>Department of Neurology, Hospital of Merano (Sabes-Asdaa), Merano-Meran, Italy; <sup>f</sup>Department of Medico-Surgical Science and Technology – Sapienza, University of Rome, Rome, Italy

### ABSTRACT

One of the most challenging issues with the sources of ancient medicine is to be able to identify the correspondence between the diseases we know today and those reported in ancient medical texts. Ancient diseases' definitions rarely help us, and the symptoms described often correspond to more than one disease. This is especially true about tuberculosis, a disease that historians of medicine habitually associates with the Greek words *phthi(n) o* (φθίνω), verb, *phthisis/phthoe* (φθισις/φθόη), noun, *phthinodes/phthisikos* (φθινώδης/φθισικός), adjective, all etymologically linked to an Indo-European root that expresses the idea of consumption in a broad sense. This article aims to analyze a group of Greek words, *branchos/branchia* (βράγχος/βράγχια), *krauros/krauro* (κραῦρος/κραυράω), and *katarrhe* (καταρρέω), that appear in nosological contexts very close to the infectious disease that today we call tuberculosis. Moreover, the paper aims to focus on the transmission pathways of TB being via animal-human contact and some ancient strategies to cure it. The symptoms, transmission pathways and therapeutic approach of tuberculosis belong to a homogeneous pathological picture that emerges from a set of texts that date back to the period between the fifth century BC and the second century AD.

### KEYWORDS

Aristotle; infectious diseases; methodology of science; transmission pathways; tuberculosis

### A passage much quoted and little studied

Most of the contributions, even recent, that trace a historical-medical profile of tuberculosis (TB) refer to an Aristotelian passage from the *History of animals* [1] (*HA*) that probably deserves a broader contextualization and analysis [2,3].

In this passage Aristotle reviews the symptomatology of some inflammatory diseases that affect animals, in particular pigs and oxen. According to Aristotle, these animals can be affected by a pathology called *branchos* (βράγχος). However, this is the only passage in Greek literature where this term appears within the context of animal diseases. A word or an expression that occurs only once within a context is called, in technical language, a *hapax*. In human beings, the term indicates hoarseness, as evidenced by its lemma in Liddell, Scott, and Jones's *Greek-English Lexicon*, the most thorough and authoritative Greek-English dictionary, and also recently by Stefan Schnieders [4].

The symptom expressed by the term *branchos* can be associated with more than one inflammatory disease [5]. As a matter of fact, Liddell, Scott and Jones provide us with the first general explanation of 'hoarseness or sore throat causing hoarseness'. The meaning is exemplified by three passages, the first from the

Hippocratic treatise *Ancient Medicine*, the second from the second book of Thucydides' *Peloponnesian War* (to describe the symptoms of the plague of Athens, 430 BC), and the third from pseudo-Aristotelian *Problems*. The generic meaning of redness (of a given tissue) is also confirmed by another source. In fact, the lexicon of Hesychius (the broadest ancient lexicon, dating back to the fifth century AD) attributes to the lemma *branchia* (βράγχια) the meaning of generic pain around the throat associated with redness [6].

The Hippocratic treatise *Ancient Medicine* [7] (*VM*, late fifth century BC) places the redness that affects the throat in a nosological framework linked to the flows of strong and noxious humors [8] that from the head first affect the eyes, causing pain, burning and, finally, inflammation, and then involves the throat and causes hoarseness, sore throat [9], erysipelas [10] and pneumonia.

The author of *VM* proposes a polemic against the physiological simplifications of some pre-Socratic philosophers. Philosophical thought was born in the Greek cities of the ancient region of Ionia (central sea-board of Asia Minor) with the pre-Socratics (sixth-fifth century BC). It was the first ontological or cosmological approach to explain the nature rules of the

Sýmpan (Universe). Among them, in Magna Graecia (Southern Italy) was Empedocles (506–443 BC) from Acragas (today called Agrigento, Sicily) with Pythagorean thought, which thinking is beyond monism and accepts not only one but four ‘ἀρχικά στοιχεία’ (primary elements) that is fire, water, earth, air [11]. The writing, in fact, does not identify the cause of a disease as arising from a single factor, but in a complex interaction of co-causes, in which the principles of heat and cold act together contributing to the genesis of well-being or illness only in relation to a more or less temperate concoction of humors.

However, in accordance with the context to which the work belongs [12], *VM* defines a pathological picture that in the history of the medical literature seems to recur in an unaltered form even in medical *lexica*.

In the Pseudo-Aristotelian *Problems* (third century BC), in the section dedicated to medical questions [13], respiratory diseases are traced back to a precise climatic picture that induces the increase of phlegm in the head [14,15]: this excess of moisture pours into the neighboring parts of the body causing coughs, hoarseness and consumption.

However, nothing authorizes us to associate this symptom exclusively with tuberculosis. Mirko Grmek [16] already warned medical historians against a hasty identification of tuberculosis in Greek sources: the generic nature of the symptoms described and the spread of respiratory diseases combined with the use of a term such as *phthisis* (φθίσις), which simply indicates consumption, exposes the risk of incorrect retro-diagnosis. In the first book of the treatise *On epidemics* [17], Hippocrates circumscribes the sense of *phthisis*, but the *Corpus Hippocraticum* preserves the double value both of consumption and disease of the respiratory system. The use of *phthoe* (φθόη) in only two passages does not resolve the ambiguity and the precise distinction of the three types of *phthisis* in the treatise *On internal affections* [18] doesn't allow a reliable identification with the pathology that we indicate with the name of tuberculosis [19]. As a matter of fact, Hippocrates' uses of φθίσις-words definitely at times point to tuberculosis, at other times his uses may not. That is to say, some of the symptoms that Hippocrates describes are so specific to Tuberculosis (type of fever, type of sweating, season of disease), that we can be fairly sure he's referring to TB. But at other times, it's not so clear [20].

Pseudo-Aristotle use the terms *phthisis* and *phthoe* without any distinction [21], whereas pseudo-Galen distinguishes them in relation to their etiopathogenesis: *phthisis* indicates the consumption of the body in a general sense, while *phthoe* the consumption following ulceration processes [22]. Galen, who also associates *phthisis* and malnutrition [23], identifies two possible causes of this consumption:

- (1) The flow which takes origin from the head.
- (2) The ulceration of the lung tissues that produces the rupture of blood vessels [24].

The first aligns with the Hippocratic tradition expressed in the *VM* treatise; the second integrates it, welcoming on the therapeutic level the biological reflections of Aristotle on homoeomeric tissues, such as flesh, or on elementary principles consisting in turn of variable mixtures of hot, cold, dry, and wet.

What about Liddell, Scott and Jones's secondary meaning for *branchos*? It refers to two swine diseases, anthrax and foot-and-mouth disease. Also, in this case, the term describes an inflammatory process that comes to affect the lungs and leads the animal to death. The passage goes on to name two other diseases of pigs that are both called *krauros* (κραῦρος). One of the two pathologies that affect oxen, is also called *krauros*. Now, it is clear that anthrax, foot-and-mouth disease and tuberculosis are related to different pathogens. However, the interesting aspect of the question lies in the use of a shared nomenclature to indicate the contiguity of infection processes between humans and animals.

In essence, the anatomical-physiological reflections that Aristotle proposes in *Parts of animals* (*PA*) and in *History of animals*, were inherited by Herophilus and Erasistratus in their dissectional approach (Alexandria, third century BC) and became a point of reference also in clinical practice [25].

If it is assumed that the homoeomeric tissues are identical for all living things, the homogeneity of the nosological pictures between man and animal is legitimized; it represents the most evident fact that emerges from the use of the medical lexicon in the *HA* passages in question: if the tissues are the same, then the infections that inflame and corrupt them are also the same.

This is confirmed, as we said above, by the case of the term *krauros*, with which Aristotle defines one of the two pathologies related to oxen [26]; the term refers to a feverish state that makes breathing warm and frequent and that quickly leads to death as a result of a serious lung disease, also demonstrated by animal dissection studies.

The pathological rotting of the bovine lung is significantly reflected in the clinical case reported in *Corpus Hippocraticum Diseases I 13* (first twenty years of the fourth century BCE): in this text, the same expression is used to indicate the outcome of an ominous nosological picture. It is, in fact, a suppurative inflammation produced by the descent of the phlegm from the head to the lungs.

The vb. *katarreo* (καταπέω) also clearly traces this inflammatory process to an imbalance of humoral flow that manifests itself in terms of quantity and movement within the body, as in the case

of *branchos*. Aristotle feels the need to clarify the pathological meaning of the term *krauros* by comparing the infinitive mood of the denominative verb (*to krauran* = τὸ κραιρᾶν) to the noun *pyretos* (πυρετός) which, in man, indicates an acute febrile state: the construction of the phrase emphasizes the total parallelism between the human and animal conditions.

In general, without any claim to identify exactly the disease to which Aristotle refers, the symptoms of *krauros* recall *Mycobacterium bovis* disease, which is transmitted from animal to man in contexts of accentuated contiguity and through the practice of slaughter [27].

The treatment of oxen, moreover, is truly emblematic for the Greek world and especially for the Athenian world, because it is linked both to the economic and social dimension of work in the fields and to the ritual practice of slaughter.

In fact, Claudius Aelianus [28] testifies that the Athenians excluded yoke oxen from sacrifice because they were fellow farmers who partook in agricultural labor [29].

It is therefore no coincidence that for one of the four occurrences of the term *oikos* (οἶκος, *home*), an entity autonomous from the State (*polis* = πόλις) in terms of aims, rules, ideals, religious system, within Aristotle's *Politics*, he defines this as a community that was formed according to nature to face daily needs, and introduces its definition with a verse of Hesiod [30] that welcomes in the founding nucleus first of all the wife and work oxen, meaning the latter as domestic slaves of the poor [31].

In ancient times (and even into the more recent past), oxen literally lived on the ground level of a house as a member of the family, and as such their social proximity contributed to the ease of spreading disease to their masters.

Moreover, if not used for fieldwork, oxen were destined for sacrifice in a very ritualized form of slaughter [32], which by virtue of the sharp tools for killing (using a *pelekys* = πέλεκυς, or ax) and cutting their meat (using a *machaira* = μάχαιρα, or knife) [33], were vectors for spreading contagions.

More generally, the comparative nosological picture that emerges at the lexical level in the use of *branchos* for animals and of *krauros* as *pyretos* of cattle, is in perfect coherence with the criteria of the anatomical-physiological description of the living that Aristotle proposes in the treatise on the parts of animals. In fact, although organic complexity makes man an animal of a special type, his nature remains the object of general zoology [34].

In *PA* Aristotle describes the tissues and the morphology of the anatomical parts and their functions,

referring to man only to define his anatomical-physiological differences [35].

The fact that the human being is reserved a paradigmatic role reinforces the impression of a close nosological contiguity between man and animal that emerged from the investigation on the use of the lexicon in *HA*.

The comparability of the symptoms extends to the modalities of their contagion which implies a close coexistence both in animal-to-human transmission and in that from man to man.

Moreover, Cockburn [36] and Hare [37] had already hypothesized the origin of human tuberculosis from bovine tuberculosis by horizontal transmission in conjunction with the domestication of oxen and with the beginning of sedentary agricultural activity: the lexical investigation of the ancient sources indicated by Grmek and their anthropological-cultural contextualization seems to support this hypothesis.

### Breathing and interhuman contagion

With regard to the inter human contagion, pseudo-Aristotle, in the *Problems*, wonders why for some diseases, such as *phthisis* it is possible to trace the contagion to proximity and for others not [38].

The answer lies in the alteration that the *phthisis* produces on the breath, making it unhealthy and heavy.

As pseudo-Aristotle points out in the *Problems*, the rapid spread of this kind of disease seems to be due to a transmissibility by air, specifically inter-human, which causes contamination when the healthy individual inhales the unhealthy and heavy breath of the sick individual. The origin of the infection remains, in any case, miasmatic and not by a microorganism.

Galen of Pergamon also asserts that infection is a consequence of proximity to the sick of *phthoe* [1], including in this category all those who in general exhale corrupt breath.

The doctor of the emperor Marcus Aurelius also notes how the homes of the TB patients are pervaded by a bad smell which confirms the *phthoe* to be the etiopathogenesis of their disease.

Inter-human transmission of TB recalls the events of a court case presented, more than five centuries before Galen, by Isocrates in the *Aegineticus* (394–390 BCE) [39,40].

The trial revolves around a disputed inheritance: Thrasilocus has no male children and therefore decides to leave his estate to a dear friend who takes care of him even if he should fall ill with *phthoe*; however, the friend is reminded that most of those who have assisted patients with *phthoe* have died of the same disease [41].

The half-sister, in fact, who after the death of Thrasilocus claims the patrimony as the closest relative of the deceased, had been careful not to assist him.

The point that unites the testimonies of Aristotle, pseudo-Aristotle, Galen and Isocrates is undoubtedly the recognition of a mechanism of transmission of TB from animal to man and from man to man.

Moreover, the author of the Hippocratic treatise *On Winds* (last quarter of the fifth century BC) identifies in the air the cause of the febrile states, likely TB, both in the case in which they are attributable to a plague and in the case in which they are due to inadequate nutrition [42]. The air introduced into the body through the breath or in conjunction with the ingestion of food becomes pathogenic if corrupted by miasmas [43]. Besides, the Hippocratic treatise *On the sacred disease* associates phthisis to the hereditary predisposition as happens with the epilepsy [44].

Miasmas accumulate and flow through other ways and the part of the body where they become the site of the disease: the excess humor in the chest is called *branchos* [45] and from it throat irritation, cough, hemorrhagic and purulent sputum are generated, very close to the refined description of the symptoms of *phthoe* proposed by the Alexandrian physician Aretaeus of Cappadocia in the treatise *On the causes and symptoms of chronic disease* 1.8 (end of the second century AD).

## The cure

A final aspect that the complex issue of TB raises is the treatment. Before the first active drug against TB was discovered (streptomycin in 1943) and before the combination regimens were adopted, history reveals a number of other recommended therapies.

Many physicians considered the air of coastal regions, especially in Egypt and Libya, to be useful for the treatment of respiratory diseases. The young Seneca, Stoic philosopher and tutor to Emperor Nero, also moved to Egypt in AD 26 to treat asthma and chronic bronchitis. The careful reading of Galen allowed Joseph Walsh [46] to reconstruct the therapeutic protocol followed by a patient of *phthisis*. It included moderate exercise, baths and precise dietary prescriptions based on fresh milk and protein foods. The regularity of activities, entertainment and the possibility of resting in a ventilated and south-facing room were supposed to be the leading strategies of the therapy.

In particular, the cure of Publius Granius Rufus [47] (first century AD) is a clear testimony of the remedies administered at the time. The context is particularly

significant because the inscription was found in the area of the sanctuary of Asclepius in Lebena (Lentas), on the island of Crete, and allows a fruitful comparison between the contents of the so-called rational medicine and religious medicine.

The *sanationes* (inscribed records of cures) of the sanctuary, in fact, attest to the practice of a real medical activity that provided for pharmacological protocols and surgical practices consistent with the current medical literature [48]: it is possible, therefore, to imagine a close collaboration between the attendants of the sanctuary (*nakoroi* = νακόροι) and professional doctors, if not a direct competence of the priests of Asclepius in the diagnosis and treatment of diseases [49]. In fact, the description of the lung infection of Publius Granius Rufus fits perfectly into the symptoms that the *Corpus Hippocraticum* identifies for *phthisis* and *phthoe*: a cough continuous for two years with sputum containing purulent tissues and blood [50].

In a second inscription [51], relating to the same patient, there is also talk of an unbearable pain in the shoulder that falls within the nosological picture of the second *phthisis* described in CH *Internal affections* 11 (= Littré, VII 192).

As for therapy, patient care seems to satisfy the three approaches of religious medicine, namely the theurgical, the dietary and the climatic. The theurgic component emerges from the administration of a mixture of sacred ash and sacred water, one coming from the altar of sacrifices, the other probably from the source that fed the water system of the sanctuary for cathartic ablutions and the needs of patients.

The climatic aspect contributes to healing through an equal and opposite mechanism with respect to the miasmatic action of the contagion.

The location of the sanctuary near the sea makes the site particularly suitable for the treatment of lung diseases, but more generally it is the very position of Lebena to make it an ideal site of hospitalization: there is the commercial port of Gortyn and the city is exposed to the south on the route to Libya and Egypt, places recommended for chest diseases.

Finally, if the Asclepian context authorizes us to trace the pathology of Publius Granius Rufus to an imbalance of the humoral *krasis* (κρᾶσις = mixture), consistent with the convictions of the CH, it is clear that the nutraceutical properties of the foods that the patient must introduce into his regimen are aimed at purging and tempering the flows of humors that caused the infection.

In the treatise *On the Regime of Acute Diseases*, wine, in particular sweet wine, is indicated to facilitate expectoration, especially if alternated with a small amount of water.

For the rest, the ingredients perform anti-inflammatory functions (iris, honey, quince), depurative (diuretic arugula, laxative peplis and figs),

emollient (hot water, egg, pitch) and balsamic (resins), as attested by the medical matter of Pliny and Dioscorides [52,53].

## Conclusions

The investigation of the lexicon of respiratory diseases and acute febrile crises in Aristotle's zoological treatises has made it possible to highlight:

- (1) The legitimate deduction of the horizontal human-animal contagion, due to the overlapping of the terms used to describe the pathology of both man and animal. Moreover, if we exclude the brief Alexandrian parenthesis of the human dissections of Herophilus and Erasistratus, the animal paradigm remains the only possible one and will continue to be so even with Galen.
- (2) The refinement of the nosological pictures traced by the Greek medical literature, but also the difficulty of identifying them, interpreting them in the light of the modern conception of TB. In this sense, the historical-linguistic approach to the treatises on natural sciences and medicine makes it possible to avoid the errors of retrodiagnosis due to the overlap between our medical nomenclature and that of the ancients.
- (3) The confirmation of the now well-known continuity between the so-called rational medicine and religious medicine through the sanatio of Publius Granius Rufus: the diagnosis of his lung disease still testifies in the first century AD a clinical picture very similar to the affections that the Hippocratic author of the treatise *On winds* describes for the *branchos*.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

The author(s) reported there is no funding associated with the work featured in this article.

## References

- [1] Balme DM, (ed., tr.). Aristotle. *History of animals*. Cambridge MA and London: Harvard University Press, 1991: bk. VIII chs.21 and 23.
- [2] Grmek MD. Le malattie all'alba della civiltà occidentale. Bologna: il Mulino; 1985. p. 310–312.
- [3] Morazzoni C, De Paschale M. The history of tuberculosis: from mummies to multidrug resistance across the royal touch. *Microbiologia Medica*. 2016;315782:31–32.
- [4] Schnieders S, (ed., tr.) Aristoteles. *Historia animalium*. Buch VIII und IX. Berlin: De Gruyter; 2019. p. 601.
- [5] Lindsay Campbell G, (ed.). *The Oxford handbook of animals in classical thought and life*. Oxford: Oxford University Press; 2014: 601.
- [6] Chantraine P, (ed.). *Dictionnaire étymologique de la langue grecque: histoire des mots*. s. v. βράγχος. Paris: Klincksieck; 1968-1980.
- [7] Jouanna J, (ed., tr.). Hippocrate. *L'ancienne médecine*. Paris: Les Belles Lettres; 1990. Ch. 19 paras. 1–2.
- [8] Squillace G. Le malattie del rheuma nel Corpus Hippocraticum. *Reumatismo*. 2007;59(1):1–5.
- [9] Gärtner F, (ed.). Galeni *De locis affectis I-II*. Berlin-Boston: De Gruyter; 2015. p. 154–156.
- [10] Jouanna J, Hippocrates. Pour une archéologie de l'école de Cnide. Paris: Les Belles Lettres; 1974. p. 192–200.
- [11] Santacrose L, Topi S, Haxhirexha K, et al. Medicine and healing in the pre-Socratic thought. A brief analysis of magic and rationalism in ancient herbal therapy. *Endocr Metab Immune Disord Drug Targets*. 2021;21(2):282–287.
- [12] Vegetti M, (ed.). *Opere di Ippocrate*. Torino: UTET; 1965.
- [13] Flashar H, (ed.). Aristoteles. *Problemata physica*. Berlin: Akademie Verlag; 1962. p. 385.
- [14] Ulacco A, (ed.). *Malattia e alterazione del calore naturale: medicina ippocratica e fisiologia aristotelica negli hosa iatrika e in altri problemata pseudo-aristotelici*. In: Centrone B, editor. *Studi sui Problemata aristotelici*. Pisa: BIBLIOPOLIS; 2011. p. 59–88.
- [15] Jouanna J, Hippocrates et les *Problemata* d'Aristote: Essai de comparaison entre *Airs, eaux, lieux*, cap. 10, *Aphorisme III 11, 14* et *Problemata I 8-12* et 19-20, In: R RW, and Pellegrin P (editors). *Hippokratische Medizin und antike Philosophie. Verhandlungen des VIII. Internationalen Hippokrates-Kolloquiums in Kloster Banz/Staffelstein vom 23. Bis. September 1993*. Olms: Hildesheim-Zürich-New York, p. 274–293.
- [16] Grmek MD. Le malattie all'alba della civiltà occidentale. Bologna: il Mulino; 1985. p. 315.
- [17] Potter P, (ed., tr.). Hippocrates. *Epidemics 1*. Cambridge Mass.-London: Harvard University Press; 2022. bk. 1, ch. 3.
- [18] Potter P, (ed., tr.). Hippocrates. *Internal affections*. Cambridge Mass.-London: Harvard University Press; 1988. chs. 10-12.
- [19] Grmek MD. Le malattie all'alba della civiltà occidentale. Bologna: il Mulino; 1985. p. 315–330.
- [20] Daniel TM, Iversen PA. Hippocrates and Tuberculosis. *Int J Tuberc Lung Dis*. 2015;19(4):373–374.
- [21] Chantraine P, ed. *Dictionnaire étymologique de la langue grecque: histoire des mots*. s. v. φθίνω. Paris: Klincksieck; 1968-1980.
- [22] Pseudo-Galen *definitiones medicae*. In: Kühn G, editor. *Claudii Galeni opera omnia*. Hildesheim: Olms; 1821. vol. 19. p. 419.
- [23] Galeni *De symptomatum differentiis liber*. In: Kühn G, editor. *Claudii Galeni opera omnia*. Hildesheim: Olms; 1824. vol. 7. p. 63.
- [24] Pease AS. Some remarks on the diagnosis and treatment of tuberculosis in antiquity. *Isis*. 1940;31(2):380–393.
- [25] Vegetti M. L'immagine del medico e lo statuto epistemologico della medicina in Galeno. In: Haase W, (ed.). *Aufstieg und Niedergang der Römischen Welt (ARNW)*. Teil II: principat. Band 37: philosophie, Wissenschaften, Technik, 2. Teilband: wissenschaften (Medizin und Biologie). Berlin-Boston: De Gruyter; 2016. p. 1672–1717.

- [26] Schnieders S, (ed., tr). Aristoteles. *Historia animalium*. Buch VIII und IX. Berlin: De Gruyter; 2019: 34 (Arist. HA VIII 23).
- [27] Di Marco V, Cinzia M, Cifani N, et al. Il suino nero dei Nebrodi quale possibile serbatoio della tubercolosi all'interno di un'area protetta (Parco dei Nebrodi): esperienze personali in sei anni di sorveglianza (2003-2008). In: Atti della Società Italiana di Patologia ed Allevamento dei Suini, XXXV Meeting Annuale, Modena, Italia, 12-13 marzo 2009: 382-390.
- [28] Wilson NG, (ed., tr). *Aelian. Historical Miscellany*. Cambridge Mass: Harvard University Press; 1997. Vol. 5. p. 14.
- [29] Durand J-L. *Sacrifice et labour en Grèce ancienne*. Paris-Rome: EFR; 1986. p. 175-176.
- [30] Most GW, (ed. tr). *Hesiod. Works and days*. Cambridge Mass: Harvard University Press; 2018. v(erse).405.
- [31] Ferrucci SL. "Oikos" nel diritto attico. Pubblico, privato e individuale nella democrazia ateniese classica. *Dike. Rivista di storia del diritto greco ed ellenistico*. 2006;9:183-210.
- [32] Detienne M, Vernant J-P, eds. *La cucina del sacrificio in terra greca*. Torino: Bollati Boringhieri; 2014. pp. 36-37.
- [33] Durand J-L. *Rituale e strumentale*. In: Detienne M, Vernant J-P, editors. *La cucina del sacrificio in terra greca*. Torino: Bollati Boringhieri; 2014. pp. 136-150.
- [34] Lennox JG. The place of mankind in Aristotle's *Zoology*. *Philos Top*. 1999;27(1):1-16.
- [35] Repici L. Colori e corpi animali nella fisiologia di Aristotele. *Med Secoli*. 2020;32(2):405-432.
- [36] Cockburn A. *The evolution and eradication of infectious diseases*. Baltimore: Johns Hopkins Press; 1963. p. 221-222.
- [37] Hare R. The antiquity of diseases caused by bacteria and viruses. In: Brothwell D, Sandison AT, editors. *Diseases in antiquity: a survey of the diseases, injuries and surgery of early populations*. Springfield: CC Thomas; 1967. p. 115-131.
- [38] Mayhew R, editor. tr. *Aristotle. Problems 1-19*. Cambridge Mass.-London: Harvard University Press. 2011. Problem 7 ch. 8.
- [39] Nutton V. The seeds of disease: an explanation of contagion and infection from the Greeks to the Renaissance. *Med Hist*. 1983;27:1-34.
- [40] Kosak JK. Heroic measures. *Hippocratic medicine in the making of Euripedian Tragedy*. Leiden-Boston: Brill; 2004. p. 104-105.
- [41] Isocrates. *Aegineticus*. In: Mandilaras BG (ed., tr.). *Isocrates. Opera Omnia, I-III*. München: KG Saur; 2003: vol. III no. XIX ch. 29.
- [42] Heiberg JL, (ed.). *Hippocratis. De flatibus*. Leipzig et Berlin: BG Teubner; 1927. ch. 6. Ins. 8-12.
- [43] Heiberg JL. ed. *Hippocratis. De flatibus*. Vol. 6. Leipzig et Berlin: BG Teubner. 1927. 20.
- [44] Littré E. (ed., tr.) *Hippocratis De morbo sacro*. In: *Ouvres complète d'Hippocrate*. 6. Amsterdam: AM Hakkert. 1961. Vol 6, p. 364.
- [45] Heiberg JL. (ed.) *Hippocratis. De flatibus*. Vol. 10. Leipzig et Berlin: BG Teubner. 1927. ch. 10 Ins. 20.
- [46] Walsh J. Galen's treatment of pulmonary tuberculosis. *Am Rev Tuberc*. 1931;24:1-41, 39-40.
- [47] Guarducci M, editor. *Inscriptiones creticae I-IV*. Roma: Libreria dello Stato; 1935-1950. I 17.17.
- [48] Melfi M. Il santuario di Asclepio a Lebena. *Atene: Scuola archeologica italiana di Atene*. 2007. p. 109.
- [49] Cilione M. Il μίσημα abortivo nelle iscrizioni di Cirene e Cos. *Med Secoli*. 2016;28(1):19-38.
- [50] Littré E (ed., tr.). *Hippocratis Praenotiones Coacae*. In: *Ouvres complète d'Hippocrate*. Amsterdam: AM Hakkert; 1961: Vol. 5 p. 680.
- [51] Guarducci M (ed.). *Inscriptiones creticae I-IV*. Roma: Libreria dello Stato; 1935-1950: Vol. I no. 17 p. In. 17.
- [52] Guarducci MEG IV. *Epigrafi Greca IV*. Libreria dello Stato: Roma; 1995. p. 156-158.
- [53] Rivoli M. *Sanatio di publius granius Rufus da Lebena*. Axon. *Iscrizioni storiche greche*. 2019;3(1):191-198.