# Bulletin of the Natural History Museum – Plovdiv

*Volume 8*
*December 2023*

REGIONAL NATURAL HISTORY MUSEUM – PLOVDIV

UNIVERSITY OF PLOVDIV PUBLISHING HOUSE

**International Standard Serial Number**
**Online ISSN 2534-9635; Print ISSN 2534-9627**

***Bulletin of the Natural History Museum – Plovdiv*** (Bull. Nat. Hist. Mus. Plovdiv) is the official scientific bulletin of the Natural History Museum – Plovdiv, published by Plovdiv University Press. The journal accepts submissions of original studies in the field of palaeontology, natural history, geology and speleology, zoology, botany, ecology, biogeography, museology, history of natural science, information about museum collections, etc.

The official language of the journal is English. Exceptions are possible, certain manuscripts may be published in Bulgarian language, with extensive abstract in English.

*Periodicity:* Annually – one issue per year (December).

*Type:* Open Access, hard copy and electronically. Free of charge to publish.

*About the Journal*

In 1970, the Natural History Museum – Plovdiv issues Volume 1 of the journal "Bulletin of the Natural Science Museum Plovdiv". In 1973 Volume 2 was released.

Before the release of the independent journal of the Natural History Museum – Plovdiv, researchers at the museum published their articles in "Annuals of the Museums in the Plovdiv Region" and from 1975 in “Bulletin of the museums in Southern Bulgaria”, which was published until 1995 (a total of 21 volumes).

With the creation of the Bulletin of the Natural History Museum – Plovdiv, the Regional Museum of Natural History – Plovdiv resumed issuing its scientific journal.

The journal accepts for publishing short messages (up to 4 pages), original research papers (from 4 to 10 pages) and review articles (over 10 pages) in the above mentioned fields and formatted according to the instructions for authors.

The logo of the journal is the paleoendemic beetle *Rhodopaea angelovi* Gruev & Tomov, 1968[1], known only from a small area in the Rhodope Mountains, south of Plovdiv. The species is named after Professor Emeritus Pavel Angelov, one of the first directors of the museum, who collected the type specimens.

*From the Editorial Board*

[1] Gruev B., V. Tomov. 1968. A new genus and species *Rhodopaea angelovi* gen. et sp. n. (Coleoptera, Chrysomelidae) from Bulgaria. Rev. Ent. URSS, XLVII(3):553-555 (in Russian with English summary).

## *Contact Publisher*

Regional Natural History Museum – Plovdiv

34 Hristo G. Danov Str., Plovdiv 4000, BULGARIA; Phone: +359 32 626683
E-mail: bnhm_plovdiv@abv.bg
Web: https://rnhm.org/en/scientific-journal/

University of Plovdiv Publishing House

24 Tsar Asen Str., Plovdiv 4000, BULGARIA

## *Open Access Policy*

Bulletin of the Natural History Museum – Plovdiv provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge. Open Access in journal publishing means:
* Direct, barrier-free, online dissemination of scientific results at no charge for readers Authors retain the copyright of their articles;
* Open Access papers may be copied, downloaded, and used for text- and data-mining purposes, provided that such uses are fully attributed on a non-commercial basis;
* High visibility of the work – anyone can read your article at no charge;
* Higher citation rates due to higher visibility;
* Quick publishing as pre-prints published immediately upon acceptance;
* Articles are archived and searched through several major OA repositories.

## *Peer review process*

All articles included in "Bulletin of the Natural History Museum – Plovdiv" are peer reviewed. Submitted manuscripts are sent to two or three independent peer reviewers, unless they are either out of scope or below threshold for the journal. These manuscripts will generally be reviewed by experts with the aim of reaching a first decision as soon as possible. The journal uses the double anonymity standard for the peer-review process.

## *Abstracting & Coverage*

- Index Copernicus (ICv2022 = 71.57)
- GEOBASE (Elsevier)
- Academic Research Index (Research Bible)
- Academic Keys
- Scientific Indexing Services
- CiteFactor
- Genamics JournalSeek
- InfoBASE Index
- Google Scholar Search Engine and others.

*Bulletin of the Natural History Museum – Plovdiv*

**2023, Volume 8 – Contents**

***Research Articles***



***Short notes***



***Miscellaneous***

Bulletin of the Natural History Museum - Plovdiv
*Bull. Nat. Hist. Mus. Plovdiv, 2023, vol. 8: 1-14*

# *The Leopard Panthera pardus (Linnaeus, 1758) in Bulgaria. A Review of the Paleontological Record and Archaeological Finds*

**Zlatozar N. Boev***

National Museum of Natural History, Bulgarian Academy of Sciences,
1 Tsar Osvoboditel Blvd., 1000 Sofia, BULGARIA
*Corresponding author: boev@nmnhs.com; zlatozarboev@gmail.com

**Abstract.** The study is an attempt to collect and present all direct and indirect information about the former existence of the leopard in Bulgaria. Data on 2 Pleistocene sites (Bacho Kiro Cave and Triagalnata Cave) of bone remains, as well as 14 archaeological monuments - 6 prehistoric (Neolithic and Chalcolithic) and 8 historical (antique and medieval) - representing objects of prehistoric and ancient art (statuettes, images) that contain or represent (presumed) images of leopards, are presented (according to literature data). The archaeologists' original interpretations of the primary sources are accompanied by the author's assessment of the reliability of their identification as leopards. It can be concluded that the leopard existed in Bulgaria until the end of the Pleistocene (until about 15,000 years ago). So far, there is no irrefutable evidence of its existence during the Holocene (Neolithic and Chalcolithic), despite the assumptions made in the literature about this. Some of the examined prehistoric monuments (Eleshnitsa, Dolnoslav, Golyamo Delchevo) probably represent statuettes of leopards, but most of the later images from antiquity were most likely borrowed from the southern provinces of the Roman Empire and cannot serve as evidence for the distribution of the leopard in Bulgaria in historical times.

**Key words:** Large carnivores, Subfossil fauna, history of Balkan wildlife, European fauna, Zooarchaeology.

## Introduction

The modern leopard *Panthera pardus* (Linnaeus, 1758) is the species with the the most extensive range among felids. Therefore, it is understandable that on the two continents it still inhabits, its range is fragmented and in the individual areas the species exists through different and well-differentiated (eight) subspecies (Kitchener et al., 2017). Despite its extensive range, the leopard is today a globally vulnerable species according to the categorization of the International Union for Conservation of Nature (Red List Status: VU - Vulnerable, A2cd (IUCN version 3.1) (Stein et al., 2015).

The Fore-Asian (Caucasian) subspecies of the leopard *Panthera pardus tuliana* Valenciennes 1856 is still found in Transcaucasia in Georgia, Armenia and Azerbaijan, as well as in Russia in the North Caucasus. These are the regions that are geographically closest to the Balkan Peninsula and the territory of Bulgaria.

According to Stein & Hayssen (2013) the species arose 0.47-0.85 Mya ago in Africa. Later (about 0.17-0.30 Mya) it migrated to Asia. The oldest (3.5 Mya) reliable leopard fossils came from the Laetoli site in Tanzania. The oldest fossils in Asia were found in Iran (Siwalik site) and dated 2.0 Mya. Werdelin et al. (2010) state that the oldest leopard remains in Africa are dated about 2 Mya, and those of Eurasia came from 1 Mya.

## Material and Methods

For the first time, an attempt has been made to summarize and present completely the archaeological and paleozoological direct and indirect evidences for the former presence of the leopard in today's Bulgarian lands. Some ancient depictions and monuments are analyzed and the paleontological localities of the species are presented. For each of them, data on their locations and dating are presented.

## Results and Discussion

### *Former distribution in Europe*

In Europe the earliest known fossils are dated 0.6 Mya (the mid Middle Pleistocene) (Ghezzo & Rook, 2015). In the Pleistocene in the north the leopard reached as far as Derbyshire (United Kingdom). The Province of Berlin (Germany) marks other northern limit in Europe. The deposits of Pleistocene leopards are most numerous in the periphery of the Alps, both to the north and to the south of the mountain massif. It is the same with the deposits around the Pyrenees in Spain and France. The leopard also penetrated the Apennine Peninsula and its spread to the south is documented to the Province of Rome (Italy). Data of Fischer (2000) show that the leopards inhabited a total of 18 (out of a total of 44) countries in Europe: Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, France, Georgia, Germany, Great Britain (including Gibraltar), Greece, Hungary, Italy, Portugal, Serbia, Slovenia, Spain, and the Netherlands. At least six sites, the Naciekowa, Obok Wschodniej, Radochowska, and Wschodnia Caves from the Sudety Mountains and the Biśnik and Dziadowa Skała Caves from the Kraków-Częstochowa Upland, have documented the presence of the leopard in Poland between MIS 10/9 and MIS 3. (Marciszak et al., 2011, 2022; Krajcarz et al., 2014). As summarized by Marciszak et al. (2022) the Pleistocene history of *P. pardus* in Europe has been documented from 312 localities.

Diedrich (2013) lists four Pleistocene leopard subspecies in Europe: *Panthera pardus begoueni* (Fraipont, 1923), *Panthera pardus sickenbergi,* Schütt, 1969, *Panthera pardus antiqua* (Cuvier, 1835), and *Panthera pardus spelaea* Bächler, 1936. The oldest lived 0.6 Mya, and the youngest (*P. p. spelaea*) appeared at the beginning of the Late Pleistocene. It survived until about 0.024 Mya in some parts of Europe (Diedrich, 2013).

After Diedrich (2013) in the mid Middle Pleistocene in Europe appeared *P. p. sickenbergi* around 0.6 Mya. Schütt (1969) and Khalaf-von Jaffa (2013) assume that *P. p. sickenbergi* in Europe was replaced by the modern form in the Middle Pleistocene. *P. p. sickenbergi* is considered “a member of a fully interglacial forest fauna” (Khalaf-von Jaffa, 2013: p. 6).

In addition a new subspecies *Panthera pardus vraonensis* Nagel, 1999) was described from Holocene deposits of Attica (Southern Greece), dated 9375±1105 BP (Bachmayer et al., 1988) and 0.025-0.007 Mya (Diedrich, 2013). The last author considered *P. p. vraonensis* a younger synonym of *P. p. spelaea.*

The youngest European leopard records came from Ukraine (1st c. AD) and Italy (Sommer & Benecke, 2006). These authors note that the question on the natural distribution of *P. pardus* in the sub-Atlantic in Europe remains unresolved.

It is believed that the last European Ice Age leopards (*P. p. spelaea*) survived in Europe until 0.025-0.024 Mya (Diedrich, 2013; Paijmans et al., 2018). The Iberian Peninsula was the last European refuge for the species (Marciszak et al., 2022). Paijmans et al.

(2018) found a deep split between African and Eurasian lineages (~0.71 Mya), with European ancient samples being sister to all Asian lineages (~0.48 Mya).

At present in Europe the leopard (*P. p. tulliana*) survived only in the North Caucasus.

### *Panthera pardus spelaea* on the Balkans and Western Anatolia

So far, 15 Quaternary localities of leopards are known from the Balkan Peninsula. Pleistocene bones of *P. p. spelaea* were excavated in 7 localities in Greece: (1) Loutra Arideas Bear Cave – Macedonia (Tsoukala et al., 2006; Symeonidis et al., 1980); (2) Vraona Cave – Attica (Fischer, 2000; Diedrich, 2013; Symeonidis et al., 1980; Nagel, 1999); (3) Petralona Cave – Chalkidiki (Baryshnikov & Tsoukala, 2010); (4) Dryos Cave - Eastern Macedonia and Thrace (Diedrich, 2013; Georgiadou-Dikaioulia et al., 2002); (5) Klisoura Cave - Western Peloponnese (Koumouzelis et al., 2001); (6) Apidima Cave - Mani Peninsula (Fischer, 2006; Diedrich, 2013) and (7) Kitseli karst - Alea, Nemea, Peloponnese (Diedrich, 2013). Bone remains and partial skeletons have been excavated also in Serbia in (8) Baranica II Cave – south-eastern Serbia (Dimitrijevic, 2011); and Bosnia and Herzegovina in (9) Vjetrenica Cave - southern Bosnia and Herzegovina (Diedrich, 2013; Miculinic, 2012).

Holocene records of leopard remains are known also from: Greece - Vraona Cave – Attica (Symeonidis et al., 1980), Montenegro - Crvena Stijena (March et al., 2017), and Late Pleistocene (Paleolithic) from Romania - Northern Dobrudja (Ştefan & Dumitraşcu, 2022). After Spassov and Stoytchev (2005) "The supposition that it inhabited South-Eastern Europe until the Holocene is indirectly supported by the discovered Neolithic and Eneolithic figurines of leopards in Bulgaria and Romania." (Spassov & Stoytchev, 2005: p. 13).

Recently in the neighboring Turkey after Başkaya et al. (2022) 84 new records (of *P. p. tulliana*) were obtained from 54 localities, most of them from the northeastern parts of the country, i.e. the spread of the species has been conclusively proven.

Late Pleistocene Anatolian records came from Karain Cave - SW Anatolia (Diedrich, 2013).

### Fossil record of *Panthera pardus* in Bulgaria

The fossil record of *P. pardus* in Bulgaria came from two Late Pleistocene localities, one in northern, and the other in southern Bulgaria (Fig. 1).

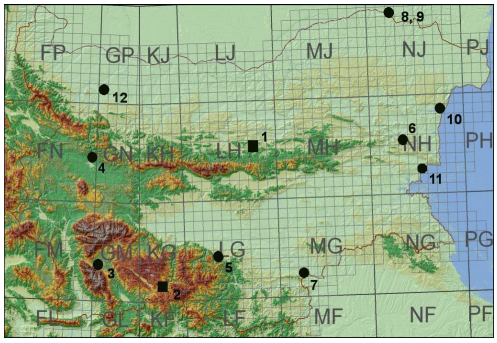


**Fig. 1.** Location of the Pleistocene sites of *Panthera pardus* and the prehistoric and ancient monuments of leopard images in Bulgaria: Squares – fossil record: Bacho Kiro Cave (1), Triagalnata Cave (2); Circles – archaeological monuments: Eleshnitsa (3), Gnilyane (4), Dolnoslav (5), Golyamo Delchevo (6), Mezek (7), Silistra (8, 9), Varna (10), Nesebar (11), Gradeshnitsa (12).

The first remains of leopards in the country have been uncovered in the

Bacho Kiro Cave (near town of Dryanovo, Gabrovo Province). They are dated to the Late Pleistocene (47,000 - 29,000 BP) (Wiszniowska, 1982). In 2019 Nikolay Spassov (NMNHS - BAS) identified new finds (limb bones) of *P. pardus* in this cave.

In 1997 in the Triagalnata Cave in the Western Rhodopes Mts. (near the village of Borino, Smolyan Province) were found mandibles of two leopards (male and female). They have been dated to the Late Glacial age (15,570±310 BP), ones of the youngest finds of *P. p. spelaea* in Europe (Spassov & Raychev, 1997). Based on detailed comparisons of teeth as well as other features, the authors found that "Rhodopean" leopard completely fitted the characteristics of previously known Mediterranean leopards. These authors believe that at least the eastern Mediterranean leopards were identical to those of the Middle East and probably belonged to the same subspecies.

## *Panthera pardus* in the monuments of prehistoric and ancient art in Bulgaria

### *Panthera pardus* in the prehistoric (Neolithic and Chalcolithic) monuments

At the beginning of the 1980s, a ceramic figurine depicting a leopard was excavated in the area of "Delnitsi" near the village of Eleshnitsa (vicinity of town of Razlog, Blagoevgrad Province) in the valley of the Mesta River (Fig. 2). It is dated 6000 BC (Early Neolithic) (Nikolov & Maslarov, 1987). The figure is so realistic that it is believed that the ancient sculptor was well acquainted with the depicted large predator. According to the authors, only the front part of the sculpture (head and neck) was found. "The ancient sculptor skillfully depicted the characteristic features of the head of this predator. To a high degree, this is due to the successfully modeled nose and the eyes elongated into slits. The mouth is represented slightly open. The ears are elongated to the sides and upwards. The animal's expression shows attention, tension. The head was covered with a red engobe of which only traces have survived. The same goes for decorating with white paint. Remains of it can be seen in the mouth (probably the teeth of the predator were shown) and also around the eyes (probably the spotted fur of the leopard was depicted)" (Nikolov & Maslarov, 1987: p. 10-11). The authors state that no other Neolithic figurines of leopards are known in that part of the Balkans. After them in Asia Minor and Anatolia, the cult of the leopard is attested from the early Neolithic and continued until the Iron Age (6$^{th}$ – 2$^{nd}$ millennium BC). Commentary: The statuette fragment undoubtedly represents a carnivore mammal of the cat family. Characteristic features in habit such as coloration, limb proportions, length and shape of ears of (theoretically) possible species exclude caracal *Caracal caracal* (Schreber, 1776), serval *Leptailurus serval* (Schreber, 1776), lynx *Lynx lynx* (Linnaeus, 1758), tiger *Panthera tigris* (Linnaeus, 1758), cheetah *Acinonyx jubatus* (Schreber, 1775) and wildcat *Felis silvestris* Schreber, 1777. The statuette of the head has the greatest similarity with a lion (lioness) *Panthera leo* (Linnaeus, 1758) and a leopard. The patterns, which can be seen as marks on the head, have served archaeologists as proof that it is a leopard. We can only tentatively accept this. It seems less likely to depict a female lion (lioness) than a leopard.

Another miniature statuette of a (presumed) leopard (Fig. 3) was found in the Okol Glava Locality, near the former village of Gnilyane (now part of the

town of Novi Iskar, Sofia Province), dated 3000-1900 BC, i.e. from the late Neolithic (referred to s. c. Kurilo culture) (Spassov & Raychev, 1997).

**Fig. 2.** Leopard figurine head from Eleshnitsa village. Early Neolithic (after Nikolov & Maslarov, 1987).

After these authors "The eyes of the depicted beast of prey from Gnilyane are specially emphasized. They are big and bulging, typically feline. The proportions are those of a large felid - rather those of a leopard - without even a hint of a lion mane." (p. 86). Commentary: The statuette fragment appears eroded and particular details on it are difficult to discern. A relatively small head set on a thick neck is noticeable. The maxillary part of the skull is relatively short. This at least distinguishes it from the canids and approaches to the felids. Determining the species affiliation of this find is quite speculative.

"Images of leopard were also found in Slatino (in the Struma Valley), and in the lowest layer of the settlement mound in Sedlare (in the Arda Valley) a female ceramic statuette "sits" on an inlay, which in Anatolia scholars always interpret like leopard skin. In all three cases the connection with Hajilar and Çatalhüyük, where the cult of this animal existed for quite long period (VII-II millennium BC), is beyond any doubt." (Nikolova & Genov, 2013: p. 274).

**Fig. 3.** ?Leopard figurine head from Gnilyane. Late Neolithic (town of Novi Iskar; after Spassov & Raychev, 1999).

In Bulgarian archaeozoology the locality near Slatino village is known with its bone remains of European lion *Panthera leo persica* (Meyer, 1826). The site is dated the end of the early Chalcolithic (middle of the 5th millennium BC (Ninov, 1989). Commentary: Despite the published information about images of leopards from the vicinity of the Slatino village, the images themselves have not been published and we cannot comment on

the reliability of their identification as leopards.

After Raduncheva (1994) for now, only one female statuette dressed in leopard skin is known from Bulgarian lands. It was discovered in the Chalcolithic production center near the mentioned above Sedlare village, Kardzhali region. Commentary: Despite the published information about images of leopards from the vicinity of the Sedlare village, the images themselves have not been published and we cannot comment on the reliability of their identification as leopards.

"In some of the temples of Dolnoslav, altars reminiscent of the outline of the "cat's" head were found. In one of the temples, a three-meter figure of a lying leopard was cleared. Despite the large schematization of the image, the small dimples covering the back of the animal allowed us to identify its species affiliation [as leopard - Z. B.]." (Raduncheva, 1994). "That is why the presence of leopard figurines and relief images of the same animal in a temple complex, such as the one near the village of Dolnoslav, is of great importance." (Raduncheva, 1994). Radiocarbon dating 5530 and 5480 ± 60 BP confirm the reference to Late Chalcolithic (Boyadzhiev, 1992). Commentary: Unfortunately, we could not come across any published images of the analyzed finds. Undoubtedly, "a three-meter figure of a lying leopard" would be of great interest, but at this stage any comments would be unwarranted. Another publication by Raduncheva & Koleva (1987) presents a fragment of a miniature ceramic statuette representing the head of a large felid - lion or leopard (Fig. 4). Deliberately placed dots (round dark spots) are noted at least on the lower jaw. There is one in the area of the nose and another under the left eye. The sickle-shaped depiction of the left eye matches the leopard's short cross-eyed black belt. The slope of the snout and the straight section of the left mandible also correspond to those of the leopard. The resemblance to a leopard cannot be completely ruled out. It even seems plausible.

**Fig. 4.** Ceramic sculpture (fragment) of the head of a large felid from Dolnoslav. Late Chalcolithic (after Raduncheva & Koleva, 1987).

An impressive statuette of a big cat (Fig. 5) was found in the settlement mound next to the village of Golyamo Delchevo, Varna region. "The paws, the tail and especially the decoration of the statuette from Ploska Mogila speak for the belonging of the depicted specimen to the group we are interested in. The graphite decoration applied to the body gives reason to assume that this is an animal with banded skin decoration. Therefore, we believe that it may be an image of a tiger. The statuette from Golyamo Delchevo is a specimen with an unprecedentedly good and accurate rendering of the facial features and the silhouette of the entire figure (Raduncheva, 1994: p. 48). Commentary: The first cervical vertebra of a lion was also found in the Neolithic settlement near Golamo Delchevo. The leopard in this locality has not been identified by

bone remains (Ivanov & Vasilev, 1975). The proportions of the head, the position of the forelegs, the length and roundness of the posterior part of the body and the inception of the tail (which is not preserved) point to a large felid. The most likely possible species are leopard and lion. Definitely not an adult male lion with a mane. A leopard is more likely to be depicted.

"In the museum in the city of Vratsa, a large clay vessel is preserved, the upper part of which is decorated with highly schematic images of leopards, which are repeated rhythmically over the entire circumference of the vessel 13." (Fig. 6). "They are used as a decorative motif." (Raduncheva, 1994: p. 48). Commentary: In fact, it is a find from the 5th millennium BC from Gradeshnitsa (Pleven region) (Nikolov, 1974). The rounded head, the spotting of the whole body with circular black dot-like spots, the two front legs (also completely spotted) are clearly visible. The body is slender, but the front legs are not elongated as in the cheetah. It is not excluded that a decorative motif was depicted, in which images of a leopard were also included.

**Fig. 5.** Statuette of a leopard from Golyamo Delchevo (Varna Region). Neolithic (after Raduncheva, 1994).

According to Spassov & Raychev (1997), the Neolithic images of leopards suggest that during the Neolithic it still inhabited Bulgarian territory.

**Fig. 6.** Stylized image of a leopard. Gradeshnitsa. 5th millennium BC (after Raduncheva, 1994).

***Panthera pardus* in the historic (Antiquity) monuments**

In the decorating of the red-figured bell-shaped crater (Fig. 7) from Milkova Mogila near Mezek village (Haskovo Province), dated end of 2nd quarter of 4th c. BC after Lazarov (1990) the "second satyr, bearded, naked, slung on left thigh leg leopard skin, in profile to right" (Lazarov, 1990: p. 110). Commentary: The curve of the posterior part of the tail, its rounded tip, as well as the evenly spaced round dotted black markings on the light background of the skin match those of the leopard.

Another bell-shaped krater (vessel) of 360-340 BC, found in 1958 in the necropolis of Messambria (now Nesebar), depicts Dionysus semi-recumbent on a bed covered with leopard skin. About another red-figured crater (Fig. 8), dated 4th c. BC Bakalova-Delijska (1960) mentions "a young maenad, … clothed

in leopard skin (p. 254)", "the tossed leopard skin with heavily flared ends (p. 254)", and "bed covered with leopard skin (p. 258)". Commentary: Regardless of the (bad) quality of the illustration (Fig. 8), two details are clearly visible - the light background of the skin with the dark point-like spots (some of which have a light central part), as well as the skin of the skinned two legs (?forelegs) of the animal.

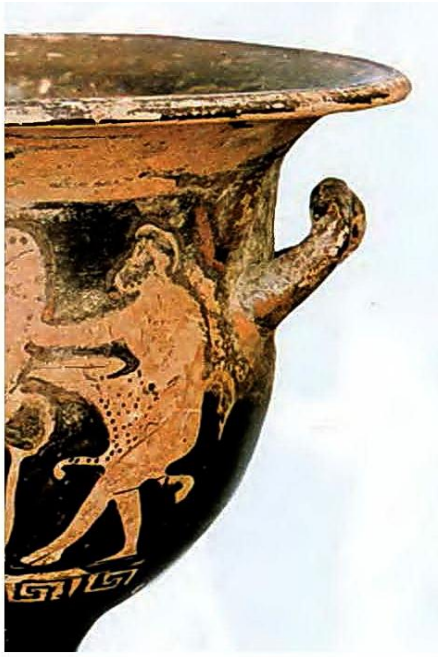

**Fig. 7.** Red-figured bell-shaped crater from Milkova Mogila near Mezek village. End of 2nd quarter of 4th c. BC. (Haskovo Province; After Lazarov, 1990).

However, this plot, as noted by Lazarov (1990), was very widespread in the Hellenistic world in antiquity. It is quite common on the ancient painted ceramics in Bulgaria. Commentary: The leopard skins were a widespread detail in the pictures representing the life of the ancient Hellenes. This means (regardless of the reliable identification of the skins as leopard skins) that in our case this ancient monument from Nessebar could not have any relation to the past distribution of the leopard in Bulgaria.

In one of the most significant monuments of Roman art in Bulgaria, the late antique Roman tomb in Silistra (dated the middle of the 4th c. AD; during the reign of Emperor Theodosius, 379-395 AD) on the vault we find realistic depictions of leopards (Fig. 9). According to Georgi Alexandrov (unpubl. data), this plot is often present in the iconography of Roman art as a certificate of noble origin, power and might. However, no one doubts the presence of leopards on Bulgarian lands, brought from the Roman provinces of Asia Minor and Syria. After (Atanasov, 2014) "… on the vault four times [the owner of tomb – Z.B.] is … shown … while hunting leopard, boar, bear, and birds." (p. 17). Commentary: The round head, the rounded ears, the short muzzle, the position of the forelegs, the clear dotted dark markings on the body point to a leopard. On the other hand, the elongated nasal part is characteristic of canids rather than felids. There are other images in this ancient monument that most archaeologists identify as leopards.

An excellently preserved bronze statuette of a leopard (Fig. 10) is found in the same Roman tomb in Silistra. It has been identified by archaeologists as leopard. Commentary: The powerful body, the strong legs, the long curved tail ending without a tassel like a lion's tail, as well as the markings on the body (although not dots, but elongated) point to the leopard.

"Completely in the spirit and aesthetics of "Developed Style" is one of the most impressive engravings among the early graffito ceramics from Bulgaria. The vessel [from Varna – Z.B.] is wide open and the entire inner plane is occupied by a figure of a running leopard." (Fig. 11).

**Fig. 8.** Red-figured crater of necropolis of Nessebar. 4th c. BC (after Bakalova-Delijska, 1960).

**Fig. 9.** Image of ? a leopard from a sgraffito fresco on the ceiling of a Roman tomb in the city of Silistra. Middle of the 4th century AD (after Atanasov, 2014).

"The silhouette is engraved with a fine line, the spots are recreated by multi-

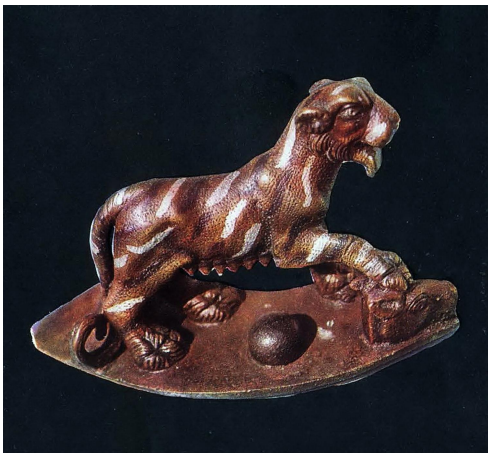

**Fig. 10.** Statuette from a chariot of a noble Roman from Durostorum representing a leopard. Late 3rd - early 4th century (after Atanasov, 2014).

ple concave points, the head is comparatively small, and the animal has a wide open mouth and a prominent tongue. The strong ones legs and strong neck emphasize the physical power of the predator. The body ends with a long tail, the tip of which is shaped like a palm tree. The image is made with exceptional skill, a sense of proportion and movement plasticity." (Manolova-Voikova, 2003: p. 215). This monument is dated 2nd half of 11th to 12th c. AD. Commentary: The image is highly stylized. The contours of individual parts of the body are depicted by arcs. The mottling of the body is carefully represented by arranged black spots on a light (white) background. The head is also highly stylized, but the animal's right eye, two ears, upper and lower jaw, teeth and tongue are well distinguished. The two front legs are thin and strongly elongated. They look more like the legs of a cheetah. However, the vertical black patch over the eyes is very characteristic of the cheetah, which is clearly absent here. Of the hind legs of the image, only their upper (proximal, femoral) part is

preserved. The dating (11th -12th c.) in itself shows that it is not a depicted animal, delivered from nature. This monument also has nothing to do with clarifying the past distribution of the leopard in Bulgaria.

**Fig. 11.** Pottery ceramics from Varna. Middle of 12th c. AD. (after Manolova-Voikova, 2003).

In the "Great Lavra" Monastery in the town of in Veliko Tarnovo a clay candlestick was found. It has "… a heraldic image on the bottom of a clay vessel - two leopards facing each other, and between them - a stylized double-headed eagle..." (Popov, 1983: p. 118). Commentary: The find is dated 12th c. AD. The publication for this monument contains no illustration, but its dating clearly indicates that it could not serve the purposes of the present study.

## Conclusions

From the presented data for 2 Pleistocene sites, 6 prehistoric (Neolithic and Chalcolithic) and 8 historical (antique and medieval) monuments, it can be concluded that the leopard existed in Bulgaria until the end of the Pleistocene (until about 15,000 years ago). So far, there is no irrefutable evidence of its existence during the Holocene (Neolithic and Chalcolithic), despite the assumptions made in the literature about this. Some of the examined prehistoric monuments (Eleshnitsa, Dolnoslav, Golyamo Delchevo) probably represent statuettes of leopards, but most of the later images from antiquity were most likely borrowed from the southern provinces of the Roman Empire and cannot serve as evidence for the distribution of the leopard in Bulgaria in the historical times. So far, no leopard bone remains have been found in Neolithic and Chalcolithic settlements in the country, but lion remains have been found in a number of sites. As noted above, other researchers state that the leopard could inhabited South Eastern Europe until the Holocene (Spassov & Raychev, 1997).

The analysis also showed something else: the archeozoological and art history literature in Bulgaria is to a certain extent "contaminated" by arbitrary interpretations of archaeologists or specialist in arts, which probably distorts our ideas about the past distribution of some animals. In such cases, the relevant finds (archaeological monuments) must be re-examined by zoologists, taking into account characteristic morphological details in habitus of animals, as well as their fossil/subfossil record.

## References

Atanasov G. 2014. *The Roman tomb in Durostorum - Silistra. Silistra, Bulgaria: Bulgartransgaz.* pp. 1-32. (in Bulgarian).

Bachmayer F., Malez V., Symeonidis N., Theodorou G., Zapfe H. 1988. Die Ausgrabung in der Hohle von Vraona (Attika) im Jahre 1985. *Sitzungsberichte der Akademie der Wissenschaften mathematisch-naturwissenschaftliche Klasse,* 197: 287-307.

Bakalova-Delijska M. 1960. Trouvailles de ceramique du littoral occidental

de la Mer Noire. *Bulletin de L'Institute d'Archeologie,* 23: 353-260. (in Bulgarian, French summary).

Baryshnikov G., Tsoukala E. 2010. New analysis of the Pleistocene carnivores from Petralona Cave (Macedonia, Greece) based on the Collection of the Thessaloniki Aristotle University. *Geobios,* 43: 289-402.

Başkaya Ş., Arpacik A., Sari A., Gündoğdu E. 2022. New records of the Anatolian leopard (*Panthera pardus tulliana* Valenciennes 1856) in Turkey. *The European Zoological Journal,* 89 (1): 991-1001, DOI: 10.1080/24750263.2022.2105963.

Boyadzhiev Y. 1992. The transition between the Eneolithic and the Bronze Age in the light of radiocarbon dating. *Arheologiya BAS,* 2: 51-52. (in Bulgarian, English summary).

Chatzopoulou K. 2005. The Small Mammal Fauna from the Loutra Aridea Bear Cave (Pella, Macedonia, Greece) with Emphasis on the Third Chamber. *Neue Forschungen zum Hohlenbaren in Europa,* 45: 57-64.

Diedrich C. G. 2013. Late Pleistocene leopards across Europe – northernmost European German population, highest elevated records in the Swiss Alps, complete skeletons in the Bosnia Herzegowina Dinarids and comparison to the Ice Age cave art. *Quaternary Science Reviews,* 76: 167-193. DOI: 10.1016/j.quascirev.2013.05.009.

Dimitrijevic V. 2011. Late Pleistocene hyaena *Crocuta crocuta spelaea* (Goldfuss, 1823) from Baranica Cave (Southeast Serbia): competition for a den site. In: Toskan, B. (Ed.). *Fragments of Ice Age environments. Proceedings in Honour of Ivan Turk's Jubilee.* Ljubljana, Slovenia, pp. 69-84.

Fischer K. 2000. Ein Leoparden - Fund, *Panthera pardus* (L., 1758), aus dem jungpleistozänen Rixdorfer Horizont von Berlin und die Verbreitung des Leoparden im Pleistozän Europas. *Mitteilungen aus dem Museum für Naturkunde in Berlin, Geowissenschaftliche Reihe,* 3: 221-227.

Georgiadou-Dikaioulia E., Symeonidis N. K., Theodorou G. E. 2002. *Palaiontologia, Spondylota. Part C.* University of Athens, Greece. (in Greek).

Ghezzo E., Rook L. 2015. The remarkable *Panthera pardus* (Felidae, Mammalia) record from Equi (Massa, Italy): taphonomy, morphology, and paleoecology. *Quaternary Science Reviews,* 110 (110): 131-151. DOI: 10.1016/j.quascirev.2014.12.020.

Ivanov S., Vasilev V. 1975. Studies of the animal bone material of the prehistoric settlement mound near Golyamo Delchevo. In: Todorova H., Ivanov, St., Vasilev, V., Hopff, M., Kwitta, K., Koll, G. (Eds). *Settlement mound near Golyamo Delchevo. Razkopki i prouchvaniya,* 5: 245- 302 (In Bulgarian).

Khalaf-von Jaffa N. 2013. Der Europäische Leopard (*Panthera pardus sickenbergi,* Schütt 1969). Gazelle. *The Palestinian Biological Bulletin,* 102: 1-17.

Kitchener A. C., Breitenmoser-Würsten C., Eizirik E., Gentry A., Werdelin L., Wilting A., Yamaguchi N., Abramov A.V., Christiansen P., Driscoll C., Duckworth J. W., Johnson W., Luo S.-J., Meijaard E., O'Donoghue P., Sanderson J., Seymour K., Bruford M., Groves C., Hoffmann M., Nowell K., Timmons Z., Tobe S. 2017. A

revised taxonomy of the Felidae: *The final report of the Cat Classification Task Force of the IUCN Cat Specialist Group. Cat News (Special Issue),* 11: 73-75.

Koumouzelis M., Ginter B., Kozłowski J. K., Pawlikowski M., Bar-Yosef O., Albert R. M., Lityńska-Zając M., Stworzewicz E., Wojtal P., Lipecki G., Tome, T., Bochenski Z. M., Pazdur A. 2001. The Early Upper Paleolithic in Greece: The Excavations in Klisoura Cave. *Journal of Archaeological Science,* 28, 515-539.

Krajcarz M. T., Krajcarz M., Marciszak A. 2014. Paleoecology of bears from MIS 8-MIS 3 deposits of Biśnik Cave based on stable isotopes (513C, 518O) and dental cementum analyses. *Quaternary International,* 326-327: 114-124.

Lazarov M. 1990. *Antique painted ceramics in Bulgaria.* Sofia, Bulgaria: Balgarski Hudozhnik Publishing House, 143 p. (in Bulgarian).

Manolova-Voikova M. 2003. Early graffiti pottery from Varna. *Bulletin du Musée National de Varna,* 34-35 (49-50) 1998-1999: 208-225.

March R. J., Whallon R., Morley M. W. 2017. Chapter 18. Studying Neanderthal Fire Structures from Crvena Stijena. In: Whallon, R. (Ed.). *Crvena Stijena in Cultural and Ecological Context.* Multidisciplinary Archaeological Research in Montenegro. National Museum of Montenegro. Montenegrin Academy of Sciences and Arts. Podgorica, Montenegro, pp. 340-449.

Marciszak A., Krajcarz M.T., Krajcarz M., Stefaniak K. 2011. The first record of leopard *Panthera pardus* Linnaeus, 1758 from the Pleistocene of Poland. *Acta Zoologica Cracoviensia,* 54A (1-2): 39-46.

Marciszak A., Lipecki G., Gornig W., Matyaszczyk L., Oszczepalińska O., Nowakowski D., Tala S. 2022. The first radiocarbon-dated remains of the leopard *Panthera pardus* (Linnaeus, 1758) from the Pleistocene of Poland. *Selected Papers from the 3rd Radiocarbon in the Environment Conference, Gliwice,* Poland, 5-9 July 2021. Radiocarbon, 64 (6): 1359-1372. DOI:10.1017/RDC.2022.33

Miculinic K. 2012. Fossil remains of leopard (*Panthera pardus*) from Vjetrenica Cave, Popovo polje, BiH (PhD thesis). Zagreb, Bosnia and Herzegovina: Zagreb University.

Nagel D. 1999. *Panthera pardus vraonensis* n. ssp., a new leopard from the Pleistocene of Vraona/Greece. *Neues Jahrbuch für Geologie und Paläontologie Monatshefte,* 1999 (3): 129-150. DOI: 10.1127/njgpm/1999/1999/129.

Nikolov B. 1974. *Gradeshnitsa.* Sofia, Bulfaria: Nauka i izkustvo Publishing House. 143 p. (in Bulgarian).

Nikolov V., Maslarov K. 1987. *Ancient settlements near Eleshnitsa.* Sofia, Bulgaria: Sofia Press Publishing House. 18 p. (in Bulgarian).

Nikolova R., Genov N. 2013. *1000 pages Bulgaria.* Sofia, Bulgaria. Ciela Norma AD. Multiprint. 1008 p. (in Bulgarian).

Ninov L. 1989. Remains of a lion in the Bulgarian lands. *Arheologiya BAS,* 2: 55-60. (in Bulgarian).

Paijmans J., Barlow A., Förster D., Henneberger K., Meyer M., Nickel B., Nagel D., Worsøe Havmøller R., Baryshnikov G., Joger U.,

Rosendahl W., Hofreiter M. 2018. Historical biogeography of the leopard (*Panthera pardus*) and its extinct Eurasian populations. *BMC Evolutionary Biology,* 18 (156): 1-12. DOI: 10.1186/s12862-018-1268-0

Popov A. 1983. Excavations of the "Great Lavra" in Veliko Tarnovo. In: Velkov, V. (Chief Ed.). Archaeological Discoveries and Excavations in 1982. Summaries. Archaeological Institute with Museum - BAS. Directorate "Museums" - KK. District Council for Culture — Pleven. "KIN" Directorate. Pleven, Bulgaria, pp. 117-119. (in Bulgarian).

Raduncheva A. 1994. “Big Cats“ in Prehistoric Religion Reconsidered. In: Borisov, B. (Ed.). Maritsa - East. *Archaeological studies.* 2: 47-50. (in Bulgarian, English summary).

Raduncheva A., Koleva B. 1987. The riddle of the village of Dolnoslav. *Kurorti,* 4: 28-29. (in Russian).

Schütt G. 1969. *Panthera pardus sickenbergi* aus den Maurer Sanden. *Neues Jahrbuch für Geologie und Paläontologie Abhandlungen,* 5: 299-310.

Sommer R. S., Benecke N. 2006. Late Pleistocene and Holocene development of the felid fauna (Felidae) of Europe: a review. *Journal of Zoology*, 269: 7-19.

Spassov N., Raychev D. 1997. Late Wurm *Panthera pardus* Remains from Bulgaria: the European Fossil Leopards and the Question of the Probable Species Survival until the Holocene on the Balkans. *Historia naturalis bulgarica,* 7: 71-96.

Spassov N., Stoytchev T. 2005. In the shadow of the cave lion and other cats: leopards and snow leopards in the prehistoric rock art of Europe, Caucasus and Central Asia. *Annuary of Department of Archaeology - New Bulgarian University,* 6: 5-15.

Ştefan V., Dumitraşcu V. 2022. Zooarchaeological analysis of the faunal remains from the Palaeolithic site of La Adam Cave (Dobrogea, SE Romania) – new data from recent excavations. In: Materiale şi cercetãri arheologice (Serie nouã), H-S 2021. Scripta praehistorica. Miscellanea in honorem Mariae Bitiri dicata. pp. 361-372; doi: 10.3406/mcarh.2021.2217.

Stein A., Hayssen V. 2013. *Panthera pardus* (Carnivora: Felidae). *Mammalian Species,* 45 (900): 30-48.

Stein A. B., Athreya V., Gerngross P., Balme G., Henschel P., Karanth U., Miquelle D., Rostro-Garcia S., Kamler J. F., Laguardia A., Khorozyan I., Ghoddousi A. 2015. Panthera pardus. The IUCN Red List of Threatened Species 2016. https://www.researchgate.net/publication/308899520_Panthera_pardus_The_IUCN_Red_List_of_Threatened_Species_2016 (Accessed on 04.02.2023).

Symeonidis N., Bachmayer F., Zapfe H. 1980. Ergebnisse weiterer Grabungen in der Höhle von Vraona (Attika, Griechenland). Annales Gaeologiques des Pays *Hellaeniques Athaenes,* 30: 291-299.

Werdelin L., Yamaguchi N., Johnson W. E., O'Brien S. J. 2010. Phylogeny and evolution of cats (Felidae). In: Macdonald, D. M., Loveridge, A. (Eds.) *The Biology and Conservation of Wild Felids*. Oxford: Oxford University Press, pp. 59-82.

Wiszniowska T. 1982. Carnivora. In: 1982. Kozłowski, J. K. (Ed.).

Excavation in the Bacho Kiro Cave (Bulgaria). Final Report. Państwowe Wydawnictwo Naukowe. Warszawa, pp. 52-55.

Tsoukala E., Bartsiokas A., Chatzopoulou K., Lazaridis G. 2006. Quaternary mammalian remains from the Kitseli Pothole (Alea, Nemea, Peloponnese). Scientific Annals, School of Geology. Aristotle University of Thessaloniki (AUTH). Thessaloniki. Special volume 98: 273-284.

Received: 03.04.2023
Accepted: 22.08.2023

Bulletin of the Natural History Museum - Plovdiv
*Bull. Nat. Hist. Mus. Plovdiv, 2023, vol. 8: 15-23*

# *The Woolly Mammoth Mammuthus primigenius (Blumenbach, 1799) (Elephantidae Gray, 1821) in the Pleistocene in Bulgaria - A Review*

**Zlatozar N. Boev***

National Museum of Natural History, Bulgarian Academy of Sciences,
1 Tsar Osvoboditel Blvd., 1000 Sofia, BULGARIA
*Corresponding author: boev@nmnhs.com; zlatozarboev@gmail.com

**Abstract.** The study presents for the first time summarized data on the presence of the Woolly Mammoth remains in Bulgaria from literature data, published in the last 144 years. The exact dates of the appearance and disappearance of the species in the country remain unknown. All the 31 published localities outlined the species presence between 90,000 and 26,000 BP. The majority (74 %) of the localities were situated between 20 and 250 m.a.s.l. in the Bulgarian lowlands and plains. The maximum altitude of the localities is 555 m a.s.l. The total number of the known finds exceeds 300.

**Key words:** Pleistocene megafauna, Proboscideans, Fauna impoverishment, Quaternary extinctions, Balkan environment.

## Introduction

The Woolly Mammoth, *Mammuthus primigenius* (Blumenbach, 1799), is the most common species of the late Pleistocene megafauna of the mammoth steppe biome and the largest Quaternary land animal of Holarctic. Its lineage arose in northeast Siberia (Beringia) and its ancestor is the steppe mammoth - *Mammuthus trogontherii* (Pohlig, 1885) (Kurten, 2007; Lister & Sher, 2015). The Woolly Mammoth appearance in Europe after 200 ka is a result of a migration from the east (Stuart et al., 2002).

At the height of its distribution it was spread on three continents - Europe, Asia and North America. The Woolly Mammoth survived until 3,700 BP (Lister & Bahn, 2007; Vartanyan *et al.*, 2008; Krzemiñska *et al.*, 2010).

In the Pleistocene the territory of Bulgaria was part of its range on the Balkans. After Álvarez-Lao *et al*. (2009) and Ma *et al*. (2021) the southern species' range border in the SE Europe passed through Balkans (the southeast parts of Bulgaria) and the southern Pyrenees.

The most detailed information about the species in Bulgaria is presented by Markov (pers. comm.), who revised most of the preserved remains and summarized that *M. primigenius* in Bulgaria is known with "over ten finds" from 6 localities: Burgas, Zaraevo, Slivo Pole, Ryahovo, Cherepish and Parvomay. The author claims that "finds of *M. primigenius* in Bulgaria are usually single - without accompanying fauna, with unclear stratigraphy and, accordingly, of unknown age". ... (p. 163). "Separate teeth and a few mandibles, mainly from North Bulgaria, demonstrate the presence of the species in the country. Again, these are isolated finds without other fauna, and the ineres-

ting problem of the last occurrence of this species in Bulgaria remains unresolved." (Markov, pers. comm.: p. 145).

After Popov (1929a) in Bulgaria "mammoth remains were found in many places (Ruse, Popovo, Markovcha (pr. Markovo) village, Karlukovo village, Burgas, etc.)". Bakalov (1932) reports on Woolly Mammoth's remains found near Burgas, Aytos, Novi Pazar, Haskovo, etc. Nikolov (1963) summarizes that remains of Woolly Mammoth in Bulgaria have been uncovered in the regions of Sofia, Lom, Svishtov, Ruse, Yambol, Plovdiv and many other places. Fuchs (1879) and Petz (1879) after Nikolov (1977) described fossils of *M. primigenius* from the vicinities of Stara Zagora[1] and Yambol.

All these scattered data show that the distribution of the Woolly Mammoth in Bulgaria has not been the subject of a special study until now. The aim of the present study is to provide the records of the Woolly Mammoth remains in literature.

**Material and Methods**

In the present study is given a review of all available data on remains of the Woolly Mammoth in Bulgaria. For each site brief data on the location, approximate altitude, age (dating) and records, years and leaders of the excavations, as well as the source of the published data are presented (Table 1).

The chronostratigraphy follows Cohen *et al*. (2013; Mya): Gelasian 2.588-1.800 (covering parts of the former Late Pliocene - Early Pleistocene); Calabrian 1.800-0.774 (Early Pleistocene); Chibanian 0.770-0.129 (Middle Pleistocene); Upper Pleistocene 0.129-0.0117 (Late Pleistocene); Greenlandian 0.0117-0.0082 (Early Holocene); Northgrippian 0.0082-0.0042 (Middle Holocene); and Meghalayan 0.0042-0.0001 (Late Holocene).

**Results and Discussion**

Markova *et al*. (2010) state that "In the Last Glacial Maximum (LGM), the mammoth was widely distributed throughout most of Europe except the Iberian Peninsula, the Apennine Peninsula, the Balkan Peninsula, and the Crimea Peninsula." (p. 482). It is obvious that this author did not have the data from Bulgaria and the other Balkan (southern) countries. Gromov & Baranov (1981) clearly state that the mammoth range included Crimea and Tanscaucasia. Other authors (Álvarez-Lao *et al*., 2009 and Ma *et al*. 2021) also support such a statement.

Collected data presented here mark that *M. primigenius* was present in the Bulgarian fauna in the Calabrian, Chibanian and the Upper Pleistocene, covering a period, approx. 90,000 - ?26, 000 BP (Table1).

A part of the localities (Table 1), are listed without specifying their exact locations. This is because we follow available published data. Thus, it turns out that for Bulgaria there are reports in the literature about records of *M. primigenius* in at least 31 localities.

Obviously, the woolly mammoth disappears from the fauna of Bulgaria during the late Pleistocene. "The lack of dated remains leaves the question of the exact time of the species' extinction unresolved." (Markov, pers. comm.: p. 192).

As is shown in Fig. 1 all the 31 localities are located in the lowlands and plains - the Danube Plain, the Upper Thracian Plain, the Burgas Lowland and the Sofia Valley. Several localities in the northwestern Bulgaria are found in the mountain foothills - in the Pre-Balkan. It makes an impression that the species has not yet been established in the

[1] In his publication Nikolov (1977) mistakenly names "Nova Zagora" as "Stara Zagora".

southwestern part of the country. This distribution is a result of the specific orography of Bulgaria - the southwestern half is mostly mountainous and unfavorable for the woolly mammoths.

**Table 1.** Localities of fossil/subfossil bone remains of *Mammuthus primigenius* in Bulgaria.

| No | Locality | Location/ Province | Altitude a.s.l. (m) | Age | Identification, type and number of finds | Years and leaders of excavations | References |
|---|---|---|---|---|---|---|---|
| 1. | Samuilitsa Cave | Near Kunino v. (Vratsa P.) | ca. 360 | Middle-Late Paleolithic (90 000 – 42 000 BP) | *Elephas primigenius*: "teeth" | 1956-1959, N. Djambazov | Djambazov (1981) |
| 2. | Temnata Dupka Cave | Near Karlukovo v. (Lovech P.) | 250 | Middle - Late Paleolithic (31,900-13,600 BP) | *Elephas primigenius*: "many bones"; „bones and teeth"; "a few enamel plates from a molar; a tusk fragment and a small milk tooth"; „bones" | 1938, R. Popov; 1982, N. Sirakov | Popov (1925, 1926, 1928, 1929b, 1931a, b, 1935, 1936, 1938); Mikov (1926) Beron *et al.* (2006) |
| 3. | Ryahovo | Near Ryahovo v. (Ruse P.) | 21 | Middle-Late Pleistocene | *Mammuthus primigenius*: "left m3, right m3, right m3, left m3, right m3" | unknown | Markov (pers. comm.) |
| 4. | Kozarnika Suhi Pech Cave | Near town of Belogradchik Vidin P. | 481 | Late Pleistocene (31,000 - 26,000 BP) | *Mammuthus primigenius*: 19 finds; "unidentified tooth" | 1996-2005, N. Sirakov, J.-L. Guadelli | Guadelli *et al.* (2005); Fernandez (2009); Sirakov *et al.* (2010, 2012) |
| 5. | Markovo | Boshkov Dol Locality, Near Markovo (Markovcha) v. (Shumen P.) | 275 | Late Pleistocene | *Elephas primigenius*: "a complete skeleton" | 1908, unknown | Popov (1920; 1929b); Poppow (1913) |
| 6. | Burgas | Burgas City (Burgas P.) | 30 | Late Pleistocene | *Elephas primigenius*: "single bones and teeth"; *Mammuthus primigenius*: "right semimandible with m3, together with a fragment of the left m3" | unknown | Anonym. (1901); Popov (1929a); Bakalov (1932); Bakalov & Nikolov (1964); Markov (pers. comm.) |
| 7. | "Karlukovo caves" (Prohodna Cave, Svirchovitsa Cave) | Near Karlukovo v. (Vratsa P.) | 250 | Late Pleistocene | *Elephas primigenius*: "single bones and teeth" | unknown | Nikolov (1977, 1983); Popov (1929a) |
| 8. | Pesht Cave | Near Staro Selo (Vratsa P.) | ca. 330 | Late Pleistocene | Mammoth: "fragments of a tusk" | 1951-1953, N. Dzhambazov | Dzhambazov (1952) |
| 9. | Navasen | Near Navasen v. (Haskovo P.) | 96 | Pleistocene | *Elephas primigenius*: "one well-preserved fossilized molar; part of a tusk" | 1932, D. Ivanov | Anonym. (1932) |
| 10. | Ovcharitsa River bank | Near Troyanovo-2 Mine (Stara Zagora P.) | 105 | Pleistocene | Mammoth: "tusk" | 1976. D. Komitov | Radichev (1976) |
| 11. | Popovo | Near town of Popovo (Targovishte P.) | 210 | Pleistocene | *Elephas primigenius*: "single bones and teeth" | 1923, D. Dobrev | Anonym. (1923); Popov (1929a) |
| 12. | Golyamata Peshtera | Near Veliko Tarnovo (Veliko Tarnovo P.) | 230 | Pleistocene | *Elephas primigenius*: "small fragments of lobe bones; right lower jaw; several fragments of left mandible; canine tooth; fragment of a molar; more than 200 tusk fragments; main part of tusk; atlas; body of cervical vertebra; 6 processi transversi and processi spinosi; more than 50 fragments of ribs (Costae); broken humerus; three carpal bones (Ossa carpi); two bones from the fingers (Phalanges); several fragments of a third phalanx (Phalanx tertia)". | 1900-1909, R. Popov | Poppow (1913); Nikolov (1977, 1983); Beron *et al.* (2006) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 13. | Mladenova Propast | Near Chiren v. (Vratsa P.) | 311 | Pleistocene | *Elephas* (*Mammuthus*) *primigenius*; no data | 1964, I. Nikolov | Nikolov (1977, 1983); Beron *et al.* (2006) |
| 14. | Zaraevo | Near Zaraevo v. (Targovishte P.) | 299 | Pleistocene | *Mammuthus primigenius*: "left and right semimandible with m1 sin. et dext." | unknown | Markov (2004, pers. comm.) |
| 15. | Slivo Pole | Near Slivo Pole v. (Ruse P.) | 23 | Pleistocene | *Mammuthus primigenius*: "right m3; left m3, right m3" | unknown | Markov (2004, pers. comm.) |
| 16. | Cherepish | Near R/W station Cherepish, near Lyutibrod v. (Vratsa P.) | 215 | Pleistocene | *Mammuthus primigenius* | unknown | Nikolov (1969); Markov (2004, pers. comm.) |
| 17. | Parvomay | Near town of Parvomay (Plovdiv P.) | 134 | Pleistocene | *Mammuthus primigenius*: "a fragment of m3d" | unknown | Bakalov & Nikolov (1964); Markov (2004, pers. comm.) |
| 18. | Pirgovo | Near Pirgovo v. (Ruse P.) | 68 | Pleistocene | *Elephas primigenius*: "remains" | 1890 | V (1896) |
| 19. | Ruse | Ruse City (Ruse P.) | 45 | Pleistocene | *Elephas primigenius*: "single bones and teeth" | 1895 | V (1896); Popov (1929a); Nikolov (1963) |
| 20. | Chervena Voda | Near Chervena Voda v. (Ruse P.) | 134 | Pleistocene | *Elephas primigenius*: "mammoth teeth" | 1892 | V (1896) |
| 21. | Harmanli | Near town of Harmanli (Haskovo P.) | 60 | Pleistocene | *Elephas primigenius*: "one well-preserved fossilized molar; part of a tusk; large leg bone" | 1931-1932 | Anonym. (1932) |
| 22. | Nova Zagora | Near town of Nova Zagora (Sliven P.) | 196 | Pleistocene | *Elephas meridionalis*: no data; *Elephas* (*Mammuthus*) *primigenius*: no data | unknown | Fuchs (1879); Nikolov (1977) |
| 23. | Yambol | Yambol City (Yambol P.) | 114 | Pleistocene | Mammoth: No data; *Elephas* (*Mammuthus*) *primigenius*: No data | unknown | Fuchs (1879); (1879); Nikolov (1963) |
| 24. | Aytos | Near town of Aytos (Burgas P.) | 95 | Pleistocene | *Elephas primigenius*: no data | unknown | Bakalov (1932) |
| 25. | Novi Pazar | Near town of Novi Pazar (Shumen P.) | 156 | Pleistocene | *Elephas primigenius*: no data | unknown | Bakalov (1932) |
| 26. | Haskovo | Haskovo City (Haskovo P.) | 203 | Pleistocene | *Elephas primigenius*: "two tusks" | unknown | Bakalov (1932) |
| 27. | Lom | Near town of Lom (Montana P.) | 20 | Pleistocene | Mammoth; no data | unknown | Nikolov (1963) |
| 28. | Sofia | Sofia City (Sofia City P.) | 555 | Pleistocene | Mammoth; no data | unknown | Nikolov (1963) |
| 29. | Svishtov | Near town of Svishtov (Veliko Tarnovo P.) | 88 | Pleistocene | Mammoth; no data | unknown | Nikolov (1963) |
| 30. | Plovdiv | Near Plovdiv City (Plovdiv P.) | 164 | Pleistocene | Mammoth; no data | unknown | Nikolov (1963) |
| 31. | Unknown locality | - | - | - | *Mammuthus primigenius*: right m3 | unknown | Markov (pers. comm.) |

Therefore, it is interesting to note here that the data from Bulgaria do not support the presented distribution map of the species by Álvarez-Lao *et al.* (2009), which shows that in the Balkans its range reached the Aegean Sea, but it is unknown why the Balkan Black Sea Coast remained outside it (Fig. 8, p. 67).

## Conclusions

The presented data confirm that the territory of Bulgaria was part of the woolly mammoth's distribution range during Pleistocene. The species was common in the largest plains and lowlands, at least in the late Pleistocene. The exact dates of the appearance and disappearance of the species in the country remain unknown. All the 31 published localities outlined the species presence at least between 90,000 and 26,000 BP. The majority (74 %) of the localities were situated between 20 and 250 m.a.s.l. The maximal localities altitude is 555 m a.s.l. The total number of the known records exceeds 300.

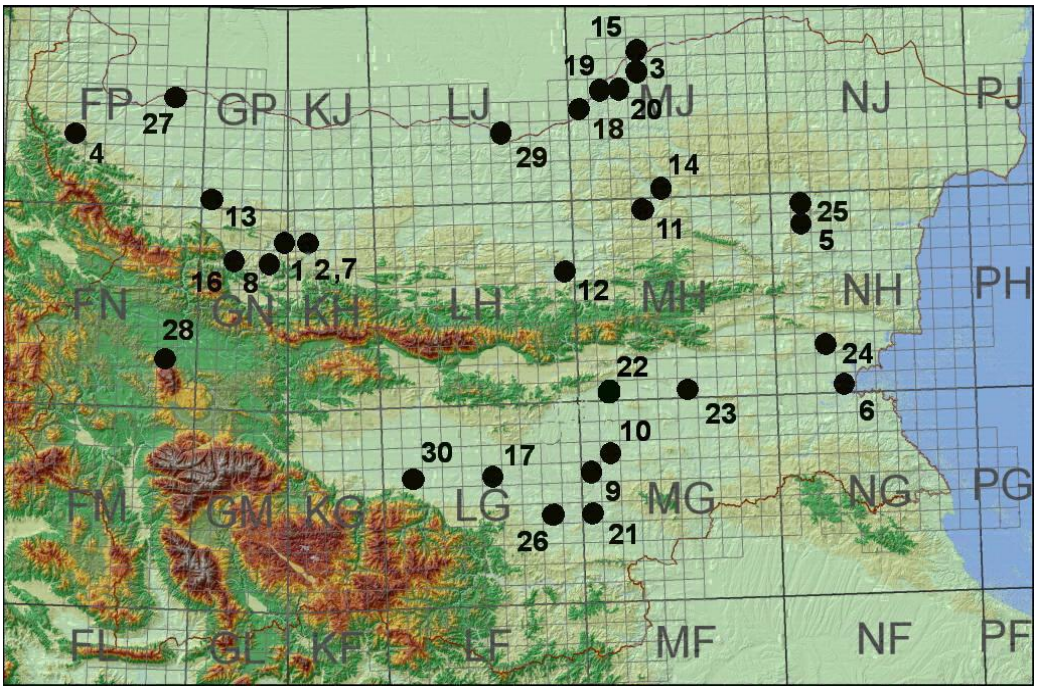


**Fig. 1.** Distribution of the Woolly Mammoth *(Mammuthus primigenius)* in the Pleistocene in Bulgaria (ref. to Table1): Samuilitsa Cave (1), Temnata Dupka Cave (2), Ryahovo (3), Kozarnika Suhi Pech Cave (4), Markovo (5), Burgas (6), "Karlukovo caves" (Prohodna Cave, Svirchovitsa Cave) (7), Pesht Cave (8), Navasen (9), Ovcharitsa River bank (10), Popovo (11), Golyamata Peshtera (12), Mladenova Propast (13), Zaraevo (14), Slivo Pole (15), Cherepish (16), Parvomay (17), Pirgovo (18), Ruse (19), Chervena Voda (20), Harmanli (21), Nova Stara Zagora (22), Yambol (23), Aytos (24), Novi Pazar (25), Haskovo (26), Lom (27), Sofia (28), Svishtov (29), Plovdiv (30).

For a significant part of the localities reported in the literature (18 out of a total of 31), there is no data on their specific location, as well as on the nature of the finds. However, the data collected here allow for the first time to outline the former general distribution of the woolly mammoth in Bulgaria, a key territory of the Balkan Peninsula and the periphery of the species range.

The first information about the species in Bulgaria was published 144 years ago (Fusch, 1879). It is apparent that all finds except those confirmed by Markov (pers. comm.) need to be revised in light of modern understandings of the composition of the genus *Mammuthus* Brookes, 1828 and the distribution of species within it. Unfortunately, the majority of these materials are now lost, their whereabouts are unknown, and they cannot be revised.

It is possible that some of the reports in the last century were misidentified and belonged to other species of the genus *Mammuthus* such as *M. rumanus* (Stefanescu, 1924), *M. meridionalis* (Nesti, 1825), *M. trogontherii* (Pohlig, 1881), reported for the country by Markov (pers. comm.), as well as of *M. intermedius* (Jourdan, 1861). However, any suggestion in this

direction would be speculative today. The information collected and presented here reflects the real state of the problem in Bulgaria at the present time.

Thus, at first glance, the present review is belittled. However, it is necessary to compile a comprehensive view of the state of study of the species, a research that has not been done so far.

As seen, the distribution of the mammoth has never been the subject of a specific research. Bearing in mind the wide distribution of the species and its large body size, which make it extremely advantageous in terms of taphonomy, there is no doubt that this scarce information will be supplemented to compile a more detailed picture of the appearance, distribution and disappearance of this species in the country.

**Acknowledgements**

The author thanks three anonymous reviewers for helpful comments and recommendations on earlier versions of the manuscript.

**References**

Álvarez-Lao D. J., R.-D. Kahlke, N. García, D. Mol. 2009. The Padul mammoth finds - On the southernmost record of *Mammuthus primigenius* in Europe and its southern spread during the Late Pleistocene. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 278: 57-70.

Anonym. 1901. Remains of prehistoric animals in Burgas region. *Priroda*, 2-3: 53. (in Bulgarian).

Anonym. 1923. Remains of Woolly Mammoth *Elephas primigenius* in Popovsko. *Priroda*, 3: 46. (in Bulgarian).

Anonym. 1932. New find of Woolly Mammoth in the region of Harmanli. *Priroda i nauka*, 2: 30. (in Bulgarian).

Bakalov P. 1932. The elephant in Bulgaria. *Priroda i nauka*, 1: 2-3 (in Bulgarian).

Bakalov P., I. Nikolov. 1964. Pleistocene mammalian fauna from Bulgaria. *Bulletin of the Geological Institute, Ser. Paleontology*, 6, 189-207. (in Bulgarian).

Beron P., T. Daaliev, A. Jalov. 2006. *Caves and Speleology in Bulgaria*. Pensoft Publishers, Sofia, 507 p.

Cohen K.M., S.C. Finney, P.L. Gibbard, J.-X. Fan. 2013. 2020. The ICS International Chronostratigraphic Chart. Episodes, 36: 199-204.

Djambazov N. 1981. Cultures prehistoriques en Bulgarie. In: Georgiev G., Cicikova, M. (Ed.), Ossements d'animaux. *Bulletin de I'Institut d'Archeologie*, 36: 54-57.

Dzhambazov N. 1952. New Paleolithic locality in Bulgaria. – the Pesht Cave. *Priroda i znanie*, 7: 19-21. (in Bulgarian).

Fernandez Ph. 2009. Mammalian dynamics and palaeoecological analysis during the Pleistocene in Kozarnika Cave Bulgaria. In: Gatsov I. Guadelli J.-L. (Eds.), *Saxa Loquuntur, Collected Works Honoring Nikolay Sirakov's 65th anniversary*. Avalon Publ. House, Sofia, pp. 59-73.

Fuchs Th. 1879. Über neue Vorkommnisse fossiler Säugetiere von Jeni Saghra (Rumelien) und von Ajnacskö in Ungarn, nebst einigen allgemeinen Bemerkungen über die sogenannte pliocäne Säugetierfauna. *Verhandlungen der k. k. geologischen Reichsanstalt*. Wien. 3: 49-59.

Gromov I., G. Baranov. (Eds.) 1981. *Catalogue of the Mammals of the Soviet Union (Pliocene-Present)*.

Nauka, Leningrad, 456 p. (in Russian).

Guadelli J.-L., N. Sirakov, S. Ivanova, S. Sirakova, E. Anastassova, P. Courtaud, I. Dimitrova, N. Djabarska, P. Fernandez, C. Ferrier, M. Fontugne, D. Gambier, A. Guadelli, D. Iordanova, N. Iordanova, M. Kovatcheva, I. Krumov, J.-C. Leblanc, J.-B. Mallye, M. Marinska, V. Miteva, V. Popov, R. Spassov, S. Taneva, N. Tisterat-Laborde, T. Tsanova. 2005. Une sequence du paléolithique inférieur au paléolithique récent dans les Balkans: la grotte Kozarnika à Orechets Nord-Ouest de la Bulgarie. In: Molines N., Moncel M.-H. & Monnier J.-L. (Eds.), *British Archaeological Reports, International Series*, 1364: 87-103.

Krzemiñska A., K. Stefaniak, J. Zych, P. Wojtal, G. Skrzypek, A. Mikolajczyk, A. Wiśniewski. 2010. A Late Pleistocene woolly mammoth from Lower Silesia, SW Poland. *Acta zoologica cracoviensia*, 53A(1-2): 51-64.

Kurten B. 2007. *Pleistocene Mammals of Europe*. Aldine Transaction A Division of Transaction Publishers, New Brunswick, London. 317 p.

Lister A. M., P. G. Bahn. 2007. *Mammoths, Giants of the Ice Age*. Frances Lincoln Limited Publishers, London, 192 p.

Lister A. M., Sher A. V. 2015. Evolution and dispersal of mammoths across the Northern Hemisphere. *Science*, 350 (6262): 805-809.

Ma J., Y. Wang, G. Baryshnikov, D. G. Drucker, K. McGrath, H. Zhang, H. Bocherens, Y. Hu. 2021. The *Mammuthus-Coelodonta* Faunal Complex at its southeastern limit: A biogeochemical paleoecology investigation in Northeast Asia. *Quaternary International*, 591: 93-106.

Markov G. (pers. comm.). 2004. *The fossil proboscideans (Proboscidea, Mammalia) of Bulgaria*. PhD thesis of Zoology. National Museum of Natural History, BAS. 225 p.

Markov G. 2004. The fossil proboscideans of Bulgaria and the importance of some Bulgarian finds - a brief review. *Historia naturalis bulgarica*, 16:139-150.

Markova A. K., Puzachenko A. Yu Plicht J., van der Kolfschoten T., Ponomarev D. V. 2010. New Data on the Dynamics of the Mammoth *Mammuthus primigenius* Distribution in Europe in the Second Half of the Late Pleistocene–Holocene. *Doklady Akademii Nauk - Earth Sciences*, 431(4): 470-483.

Mikov V. 1926. Caves and precipices between Iskar and Vit rivers. *Estestvoznanie i geographiya*, 7-8: 236-249. (in Bulgarian).

Nikolov I. 1963. Valuable finds of large mammals. *Pogled*, 11.08.1963. (in Bulgarian).

Nikolov I. 1969. Find of *Mammuthus primigenius* near Cherepish r/w station. *Bulletin of the Geological Institute, Ser. Paleontology*, 18, 105-110. (in Bulgarian, English and German summary).

Nikolov I. 1977. Review of the cave fossil fauna of Bulgaria and future problems. In: Dinev L., Panayotov, T. & Popov, N. (Eds.), *Spelelogy. Proceedings of the Speleological Conference, Held on 10 December 1976, Organised by the Bulgarian Academy of Sciences, and Bulgarian Touristic Union - Bulgarian Speleological Federation.* Bulgarian Academy of Sciences, Sofia, pp. 98-101. (in Bulgarian).

Nikolov I. 1983. Some notes on the cave fossil mammalian fauna in Bulgaria. In: Dinev L. (Ed.), *Fourth European Regional Conference on Speleology, September 1980, Sofia*. pp. pp. 215-218. (in Bulgarian).

Petz A. 1879. *Fossile Säugetiere von Baltavar jahro k.* - Ungarischen Geologischen Reichsanstalt, Budapest. S. 248 p.

Popov R. 1920. The prehistoric man of the Paleolithic epoch. *Estestvoznanie i geografiya*, 1 2: 1-40. (in Bulgarian).

Popov R. 1925. New findings of the prehistoric man in Bulgaria. *Priroda*, 3-4: 33-34. (in Bulgarian).

Popov R. 1926. The Temnata Doupka Cave near Karlukovo. *Balgarski turist*, 1: 5-8. (in Bulgarian).

Popov R. 1928. *Culture and life of the prehistoric man in Bulgaria*. Part I. Stone Epoch. Bulgarian Archaeological Institute, Sofia, 64 p. (in Bulgarian).

Popov R. 1929a. *The man of the Ice Epoch in Europe.* Sofia. Hudozhnik Printing House, 80 p. (in Bulgarian).

Popov R. 1929b. *Prehistorical Bulgaria*. Hristo Danov Publ. House, Sofia, 76 p. (in Bulgarian).

Popov R. 1931a. Temnata Dupka – a new locality of the Paleolithic in Bulgaria. *Izdaniya na Narodniya archeologiceski muzey v Sofia*. State Printing House, Sofia, 148 p. (in Bulgarian).

Popov R. 1931b. Importance of our caves for our cultural history. *Niva*, 3 (43): 6-7. (in Bulgarian).

Popov R. 1935. The cave as a repository of paleontological material. *Priroda i nauka,* 8-9: 126-128. (in Bulgarian).

Popov R. 1936. Fossil and subfossil animal remains in the explored until now caves in Bulgaria. *Bulletin de la Societe Speleologique de Sofia*, 1: 1-12. (in Bulgarian).

Popov R. 1938. Oldest human remains in Bulgaria. *Rodina*, 1: 66-117. (in Bulgarian).

Poppow R. 1913. Beitrag zur Kenntnis der Diluvialfauna Bulgariens. *Spisanie na Balgarskata akademiya na naukite*, 7: 115-142+ 8 plts. (in Bulgarian, German summary).

Radichev S. 1976. Nahodka na 500 000 godini. *Anteni*, 33/13.08.1976. (in Bulgarian).

Sirakov N., J.-L. Guadelli, S. Ivanova, S. Sirakova, M. Boudadi Maligne, I. Dimitrova, P. Fernandez, C. Ferrier, A. Guadelli, D. Iordanova, N. Iordanova, M. Kovatcheva, I. Krumov, J.-C. Leblanc, V. Miteva, V. Popov, R. Spassov, S. Taneva, T. Tsanova. 2010. An ancient continuous human presence in the Balkans and the beginnings of human settlement in western Eurasia: A Lower Pleistocene example of the Lower Palaeolithic levels in Kozarnika Cave (Northwestern Bulgaria). *Quaternary International*, 223-224: 94-106.

Sirakov N., J.-L.Guadelli, S. Sirakova, A. Guadelli, S. Taneva, I. Krumov, I. Dimitrova, N. Zahariev. 2019a. The Paleolithic cave site of Kozarnika: transition from middle to upper Paleolithic. In: Popov, H. (Ed.), *Archeological Discoveries and Excavations in 2018.* BAS, National Archaeological Institute with Museum. Sofia. Bulged OOD Publishing House. pp. 1-3. (in Bulgarian, English summary).

Sirakov N., J.-L. Guadelli, S. Sirakova, S. Ivanova, Ph. Fernandez, S. Taneva, A. Guadelli, V. Miteva, I. Krumov, I. Dimitrova, R. Spasov. 2012. Bulgarian-French studies of Palaeolithic dwellings in Kozarnika Cave. In: Gurova, M (Ed.), *Archaeological Discoveries and*

*Excavations in 2011*. Avangard Publishing House, Sofia. pp. 27-29.

Sirakov N., T. Tsanova, J.-J. Hublin, S. Sirakova, S. McPherron, I. Krumov, R. Spasov, N. Zahariev, E. Anasstassova, H. Fewlas. 2019b. The Bacho Kiro Cave: transition from late middle Paleolithic through middle/upper Paleolithic. In: Popov, H. (Ed.), *Archeological Discoveries and Excavations in 2018*. BAS, National Archaeological Institute with Museum. Sofia. Bulged OOD Publishing House. pp. 4-6. (in Bulgarian, English summary).

Stuart A.J., L.D. Sulerzhitsky, L.A. Orlova, Y.V. Kuzmin, A.M. Lister. 2002. The latest woolly mammoths (*Mammuthus primigenius* Blumenbach) in Europe and Asia: a review of the current evidence. *Quaternary Science Reviews*, 21: 1559-1569.

V. 1896. Mammoth's bones in the Ruse vicinity. *Priroda*, 10: 153. (in Bulgarian).

Vartanyan S.L., K.A. Arslanov, J.A. Karhu, G. Possnert, L.D. Sulerzhitsky. 2008. Collection of radiocarbon dates on the mammoths (*Mammuthus primigenius*) and other genera of Wrangel Island, northeast Siberia, Russia. *Quaternary Research*, 70: 51-59.

Received: 15.04.2023
Accepted: 05.07.2023

Bulletin of the Natural History Museum - Plovdiv
*Bull. Nat. Hist. Mus. Plovdiv, 2023, vol. 8: 25-35*

# *Past and Present Distribution of the Greater Flamingo (Phoenicopterus roseus Pallas, 1811) (Phoenicopteridae Bonaparte, 1831) in Bulgaria*

**Zlatozar N. Boev***

National Museum of Natural History, Bulgarian Academy of Sciences,
1 Tsar Osvoboditel Blvd., 1000 Sofia, BULGARIA
*Corresponding author: boev@nmnhs.com; zlatozarboev@gmail.com

**Abstract.** At least a total of 73 observations of the greater flamingo in Bulgaria have been recorded between 1864 and 2023, 69.2 % of which have been done in autumn-winter. The species has been observed in no less than 17 localities, 9 of which are located along the Bulgarian Black Sea coast. The largest number of flamingos observed at a single locality (Atanasovsko Lake) exceeds 3000 birds. Burgas wetlands (Atanasovsko Lake, Pomoriysko Lake, Poda Protected Area) are the most often visited sites in the country. In the spring of 2023 the flamingos attempted breeding (nest constructing) in Atanasovsko Lake.

**Keywords:** Water birds, Endangered birds, Birds of coastal lagunes, Changes in avian phenology.

## Introduction

In the recent European avifauna, the greater flamingo (*Phoenicopterus roseus* Pallas, 1811) is a Tertiary relict. The oldest fossil record of flamingoes (*Phoenicopterus* spp.) on the Balkan Peninsula originates from the Late Miocene of Pikermi, Greece (Mlíkovský, 2002).

The present conservation status of the greater flamingo is globally "Least Concern". It is an aquatic bird, mainly occuring in brackish and saline wetlands in three zoogeographical realms – Afrotropical, Indomalayan, and Palearctic (BirdLife International, 2022; Salvador et al., 2022).

Most of present territory of Bulgaria lies out of the recent breeding species' range (Salvador et al., 2022). The aim of the present study is to summarize and analyze all published data from the country, as well as available unpublished observations of Bulgarian and foreign ornithologists about distribution of the greater flamingo in Bulgaria from the beginning of ornithological studies until 2023.

The species is considered as "Endangered" in the "Red Book of PR of Bulgaria" (Boev, 1985). Michev (1990) refers greater flamingos in Bulgaria as *Phoenicopterus ruber roseus* Pallas, 1811, a taxon that is now regarded as *Phoenicopterus roseus roseus* Pallas, 1811 (Dickinson & Remsen, 2013).

## Material and Methods

An attempt to check and gather all scattered data on the species' observations in the country is made since the earliest publications of 19th century of foreign explorers. Brief data on the observed birds, number, date, the age of individuals, localities and references of all observations are provided, divided in

five groups according to bird phenology: (1) spring migration (1 March - 19 April), (2) breeding season (egg laying – 20 April – 15 May; chick hatching – 15 May – 15 August), (3) autumn migration (16 August - 30 October), (4) wintering (1 November – 29 February) (after Cramp & Simmons, 1977), and (5) untimed observation (Table1).

It should be noted that, in addition to the data collected here from published reports, a number of other data (with varying degrees of precision, some with limited access) are available, most of which coincide with the main localities of the species presented in the article. For seasonal species' occurrence we used data of Ebird (2023). The accessible data of the Bulgarian Society for the Protection of Birds (BSPB) have been used also. Most of the observations made by the experts of the BSPB are regularly published online in various news site in the Internet. They are cited here under the names of the corresponding observers. Often the same observation was reported multiple times at different sites. In such cases, we have presented these data in the Table. 1 only once.

**Table 1.** Observations of the greater flamingo in Bulgaria (1864-2023).

| No | Date | Locality | Region | Observed birds | Reference |
|---|---|---|---|---|---|
| | | | **Spring migration (1 March – 19 April)** | | |
| 1. | 24.03.1912 | near town of Svishtov | Veliko Tarnovo Region | 1 | Wallis (1913) |
| 2. | 28.03.1981 | Atanasovsko Lake near Burgas City | Burgas Region | 1 | Nankinov & Darakchiev (1981) |
| 3. | 28.03.1912 | Near Sofia | Sofia Region | 1 | Wallis (1913) |
| 4. | 10.04.2023 | Atanasovsko Lake near Burgas City | Burgas Region | ~600 including 80 nesting | BSPB (2023a) |
| 5. | 18.04.2023 | Atanasovsko Lake near Burgas City | Burgas Region | ~600 including 80 nest constructing | [Mladenov] 2023 |
| | | | **Breeding period (20 April – 15 August)** | | |
| 6. | 26.04.1991 | Fishponds near Yambol City | Yambol Region | 9 | Nankinov & Kirilov (1992) |
| 7. | 26.04.2022 | Shabla Lake | Dobrich Region | >29 | Krasteva (2022) |
| 8. | May 1966 | Alepu Marsh near town of Sozopol | Burgas Region | 5 | Nankinov & Darakchiev (1981) |
| 9. | End of May 1992 | northern part of Atanasovsko Lake near Burgas | Burgas Region | 300 | Nankinov & Kirilov (1992) |
| 10. | Spring, 2022 | Shabla Lake | Dobrich Region | ~ | Nikolova (2022) |
| 11. | 29.05.2017 | Poda Protected Area | Burgas Region | ~ | Vladimyr Deryabin |
| 12. | spring, 1965 | Nanevska Tuzla (Taukliman) | Dobrich Region | ~ 10 | Slavinski (1973); Boev (1982) |
| 13. | spring, 1890 | Iskar River between the villages Kumanitsa and Vrazhdebna | Sofia Region | 4 | Hristovich (1893); Vasilev (1953); Boev (1982) |
| 14. | spring and summer, 1981 | Salt Farms, Atanasovsko Lake near Burgas City | Burgas Region | 1 juv. | Boev (1982) |
| 15. | 17.08.2019 | Atanasovsko Lake near Burgas City | Burgas Region | 30 | P. Iankov (unpubl. data) |
| 16. | 19.08.2019 | Atanasovsko Lake near Burgas City | Burgas Region | 159 (120 ad., 39 juv.) | Kehayova (2019) |
| 17. | 20.08.2023 | Atanasovsko Lake near Burgas City | Burgas Region | 15 | Z. Boev (unpubl. data) |
| 18. | 25.08.2023 | Atanasovsko Lake near Burgas City | Burgas Region | 338 | BSPB (2023b) |
| 19. | late August 2019 | Atanasovsko Lake near Burgas City | Burgas Region | 160 | Kehayova (2022) |
| 20. | Breeding season | Mandra-Poda Lake Complex near Burgas City | Burgas Region | 1-4 | Kostadinova & Gramatikov (2007) |
| | | | **Autumn migration (16 August – 30 October)** | | |
| 21. | 01.09.1990 | Valley between towns of Aytos and Kameno | Burgas Region | ~1500 | Nankinov & Kirilov (1992) |
| 22. | 03.09.1981 | Atanasovsko Lake near Burgas City | Burgas Region | 1 ad. | Boev (1982); Vatev (1991) |

| | | | | | |
|---|---|---|---|---|---|
| 23. | 09.09.2022 | Pomoriysko Lake | Burgas Region | ~3000 | Suknarov (2022) |
| 24. | 16.09. - 15.10.2014 | Atanasovsko Lake near Burgas City | Burgas Region | 2 juv. | Valcheva (2014) |
| 25. | 17.09.2019 | Studen Kladenets Reservoir | Kardzhali Region | 13 | BSPB (2019) |
| 26. | 20.09.1984 | Atanasovsko Lake near Burgas City | Burgas Region | 1 | Michev (1998) |
| 27. | 21.09.1999 | Atanasovsko Lake near Burgas City | Burgas Region | 1 juv. | Michev et al. (2004) |
| 28. | 24.09.1959 | Persina Nature Reserve (Persina Island in Danube River) | Pleven Region | 6 | Paspaleva-Antonova (1961); Boev (1982); Vatev (1991) |
| 29. | 26.09.1981-01.1982 | Atanasovsko Lake near Burgas City | Burgas Region | 1 | Michev (1997, 1998) |
| 30. | 29.09. 1981 | near Burgas | Burgas Region | 1 ad. | Vatev (1991) |
| 31. | 20.09.1984 | Atanasovsko Lake near Burgas City | Burgas Region | 3 | P. Arsov (Michev, 1997; Michev et al., 2004) |
| 32. | 1st week, October 2020 | Burgas Lake | Burgas Region | 1300 | Anonym (2020) |
| 33. | 01.10.1982 | near Burgas | Burgas Region | 1 juv. | Vatev (1991) |
| 34. | 10.10.2017 | Studen Kladenets Reservoir | Kardzhali Region | 53 (14 ad., 39 juv.) | [Hristov, H.] (2017b); Anonym. (2017b) |
| 35. | 11.10.2017 | Atanasovsko Lake near Burgas City | Burgas Region | 38 | [Kolev] (2017) |
| 36. | 15.10.1986 | near Burgas | Burgas Region | 1 juv. | Vatev (1991) |
| | | **Wintering period (1 November – 29 February)** | | | |
| 37. | 09.11.2021 | Shabla Lake | Dobrich Region | 8 (2 ad., 6 juv.) | [Iliev, M.] 2021 |
| 38. | 09.11.2022 | Pomoriysko Lake | Burgas Region | 1400 | Suknarov (2022) |
| 39. | 15.11.2022 | Pomoriysko Lake | Burgas Region | ~ | Bedrosyan (2022) |
| 40. | 10.11.2001 | Atanasovsko Lake near Burgas City | Burgas Region | 1 juv. | Michev et al. (2004) |
| 41. | 11.11.2018 | Atanasovsko Lake near Burgas City | Burgas Region | 134 | Uzunov (2018) |
| 42. | 12.11.2022 | Atanasovsko Lake near Burgas City | Burgas Region | ~ 2300 | [Tsenova] (2022) |
| 43. | 19.11.2014 | Atanasovsko Lake near Burgas City | Burgas Region | 2 ad., 3 juv. | Chaleva (2014) |
| 44. | 19.11.1932 | an island in Maritsa River near town of Simeonovgrad | Haskovo Region | 6 | Patev (1950), Vasilev (1953); Boev (1982) |
| 45. | 26.11.2020 | Atanasovsko Lake near Burgas City | Burgas Region | 1646 | Kehayova (2021) |
| 46. | November 2020 | Atanasovsko Lake near Burgas City | Burgas Region | 785 | Kehayova (2021) |
| 47. | November 2016 | Studen Kladenets Reservoir | Kardzhali Region | 7 | [Hristov] (2017b) |
| 48. | 20.12.1962 | Atanasovsko Lake near Burgas City | Burgas Region | 6 | Boev (1982) |
| 49. | 20.12.1970 | near Burgas | Burgas Region | 1 | Johnson & Biber (1971); Johnson (1989), cited after Vatev (1991) |
| 50. | 30.12.2021-01.01.2022 | Atanasovsko Lake near Burgas City | Burgas Region | ~20 ad., ~ 12 juv. | Z. Boev (unpubl. data) |
| 51. | 31.12.2022 | Atanasovsko Lake near Burgas City | Burgas Region | ~90 | Z. Boev (unpubl. data) |
| 52. | 31.12.2022 | Pomoriysko Lake near town of Pomorie | Burgas Region | ~15 | Z. Boev (unpubl. data) |
| 53. | Winter | Mandra-Poda Complex near Burgas City | Burgas Region | 0-5 | Kostadinova & Gramatikov (2007) |
| 54. | Winter, 2019 | Atanasovsko Lake near Burgas City | Burgas Region | 159 | Apostolov (2020) |
| 55. | 01.01.2023 | Atanasovsko Lake near Burgas City | Burgas Region | ~120 | Z. Boev (unpubl. data) |
| 56. | 01.01.2023 | Pomoriysko Lake near town of Pomorie | Burgas Region | ~45 | Z. Boev (unpubl. data) |
| 57. | 12-15.01.2023 | Atanasovsko Lake and Poda Locality near Burgas City. Pomoriysko Lake near Pomorie | Burgas Region | ~3000 | Angelova (2023) |
| 58. | 12-15.01.2023 | Atanasovsko Lake and Poda Locality near Burgas City. Pomoriysko Lake near Pomorie | Burgas Region | 2712 | BSPB (2023c) |
| 59. | 14.01.2017 | Arda River | Kardzhali Region | ~ | Anonym. (2017a) |
| 60. | 16.01.2023 | Atanasovsko Lake and Poda Locality near Burgas City. Pomoriysko Lake near Pomorie | Burgas Region | >2700 | Dimitrov (2023) |
| 61. | 22.01.2021 | Atanasovsko Lake and Poda Locality near Burgas City. Pomoriysko Lake near Pomorie | Burgas Region | 981 | Anonym. (2021a) |
| 62. | January | Pchelina Reservoir | Pernik Region | ~ | Anonym. (2021b) |

| | | | | | |
|---|---|---|---|---|---|
| 63. | 2020 January-February 2016 | Studen Kladenets Reservoir | Kardzhali Region | 12 | [Hristov, H.] (2017a) |
| 64. | 01.02. 1982 | Atanasovsko Lake near Burgas City | Burgas Region | 1 ad. | Nankinov & Darakchiev (1981) |
| 65. | February 1981 | Atanasovsko Lake near Burgas City | Burgas Region | 1 juv. | Boev (1982) |
| | | **Untimed observations** | | | |
| 66. | 1864 | Danube Delta | At present out of Bulgarian territory | ~ | Allard (1864) |
| 67. | Migration period | Salt marshes along the Bulgarian Black Sea coast | (mainly) Burgas Region | ~ | Simeonov (1972) |
| 68. | 2014-2016 | Atanasovsko Lake near Burgas City | Burgas Region | 3-5 | Uzunov (2021) |
| 69. | [often] | along the Bulgarian Black Sea coast. | (mainly) Burgas Region | ~ | Nankinov & Draktchiev (1981); Boev (1985); Michev (1990) |
| 70. | 1860-s | near town of Chernomorets | Burgas Region | ~ | Hristovich (1893); Patev (1950); Boev (1982) |
| 71. | 2018 | Atanasovsko Lake near Burgas City | Burgas Region | 4 | Iankov (2019) |
| 72. | 2019 | Atanasovsko Lake near Burgas City | Burgas Region | 160 | Adams et al. (2022) |
| 73. | 2022 | Atanasovsko Lake near Burgas City | Burgas Region | >1000 | Adams et al. (2022) |

## Results and Discussion

*20th century records on the Balkans*

After Talpeanu & Paspaleva (1973) the greater flamingo is accidental in the neighbouring Romania, where it was recorded in June, October and January. The authors explained its appearance in Romania by the movement of individuals from the Caspian Sea or the Camargue (Southern France), where the species had breeding colonies. In 1969-1972 it was recorded in the Sinoe lagoon and the region of Galati on Danube River.

Boev (1985) supposed that the birds observed on the Balkan Peninsula most likely originated from the former colony from Van Lake in southeast Turkey. Currently, Turkey's main breeding colony is located in Lake Tuz (Balkiz et al., 2007).

Current studies show that some of the birds recorded in Bulgaria (Atanasovsko Lake (Burgas Wetlands) originate from Turkey, Greece, France and Spain (Desant, 2021; Kehayova, 2021; [Tsenova, 2022]). The longest distance of the young Mediterranean greater flamingos dispersion is 2231 km from Punta de la Banya (NE Spain) to Atanasovsko Lake (Desant, 2021).

According to Michev (1990) flamingos visit Bulgaria irregularly outside the breeding period. Nankinov & Kirilov (1992) stated that there is no temporal pattern in visits of the greater flamingo to Bulgaria and all published reports from Bulgaria refer to observations of single birds and small groups. Michev et al. (2004) considered the species as vagrant in Bulgaria. After Kostadinova & Gramatikov (2007) the species is represented in Bulgaria by solitary birds that winter irregularly. More recent observations from 2000 onwards show that the species has a year-round presence in the country with several tens and even hundreds or thousands of individuals. Bulgaria is located on the northern periphery of the species' European breeding range (Michev, 1990; Salvador et al., 2022)

*Recent distribution*

In the data-base of e-bird (Ebird, 2022) a total of 754 species' observations have been registered throughout the year (except 2nd week of

July) until 21.12.2022. These data have been gathered between 1990 and 2023.

Collected data (Table 1) show a permanent increasing number of bird records in the country during the last century, as also reported in Ebird. For the first 100 years of ornithological observations of the greater flamingo in Bulgaria (1890-1990), a total of 23 notices of encounters of the species were published in its modern territory (Table 1), representing 31.5 % of all published observations, but sightings are becoming significantly more frequent. Indeed, in 1990-2023 76.7 % of the encounters of the species were reported. We should have in mind the rapid increasing of the number of Bulgarian and foreign birdwatchers and field ornithologists in the last decades. On the other hand, the number of greater flamingos is increasing globally, the species occupied new breeding grounds in the Mediterranean (Salvador et al., 2022). Thus, the increased species' presence in Bulgaria is part of a larger process, probably also due to global warming.

In the spring of 2023, the first nesting attempts were already observed of the greater flamingo in the Atanasovsko Lake. About 80 birds from the flock of about 600 birds staying in the lake have started nesting, but eggs laid and brooding have not been detected ([Mladenov], 2023; BSPB, 2023a), so the establishment of a breeding colony at this site could occur in the next years.

The Atanasovsko Lake is defined as "the only more regular occurrence of the greater flamingo (*Phoenicopterus ruber*) in Bulgaria" in winter (Michev et al., 2015).

Despite these discrepancies in the data, we accept the overall change in the frequency of sightings over the years during the autumn-winter period is similar to the data collected by us (Table 1). There is also a coincidence in the reduction of these observations during the spring-summer season.

**Table 2.** Seasonal distribution of the observations of *Phoenicopterus roseus* in Bulgaria between 1990 and 19.05.2023 (after Ebird, 2023).

| Month | Number of observations | Percent of total number of observations |
|---|---|---|
| January | 56 | 8.2 |
| February | 55 | 8.0 |
| March | 39 | 5.7 |
| April | 17 | 2.5 |
| May | 21 | 3.1 |
| June | 22 | 3.2 |
| Jully | 22 | 3.2 |
| August | 48 | 7.1 |
| September | 123 | 18.0 |
| October | 122 | 17.8 |
| November | 96 | 14.0 |
| December | 116 | 17.0 |
| **Total** | **737** | **107.8**[1] |

[1] The sum of all months of the year according to Ebird data exceeds 100%. It is likely that some of the observations span consecutive days of two consecutive months.

When taking into account the seasonality of the greater flamingo in Bulgaria it is necessary to consider the following: 1) Studies on the distribution, numbers and residence of the species for the whole country are lacking; 2) The species in Bulgaria and on the Balkans in general occurs year-round (Figs. 1-2), although the majority of individuals in the region are wintering. Regardless of the number of committed observations, the number of specimens observed has two distinct peaks - autumn (September) and winter (December), corresponding to the periods of the most massive movements during the autumn migration and (sometimes) during the winter. About 61.6 % of the observations have been done in the autumn-winter period (Tables 1-3).

**Fig. 1.** Wintering grater flamingos (*Phoenicopterus roseus*) and Common Shelducks (*Tadorna tadorna*) in the Atanasovsko Lake near Burgas City, 31.12.2022. Photo: Z. Boev.

**Fig. 2.** Summering grater flamingos (*Phoenicopterus roseus*) in the Atanasovsko Lake near Burgas City, 20.08.2023. Photo: Zlatozar Z. Boev.

**Conclusions**

In the last 2-3 decades, the number of the greater flamingo sightings in Bulgaria has increased sharply. The species has been observed in no less than 17 localities, most of which are located along the Bulgarian Black Sea coast. 76.7 % of the encounters of the species were reported in the period 1990-2023.

The greater flamingo occurs in Bulgarian wetlands throughout the year (Tables 1-3). About 69.2 % of the observations in Bulgaria have been done in the autumn-winter period.

**Table 3.** Comparison of seasonal distribution of the observations of *Phoenicopterus roseus* in Bulgaria between 1864 and 2023 and data of Ebird (2022) from 1990 to 2022.

| Period | Number of obser-vations | Percentage of all timed observations | Percentage of all observations after Ebird (2022) |
|---|---|---|---|
| Spring migration | 5 | 7.7 | ~8.2 |
| Breeding season | 15 | 23.1 | ~19.1 |
| Autumn migration | 16 | 24.6 | ~35.8 |
| Wintering season | 29 | 44.6 | ~47.2 |
| Untimed | (8) | - | - |

The largest number of flamingos observed at a single observation exceeds 3000 birds. Burgas wetlands (Atanasovsko Lake, Pomoriysko Lake, Poda Protected Area) are the most often visited sites.

Sometimes flocks also visit the shallows in dams in the interior of the country.

In the spring of 2023 about 80 flamingos attempted breeding - observed are nest-building without egg-laying.

Of the 17 established localities of the species in the country, 2 are located along the Danube River, 3 – in the interior of Western Bulgaria, 4 – in the interior of Southern Bulgaria and 8 – on the Black Sea Coast (Fig. 3).

**Acknowledgements**

The author thanks Mr. Lyubomir Profirov (Ecological Consultant & Wildlife Tourguide), who paid attention and encouraged him to write this article. He also thanks two anonymous reviewers for their helpful comments and

additions to an earlier version of the manuscript.

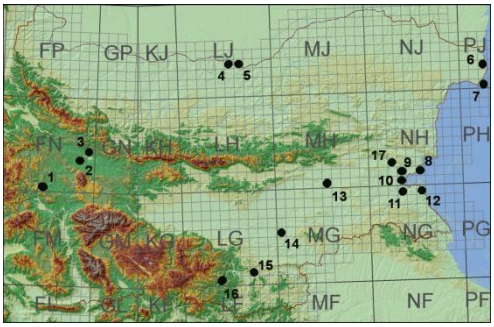


**Fig. 3.** Distribution of the grater flamingos (*Phoenicopterus roseus*) in Bulgaria: Pchelina Reservoir (1); Sofia (2); Kumanitsa-Vrazhdebna (3); Persina Nature Reserve(4); Svishtov (5); Shabla Lake (6); Nanevska Tuzla (7); Pomoriysko Lake (8); Atanasovsko Lake (10); Mandra Lake and Poda Protected Locality (11); Alepy Marsh and Chernomorets (12); Fishponds near Yambol (13); Simeonovgrad (14); Studen Kladenets Reservoir (15); Arda River (16); Aytos (17).

## References

Adams A., Allen P., Andreas E. 2000. Conservation Leadership Capstone Project in Bulgaria. Available at: https://storymaps.arcgis.com/stories/09f5cdea924f4d2ba4fcf734f3ec6df2 (Accessed on: 25.11.2022).

Allard C. 1864. *La Bulgarie orientale*. Adrien Le Clerc: C. Dillet, Paris, 296 p.

Angelova L. 2023. A record number of Greater flamingos in our country. Available at: https://novini.bg/bylgariya/obshtestvo/761123 (Accessed on: 23.01.2023). (in Bulgarian).

Anonym., 2017a. Greater flamingo and tundra swan are among the guests on the Arda river this winter. Available at: https://www.dnevnik.bg/zelen/biorazno obrazie/2017/01/17/2900985_rozovo_flamingo_i_tundrov_lebed_sa_sred_gostite_po/ (Accessed on: 26.08.2023). (in Bulgarian).

Anonym. 2017b. Exotic flamingo birds were photographed in the Eastern Rhodopes. Available at: https://miau.bg/n-88441-Екзотични_птици_фламинго_бяха_заснети_в_Източните_Родопи (Accessed on: 26.08.2023). (in Bulgarian).

Anonym., 2020. The first red-breasted geese arrived in Bulgaria. Available at:https://bnr.bg/horizont/post/101371338/parvite-chervenogushi-gaski-pristignaha-v-balgaria (Accessed on: 26.08.2023).

Anonym., 2021a. How many endangered species of birds winter in our country? Available at: https://darik.bg/kolko-zastrasheni-vidove-ptici-zimuvat-u-nas. (Accessed on: 26.08.2023).

Anonym., 2021b. After cleaning the Pchelina dam, volunteers will preserve the chapel of St. Yoan Letni. Available at: https://dobrotoliubie.com/2021/04/22/след-почистване-на-язовир-пчелина-доб/ (Accessed on 26.08.2022). (in Bulgarian).

Apostolov A. 2020. The Atanasovsko Lake, a bird paradise. Priroda, BAS, 3: 60-68. (in Bulgarian).

Balkız, Ö, Özesmi, U., Pradel, R., Germain, C., Sıkı, M., Amat, J. A., Rendón-Martos, M., Baccetti, N., Béchet, A. 2007. Range of the Greater Flamingo, *Phoenicopterus roseus*, metapopulation in the Mediterranean: new insights from Turkey. Journal of Ornithology, DOI: 10.1007/s10336-007-0136-2.

Bedrosyan, D. 2022. Unusual and beautiful: Lake Pomorie became a winter stop for the greater flamingo. Available at:

https://darik.bg/neobichaino-i-krasivo-pomoriiskoto-ezero-stana-zimna-spirka-za-rozovoto-flamingo. (Accessed on: 26.08.2023). (in Bulgarian).

BirdLife International. 2022. Species factsheet: *Phoenicopterus roseus*. Available at: http://www.birdlife.org (Accessed on 03/08/2022).

Boev N. [signed N. Krumov]. Phlamingo, come to us!. *Lov i ribolov*, 5: 23. (in Bulgarian).

Boev N. 1985. Rozovo flamingo (*Phoenicopterus roseus* Pall., 1811). *In:* Botev B. & Peshev, Ts. (Eds.). *Red Data Book of the People's Republic of Bulgaria*. Volume 2. Animals. Publishing House of the Bulgarian Academy of Sciences, Sofia, 54. (In Bulgarian, English summary).

BSPB. 2019. 13 but not fatal greater flamingos were observed at Studen Kladenets Reservoir. Available at: https://bspb.org/13-но-не-фатални-розови-фламинга-са-набл/ (Accessed on: 19.05.2023). (in Bulgarian).

BSPB. 2023a. For the first time, a Greater flamingo nests in our country - in Burgas. April 11, 2023. Available at: https://tvn.bg/za-parvi-pat-rozovo-flamingo-gnezdi-u-nas-v-burgas/ (Accessed on: 19.05.2023). (in Bulgarian).

BSPB. 2023b SmartBirds. Available at: https://smartbirds.org/birds (Accessed on: 26.08.2023).

BSPB. 2023c. Results of the 47th census of wintering waterfowl. Available at: https://bspb.org/резултати-от-47-то-преброяване-на-зимува/ (Accessed on: 19.01.2023). (in Bulgarian).

Chaleva L. 2014. Five rose flamingoes in the Atanasovsko Lake. Available at: http://burgas.dir.bg/gallery.php?id=17845376 (Accessed on 20.14.2014).

Cramp S., K. Simmons (Eds.). 1977. *The Birds of the Western Palearctic*. Vol. I. Oxford - London - New York, Oxford University Press. 722 p.

Desant. 2021. A greater flamingo flew over 2,000 km from Spain to Lake Athanasius. Available at: https://www.desant.net/show-news/55110 (Accessed on: 26.08.2023).

Dickinson E. C., J. V. Remsen Jr. (Eds). 2013. *The Howard & Moore Complete Checklist of the Birds of the World. 4th. Edition*, Vol. 1, Aves Press, Eastboume, U.K., 461 p.

Dimitrov, St. 2023. Over 2,700 birds of the greater flamingo species are wintering in our country this year. Available at: https://www.bta.bg/bg/news/bulgaria/391220-nad-2700-ptitsi-ot-vida-rozovo-flamingo-zimuvat-u-nas-prez-tazi-godina-pokaza-t (Accessed on: 26.08.2023). (in Bulgarian).

Ebird. 2022. *Phoenicopterus roseus*. Data for Bulgaria. Available at: https://ebird.org/species/grefla3/BG (Accessed on 21.12.2022).

[Hristov, H.] 2017a. A colony of greater flamingos near the "Studen Kladenets" dam in the Eastern Rhodopes. Available at: https://bnr.bg/post/100882902/kolonia-ot-rozovo-flamingo-krai-azovir-studen-kladenec-v-iztochnite-rodopi (Accessed on: 26.08.2023). (in Bulgarian).

[Hristov, H.] 2017b. The appearance of the greater flamingo in our country is related to climate change Available at: https://www.actualno.com/burgas/pojavata-na-rozovoto-flamingo-u-nas-e-svyrzano-s-promjanata-na-klimata-news_638318.html (Accessed on: 26.08.2023). (in Bulgarian).

Hristovich G. 1893. *Phoenicopterus roseus* Flamingo. *Priroda*, 1: 6-7. (in Bulgarian).

Iankov P. 2019. *Methods of monitoring of the target bird species in the "Atanasovsko Lake" protected zone.* Bulgarian Society for the protection of birds, Burgas, 12 p. (in Bulgarian).

[Iliev, M.] 2021. Attraction in Shablenska tuzla: 8 greater flamingo birds flew in. Available at: https://pronewsdobrich.bg/atraktsiya-v-shablenskata-tuzla-doletyaha-8-ptitsi-rozovo-flamingo-p174002 (Accessed on: 26.08.2023). (in Bulgarian).

Johnson A. R. 1989. Movements of Greater flamingos (*Phoenicopterus ruber*) in the Western Palearctic. *Revue d'Écologie (La Terre et la Vie)*, 44:75-94.

Johnson A., Biber O. 1971. *I.W.R.B. Goose Working Group mission in eastern Europe, December 1970.* Manuscript. Station Biologique de Tour de Vallat, 12 p.

Kehayova, M. 2019. A flock of 160 greater flamingo birds graces Lake Atanasovsko. Available at: https://trud.bg/ято-от-160-птици-розово-фламинго-краси-ат/ (Accessed on 26.08.2022). (in Bulgarian).

Kehayova, M. 2021. A record of 1,600 birds: The greater flamingo settled in the Atanasovsko Lake. Available at: https://trud.bg/рекорд-от-1600-птици-розово-фламинго-се-засели-в-атанасовското-езеро/ (Accessed on 26.08.2022). (in Bulgarian).

Kehayova, M. 2022. A greater flamingo drives Burgas airport crazy. Available at: https://trud.bg/розово-фламинго-подлудява-летище-бур/ (Accessed on 01.09.2022). (in Bulgarian).

[Kolev, N.] 2017. As many as 38 flamingos have been seen and photographed these days in Atanasovsko. Available at: 30882041aabfe9f6e2553ef3eb4f6422.pdf (Accessed on: 26.08.2023). (in Bulgarian).

Kostadinova I., M. Gramatikov (Eds.) 2007. *Important Bird Areas in Bulgaria and Natura 2000. Bulgarian Society for the Protection of Birds*, Conservation Series, Book 11. Sofia, BSPB, 640 p.

Krasteva, St. 2022. Greater flamingo in the Shablenska Tuzla. Available at: https://visitdobrich.bg/2022/04/26/rozovo-flamingo-v-shablenska-tuzla/. (Accessed on 26.08.2022). (in Bulgarian).

Michev T. 1990. *Phoenicopterus ruber roseus* Pallas, 1811 – Rozovo flamingo. *In:* Simeonov, S., Michev, T., Nankinov, D. *Fauna of Bulgaria*, Vol. 20. Aves, Part I. Publishing House of the Bulfarian Academy of Sciences. Sofia, 134-135. (in Bulgarian, English summary).

Michev T. 1997. *Ecology and conservation of the Atanasovsko Lake*. Bulgarian-Swiss Program for Biodiversity Conservation. Collected scientific reports of experts. Sofia, 112 p.

Michev T. 1998. *Atanasovsko Lake Reserve: Management Plan*. Ministry of the Environment and Waters Sweizer. Vogelschutz Bulgaria Switzerland. 65 p.

Michev T. (Team leader) 2015. *Project to update a management plan on Maintained Reserve "Atanasovsko Ezero". Regional Environmental and Water Inspection – Burgas.* Operational Program "Environment 2007-2013". Burgas, 429 p. (in Bulgarian).

Michev T., L. Profirov, M. Dimitrov, K. Nyagolov. 2004. *The birds of Lake Atanasovsko. Status and Checklist.* Second Edition. Bourgas Wetlands. Bourgas, 45 p.

[Mladenov] 2023. Birds of the greater flamingo species have started building

nests in our country. Available at: https://www.sinoptik.bg//news/ptici-ot-vida-rozovo-flamingo-zapochnaha-da-stroiat-gnezda-u-nas-9193 (Accessed on: 19.05.2023). (in Bulgarian).

Mlíkovský J. 2002. *Cenozoic Birds of the World*. Part 1, Europe. Praha, Ninox Press. 406 p.

Nankinov D., S. Kirilov. 1992. Big flocks of Flamingoes (*Phoenicopierus ruber*) in Bulgaria. *Ornithologische Mitteilungen,* 44(4): 102.

Nankinov D., A. Draktchiev. 1981. The flamingo (*Phoenicopterus roseus*) in Bulgaria. *Travaux scientifiques*, 19(4) Biologie: 209-212. (in Bulgarian, English summary).

Nikolova Zh. 2022. Marijan Zhechev, mayor of Shabla: By the end of the summer, a birdwatching shelter will be built in the area of Shabla Tuzla. Available at: https://www.focus-news.net/novini/regioni/Mariyan-Zhechev-kmet-na-Shabla-Do-kraya-na-lyatoto-v-raiona-na-Shablenska-tuzla-shte-bude-izgradeno-ukritie-za-nablyudenie-na-ptici-1368189 (Accessed on 26.08.2023). (in Bulgarian).

Paspaleva-Antonova M. 1961. *Exploration de l'ornithofaune de la côte bulgare du Danube.* Manuscript. Institute of Zoology, BAS, Sofia, 145 p. (in Bulgarian).

Patev P. 1950. *Birds in Bulgaria*. Fauna of Bulgaria, Vol. 1. Publishing House of the Bulfarian Academy of Sciences. Sofia, 364 p. (in Bulgarian, English summary).

Salvador A., M. Á. Rendón, J. A. Amat, M. Rendón-Martos (2022). Greater Flamingo (*Phoenicopterus roseus*), version 2.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. DOI: 10.2173/bow.grefla3.02.

Simeonov S. 1972. Greater flamingo. *Priroda i znanie,* 3: 23-25. (in Bulgarian).

Slavinski P. 1973. *Flight over the seaside home*. Narodna Mladezh Publishing House, Sofia, 190 p. (in Bulgarian).

Suknarov S. 2022. Lake Pomorie is home to colonies of the exotic greater flamingo. Available at: https://bntnews.bg/news/pomoriyskoto-ezero-priyuti-kolonii-ot-ekzotichnoto-rozovo-flamingo-1213513news.html (Accessed on 26.08.2023) (in Bulgarian).

Talpeanu M., M. Paspaleva. 1973. *Oiseaux de delta du Danube*. Bucuresti, Ştiinţificâ. 289 p.

[Tsenova, R.] 2022. The presence of a large number of greater flamingos in Lake Atanasovsko is serious evidence of climate change, an expert believes. Available at: https://www.bta.bg/bg/news/bulgaria/regional-news/oblast-burgas/361074-prisastvieto-na-golyam-broy-rozovi-flamingi-v-atanasovskoto-ezero-e-seriozno-d. (Accessed on: 26.08.2023). (in Bulgarian).

Uzunov G. 2018. Over 5,000 greater white-fronted geese were observed near Svishtov. Available at: https://agrozona.bg/nad-5000-golemi-belocheli-gaski-byaha-nablyudavani-v-kray-svishtov/(Accessed on 26.08.2023). (in Bulgarian).

Uzunov S. 2021. Why the Rose flamingo settled permanently in Burgas? Available at: https://uniconbg.com/post/56745-zasho-rozovoto-flamingo-se-zaseli-traino-v-burgas.html (Accessed on 30.08.2022). (in Bulgarian).

Valcheva M. 2014. Rose flamingoes in the Atanasovsko Lake. *Za Ptitsite*, 1: 8. (in Bulgarian).

Vasilev Iv. 1953. Flamingo (*Phoenicopterus roseus* Pall.). Priroda i znanie, 9: 18-21. (in Bulgarian).

Vatev I. 1991. Observations du Flamant rose *Phoenicopferus ruber* en Bulgaria. *Alauda*, 59 (1): 53-54.

Wallis, H. M. 1913. Spring-migrations in the Balkans. Winter visitors to the Balkans. Residents. *Bulletin of the British Ornithological Club,* 31: 92-96.

Received: 19.05.2023
Accepted: 05.09.2023

Bulletin of the Natural History Museum - Plovdiv

*Bull. Nat. Hist. Mus. Plovdiv, 2023, vol. 8: 37-41*

***Short note***

# *First record of the flying fox mite Meristaspis calcarata (Hirst) on Ursula Island, Philippines (Dermanyssoidea: Spinturnicidae)*

**Ace Kevin S. Amarga[1, 2, 3] ***

[1] Biodiversity Program, Taiwan International Graduate Program, Biodiversity Research Center, Academia Sinica, Taipei, TAIWAN.
[2] School of Life Science, National Taiwan Normal University- Gongguan, Taipei, TAIWAN
[3] International Union for Conservation of Nature Species Survival Commission (IUCN SSC) Parasite Specialist Group
*Corresponding email: ace_amarga061@yahoo.com

**Abstract.** *Meristaspis* Kolenati is a small genus of dermanyssoid mites exclusively ectoparasitic on bats. This paper reports the first published record of the flying fox mite *Meristaspis calcarata* (Hirst) on Ursula Island, Philippines. Also, this account represents the first documentation of an ectoparasitic acarine in Ursula Island.

**Key words:** distribution, ectoparasite, *Meristaspis calcarata*, Philippines, *Pteropus*.

## Introduction

The family Spinturnicidae Oudemans comprises a small group of dermanyssoid mites exclusively ectoparasitic on bats (Chiroptera). This family is represented by 110 species belonging to 12 genera and is cosmopolitan in distribution (Beron, 2020). Spinturnicid mites usually attach to the patagium of their bat hosts. Recently, genotypes of hemotropic mycoplasmas (Wang *et al*., 2023) as well as *Bartonella* (Han *et al*., 2021) were reported on spinturnicid mites. Thus, indicating that spinturnicids portray a significant role as vectors. In the Philippines, nine spinturnicid species have previously been documented, representing the genera *Ancystropus* Kolenati, *Meristaspis* Kolenati, *Paraperiglischrus* Rudnick, and *Spinturnix* von Heyden (Cuy, 1979). Published accounts describing the geographic distribution of Philippine spinturnicid mites include those of Delfinado & Baker (1963), Baker & Delfinado (1964), Prasad (1969), Cuy (1979), Fain (2002), and Amarga *et al*. (2017).

Ursula Island is a small wildlife sanctuary situated in southern Palawan, Philippines (Fig. 1). Despite its limited land area and forest cover, it is home to a diverse native fauna, including *Ducula bicolor* (Scopoli) (Pied imperial pigeon), *Megapodius cumingii* Dillwyn (Philippine megapode), and *Otus mantananensis* (Sharpe) (Mantanani scops owl) (Gonzalez, 1996; Birdlife International, 2023). However, the ectoparasite fauna of Ursula Island remains poorly known, the only prior

record being that of the nycteribiid bat fly *Cyclopodia horsfieldi* de Meijere, collected on *Pteropus hypomelanus* Temminck (Island flying fox) (Amarga & Hastriter, 2023). Here, the spinturnicid mite *Meristaspis calcarata* (Hirst) is reported from Ursula Island for the first time; this is also the first record of the genus *Meristaspis* from Ursula Island.

## Material and methods

Mite specimens were examined in the Entomology Collection of the National Museum of Natural Science (NMNS), Taichung City, Taiwan. Morphological characters were examined using a Leica DM500 compound microscope (Fisher Scientific, United Kingdom), and species determination were based on the taxonomic descriptions of Delfinado & Baker (1963). The higher classification of the genus *Meristaspis* adopted here is that of Beaulieu *et al*. (2011), while host names follow Burgin *et al*. (2020).

## Results and Discussion

Superorder Parasitiformes Reuter
Order Mesostigmata Canestrini
Suborder Monogynaspida Camin & Gorirossi
Infraorder Gamasina Kramer
Hyporder Dermanyssiae Evans & Till
Superfamily Dermanyssoidea Kolenati
Family Spinturnicidae Oudemans
Genus *Meristaspis* Kolenati

***Meristaspis calcarata* (Hirst, 1923) (Figs. 2-3)**

*Ancystropus calcaratus* Hirst, 1923: 983. Type host: *Pteropus* sp. Type locality: Rook Island (Indonesia). Holotype: ♀ in Natural History Museum (London).

*Meristaspis calcarata* (Hirst) Domrow, 1972: 548.

**Diagnosis:** Transverse line of idiosoma absent; peritreme completely dorsal; marginal hook projection on coxa I conspicuous; distal setae on tarsus I flattened. Additional characters are provided by Hirst (1923) and Delfinado & Baker (1963).

**Material examined: PHILIPPINES:** ex. *Pteropus hypomelanus*: 1♂ (NMNS 8722-11), 2♀♀ (NMNS 8722-10, NMNS 8722-12), Palawan Province, Bataraza municipality, Ursula Island, 22-26.VI.2019, coll. R. Giganto. ***New island record***.

*Meristaspis* is a small genus of spinturnicid mites represented by six species worldwide (Beron, 2020), and in the Philippines four species have been recorded (Cuy, 1979). Of these, *M. calcarata* is primarily associated with flying foxes (Pteropodidae). This species was first collected in 1913 from undetermined *Pteropus* species on Rook Island. Hirst (1923) first described *M. calcarata* under the genus *Ancystropus*, but the species was subsequently transferred to *Meristaspis* by Domrow (1972).

Because flying foxes are capable of transoceanic flights, the geographic range of *M. calcarata* is broad. In the Oriental zoogeographic region and Oceania, this mite has been recorded from the Philippines and Micronesia (Guam and Saipan), but it also has been collected in southeastern Australia, New Guinea, and the Solomon Islands (Australasian region), and its range extends to Madagascar (Afrotropical region) (Delfinado & Baker, 1963; Baker & Delfinado, 1964; Prasad, 1969; Domrow, 1979). In the Philippines, *M. calcarata* was first documented by Delfinado & Baker (1963) on Puerto Princesa, Palawan, and Cuernos de Negros (Negros Island). Additional collections were made by Cuy (1979) from Cabugan Islet, Puerto Princesa. The specimens of *M. calcarata* from

Ursula Island constitute a new geographic record for the Philippines. To date, all Philippine specimens of *M. calcarata* have been recovered from bats of the genus *Pteropus*, indicating that flying foxes are the primary hosts of this mite species. Additional known hosts of *M. calcarata* include *P. hypomelanus* (Island flying fox, Fig. 4B), *P. pumilus* Miller (Little golden-mantled flying fox, Fig. 4A), *P. speciosus* Andersen (Philippine gray flying fox), and *P. vampyrus* (Large flying fox) (Delfinado & Baker, 1963; Baker & Delfinado, 1964; Cuy, 1979).

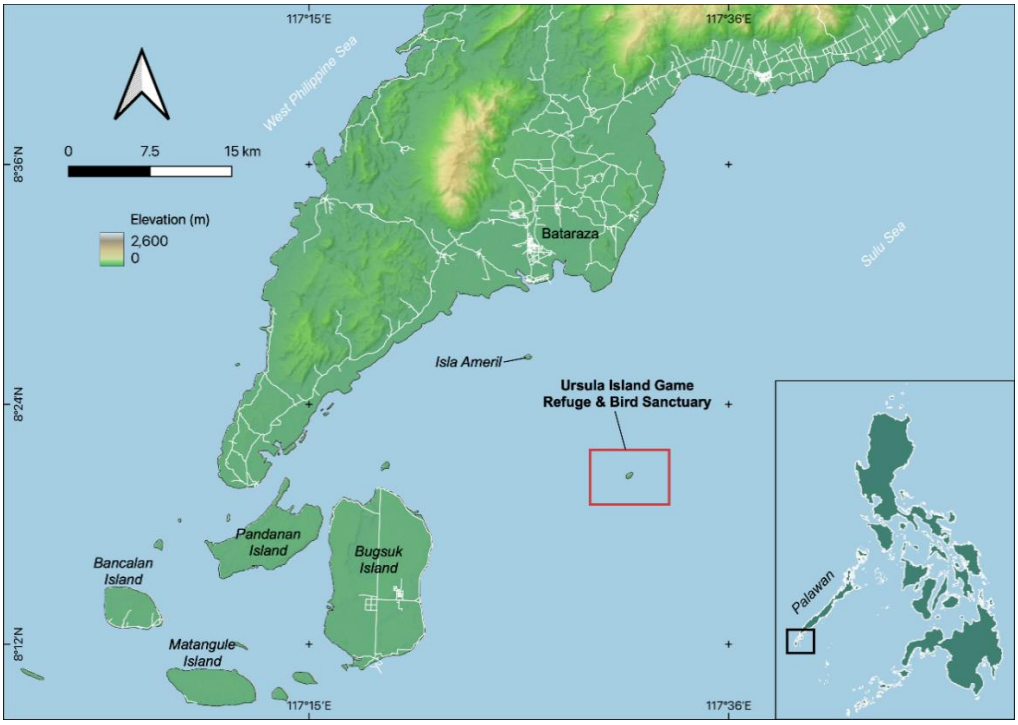


**Fig. 1.** Location of Ursula Island in southern Palawan, the Philippines.

**Fig. 2.** Slide mount female *Meristaspis calcarata* from Ursula Island (ventrum).

**Acknowledgments**

The author thanks Dr. Jing-Fu Tsai (National Museum of Natural Science) for allowing access to parasite collections, Dr. Hui-Yun Tseng (National Taiwan University) for providing laboratory space, Dr. Richard G. Robbins (Walter Reed Biosystematics Unit, Department of Entomology, Smithsonian Institution) for the review and comments of the earlier version of the manuscript, and Mr. Christian Supsup (Kansas University) for providing the Ursula Island map (Fig. 1).

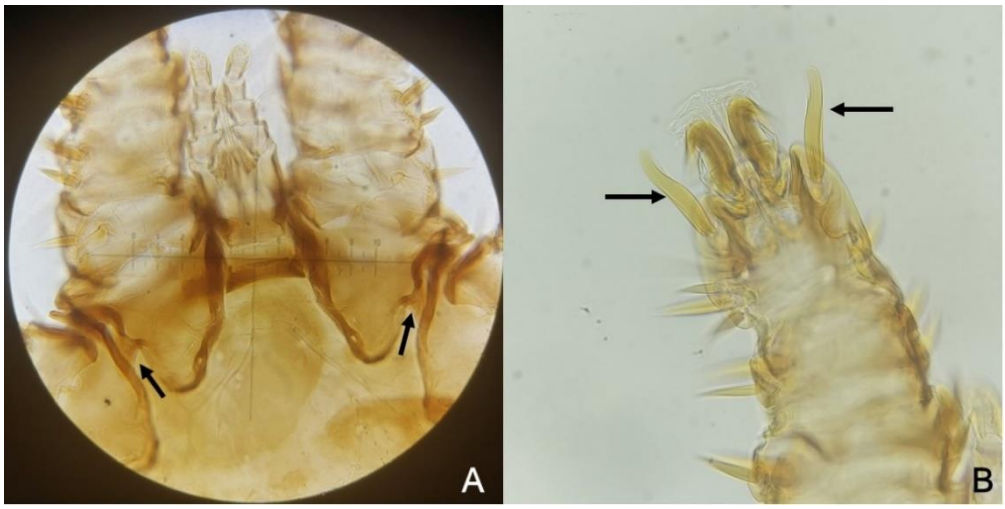


**Fig. 3.** Some characters of *M. calcarata*: (A) prominent marginal hook projection on coxa I (black arrow); (B) distal setae on tarsus I flattened (black arrow).

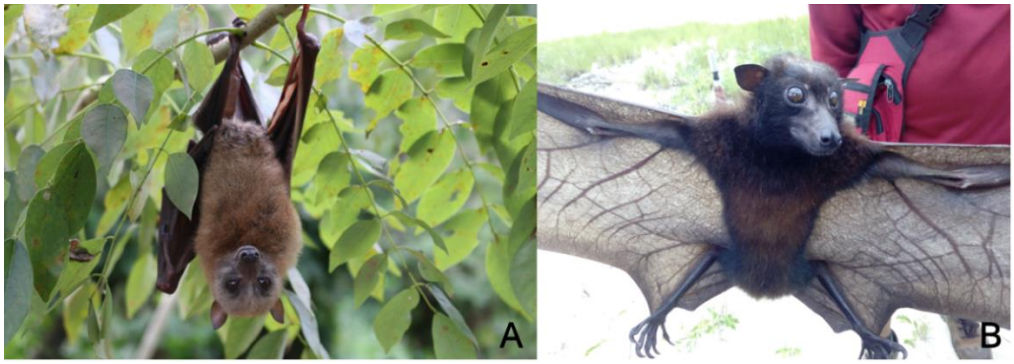


**Fig. 4.** Some of the host species of *Meristaspis calcarata* in the Philippines: (A) *Pteropus pumilus*; (B*) Pteropus hypomelanus*.

## References

Amarga A.K.S., Alviola P.A., Lit I., S.A. Yap. 2017. Checklist of ectoparasitic arthropods among cave-dwelling bats from Marinduque Island, Philippines. *Check List*, 13(1): 2029.

Amarga A.K.S., M.W. Hastriter. 2023. First record of the flying fox bat fly *Cyclopodia horsfieldi* de Meijere, 1899 (Diptera: Hippoboscoidea: Nycteribiidae) on Ursula Island, Philippines. *Historia naturalis bulgarica*, 45(2): 25-29.

Baker E.W., M.D. Delfinado. 1964. Spinturnicidae of South East Asia and the Pacific Region. *Pacific Insects*, 6(4): 571-591.

Beaulieu F., Dowling A.P.G., Klompen H., de Moraes G.J., D.E. Walter. 2011. Superorder Parasitiformes Reuter, 1909. In: Zhang Z.-Q. (ed.) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. *Zootaxa*, 3148: 123-128.

Beron P. 2020. Acarorum Catalogus VI. Order Mesostigmata. Gamasina: Dermanyssoidea (Rhinonyssidae, Spinturnicidae). Pensoft & National Museum of Natural

History, Sofia, Bulgaria, 265 pp.

BirdLife International. 2023. Important Bird Areas factsheet: Ursula Island. http://www.birdlife.org. Accessed 26 April 2023.

Burgin C.J., Wilson D.E., Mitterrmeier R.A., Rylands A.B., Lacher T.E., W. Schrest. 2020. Illustrated Checklist of Mammals of the World. Volume 2: Eulipotyphla to Carnivora. Lynx Edicions, Barcelona.

Cuy L.S. 1979. Synopsis of Philippine Spinturnicidae (Acarina: Mesostigmata). *Kalikasan, Philippine Journal of Biology*, 8(2): 162-172.

Delfinado M.D., E.W. Baker. 1963. Mites of the family Spinturnicidae from the Philippines (Acarina). *Pacific Insects*, 5(4): 905-920.

Domrow R. 1972. Acari Spinturnicidae from Australia and New Guinea. *Acarologia*, 13: 552-584.

Fain A. 2002. Notes on a small collection of mites (Acari) parasitic on bats in the Philippines. *Acarologia*, 42(1): 67-74.

Gonzalez J.C.T. 1996. The status of the birds of Ursula Island, Palawan, Philippines. *Bulletin of the Oriental Bird Club*, 2(3): 38-41.

Han H.-J., Li Z.-M., Li X., Liu J.-X., Peng Q.-M., Wang R., Gu X.-L., Jiang Y., Zhou C.-M., Li D., Xiao X., X.-J Yu. 2021. Bats and their ectoparasites (Nycteribiidae and Spinturnicidae) carry diverse novel *Bartonella* genotypes, China. *Transboundary and Emerging Diseases*, 69: 845-858.

Hirst S. 1923. On some new or little-known species of Acari. *Journal of Zoology*, 93(4): 971–1011.

Prasad V. 1969. New species of bat mites from Southeast Asia and the Pacific region, with a note on *Periglischrodes gressitti* Bak. & Delf. (Acarina: Spinturnicidae). *Proceedings of the Entomological Society of Washington*, 71: 533-540.

Wang R., Li Z.-M., Peng Q.-M., Gu X.-L., Zhou C.-M., Xiao X., Han H.-J., X.-J Yu. 2023. High prevalence and genetic diversity of hemoplasmas in bats and bat ectoparasites from China. One Health, 16: 100498.

Received: 22.05.2023
Accepted: 26.10.2023

Bulletin of the Natural History Museum - Plovdiv

*Bull. Nat. Hist. Mus. Plovdiv, 2023, vol. 8: 43-48*

***Short note***

# *First Report of Euphaea refulgens Hagen in Selys, 1853 (Odonata: Euphaeidae) on Mayon Volcano Natural Park, with Some Records from Luzon and Mindoro Islands, the Philippines*

**Ace Kevin S. Amarga[1,2,*], Wei Ann Jane A. Mercado[3]**

[1] Biodiversity Program, Taiwan International Graduate Program, Biodiversity Research Center, Academia Sinica, Taipei, TAIWAN.
[2] School of Life Science, National Taiwan Normal University - Gongguan, Taipei, TAIWAN
[3] Insect Taxonomy Laboratory, Institute of Weed Science, Entomology, and Plant Pathology, University of the Philippines Los Baños, Laguna, PHILIPPINES
*Corresponding email: ace_amarga061@yahoo.com

**Abstract.** *Euphaea refulgens* Hagen in Selys, 1853 is one of the three *Euphaea* species endemic in the Philippines and known only in Greater Luzon faunal region and Mindoro Island. This short note reports the first published documentation of *E. refulgens* in Mayon Volcano Natural Park, an active stratovolcano and a protected area situated in the Bicol peninsula, Luzon Island. In addition, some records of *E. refulgens* from institutional collections and field observations were provided.

**Key words:** Albay, Bicol peninsula, *Euphaea*, Philippines.

## Introduction

*Euphaea* Selys, 1840 is a small genus of damselfly predominantly occurring in the Oriental faunal region. *Euphaea* damselflies usually exhibit wing sexual dimorphism wherein males tend to have prominent iridescent colorations. On the other hand, females usually have dull coloration (Phan *et al*., 2018). *Euphaea* species usually inhabit forested streams on semi- closed or closed canopies. Currently, the genus *Euphaea* is represented by more than 30 species distributed across Southeast Asia, extending to India, southern China, Taiwan, Japan, and the Lesser Sunda.

Mayon Volcano is an active stratovolcano situated in the Bicol Peninsula, the southern region of Luzon Island (Lagmay *et al*., 2005). This volcano is also a part of the Luzon Volcanic Belt and considered as the most active volcano in the Philippine archipelago (Kinoshita *et al*., 2008). Currently, Mayon Volcano was designated as natural park and home to a variety of native flora and fauna (Dinets, 2001; Buot, Jr., 2009; Siler *et al*., 2017; Kyriazis *et a*l., 2018; Menard & Siler, 2018). To date, there is no published account of *Euphaea* species occurring on Mayon Volcano Natural Park. In addition, zygopteran fauna is poorly known in this protected area. This paper presents the first published record of *Euphaea refulgens* Hagen in Selys, 1853 on Mayon Volcano Natural Park, an endemic species found in Greater Luzon

faunal region. Also, additional records of *E. refulgens* from Luzon and Mindoro islands are provided.

## Material and methods

Records of *Euphaea refulgens* presented in this paper were obtained by examining specimens deposited in the following institutional collections in the Philippines and Taiwan: **ADMU**- Ateneo de Manila University Biodiversity Laboratory, Manila, Philippines; **ENT-NMNH**- Entomology Collections-National Museum ofNatural History, Manila, Philippines; **ITL**- Insect Taxonomy Laboratory, College of Agriculture and Food Science, University of the Philippines Los Baños, Laguna, Philippines; **NTNU**- National Taiwan Normal University. Additional field observations were also provided along with geographic coordinates.

## Results and Discussion

Order Odonata Fabricius
Suborder Zygoptera Selys
Superfamily Calopterygoidea Selys
Family Euphaeidae Jacobson & Bianchi

***Euphaea refulgens* Hagen in Selys, 1853 (Figs. 2-3)**

*Euphaea refulgens* Hagen in Selys, 1853: 53. Type locality: Philippines (Manila). Holotype: ♂ in Naturhistorisches Museum Wien (Austria).

*Euphaea semperi* Selys, 1879.

**Material examined**: **PHILIPPINES: LUZON ISLAND: ALBAY**: 1♂, Mt. Mayon, 21-31.V.1981, leg. Alagar & Samarita (ENT-NMNH).

**Additional material examined**: **LAGUNA:** 4♂, 6♀, Molawin creek, Mt. Makiling, Los Baños, VII.2019, leg. CB Cuevas & GA Gestiada (NTNU); 1♂, Mt. Makiling, Laguna, 17.II.2016, leg. CS Reach (ITL-CSR006); 1♂, Jamboree, Los Baños, Luzon, 30.III.2001, leg. LD Reyes (ILT-25410); 1♂, College, Los Baños, Laguna, I.2001, leg. RT Subagan (ITL-25412); 1♂, flat rocks, Mt. Makiling, 03.III.2001, leg. SD Letana (ITL-25419); 1♀, College, Los Baños, Laguna, III.2001, leg. M Cervantes (ITL-25417); 1♂, College, Los Baños, Laguna, 09.V.2016, leg. HT Caldso (ITL-25430); 1♂, Jamboree, Los Baños, Luzon, 30.III.2001, leg. LD Reyes (ITL-25413); 1♂, Jamboree, Los Baños, Luzon, 30.III.2001, leg. LD Reyes (ILT-25416); 1♂, El Kabayo, Subic, Zambales, 24.III.2016, collector n/a (ITL-25463); 1♂, Canlubang, Laguna, 27.II.1999, H Dupo Jr. (ITL-25489); Canlubang, Laguna, 03.VIII.1998, leg. AL Barrion (ITL-25492); Mt. Makiling, Laguna, 25.II.2005, leg. RPB Malijan (ITL-25494); UP Los Baños, Laguna, II.1994, leg. HP Roy Jr. (ITL-25495); Mt. Makiling, Laguna, 25.II.2005, leg. RPB Malijan (ITL 25496); Mt. Makiling, Laguna, III.2019, leg. PJ San Diego (ITL-25499); Los Baños, Laguna, I.2002, leg. Y Suami (ITL-25501); UP Los Baños, Laguna, 16.I.2008, leg. JC Banasihan (ITL-25502); UP Los Baños, Laguna, 16.I.2008, leg. JC Banasihan (ITL-25503); Molawin creek, Mt. Makiling, 15.VIII.2007, leg. ND Tung (ITL-25505); 1♂, flat rocks, Mt. Makiling, 11.III.2001, leg. S Padua (ITL-25508); Mt. Makiling, Laguna, 24.III.2007, leg. AC Acebes (ITL-25512); Botanical Garden, UP Los Baños, Laguna, 11.III.1989, leg. E Alviar (ITL-25528); 1♀, New Dorm, UP Los Baños, Laguna, 27.I.2008, leg. JPT Sanchez (ITL-25519).

**LA UNION**: Bacnotan, La Union, Luzon, 16.VIII.1998, leg. Tabafunda (ITL-25493). **MANILA**: 1♂, Ermita, Manila, 07.VII.1951, leg. FS Gachalian (ENT-NMNH); 1♀, Sta. Mesa Heights, Quezon City, 14.VI.1953, collector n/a (ENT-NMNH).

**NUEVA ECIJA**: Muñoz, Nueva Ecija, 22.II.2001, leg. MG Patricia (ITL-25500).

**QUEZON**: Dolores, Quezon, III.1999, leg. J Villarante (ITL-25497);

1♂, Dolores, Quezon, XII.1998, leg. JDL Villarante (ITL-25506) 1♂, National Botanical Garden, Land Grant, Real, Quezon, X.1975, leg. RE Alagau et al. (ENT-NMNH).

**ZAMBALES**: 1♂, El Kabayo, Subic, 24.III.2016, leg. JE Umeres (ITL-25462); El Kabayo, Subic, 14.III.2014, leg. GPR Tamayo (ITL-25460); 1♂, Binictican, Subic, Zambales, 19.III.1997, leg. M Sanlog (ITL-25491); Binictican, Subic, Zambales, 12.IV.1997, leg. VP Gapud (ITL-25509); Binictican, Subic, Zambales, 12.IV.1997, leg. VP Gapud (ITL-25520); 1♂, Binictican, Subic, Zambales, 12.IV.1997, leg. VP Gapud (ITL-25521); 1♂, Binictican, Subic, Zambales, 12.IV.1997, leg. VP Gapud (ITL-25523); 1♂, Binictican, Subic, Zambales, 12.IV.1997, leg. VP Gapud (ITL-25524); 1♂, Binictican, Subic, Zambales, 12.IV.1997, leg. VP Gapud (ITL-25526); 1♂, Binictican river, Subic, 27.IV.1998, leg. VP Gapud (ITL-25527).

**MINDORO**: 1♀, 2♂, San Vicente, Roxas, Oriental Mindoro, 30.VI.2012, leg. C Pangantihon (ADMU).

**Additional field observations (see Fig. 1)**: Bayugin Falls, Bulusan, Sorsogon, Luzon (124.119066, 12.738507), 19.VII.2019; Busay Falls, Malilipot, Albay, Luzon (123.794997, 13.308381), 30.III.2018; Buntot Palos Falls, Pangil, Laguna, Luzon (121.493378, 14.415406), 20.VIII.2018; Vera Falls, Malinao, Albay, Luzon (123.621299, 13.352393), 03.VI.2018.

The genus *Euphaea* in the Philippines is represented by four species: *E. amphicyana*, *E. cora*, *E. refulgens*, and *E. subcostalis*. The former three are endemic while *E. subcostalis* is a Bornean species. Account of *E. subcostalis* in the Philippines was first reported by Hämäläinen & Müller (1997) from specimen collected in Palawan Island. During the last ice age, Palawan and its nearby smaller islands have been connected to Borneo and shares certain Sundaic faunal affinity to the latter (Heaney, 1985; Piper *et al*., 2011). *Euphaea amphicyana* Ris, 1930 is endemic to the Greater Mindanao faunal region and have been recorded in the islands of Samar, Leyte, Panaon, Homonhon, Mindanao, Dinagat, and Basilan (Ris, 1930; Hämäläinen & Müller, 1997; Villanueva, 2011; Guadalquiver *et al*., 2022). *Euphaea cora* Ris, 1930 is also another Greater Mindanao faunal region endemic and have been recorded from Samar, Mindanao, and Basilan (Hämäläinen & Müller, 1997). Both *E. amphicyana* and *E. cora* were first described from male specimens collected on unspecified locality in Surigao (Mindanao Island) (Ris, 1930).

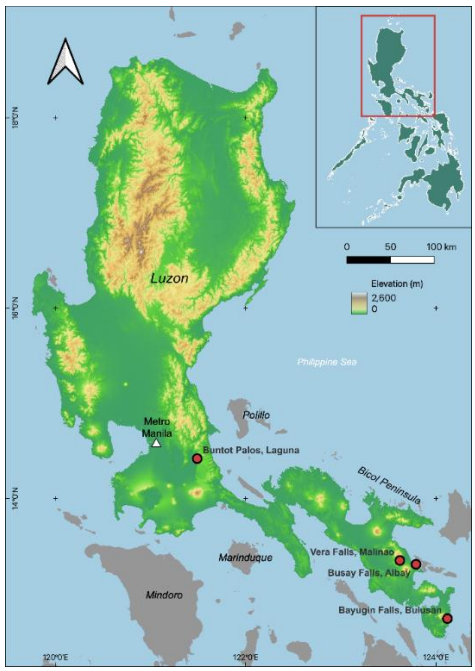


**Fig. 1.** Additional field observation records of the Luzon gossamerwing (*Euphaea refulgens*) in Southern Luzon, Philippines (red dots).

On the other hand, *E. refulgens* is endemic to Greater Luzon faunal region. This species was first described from a male specimen collected in Manila (Selys, 1853). *Euphaea refulgens* is a widespread forest-dwelling species and have been documented in several islands across the Greater Luzon faunal region such as Calayan, Luzon, Polillo, Marinduque, Catanduanes, and Mindoro (Needham & Gyger, 1939; Hämäläinen & Müller, 1997; Gapud, 2006; Villanueva, 2009, 2010; Villanueva & Gil, 2011; Villanueva *et al*., 2012; Estacio *et al*., 2020; Amarga & Mercado, 2022). *Euphaea refulgens* inhabit forest streams with semi-closed canopy (Gapud, 2006). In addition, Lok & Orr (2009) noted that *E. refulgens* can breed in pools beneath waterfalls. Furthermore, this record adds to the account of Odonata fauna inhabiting Mayon Volcano National Park as well as contribute to the current distribution records of *Euphaea refulgens* in Luzon Island, Philippines.

**Acknowledgments**

The authors would like to thank Dr. Hendrik Freitag (Ateneo de Manila University), Dr. Jessamyn Recuenco-Adorada (University of the Philippines Los Baños), and Perry Archival Buenavente (National Museum of Natural History- Philippines) for providing access on *Euphaea* specimens, Makiling Center for Mountain Ecosystems (Los Baños, Laguna) for providing collection permit on Mt. Makiling Forest Reserve (GP No. FWD-2019-054), Dr. Hui-Yun Tseng (National Taiwan University) for providing laboratory space for the first author, Mr. Christian Supsup (Kansas University) for assistance in creating the map shown as Fig. 1, and to Ms. Geleena Gestiada (Asia Pacific College) and Mr. Christian Cuevas (National Fisheries Research and Development Institute) for various field assistance.

**Fig. 2.** Fore- and hind wings of a male *Euphaea refulgens* showing metallic coloration.

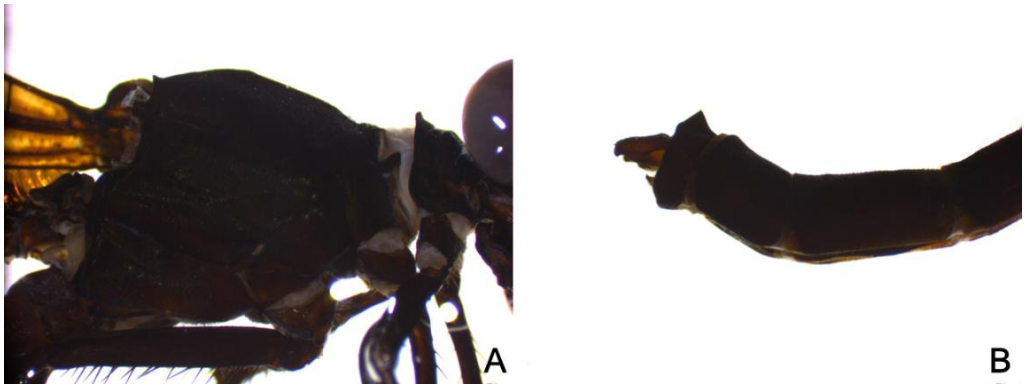


**Fig. 3.** Lateral view of thorax (A) and terminal region of abdomen (B) of male *E. refulgens*.

**References**

Amarga A.K.S., W.A.J. Mercado. 2022. First preliminary records of Odonata fauna in Malinao Volcano, Luzon Island, Philippines. *Bulletin of the Natural History Museum- Plovdiv*, 7: 21-25.

Buot Jr., I.E. 2009. An ethnobotanical study of the plant biodiversity of Mt. Mayon, Bicol Peninsula, Albay, Philippines. *Journal of Nature Studies*, 8(1): 1-10.

Dinets V. 2001. Ornithological records from Luzon during January-February 2001, including a description of the voice of Luzon Rail *Lewinia mirificus*. *Oriental Bird Club Bulletin*, 34: 40-41.

Estacio R.D., Villanueva R.J.T., H. Freitag. 2020. Odonata fauna of riparian habitats in selected areas of Luzon and Mindoro region. *International Journal of Scientific and Research Publications*, 10(8): 788-794.

Gapud V.P. 2006. Damselflies (Odonata: Zygoptera) of Greater Luzon, Philippines with description of two new species. *Philippine Entomologist*, 19(2): 1-42.

Guadalquiver D.M.E., Nuñeza O.M., R.J.T. Villanueva. 2022. Odonatofauna in the freshwater system of Kibalabag, Malaybalay City, Bukidnon, Philippines. *Biodiversitas*, 23(4): 1857-1863.

Hämäläinen M., R.A. Müller. 1997. Synopsis of the Philippine Odonata, with lists of species recorded from forty islands. *Odonatologica*, 26(3): 249-315.

Heaney L.R. 1985. Zoogeographic evidence for middle and late Pleistocene land bridges to the Philippine Islands. *Modern Quaternary Research in Southeast Asia*, 9: 127-143.

Kinoshita K., Tsuchida S., Corpuz E., Laguerta E., Tupper A., Kanagaki C., Hamada S., N. Iino. 2008. Ground and satellite-based observations of Mayon Volcano, Philippines. *South Pacific Studies*, 28(2): 53-68.

Kyriazis C.C., Alam B., Wjodyla M., Hackett S., Hosner P., Mays Jr., H.L., Heaney L.R., S. Reddy. 2018. Colonization and diversification of the white-browed shortwing (Aves :Muscicapidae: *Brachypteryx montana*) in the Philippines. *Molecular Phylogenetics and Evolution*, 121: 121-131

Lagmay A.M.F., Tengonciang A.M.P., H. Uy. 2005. Structural setting of the Bicol Basin and kinematic analysis.

of fractures on Mayon Volcano, Philippines. *Journal of Volcanology and Geothermal Research*, 144: 23-36.

Lok A.F.S.L., A.G. Orr. 2009. The biology of *Euphaea impar* Selys (Odonata: Euphaeidae) in Singapore. *Nature in Singapore*, 2: 135-140.

Menard K.L., C.D. Siler. 2018. New genus and two new species of Hyaliodini from the Philippines (Miridae, Deraeocorinae). *ZooKeys*, 796: 131-146.

Needham J.G., M.K. Gyger. 1939. The Odonata of the Philippines, II. Suborder Zygoptera. *Philippine Journal of Science*, 70: 239-314.

Phan Q.T., Kompier T., Karube H., F. Hayashi. 2018. A synopsis of Euphaeidae (Odonata: Zygoptera) of Vietnam, with description of two new species of *Euphaea*. Zootaxa, 4375 (2): 151-190.

Piper P.J., Ochoa J., Robles E.C., H. Lewis. 2011. Palaeozoology of Palawan Island, Philippines. *Quaternary International*, 233(2): 142-158.

Ris F. 1930. Vier neue Calopterygiden (Odonata) von den Philippinen und Palawan. *Mittellungen der Münchner Entomologischen Gesellschaft*, 20: 71-92.

Selys Longchamps E. 1853. Synopsis des Caloptérygines. *Bulletin de l'Academie Royale des sciences, des lettres et des beaux-arts de Belgique*, 20 (Annexe): 1-73.

Selys Longchamps E. 1879. Quatriemes Additions au Synopsis des Calopterygines. *Bulletin Academie royale Belgique Serie*, 47(2): 349-409.

Siler C.D., Davis D.R., Watters J.L., Freitas E.S., Griffith O.W. Binaday J.W.B., Lobos A.H.T., Amarga A.K.S., R.M. Brown. 2017. First record of the *Pseudogekko brevipes* complex from the Northern Philippines, with description of a new species. *Herpetologica*, 73(2): 162-175.

Villanueva R.J.T. 2009. Dragonflies of Babuyan and Batanes group of Islands, Philippines (Insecta: Odonata). *International Dragonfly Fund- Report*, 17: 1-16.

Villanueva R.J.T. 2010, Dragonflies of Polillo Island, Philippines. *International Dragonfly Fund-Report*, 23: 1-24.

Villanueva R.J.T. 2011. Odonata fauna of Diomabok Lake and its surroundings, Davao Oriental, Mindanao Island, Philippines. *International Dragonfly Fund-Report*, 38: 1-29.

Villanueva R.J.T., J.R.S. Gil. 2011. Odonata fauna of Catanduanes Island, Philippines. *International Dragonfly Fund- Report*, 39: 1-38.

Villanueva R.J.T., van Weerd M., H. Cahilog. 2012. Odonata recorded in February 2012 in Isabela and Aurora provinces, Luzon Island and Polillo Island, Philippines. *International Dragonfly Fund- Report*, 49: 1-42.

Received: 13.09.2023
Accepted: 26.10.2023

Bulletin of the Natural History Museum - Plovdiv

*Bull. Nat. Hist. Mus. Plovdiv, 2023, vol. 8:49-54*

***Short note***

# *Co-occurrence of Amblyomma cordiferum Neumann and Amblyomma helvolum Koch (Ixodida: Ixodidae) on Elaphe carinata (Günther) (Squamata: Colubridae) from Orchid Island, Taiwan*

**Ace Kevin S. Amarga[1, 2, 3*], Richard G. Robbins[4, 5, 6]**

[1] Biodiversity Program, Taiwan International Graduate Program, Biodiversity Research Center, Academia Sinica, Nangang District, Taipei 11529, Taiwan
[2] School of Life Science, National Taiwan Normal University, Wenshan District, Taipei 11677, Taiwan
[3] International Union for Conservation of Nature Species Survival Commission (IUCN SSC) Parasite Specialist Group
[4] Walter Reed Biosystematics Unit, Smithsonian Institution, Museum Support Center, Suitland, Maryland 20746, U.S.A.
[5] One Health Branch, Walter Reed Army Institute of Research, Silver Spring, Maryland 20910, U.S.A.
[6] Department of Entomology, Smithsonian Institution, National Museum of Natural History, Washington, DC 20560, U.S.A.
*Corresponding author. E-mail address: ace_amarga061@yahoo.com

**Abstract.** *Elaphe carinata* (Günther), the Taiwan stink snake, is a colubrid species native to East Asia and Southeast Asia, where it is known to host various Asiatic tick species. This study provides the first published account of the co-occurrence of two reptile ticks, *Amblyomma cordiferum* Neumann and *A. helvolum* Koch, on *E. carinata* from Orchid Island, southeast of Taiwan. Further research is recommended to determine whether additional tick species co-occur on reptiles in the Taiwan area and to document their associated pathogens.

**Key words:** Amblyomminae, Ixodidae, Reptilia, Taiwan.

## Introduction

Orchid Island, also known as Botel Tobago or Lanyu, is a small volcanic island southeast of mainland Taiwan (Fig. 1A), characterized by andesitic and tuffaceous agglomerates (Juang & Chen, 2002). Situated within the Taiwan-Luzon volcanic belt (Ye *et al*., 2022), this island is known for its rich biodiversity, including several endemic plants (Hsu & Wolf 2009), vertebrates (Ota 1987), and invertebrates (Shen & Tsai, 2002; Buchsbaum *et al*., 2020; Ballarin *et al*., 2021), making it an ecological hotspot for the study species interactions. Of particular interest is the island's diverse herpetofauna, comprising 16 species representing 15 genera (Uetz & Hallerman, 2023), including such endemics as the Taiwan japalure, *Diploderma swinhonis* (Günther), and the Formosa kukri, *Oligodon formosanus* (Günther).

The Taiwan stink snake, *Elaphe carinata* (Günther), a colubrid species native to East and Southeast Asia, is

common and widespread in Taiwan, including Orchid Island (Xiang & Li 2009). This species chiefly inhabits lowland secondary forests or forest edges but may also be found in agricultural areas and open fields. Because of its broad distribution and varied habitats, *E. carinata* is a useful subject for ecological studies (Uetz & Hallerman 2023), playing a significant role in the local ecosystem, as evidenced by its interactions with a diverse range of parasitic organisms, such as Apicomplexa (Han *et al*., 2015), Pseudophyllidea (Wang *et al*., 2014), Ascaridoidea (Li *et al*., 2014), and Ixodidae (Amarga *et al*., 2023a, b). Here, we describe the co-occurrence of two reptile ticks, *Amblyomma cordiferum* Neumann and *A. helvolum* Koch, on *E. carinata* collected from Orchid Island. Although ours is not the first collection of these two tick species on *E. carinata* in Taiwan, we believe it to be the first published report of this phenomenon.

## Material and methods

On 08 June 2023, an adult Taiwan stink snake was collected at Yunghsing Farm, Yehyin Village, Orchid Island (22.030744, 121.580077), where upon closer inspection it was observed to be hosting 12 tick specimens (Fig. 1B). The ticks were carefully collected using fine-tipped forceps and sent to the Herpetology Laboratory at National Taiwan Normal University (Taipei, Taiwan). Tick specimens were examined under a dissecting microscope (Nikon SMZ645) and identified using the key of Voltzit & Keirans (2002).

## Results and Discussion

Order Ixodida Leach
Superfamily Ixodoidea Leach
Family Ixodidae Koch
Subfamily Amblyomminae Koch
Genus *Amblyomma* Koch

***Amblyomma cordiferum* Neumann (Fig. 2A)**

*Amblyomma cordiferum* Neumann, 1899: 218. Type locality: Indonesia (Banda Islands).

**Material examined: Taiwan: Taitung County: Orchid Island**: on *Elaphe carinata*: 10♀♀, Yunghsing Farm, Yehyin Village, 08.VI.2023, local collector.

***Amblyomma helvolum* Koch (Fig. 2B)**

*Amblyomma helvolum* Koch, 1844: 230. Type locality: Philippines (Manila).

**Material examined: Taiwan: Taitung County: Orchid Island**: on *Elaphe carinata*: 2♂♂, Yunghsing Farm, Yehyin Village, 08.VI.2023, local collector.

In Taiwan, there are three species of *Amblyomma* ticks ectoparasitic on *E. carinata*: *A. cordiferum*, *A. helvolum*, and *A. varanense* (Supino). Parasitism by *A. cordiferum* on Taiwan *E. carinata* was first recorded by Voltzit & Keirans (2002), with subsequent reporting by Amarga *et al*. (2023a). In the case of *A. helvolum* on *E. carinata* in Taiwan, Chao *et al*. (2013) provided the first report, followed by Amarga *et al*. (2023b). In addition, Robbins (1996) reported *A. varanense* on *E. carinata* collected in Makung, Penghu Islands. Our collection, from an adult *E. carinata*, contained 12 specimens: 10 female *A. cordiferum* (9 partly engorged, 1 fully engorged) and *A. helvolum* (2 males) (Fig. 1B).

This is the first published report of *A. cordiferum* and *A. helvolum* co-infesting a single host on Orchid Island or elsewhere in Taiwan. However, it is not the first record of this phenomenon. In March 1959, R. E. Kuntz collected two *E. carinata* on Orchid Island; both snakes were infested with a single female specimen of *A. cordiferum*, while the first snake also yielded 9 males and 5 females of *A. helvolum*, and the second snake carried 4 males and 1 female of

this species. Most specimens from the two collections were subsequently deposited in the U.S. National Tick Collection and bear accession numbers 047037 and 047042.

Multi-species co-occurrence of parasites on a single host has been reported across several vertebrate taxa. Ticks are known to co-occur with other ectoparasitic arthropods, such as lice (Phthiraptera), fleas (Siphonaptera), and mites (Caron-Lévesque & Careau 2023; Fernández-Muñoz *et al*., 2023), especially on mammals and birds. In snakes, this finding has also been documented by Kumar (2022), who reported unidentified *Amblyomma* and *Rhipicephalus* ticks on a single specimen of *Naja naja* (Indian cobra). Our account of the co-occurrence of *A. cordiferum* and *A. helvolum* suggests that these tick species are ecologically sympatric. Additionally, recent reports by Amarga *et al*. (2023a, b) imply that both tick species parasitize a broad range of reptiles in Taiwan and may therefore be expected to occur together on additional hosts.

Co-occurrence of parasites on a particular host group can be attributed to several biological and environmental factors. For example, polyxenous species, such as *A. helvolum*, are more likely to be found in association with reptile tick species that have a narrower host range. Additionally, host attributes, such as habitat preferences, phenology, foraging capacity, and age or sex, may determine ectoparasite load and co-occurrence (Sáez-Ventura *et al*., 2022). On the other hand, parasite species that are ecologically sympatric or highly host specific may be subject to greater competition and consequent negative interactions (Kuris & Lafferty, 1994; Veitch *et al*., 2020), leading to the decline of less competitive species (Herrmann *et al*., 2013), although tick host specificity has long been regarded as a limited phenomenon (Hoogstraal & Aeschlimann, 1982).

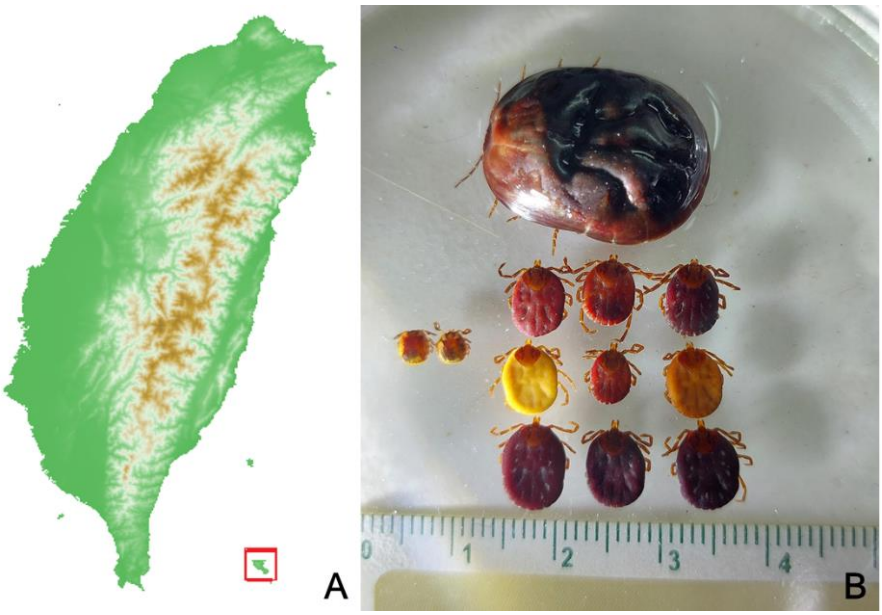


**Fig. 1A.** Map showing the location of Orchid Island in relation to Taiwan. **B.** Two male *Amblyomma helvolum* (left) and 10 female *Amblyomma cordiferum* (right) collected from an adult *Elaphe carinata* on Orchid Island, Taiwan.

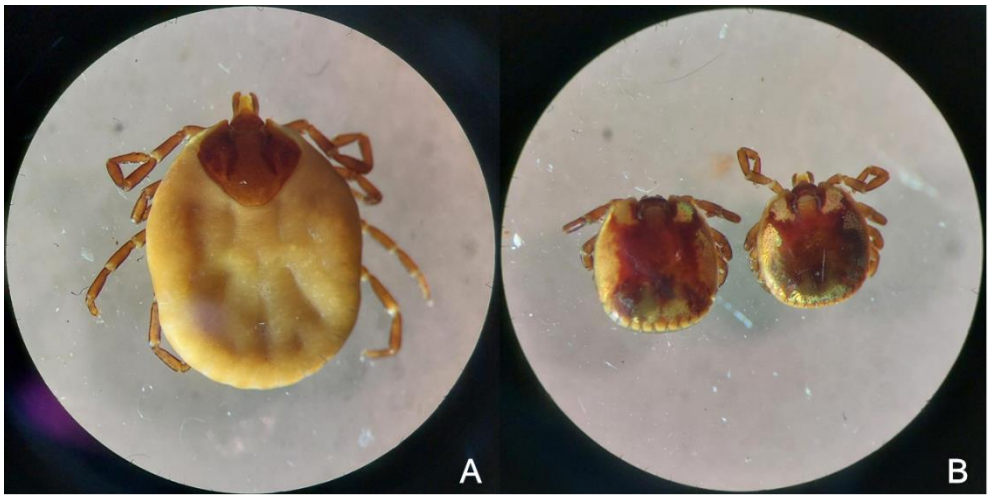


**Fig. 2A.** A partly engorged female of *Amblyomma cordiferum*. **B.** Males of *Amblyomma helvolum*

It should also be borne in mind that tick co-feeding may result in the passage of pathogens from infected to uninfected vectors, significantly impacting the transmission dynamics of tick-associated microbes, as well as host symptomatology (Thompson *et al*., 2001; Tomanović *et al*., 2010; Voordouw, 2015). For this reason, all cases of multi-species parasitism warrant reporting and further study.

**Acknowledgments**

The authors thank Dr. Si-Min Lin, National Taiwan Normal University, for providing laboratory space and for aid in obtaining the snake and tick samples. Tzong-Han Lin created the map in Fig. 1. All material in this paper has been reviewed by the Walter Reed Army Institute of Research. There is no objection to its presentation and/or publication. The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or reflecting the true views of the U.S Department of the Army or the Department of Defense.

**References**

Amarga A.K.S., Lin W.-L., Fu Y.-S., Fang W.-H., Robbins R.G., Lin, S.-M. 2023a. Host associations of the snake tick *Amblyomma cordiferum* Neumann, 1899 (Ixodida: Ixodidae), with new host records from Taiwan. *Systematic & Applied Acarology*, 28(5): 815-827.

Amarga A.K.S., Lin J.-W., Tseng H.-Y., Robbins R.G., Kwak M.L., Lin, S.-M. 2023b. New host records of the reptile tick *Amblyomma helvolum* Koch (Ixodida: Ixodidae: Amblyomminae) in Taiwan. *Systematic & Applied Acarology*, 28(5): 931-943.

Ballarin F., Yamasaki T., Su, Y.-C. 2021. A survey on poorly known rainforest litter-dwelling spiders of Orchid Island (Lanyu, Taiwan) with the description of a new species (Araneae: Linyphiidae, Tetrablemmidae, and Theridiosomatidae). *Zootaxa*, 4927(2): 197-208.

Buchsbaum U., Chen M.-Y., Chen, D.-J. 2020. *Pterotopteryx taoa* sp. nov.

from Lanyu Island, Taiwan. *Spixiana*, 43(1): 137-145.

Caron-Lévesque M., V. Careau, V. 2023. Of mice, ticks, and fleas: host behaviour and co-occurring parasites. *Canadian Journal of Zoology*, 101(7): 510-521.

Chao L.-L., Hsieh C.-K., Shih, C.-M. 2013. First report of *Amblyomma helvolum* (Acari: Ixodidae) from the Taiwan stink snake, *Elaphe carinata* (Reptilia: Colubridae), collected in southern Taiwan. *Ticks and Tick-borne Diseases*, 4(3): 246-250.

Fernández-Muñoz M.J., Cadtillo-Contreras R., Pérez J.M., Granados J.E., Márquez F.J., López-Montoya, A.J. 2023. Co-infection patterns in the ectoparasitic community affecting the Iberian ibex *Capra pyrenaica*. *Parasites & Vectors*, 16(1): 172.

Han H., Wu Y., Dong H., Zhu S., Zhao Q., Wu D., Pei E., Wang Y., Huang, B. 2015. First report of Hepatozoon (Apicomplexa: Adeleorina) from king ratsnake (*Elaphe carinata*) inShanghai, with description of a new species. *Acta Parasitologica*, 60(2): 266-274.

Herrmann C., Gern L., Voordouw, M.J. 2013. Species co-occurrence patterns among Lyme borreliosis pathogens in the tick vector *Ixodes ricinus*. *Applied Environmental Microbiology*, 79: 7273-7280.

Hoogstraal H., Aeschlimann, A. 1982. Tick-host specificity. *Mitteilungen der schweizerischen entomologischen Gesellschaft/Bulletin de la Société entomologique Suisse*, 55: 5-32.

Hsu R., Wolf, J.H.D. 2009. Diversity and phytogeography of vascular epiphytes in a tropical-subtropical transition island, Taiwan. *Flora*, 204(8): 612-627.

Juang W.-S., Chen, J.-C. 2002. The topographic landscapes of volcanic necks on Lanyu, Taitung, Taiwan. *Collection and Research*, 15: 87-95.

Koch C.L. 1844. Systematiche Übersicht über die Ordnung der Zecken. *Archiv für Naturgeschichte*, 10(1): 217-239.

Kumar C. 2022. A tick surveillance study in rescued snakes of Solapur District, Maharashtra: the ticks infesting rescued snakes of Solapur: a prevalence study. *International Journal of Allied Sciences*, 13(11): 14-19.

Kuris A.M., Lafferty, K.D. 1994. Community structure: larval trematodes in snail hosts. *Annual Review of Ecology, Evolution, and Systematics*, 25: 189-217.

Li L., Guo Y.-N., Li J., Zhang, L.-P. 2014. *Ophidascaris wangi* sp. n. and *O. najae* (Gedoelst, 1916) (Ascaridida: Ascaridoidea) from snakes in China. *Folia Parasitologica*, 61(6): 571-580.

Neumann L.G. 1899. Révision de la famille des Ixodidés (3e mémoire). *Mémoires de la Société Zoologique de France*, 14: 107-294.

Ota H. 1987. A new species of *Lepidodactylus* (Gekkonidae: Reptilia) from Lanyu island, Taiwan. *Copeia*, 1987(1): 164-169.

Robbins R.G. 1996. Does *Aponomma varanensis* (Acari: Ixodida: Ixodidae) occur on the Taiwanese mainland? *Journal of Parasitology*, 82 (4): 672-673.

Sáez-Ventura A., López-Montoya A.J., Luna A., Romero-Vidal P., Palma A., Tella J.L., Carrete M., Liébanas G.M., Pérez, J.M. 2022. Drivers of the ectoparasite community and co-infection patterns in rural and urban burrowing owls. *Biology*, 11(8): 1141.

Shen H.-P., Tsai, C.-F. 2002. A new earthworm of the genus *Pithemera* (Oligochaeta: Megascolecidae) from the Lanyu island (Botel Tobago). *Journal of the National Museum*, 55 (2): 1-7.

Thompson C., Spielman A., Krause, P.J. 2001. Coinfecting deer-associated zoonoses; Lyme disease, babesiosis, and ehrlichiosis. *Clinical Infectious Diseases*, 22: 676-685.

Tomanović S., Radulović Ž., Masuzawa T., Milutinović, M. 2010. Coexistence of emerging bacterial pathogens in *Ixodes ricinus* ticks in Siberia. *Parasite*, 17: 211-217.

Uetz P., Hallermann, J. 2023. *The Reptile Database*. Zoological Museum, Hamburg, Germany. https://reptile-database.reptarium.cz/. Accessed 12 August 2023.

Veitch J.S.M., Bowman J., Schulte-Hostedde, A.I. 2020. Parasite speciesco-occurrence patterns on *Peromyscus*: Joint species distribution modelling. *International Journal for Parasitology: Parasites and Wildlife*, 12: 199-206.

Voltzit O.V., Keirans, J.E. 2002. A review of Asian *Amblyomma* species (Acari, Ixodida, Ixodidae). *Acarina*, 10(2): 95-136.Voordouw M.J. 2015. Co-feeding transmission in Lyme disease pathogens. *Parasitology*, 142(2): 290-302.

Wang F., Li W., Hua L., Gong S., Xiao S., Hou F., Ge Y., Yang, G. 2014. *Spirometra* (Pseudophyllidea, Diphyllobothriidae) severely infecting wild-caught snakes from food markets in Guangzhou and Shenzhen, Guangdong, China: implications for public health. *Scientific World Journal*, 2014: 874014.

Xiang G., Li, P. 2009. *Colored Illustrations of Amphibians and Reptiles of Taiwan*. Huayu Nature Book Trade Co. Ltd., 336 pp. (in Chinese)

Ye Y.-J., Huang J.-P., Nguyen H.N., Villanueva R.J.T., Amarga A.K.S., Tseng, H.-Y. 2022. Comparative phylogeography in the Taiwan-Luzon volcanic belt indicates fast diversification history of *Pachyrhynchus* weevils (Coleoptera: Curculionidae). *Insect Systematics and Diversity*, 6(6): 1-14.

Prasad V. 1969. New species of bat mites from Southeast Asia and the Pacific region, with a note on *Periglischrodes gressitti* Bak. & Delf. (Acarina: Spinturnicidae). *Proceedings of the Entomological Society of Washington*, 71: 533-540.

Wang R., Li Z.-M., Peng Q.-M., Gu X.-L., Zhou C.-M., Xiao X., Han H.-J., X.-J Yu. 2023. High prevalence and genetic diversity of hemoplasmas in bats and bat ectoparasites from China. One Health, 16: 100498.

Received: 28.10.2023
Accepted: 27.11.2023

***Miscellaneous***

# *Професор емеритус д.б.н. Павел Ангелов на 90 години*

**Димитър Н. Бечев**

ПУ "Паисий Хилендарски, Биологически факултет, Катедра "Зоология",
ул. "Цар Асен" №24, BG-4000, гр. Пловдив, E-mail: dbechev@abv.bg

Както се казва „Дай Боже всекиму". Но с неговия бистър ум.

Много може да се каже за проф. Ангелов и то никога няма да е напълно достатъчно.

Роден на 6 юли 1932 г. в Стара Загора. Завършил средно образование във Второ единно смесено училище - Пловдив. Завършил биология в Софийски университет „Св. Кл. Охридски" през 1956 г. Като студент е на квартира у Пенчо Дренски.

Бил е директор на Регионалният Природонаучен музей в гр. Пловдив. От януари 1963 г. е доцент и създател на Катедра "Зоология на безгръбначните животни" във Висшия педагогически институт - Пловдив (сега ПУ „Паисий Хилендарски"). До пенсионирането си през 2000 г. е преподавател в катедра "Зоология".

Защитава докторската си дисертация през 1965г. и става доктор на биологическите науки през 1980 г. Професор по зоология от 1970 г. От 1968 г. до 1972 г. е заместник ректор на ПУ „Паисий Хилендарски", а в периода 1979-1983 г. бива избран и за ректор. Автор е на много научни публикации, монографии и учебници [1].

Създател на пловдивска школа в областта на ентомологията. Ръководил 14 защитили дисертации докторанти, които по-късно са преподаватели в университети и научни работници.

Желаем му здраве.

Проф. дбн Павел Ангелов от периода му като Ректор на ПУ (1979-1983 г.).

[1] Повече информация в Bulletin of the Natural History Museum - Plovdiv, 2017, Брой 2: 35-36, „Професор д.б.н. Павел Ангелов на 85 години".

Bulletin of the Natural History Museum - Plovdiv
*Bull. Nat. Hist. Mus. Plovdiv, 2023, vol. 8: pp. 57-71*

***Miscellaneous***

# *Petar Shurulinkov (1975-2023) - A Promising Bulgarian Ornithologist, Suddenly Stopped by Fate. A Biobibliography*

**Zlatozar N. Boev***

National Museum of Natural History, Bulgarian Academy of Sciences,
1 Blvd. Tsar Osvoboditel, 1000 Sofia, BULGARIA
*Corresponding author: boev@nmnhs.com; zlatozarboev@gmail.com

**Short biographic notes**

Petar Stanislavov Shurulinkov was born on December 25, 1975 in Sofia. He graduated from high school in 1993 in the National Gymnasium of Natural Sciences and Mathematics "Academician Lyubomir Chakalov" in Sofia. In the same year, he applied and was accepted as a student at the Department of "Vertebrate Zoology and Anthropology" at the Faculty of Biology of Sofia University "St. Kliment Ohridski" (1993-1998).

Assoc. Prof. Petar Shurulinkov in the Bird exhibition hall. National Museum of Natural History, BAS. 18.04.2016. Photo: Z. Boev.

His entire scientific career was spent at the Bulgarian Academy of Sciences. In the former Institute of Zoology, he defended his PhD thesis in zoology in 2003 after a three-year (2000-2003) scholarship (Shurulinkov, 2003).

In 2009 he obtained his habilitation as a senior research associate II degree at the Institute of Zoology at the Bulgarian Academy of Sciences. In 2010 he has moved at the National Museum of Natural History at the Bulgarian Academy of Sciences (NMNHS-BAS) as an Associate Professor and a curator of the ornithological collection of dry preparations of birds and that of bird nests and eggs. In the museum, the Associate Professor Petar Shurulinkov established himself as one of the outstanding environmentalists, showed good legislative awareness and an active civic position in solving various problems. Peter is the winner of the Jury Award of the Bulgarian Biodiversity Foundation in the Nature Activist category for 2022.

He is the author of over 140 scientific publications, mostly in the field of ornithology and bird parasitology, among them 8 books, 4 action plans for rare bird species and 33 articles (chapters) of scientific books, 11 essays on bird species in the second edition of the Red Book of Bulgaria. He participated in 15 scientific conferences with reports on parasitology and ornithology. Petar's works have been cited more than 430 times in the country and abroad.

Dr. Petar Shurulinkov has been an active member of the Balkan Wildlife Association for 3 decades. He was also a member of the Bulgarian Parasitological Society.

Petar's main scientific contributions are in the field of ornithology, parasitology and nature conservation. In the field of ornithology he worked intensively on the distribution, migration, population dynamics, biology and ecology of birds. In the field of parasitology his achievement are on the blood unicellular parasites of birds; fauna and distribution of hemosporidians in Bulgaria; influence of various factors on the extent of infection of birds with Haemosporidia; impact of Haemosporidia on wild birds and on migration in migratory species. His contributions in the nature conservation are in the field of protection of birds; conservation legislation, important bird areas for the protection of birds and their habitats. P. Shurulinkov published his research in 17 countries: Austria, Bulgaria, Denmark, Germany, Great Britain, Finland, Italy, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, the Czech Republic, the Netherlands, the United States, and Ukraine in 5 languages (Bulgarian, English Russian, German, and Czech).

Peter was the supervisor of two PhD students who successfully defended their dissertations in 2022 and 2023 (Gerdzhikov, 2022; Daskalova, 2023).

One of the last initiatives of Assoc. Prof. P. Shurulinkov was the Ornithological Camp "Durankulak" (NE Bulgaria on the Via Pontica flyway), organized by the NMNHS-BAS. In the last few years, ten or more thousands of birds of about 90-100 species have ringed in it. This takes this camp at the first place on the Balkan Peninsula.

It was there that P. Shurulinkov established the Dusky warbler (*Phylloscopus fuscatus* (Blyth, 1842)) as a new species for the Bulgarian avifauna. The premature death (09.08.2023) of this promising young scientist caused a great loss to the entire Bulgarian ornithological community. In his memory, the Ornithological Camp in Durankulak was named "Peter Shurulinkov".

Assoc. Prof. Petar Shurulinkov at the new Bird skin depot. National Museum of Natural History, BAS. 21.05.2014. Photo: Z. Boev.

## Bibliography


### 1998

1. Nankinov D., P. Shurulinkov, I. Nikolov, B. Nikolov, S. Dalaktchieva, I. Hristov, R. Stanchev, A. Rogev, A. Dutsov & M. Sarov 1998. Studies of the Waders (Charadriiformes) on the wetlands around Sofia (Bulgaria). *Rivista Italiana di Ornitologia*, 68(1): 63-83.

### 1999

2. Nankinov D., S. Dalakchieva, B. Nikolov, P. Shurulinkov, K. Popov, S. Kirilov, K. Zareva, B. Borisov, G. Stoyanov, N. Nankinov, N. Minchev, D. Kyuchukov, I. Nikolov, R. Stanchev & E. Ganchev 1999. Studies on the behavior of birds during the solar eclipse of August 11, 1999. *In:* Modern problems of solar-terrestrial impacts. *Collection of reports of the VI National Conference with an interpartum on modern problems of solar-terrestrial impacts*, 18-19.XI. 1999, Sofia, 97-100. (in Bulgarian, English summary).

### 2000

3. Nankinov D., S. Dalaktchieva, K. Popov, S. Kirilov, P. Iankov, R. Stanchev & P. Shurulinkov 2001. Die Invasion des Rosenstares in Bulgarien im Jahre 2000. *Ornithologische Mitteilungen*, 53(6-7): 240-245.

**2001**

4. Shurulinkov P. & I. Hristov 2001. *The birds of Nature Park Vitosha*. Field Guide. GEOSOFT EOOD, Sofia, November 2001, 153 p. (in Bulgarian).
5. Shurulinkov P., B. Nikolov & R. Tsonev 2001. On the distribution of the Black-headed Bunting (*Emberiza melanocephala*) in Bulgaria. *In: Bunting Studies in Europe*, Bogucki Wydawnictwo Naukowe, Poznan, 81-88.
6. Nikolov B., I. Hristov, P. Shurulinkov, I. Nikolov, A. Rogev, A. Dutsov & R. Stanchev 2001. New data on some poorly studied species of forest owls (*Strix uralensis*, *Glaucidium passerinum*, *Aegolius funereus*) in Bulgaria. *Forest Science*, 38(1/2): 75-86.
7. Shurulinkov P. S. & R. T. Tsonev 2001. First observation of the Desert Wheatear *Oenanthe deserti* in Bulgaria. *Acrocephalus*, 22 (104/105): 53.
8. Nankinov D., S. Dalakthieva, B. Nikolov, P. Shurulinkov, K. Popov, S. Kirilov, K. Zareva, B. Borisov, G. Stojanov, N. Nankinov, N. Minchev, D. Kjuchukov, I. Nikolov, R. Stanchev & E. Ganchev 2001. Studying the behaviour of birds during the solar eclipse on August 11, 1999. *Russian Ornithological Journal*, 142: 355-369 .

**2002**

9. Shurulinkov P. & V. Golemansky (2002) Haemoproteids (Haemosporida: Haemoproteidae) of Wild Birds in Bulgaria. *Acta protozoologica*, 41: 359-374.
10. Zehtinjiev P., P. Shurulinkov & R. Tsonev (2002) Present status of the Great Bustard (*Otis tarda*) in Bulgaria. International community for the conservation of bustards. *Materials of the International Scientific and Practical Conference*, Kharkiv, 24-28. October 2001, 42-46.

**2003**

11. Shurulinkov P. 2003. *Composition, distribution and ecology of the blood unicellular parasites of wild birds from Bulgaria*. Institute of Zoology, Bulgarian Academy of Sciences. Abstract of PhD thesis. Sofia, 28 pp. (in Bulgarian).
12. Stoyanov G., P Shurulinkov, D. Kjutchukov, P. Spakovski, V. Delov, K. Vultchev & A. Stoyanov 2003. Vom Bruten der Waldschnepfe *Scolopax rusticola* in Bulgarien. *Ornithologische Mitteilungen*, 55 (6): 211-217.
13. Shurulinkov P., B. Nikolov, R. Tsonev, I. Nikolov, A. Roguev, M. Sarov, A. Dutsov, P. Podlesniy, R. Stanchev & I. Hristov 2003. A contribution to the occurrence of some rare and poorly studied species of birds during the nesting season in maritime Dobroudza. *Annual of Sofia University "St. Kliment Ohridski"*, Fac. of Biol., book 1 - Zoology, 93-94: 31-39.
14. Shurulinkov P., B. Nikolov, G. Stoyanov & I. Nikolov 2003. Erstes sicheres Bruten des Karmingimpels in Bulgarien. *Ornithologische Mitteilungen*, 55(4): 122-127.
15. Shurulinkov P. & V. Golemansky 2003. *Plasmodium* and *Leucocytozoon* (Sporozoa: Haemosporida) of Wild Birds in Bulgaria. *Acta protozoologica*, 42: 205-214.
16. Shurulinkov P., G. Stoyanov, P. Tzvetkov, K. Vultchev, R. Kolchagov & M. Ilieva 2003. Distribution and abundance of Tengmalm's Owl *Aegolius funereus* on

Mount Pirin, southwest Bulgaria. *Sandgrouse*, 25(2): 103-117.

17. Shurulinkov P., D. Ragyov & M. Ilieva. 2003. Dalmatian Pelican *Pelecanus crispus* - Kodrasti pelikan - pozno jesensko opazovanje večje jate 188 osebkov 16.11.2001 na otočku Gorni Tsibar na reki Donavi, vzhodno od mesta Lom v SZ Bolgariji, (43,49N,23,32E). *Acrocephalus*, 24 (116): 39
18. Shurulinkov P., D. Ragyov, T. Zlatanov & J. Day 2003. Tundra Swan *Cygnus columbianus bewickii* Mali labod - 6 osebkov, opazovstnih 21.12.2002 na akumuladjskem jezeru Pjasačnik blizu mesta Plovdiv (44.24N, 24.33E). Ptice so bile v dnizbi 50 labodov grbccv *Cygnus olor* in 7 labodov pevcev *C. cygnus*. Gie za redko zimsko opazovanje v zahodni Bolgariji. - *Acrocephalus* 14(116): 39.
19. Stoyanov G. & P. Shurulinkov 2003. Late nesting of the Common Swift *Apus apus* and the Pallid Swift *Apus pallidus* in Bulgaria. Pozno gnezdenje hudournika *Apus apus* i bledega hudournika *Apus pallidus* v Bolgariji. *Acrocephalus*, 24 (119): 145-146.
20. Stoyanov G. & P. Shurulinkov 2003. Alpine Chough *Pyrrhocorax graculus*. *Acrocephalus*, 24 (116): 42-43.

**2004**

21. Shurulinkov P. 2004. Erstnachweis der Wustengrasmucke *Sylvia nana* in Bulgarien. *Ornithologische Mitteilungen*, 56(3): 77-79.
22. Shurulinkov P. 2004. Prevalence of Haematozoa in wild birds in relation with the host's age and migratory status. *Acta zoologica bulgarica*, 56(2): 223-232.
23. Jovani R., L. Amo, E. Arriero, O. Krone, A. Marzal, P. Shurulinkov, G. Tomas, D. Sol, J. Hagen, P. Lopez, J. Martin, C. Navarro & J. Torres 2004. Double gametocyte infections in apicomplexan parasites of birds and reptiles. *Parasitology Research*, 94(2): 155-157.
24. Shurulinkov P., M. Ilieva, J. Day & K. Vultchev 2004. Beobachtungen zur Brutvogelfauna der westlichen und zentralen Turkei. *Ornithologische Mitteilungen*, 56 (10): 347-352.
25. Nankinov D., P. Shurulinkov, B. Nikolov, I. Nikolov, I. Hristov, R. Stanchev, S. Dalakchieva, A. Dutsov, M. Sarov & A. Rogev 2004. *Goose-like birds (Anseriformes) in wetlands near the city of Sofia.* Bulgarian Ornithological Center. Institute of Zoology, BAS, Sofia, 135 p. (in Bulgarian, English summary)
26. Nankinov D., A. Dutsov, B. Nikolov, B. Borisov, G. Stoyanov, G. Gradev, D. Georgiev, D. Popov, D. Domuschiev, D. Kirov, E. Tilova, I. Nikolov, I. Ivanov, K. Dichev, K. Popov, N. Karaivanov, N. Todorov, P. Shurulinkov, R. Stanchev, R. Alexov, R. Tsonev, S. Dalakchieva, S. Ivanov, S. Marin, S. Staykov, S. Nikolov & H. Nikolov 2004. *Number of national populations of birds breeding in Bulgaria, 2004*. Green Balkans, Plovdiv, 2004, 32 p. (in Bulgarian, English summary).
27. Shurulinkov P. 2004. Kittiwake *Rissa tridactyla*. *Acrocephalus*, 25 (123): 234.
28. Nikolov I., S. Velkov, R. Stanchev, I. Hristov & P. Shurulinkov 2004. Moustached Warbler *Acrocephalus melanopogon*. *Acrocephalus*, 25 (123): 235.
29. Shurulinkov P., E. Komitov, T. Zlatanov & L. Vultchev 2004. Eleonora's Falcon *Falco eleonorae* and Griffon Vulture *Gyps fulvus*. *Acrocephalus*, 25 (122): 174.

**2005**

30. Shurulinkov P. & I. Nikolov 2005. Recent status of the breeding avifauna in the canyons of the Rousenski Lom river system, North-eastern Bulgaria. *Ciconia*, 13: 77-87.
31. Shurulinkov P. & G. Stoyanov 2005. Uber die sudlichste Grenze des Sperlingkauz-Vorkommens, *Glaucidium passerinum*. *Ornithologische Mitteilungen*, 57(6): 198-200.
32. Shurulinkov P. 2005. On the breeding biology of Skylark, *Alauda arvensis cantarella* (Aves: Passeriformes) in West Bulgaria. *Acta zoologica bulgarica*, 57(2): 207-216.
33. Shurulinkov P. 2005. Occurrence of haematozoan parasites of genus Hepatozoon (Apicomplexa: Hepatozoidae) in wild birds in Bulgaria. *Acta zoologica bulgarica*, 57 (2): 245-252.
34. Shurulinkov P. & G. Stoyanov 2005. New data on the distribution of Tengmalm's Owl (*Aegolius funereus*) in Western Bulgaria. *Buteo*, 14: 61-66.
35. Nikolov B., L. Hristova, S. Nikolov, P. Shurulinkov & A. Dutsov 2006. Abnormally plumaged Woodchat Shrikes in Bulgaria, with notes on albino and leucistic Laniidae worldwide. *Dutch Birding*, 28 (2):90-95.
36. Nikolov I., Risonev & P. Shurulinkov 2005. Recent data on the inland breeding of Great Cormorant (*Phalacrocorax carbo*) in Bulgaria. *Ciconia*, 14: 68-73.
37. Shurulinkov P., R. Tsonev, B. Nikolov & G. Stoyanov & L. Asenov 2005. *Birds of the Middle Danube Plain*. Green Balkans Federation, Sofia, 120 pp. (in Bulgarian, English summary).
38. Stoyanov, G. & P. Shurulinkov 2005. Osprey *Pandion haliaetus* Ribji orel - verjetno gnezdenje para v bližini I zadrževalnika Ogosta (UTM FP70, SV Bolgarija) med letoma 1997 in 2004. *Acrocephalus*, 26: 202.
39. Shurulinkov P. 2005. Fauna of the Nature Park "Persina". *Danube Wetlands. Management of Danube Wetlands*. Reports of surveys and studies carried out in the process of developing a Management Plan for the Persina Nature Park, 2005, 30 pp. (in Bulgarian, English summary).
40. Shurulinkov P. 2005. Parasitic Skua *Stercorarius parasiticus* Bodičasta govnačka - odrasel osebek opažen 29.9-2003 na zadrževalniku Iskar (UTM GN 10; Z Bolgarija). *Acrocephalus*, 26 (126): 161.
41. Shurulinkov P. 2005. Knot *Calidris canutus* Veliki prodnik - dva osebka opazovana na poplavljenem travniku ob Donavi, zahodno od mesta Belene (UTM LG 43, S Bolgarija); eden izmed redkih podatkov za spomladansko seltev velikega prodnika v notranjosti Bolgarije. *Acrocephalus*, 26 (126): 161.
42. Shurulinkov P., Ilieva, M. & J. Day 2005. Great Black-headed Gull *Larus ichthyaetus* Ribji galeb - več opažanj na jezeru Mandra (UTM NG 39, JV Bolgarija); 8 os. 20.2.2004, 18 os. 24.2.2004. 1 os. 26.2.2004; doslej najvecje stevilo osebkov za Bolgarijo. *Acrocephalus*, 26 (126): 161.

**2006**

43. Shurulinkov P. & N. Chakarov 2006. Prevalence of blood parasites in different local populations of reed warbler (*Acrocephalus scirpaceus*) and great reed warbler (*Acrocephalus arundinaceus*). *Parasitology Research*, 99(5): 588-592.

44. Nikolov I., P. Shurulinkov, R. Pankova & S. Konaklieva 2006. Observations of Barnacle Goose in Bulgaria. *Alula*, 12(2): 92-93.
45. Nikolov B., L. Nikolov, L. Hristova & P. Shurulinkov 2006. Dritter Nachweis der Kanadagans *Branta canadensis* in Bulgarien. *Ornithologische Mitteilungen*, 58 (6/7): 242-243.
46. Shurulinkov P. & G. Stoyanov 2006. Some new findings of Pigmy Owl *Glaucidium passerinum* and Tengmalm's Owl *Aegolius funereus* in Western and Southern Bulgaria. *Acrocephalus*, 27 (128-129): 65-68.
47. Shurulinkov P., B. Nikolov, P. Statkov, L. Hristova, A. Ralev, H. Dinkov, K. Hristov & L. Hristov 2006. Erster sicherer Brutnachweis des Scwarzhalstauchers nach uber einem Jahrungsdert in der Sofia-Ebene, Bulgarien. *Ornithologische Mitteilungen*, 58 (11): 376-379.
48. Nikolov B., L. Nikolov, P. Shurulinkov, S. Velkov, L. Hristova, G. Daskalova & A. Ralev 2007. Ungewohniche Anzahlen der Beigente *Aythya marila* im Februar 2006 entlang der bulgarischer Kuste. *Ornithologische Mitteilungen*, 59(1): 28-29.

**2007**

49. Shurulinkov P. & G. Daskalova 2007. Ruckkehr des Seeadlers *Haliaeetus albicilla* als Brutvogel nach Bulgarisch-Thrazien-Erste Brut am Tunja-Flub nach 1942. *Ornithologische Mitteilunge*n, 59(10): 330-332.
50. Shurulinkov P., I. Hristov, K. Hristov, I. Nikolov, B. Nikolov, S. Velkov, H. Dinkov, A. Ralev, N. Chakarov, D. Ragyov, R. Stanchev, L. Spassov & I. Hristova 2007. Birds of Dragoman marsh and Chepun hills, W-Bulgaria - checklist, status and recent development of water birds populations. *Journal of Balkan Ecology*, 10(3): 251-264.
51. Shurulinkov P., I. Nikolov, D. Demerdjiev, K. Bedev, H. Dinkov, G. Daskalova, S. Stoychev, I. Hristov & A. Ralev 2007. Die aktuelle Brutverbreitung und die Bestande koloniebrutender Reiher und Kormorane in Bulgarien. *Ornithologische Mitteilungen*, 59(11): 370-378.
52. Shurulinkov P. & N. Chakarov 2007. Blood parasite infections of some passerine migratory birds during autumn migration through West Bulgaria. *Acta zoologica bulgarica*, 59(3):301-308.
53. Shurulinkov P., A. Ralev, G. Daskalova & N. Chakarov 2007. Distribution, numbers and habitat of Pigmy Owl, *Glaucidium passerinum* in Rhodopes Mts (S-Bulgaria). *Acrocephalu*s, 28(135): 159-163.
54. Shurulinkov P., R. Tsonev & E. Todorov 2007. Nikopolsko plateau. *In:* Konstantinova, I., M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000*. BSPB, Conservation Series, Book 11, Sofia, 373-375.
55. Shurulinkov P. & R. Tsonev 2007. Studenets. *In:* Konstantinova, I., M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000*. BSPB, Conservation Series, Book 11, Sofia, 376-378.
56. Plachiiski D., T. Petrov, B. Ivanov, S. Velkov, I. Nikolov, B. Nikolov, P. Shurulinkov & R. Stanchev 2007. Maritsa - Plovdiv. *In:* Konstantinova, I. & M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000*. BSPB, Conservation Series, Book 11, Sofia, 417-419.
57. Shurulinkov P. & R. Tsonev 2007. Obnova. *In:* Konstantinova, I. & M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000. BSPB*, Conservation

Series, Book 11, Sofia, 440-442.
58. Stefanov T., P. Iankov, P. Shurulinkov & B. Nikolov 2007. Rupite. *In:* Konstantinova & I., M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000*. BSPB, Conservation Series, Book 11, Sofia, 447-449.
59. Shurulinkov P., R. Tsonev, T. Zlatanov & E. Todorov 2007. Devetashko plateau. *In:* Kostadinova, I. & M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000*. BSPB, Conservation Series, Book 11, Sofia, 456-458.
60. Delov V., P. Iankov, N. Petkov, P. Shurulinkov & S. Velkov 2007. Rayanovtsi, BG001. *In:* Konstantinova, I. & M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000*. BSPB, Conservation Series, Book 11, Sofia, 120-122.
61. Iankov P., V. Delov, B. Barov, A. Ignatov, T. Robertson, R. Nedialkov, S. Velkov, I. Nikolov, B. Nikolov, P. Shurulinkov & N. Karaivanov 2007. Melnik Pyramids, BG072. *In:* Konstantinova, I. & M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000*. BSPB, Conservation Series, Book 11, Sofia, 366-368.
62. Delov V., P. Shurulinkov, T. Zlatanov & R. Tsonev 2007. Mikre, BG088. *In:* Konstantinova, I. & M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000*. BSPB, Conservation Series, Book 11. Sofia, 420-422.
63. Spiridonov J., S. Spasov, P. Shurulinkov, I. Nikolov, B. Nikolov & S. Velkov 2007. Kresna gorge. *In:* Konstantinova, I. & M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000*. BSPB, Conservation Series, Book 11, Sofia, 127-130.
64. Georgiev D., D. Dimitrov, V. Vasilev, I. Ivanov, P. Shurulinkov & T. Zlatanov 2007. Provadiysko-Royaksko plateau. *In:* Konstantinova, I. & M. Gramatikov (eds). *Important Bird Areas in Bulgaria and NATURA 2000*. BSPB, Conservation Series, Book 11, Sofia, 246-248.

**2008**

65. Shurulinkov P., I. Nikolov, G. Daskalova, B. Nikolov & G. Stoyanov 2008. Further range expansion of the Isabelline Wheatear *Oenanthe isabellina* in Bulgaria. *Ciconia*, 16: 49-56.
66. Shurulinkov P., G. Daskalova, I. Hristov, M. Ilieva, R. Pankova & J. Day 2008. Contribution to the knowledge on the breeding ornithofauna of Eastern Turkey. *Acta zoologica bulgarica*, 60(2): 125-133.
67. Hristov K., P. Shurulinkov, A. Ralev & I. Zafirov 2008. Great White Egret (*Egretta alba*) – a new breeding species of a mixed heronry at Dragoman marsh, Western Bulgaria. *Acta zoologica bulgarica*, 60(2): 209-212.
68. Pacenovsky S. & P. Shurulinkov 2008. Latest data on distribution of the Pigmy Owl (*Glaucidium passerinum*) in Bulgaria and Slovakia including population density comparison. *Slovak Raptor Journal*, 2: 91-106.
69. Nikolov B., G. Stoyanov, D. Ragyov, P. Shurulinkov & I. Nikolov 2008. High-altitude records of the Great Grey Shrike *Lanius excubitor* during winter-time in Bulgaria. *Acrocephalus*, 29 (138/139): 185-186.
70. Shurulinkov P., S. Stoichev, G. Gerassimov, I. Mitev & V. Delov 2008. Common Quail (*Coturnix coturnix*). *In:* Iankov, P. (ed.) *Atlas of the Breeding Birds in Bulgaria*. BSPB Conservation Series, Book 10, BSPB Sofia, 202-203.

71. Shurulinkov P., S. Stoichev, G. Gerassimov, T. Petrov & G. Daskalova 2008. Stone Curlew (*Burhinus oedicnemus*) *In:* Iankov, P. (ed.) *Atlas of the Breeding Birds in Bulgaria*. BSPB Conservation Series, Book 10, BSPB Sofia, 238-239.
72. Shurulinkov P., S. Stoichev & S. Donchev 2008. Orphean Warbler (*Sylvia hortensis*). *In:* Iankov, P. (ed.) *Atlas of the Breeding Birds in Bulgaria. BSPB*. Conservation Series, Book 10, BSPB Sofia, 498-499.
73. Shurulinkov P. & S. Stoichev 2008. Stonechat (*Saxicola torquata*). *In:* Iankov, P. (ed.) *Atlas of the Breeding Birds in Bulgaria*. BSPB Conservation Series, Book 10, BSPB Sofia, 438-439.
74. Shurulinkov P., S. Stoichev, B. Ivanov, S. Gigov, D. Georgiev & E. Stoynov 2008. Woodchat Shrike (*Lanius senator*). *In:* Iankov, P. (ed.) *Atlas of the Breeding Birds in Bulgaria*. BSPB Conservation Series, Book 10, BSPB Sofia, 570-571.
75. Shurulinkov P. & S. Stoichev 2008. Nightjar (*Caprimulgus europaeus*). *In:* Iankov, P. (ed.) *Atlas of the Breeding Birds in Bulgaria*. BSPB Conservation Series, Book 10, BSPB Sofia, 340-341.
76. Gerassimov G., Z. Boev & P. Shurulinkov 2008. Hazel Grouse (*Bonasa bonasia*). *In:* Iankov, P. (ed.) *Atlas of the Breeding Birds in Bulgaria*. BSPB Conservation Series, Book 10, BSPB Sofia, 190-191.
77. Ivanov B., E. Todorov, D. Georgiev, P. Shurulinkov & G. Daskalova 2008. White tailed Eagle (*Haliaeetus albicilla*). *In:* Iankov, P. (ed.) *Atlas of the Breeding Birds in Bulgaria*. BSPB Conservation Series, Book 10, BSPB Sofia, 128-129.

**2009**

78. Shurulinkov P. & M. Ilieva 2009. Spatial and temporal differences in the blood parasite fauna of passerine birds during the spring migration in Bulgaria. *Parasitology Research*, 104(6):1453-1458.
79. Stoyanov G. & P. Shurulinkov. 2009. Die Vogel des bulgarishen Teils des Slavyanka-Gebirges. Teil 1. *Ornithologishe Mitteilungen*, 61 (11): 363-368.
80. Stoyanov G. & P. Shurulinkov 2009. Die Vogel des bulgarishen Teils des Slavyanka-Gebirges. Ergebnisse, Teil 2. *Ornithologishe Mitteilungen*, 61 (12): 389-395.
81. Shurulinkov P. & R. Tsonev 2009. Die Wasservogel der unteren Donau-Niederungen wahrend der Sommerflutten 2005 und 2006. *Ornithologishe Mitteilungen*, 61 (10): 317-324.
82. Dimova D. & P. Shurulinkov. 2009. *Rare and protected species, objects of conservation, according to the concept of forests of high conservation value in the Rhodopes*. Rodopi Project. Sofia, 136 p.

**2010**

83. Shurulinkov P., G. Daskalova, A. Ralev & V. Elenkova 2010. New data on the breeding of White-winged Tern (*Chlidonias leucoptera*) in Bulgaria. *Acta Zoological Bulgarica*, 62(3): 301-306.
84. Daskalova G. & P. Shurulinkov 2010. Neues zur Brutvogelfauna des Tserkovski Reservoirs in Sudost-Bulgarien. *Ornithologishe Mitteilungen*, 62(12): 408-412.

**2011**

85. Shurulinkov P., G. Daskalova, N. Chakarov, K. Hristov, S. Dyulgerova, Y. Gocheva, S. Cheshmedzhiev, M. Madzharov & I. Dimchev 2011. Characteristics of soaring birds' spring migration over inland SE Bulgaria. *Acrocephalus*, 32 (148/149): 29-43.
86. Shurulinkov P. 2012. Presumed hybrid Black-headed x Black-backed Citrine Wagtail in Bulgaria in April 2011. *Dutch Birding*, 34(2): 108-109.
87. Ruzic M, P. Shurulinkov, G. Daskalova, A. Ralev, L. Spasov & M. Popovic 2011. Semi-collared Flycatcher *Ficedula semitorquata* - a new breeding species in Serbia. *Ciconia*, 20: 72-76.
88. Shurulinkov P., J. Spiridonov, T. Zlatanov, B. Nikolov, S. Nikolov & R. Stanchev 2011. Tengmalm's Owl (*Aegolius funereus*). *In:* Golemansky V. (Ed.) *Red Data Book of Bulgaria*, vol. 2. Animals. BAS, MOEW, Sofia. 274.
89. Shurulinkov P., V. Delov, D. Kyuchukov, S. Nikolov & G. Stoyanov 2011. Woodcock (*Scolopax rusticola*). *In:* Golemansky V. (Ed.) *Red Data Book of Bulgaria*, vol. 2. Animals. BAS, MOEW, Sofia. 182.
90. Shurulinkov P. 2011. Green Sandpiper (*Tringa ochropus). In:* Golemansky V. (Ed.) *Red Data Book of Bulgaria*, vol. 2. Animals. BAS, MOEW, Sofia. 183.
91. Shurulinkov P. 2011. Short-toed Lark (*Calandrella brachydactyla*). *In:* Golemansky V. (ed.) *Red Data Book of Bulgaria*, vol. 2. Animals. BAS, MOEW, Sofia. 277.
92. Shurulinkov P., I. Vatev, B. Ivanov & N. Karaivanov 2011. Calandra Lark (*Melanocorypha calandra*). *In:* Golemansky V. (ed.) *Red Data Book of Bulgaria*, vol. 2. Animals. BAS, MOEW, Sofia. 196.
93. Shurulinkov P. 2011. Cetti's Warbler (*Cettia cetti*). *In:* Golemansky V. (ed.) *Red Data Book of Bulgaria*. vol. 2. Animals. BAS, MOEW, Sofia. 198.
94. Spiridonov J., B. Nikolov & P. Shurulinkov 2011. Pigmy Owl (*Glaucidium passerinum*). *In:* Golemansky V. (ed.) *Red Data Book of Bulgaria*, vol. 2. Animals. BAS, MOEW, Sofia. 191.
95. Spiridonov J., P. Shurulinkov & T. Zlatanov 2011. Three-toed Woodpecker (*Picoides tridactylus*). *In:* Golemansky V. (ed.) *Red Data Book of Bulgaria*, vol. 2. Animals. BAS, MOEW, Sofia. 195.
96. Spiridonov J., P. Shurulinkov & B. Nikolov 2011. Ural Owl (*Strix uralensis*). *In:* Golemansky V. (ed.) *Red Data Book of Bulgaria*, vol. 2. Animals. BAS, MOEW, Sofia. 192.
97. Domuschiev D. & P. Shurulinkov 2011. Booted eagle (*Hieraaetus pennatus*). *In:* Golemansky V. (ed.) *Red data book of Bulgaria*, vol. 2. Animals. BAS, MOEW, Sofia. 266.
98. Ivanov B. & P. Shurulinkov 2011. Orphean Warbler (*Sylvia crassirostris*). *In:* Golemansky V. (ed.) *Red data book of Bulgaria*, vol. 2. Animals. 113. BAS, MOEW, Sofia. 285.

**2012**

99. Shurulinkov P., N. Chakarov & G. Daskalova 2012. Blood parasites, body condition and wing length in two subspecies of Yellow Wagtail (*Motacilla flava*)

during migration. *Parasitology Research*, 110(5): 2043-2051. DOI 10. 1007/s00436-011-2733-5 (online first, 25. 01. 2012).

100. Shurulinkov P., G Stoyanov, E. Komitov, G. Daskalova & A. Ralev 2012. Contribution to the knowledge on distribution, number and habitat preferences of rare and endangered birds in Western Rhodopes Mts. Southern Bulgaria. Strigiformes and Piciformes. *Acta zoologica bulgarica*, 64(1): 43-56.
101. Ralev A., M. Popovic, M. Ruzic, P. Shurulinkov, G. Daskalova, L. Spassov & J. Crnobrnja Isailovic 2012. A new record of *Testudo graeca ibera* Pallas, 1814, in southern Serbia. *Herpetozoa*, 25(3/4): 151-153.

**2013**

102. Shurulinkov P., G. Daskalova & R. Tzonev 2013. Breeding Waterbirds in Temporally Flooded Wetlands in Northern Bulgaria. *Acta zoologica bulgarica*, 65(2): 207-215.
103. Moller A. P., S. Merino, J. Soler, A. Antonov, E. Badas, M. Calero-Torralbo, F. de Lope, T. Eeva, J. Figuerola, E. Flensted-Jensen, L. Garamszegi, S. Gonzalez-Braojos, H. Gwinner, S. Hanssen, D. Heylen, P. IImonen, K. Klarborg, E. Korpimaki, J. Martinez, J. Martinez-de la Puente, A. Marzal, E. Matthysen, P. Matyjasiak, M. Molina-Morales, J. Moreno, T. Mousseau, J. Nielsens, P. Pap, J. Rivero-de Aguilar, P. Shurulinkov, T. Slagsvold, T. Szep, E. Szollosi, J. Torok, R. Vaclav, F. Valera & N. Ziane N. 2013. Assessing the Effects of Climate on Host-Parasite Interaction: A Comparative Study of European Birds and their Parasites. *PLoS ONE*, 8(12): e82886. doi:10. 1371/journal. pone. 0082886.
104. Shurulinkov P., G. Daskalova, G. Stoyanov, V. Delov, S. Dalakchieva, I. Angelov, B. Borisov & P. Tsvetkov 2013. *Methodology for monitoring nesting bird species*. Project "Field studies of species distribution/status assessment of species and habitats on the territory of the entire country – Phase I". Operational program Environment 2007-2013. Environmental Executive Agency, Sofia, 27 p. (in Bulgarian).

**2014**

105. Nikolov I., P. Shurulinkov & B. Borisov 2014. Status of the breeding populations of Great Cormorants in Bulgaria in 2012. *In:* Bregnballe T., Lynch J., Parz-Gollner R., Marion L.,Volponi S., Paquet J. Y, Carss D. N., van Eerden M. R. (eds.) Breeding numbers of Great Cormorants *Phalacrocorax carbo* in the Western Palearctic, 2012-2013. *Scientific Report from DCE – Danish Centre for Environment and Energy*, 99: 78-81.
106. Klvana P., J. Cepak, T. Albrecht, P. Munclinger & P. Surulinkov 2014. Sledovani migrace hyli rudych za pouziti geolokatoru. *Krouzkovanec*, 17: 7-8.
107. Shurulinkov, P. & G. Daskalova 2014. The feathered world (birds). *In:* Popov, A. (ed.) 2014. *The natural wealth of Vitosha Nature Park*. Directorate of Vitosha Nature Park, National Museum of Natural History - BAS. Sofia, Military Publishing House Ltd. 122-141. (in Bulgarian).
108. Shurulinkov P. 2014. *Action plan for conservation of Bittern (Botaurus stellaris) in Bulgaria, 2014-2023*. MOEW, Sofia, 50 p. (in Bulgarian, English summary).

**2015**

109. Todorov E., G. Daskalova & P. Shurulinkov 2015. Current breeding distribution and conservation of White-tailed Eagle, *Haliaeetus albicilla* (L.) in Bulgaria. *Acta zoologica bulgarica*, 67(1): 3-10.
110. Shurulinkov P. & D. Fedchuk 2015. Observations of Pigmy Owl (*Glaucidium passerinum*) and Three-toed Woodpecker (*Picoides tridactylus*) in Mt. Durmitor, Montenegro. *Historia naturalis bulgarica*, 22:101-103.
111. Savev S., M. Borisov, R. Bekchiev, R Kostova, N. Tsankov, P. Shurulinkov & B. Petrov 2015. *Old forests in Strandja Nature Park - conservation and sustainable management*. Strandja Nature Park Directorate, Malko Tarnovo, 200 pp. (in Bulgarian, English summary).
112. Shurulinkov P., G. Daskalova, S. Avramov, D. Plachiyski, G. Popgeorgiev, G. Gerdzhikov & K. Angelova 2015. *Action plan for the White-backed Woodpecker (Dendrocopos leucotos) in Bulgaria (2016-2025)*. Sofia. Bulgarian Biodiversity Foundation. 73 pp. (in Bulgarian, English summary).
113. Plachiyski D., S. Nikolov, G. Popgeorgiev, S. Avramov, K. Valchev, P. Shurulinkov, K. Angelov & G. Daskalova 2015. *Action plan for the grouse (Tetrao urogallus) in Bulgaria for the period 2016-2025*. Sofia, BSE and Ministry of Education and Culture: 105 pp. (in Bulgarian, English summary).
114. Shurulinkov P. 2015. Among the birds of Vitosha. *Priroda*, BAS, 3: 86-93. (in Bulgarian).

**2016**

115. Shurulinkov P., G. Daskalova, S. Avramov, D. Plachiyski, G. Popgeorgiev, G. Gerdzhikov & K. Angelova 2016. *Action plan for the Three-toed Woodpecker (Picoides tridactylus) in Bulgaria (2016-2025)*. Sofia. Bulgarian Biodiversity Foundation. 57 p.
116. Daskalova G., P. Shurulinkov, G. P. Stoyanov & B. Borisov 2016. Observations of the lesser kestrel (*Falco naumanni*) in Bulgaria during the period of post-breeding dispersal. *Slovak Raptor Journal*, DOI: 10. 1515/srj-2016-0001.
117. Shurulinkov P., G. Daskalova, S. Michov & V. Koev 2016. The distribution, numbers, and breeding of terns and waders on the sand islands along the Bulgarian-Romanian section of the Danube. *North-Western Journal of Zoology*, 12(1):65-77.
118. Stoyanov G. & P. Surulinkov 2016. Neue Daten zur Brutverbreitung und Habitatpraferenz der Haubenmeise *Lophophanes cristatus* in Sudwestbulgarien. *Ornithologische Mitteilungen*, 68(3/4): 131-136.
119. Daskalova G., P. Shurulinkov, P. Petrov, M. Dilovska, A. Ivanova & G. Dilovski 2016. White Stork in Sliven district, 2014-2015. *In:* Cheshmedzhiev S., G. Popgerogiev, T. Petrov, Y. Kornilev, S. Spasov & S. Stoychev. White Stork in Bulgaria during 2014-2015. BSPB, Sofia.
120. Shurulinkov P., G. Daskalova & P. Petrov 2016. White Stork in Yambol district, 2014-2015. *In:* Cheshmedzhiev S., G. Popgerogiev, T. Petrov, Y. Kornilev, S. Spasov & S. Stoychev. *White Stork in Bulgaria during 2014-2015*. BSPB, Sofia. 55.
121. Cheshmedzhiev S., V. Panev, P. Shurulinkov, G. Daskalova, P. Petrov, J.

Mocheva, D. Gospodinov, H. Ivanov, A. Ilinova, V. Mladenov & R. Georgieva 2016. White Stork in Stara Zagora district, 2014-2015. *In:* Cheshmedzhiev S., G. Popgerogiev, T. Petrov, Y. Kornilev, S. Spasov & S. Stoychev. *White Stork in Bulgaria during 2014-2015*. BSPB, Sofia. 49.

**2017**

122. Nikolov B. & P. Shurulinkov 2017. Professor Dimitar Nankinov is 75 years old! *Russian Ornithological Journal*, 26 (1495): 3709-3715. (in Russian, English summary).

**2018**

123. Shurulinkov P., L. Spasov, G.P. Stoyanov & N. Chakarov 2018. Blood parasite infections in a wild population of ravens (*Corvus corax*) in Bulgaria. *Malaria Journal*, 17: 33 https://doi. org/10. 1186/s12936-018-2179-7
124. Georgiev K., S. Thorn, T. Zlatanov, B. Nikolov, P. Shurulinkov, G. Daskalova & S. Gottschalk 2018. Evaluating the importance of managed forests as habitat for the Semi-collared Flycatcher (*Ficedula semitorquata*). *Forest Ecology and Management*, 419-420: 123-129. https://doi. org/10.1016/j.foreco.2018.03.041
125. Daskalova G. & P. Shurulinkov 2018. Characteristics of the hunting behavior of the Red-footed Falcon (*Falco vespertinus*) in South-Eastern Bulgaria. *ZooNotes*, 125: 1-4.
126. Shurulinkov P., G. Daskalova, D. Kirov, B. Borisov, L. Spasov, A. Ralev, I. Stoev & A. Mechev 2018. Avifauna of "Bulgarka" Nature Park with distribution, population size and breeding density data for the species of conservation importance. *Forestry Ideas*, 24, 1 (55): 3-22.
127. Shurulinkov P. & D. Avtanski 2018. Records of Tengmalm's Owl (*Aegolius funereus*) from the Sar Mts, Republic of Macedonia. *Historia naturalis bulgarica*, 28: 1-4.
128. Gerdzhikov K., K. Georgiev, D. Plachiyski, T. Zlatanov & P. Shurulinkov 2018. Habitat Requirements of the White-backed Woodpecker *Dendrocopos leucotos lilfordi* (Sharpe & Dresser, 1871) (Piciformes: Picidae) in Strandzha Mountain, Bulgaria. *Acta zoologica bulgarica*, 70(4): 527534.

**2019**

129. Cheshmedzhiev S., P. Shurulinkov & G. Daskalova 2019. Status and distribution of diurnal birds of prey and the Black Stork along the Bulgarian section of the Danube River. *In:* Shurulinkov P. et al. (eds.) *Biodiversity of the Bulgarian-Romanian section of the Lower Danube*. Nova Publishers, New York, 375-398.
130. Shurulinkov P., G. Daskalova, S. Cheshmedzhiev, K. Kirov, V. Koev, H. Dinkov, I. Hristov, I. Nikolov, S. Mihov & Y. Kutsarov 2019. Heron and cormorant colonies along the Bulgarian-Romanian section of the Danube River: Status and Trends 2010-2014. *In:* Shurulinkov P. et al. (eds.) *Biodiversity of the Bulgarian-Romanian section of the Lower Danube*. Nova Publishers, New York, 315-340.
131. Shurulinkov P., S. Cheshmedzhiev, G. Daskalova, H. Dinkov, K. Kirov, I. Hristov, Y. Kutsarov, V. Koev & S. Mihov 2019. Recent data on the distribution and

numbers of the water birds in the wetlands along the Bulgarian-Romanian section of the Danube River. *In:* Shurulinkov P. et al. (eds.) *Biodiversity of the Bulgarian-Romanian section of the Lower Danube*. Nova Publishers, New York, 341-374.

132. Shurulinkov P., Z. Hubenov, S. Beshkov & G. Popgeorgiev (eds.) 2019. *Biodiversity of the Bulgarian-Romanian section of the Lower Danube*. Nova Publishers, New York, 441 p.
133. Daskalova G., P. Shurulinkov & G. Popgeorgiev. 2019. Distribution, population density and habitat preferences preferences of Barn Owl (*Tyto alba*) in Sliven and Yambol districts, SE-Bulgaria. *5-th International Congress on Biodiversity: "Taxonomy, Speciation and Euro-Mediterranean Biodiversity*", Sofia, 11-13.X.2019 (Poster presentation).
134. Shurulinkov P., P. Bergkamp, N. Chakarov, A. Ralev, N. Alexandrov, P. Tzvetkov, G. Daskalova, I. Tonev, K. Hristov, P. Simeonov, M. Iliev & M. Dimitrova 2019. *Species composition and numbers of birds captured at Durankulak ringing camp, NE Bulgaria during autumn 2019*. Technical Report, December 2019. DOI: 10.13140/RG.2.2.14378.16321/1

**2020**

135. Shurulinkov P., G. Daskalova, K. Popov, S. Dalakchieva, R. Tsonev, I. Dimchev & A. Ralev. 2020. Recent changes in the presence status and numbers of ruddy shelduck (*Tadorna ferruginea*) in the Eastern Balkans. *Historia naturalis bulgarica*, 41: 41-49.
136. Daskalova G, P. Shurulinkov, I. Angelov & P. Petrov 2020. *The birds of the Tundzhan hilly plain*. GlobeEdit, ISBN - 978-6200608499, 408 pp.

**2021**

137. Shurulinkov P. Bergkamp, N. Aleksandrov, P. Simeonov, A. Ralev, P. Tsvetkov, K. Popov, G. Daskalova, K. Dimitrova, K. Hristov, I. Hristov, J. Gradinarov, I. Tonev, B. Hotinov, D. Dimitrov, M. Ottensman, T. Rinaud & N. Chakarov 2021. Vagrant species of birds captured at Durankulak ringing camp, NE Bulgaria, 2019-2020. *Historia naturalis bulgarica*, 42:89-94.
138. Shurulinkov P., A. Ralev, P. Tzvetkov, K. Valchev, G. Daskalova, S. Arangelov, R. Kolchagov, I. Hristov & P. Dimov 2021. Endangered birds of old growth forests in the Pirin National Park, SW Bulgaria: habitat preferrences, distribution and population sizes in 2001-2019. Ohrozene vtaky pralesov v Narodnom parku Pirin, JV Bulharsko: habitatove preferencie, rozsirenie a velkostpopulacii v rokoch 2001-2019. *Tichodroma*, 33. (2021) ISSN 1337-026X.

**2022**

139. Shurulinkov P., R. Tzonev, G. Daskalova, P. Tzvetkov & Z. Gradinarov. 2022. Mass winter movements of Yelkouan Shearwaters (*Puffinus yelkouan*) along the Bulgarian Black Sea coast. – *ZooNotes*, 200: 1-3.
140. Dravecký M., P. Shurulinkov, G. Dilovski, M. Revický, G. Daskalova & J. Obuch 2022. Diet composition of the long-legged buzzard (*Buteo rufinus*) in southeastern Bulgaria/ Zloženie potravy myšiaka hrdzavého (*Buteo rufinus*) v juhovýchodnom

Bulharsku. *Raptor Journal*, 16: 1–15. DOI:10.2478/srj-2022-0001.

141. Cerman K., D. Rajković, B. Topić, G. Topić, P. Shurulinkov, T. Mihelič & J. Delgado 2022. Environmental Niche Modelling Predicts a Contraction in the Potential Distribution of Two Boreal Owl Species under Different Climate Scenarios. *Animals*, 12, 3226. https://doi.org/10.3390/ani12223226.
142. Gerdzhikov G., D. Plachiyski, G. Popgeorgiev, St. Avramov, D. Demerdzhiev, G. Daskalova & P. Shurulinkov 2022. White-backed (Lilford's) Woodpecker *Dendrocopos leucotos lilfordi* Sharpe & Dresser, 1871: distribution and population density in Bulgaria. *North-Western Journal of Zoology*, 18 (1): 65-70.

**2023**

143. Shurulinkov P., P. Bergkamp, N. Alexandrov, I. Tonev, R. Tomova, P. Simeonov, B. Konakchieva, St.-T. Trendafilova & B. Hotinov 2023. Extraordinary occurrence of Pallas's leaf warbler (*Phylloscopus proregulus* Pallas, 1811) in Bulgaria and the Balkan Peninsula in the autumn and winter of 2022/2023. *Historia naturalis bulgarica*, 45 (5): 143–147.

**References**

Daskalova G. 2023. *Comparative analysis of the main characteristics in the behavior of falcon birds (Falconidae family) nesting on the Balkan Peninsula*. National Museum of Natural History, Bulgarian Academy of Sciences. Abstract of PhD thesis. Sofia, 1-40. (in Bulgarian).

Gerdzhikov G. 2022. *Habitat requirements of the Southern White-backed Woodpecker (Dendrocopos leucotos lilfordi) in Bulgaria*. National Museum of Natural History, Bulgarian Academy of Sciences. Abstract of PhD thesis. Sofia, 1-28. (in Bulgarian).

Shurulinkov P. 2003. Composition, distribution and ecology of the blood unicellular parasites of wild birds from Bulgaria. Abstract of PhD thesis. Institute of Zoology, BAS. Sofia, 1-28. (in Bulgarian).

Bulletin of the Natural History Museum - Plovdiv
*Bull. Nat. Hist. Mus. Plovdiv, 2023, vol. 8: pp. 73-93*

***Miscellaneous***

# *Assoc. Prof. Dr. Tseno Petrov and the Modern Bulgarian Ornithology - A bio-bibliography of an Honored Bulgarian Ornithologist on Occasion of his 80th Anniversary*

**Dimitar A. Demerdzhiev[1*], Zlatozar N. Boev[2]**

1- Bulgarian Society for the Protection of Birds / BirdLife Bulgaria
National Museum of Natural History, Sofia, BULGARIA
5 Leonardo da Vinci Str., Plovdiv, BULGARIA
2 - National Museum of Natural History, Bulgarian Academy of Sciences,
1 Blvd. Tsar Osvoboditel, 1000 Sofia, BULGARIA
*Corresponding author: dimitar.demerdzhiev@bspb.org;
dimitar.demerdzhiev@gmail.com

**Abstract.** An attempt has been made to collect and summarize the entire scientific work of the ornithologist Associate Professor Dr. Tseno Hristov Petrov - a long-time curator at the Natural History Museum in the city of Plovdiv. For the first time, the complete bibliography of his works is presented, containing 202 titles, mainly of publications in specialized scientific editions, published in the period 1970-2022. Brief biographical data on the scholar are also presented. The publication is on the occasion of his 80th birthday.

**Key words:** ornithology, Bulgarian science, Natural History Museum in Plovdiv, Birds of the Balkans, Birds of Sredna Gora Mts.

Tseno Hristov Petrov (Fig. 1) was born on May 19, 1943 in town of Karlovo. His father, Hristo Petrov, was a priest and suffered from the "people's democratic" government, which was established in Bulgaria after September 9, 1944 with the support of the Soviet occupation troops.

In 1968, he completed his higher education at the Faculty of Biology of the University of Plovdiv “Paisii Hilendarski”. From 1968 to 1970, he worked as a teacher at the Secondary Polytechnic School in the town of Laki. He joined the Natural History Museum in Plovdiv in 1970, where he was appointed as a curator (Fig. 2), and in 1973 he took the position of junior research fellow (assistant professor). In 1983, he defended his PhD thesis on the topic: "Ornithological studies in Sredna Gora Mts". He obtained his habilitation in 1988 as a senior research associate (associate professor).

With his activity, he contributes enormously to the renovation of the funds and expositions of birds and mammals in the museum in Plovdiv. As a scientific consultant, he also helps in the construction of the museum exposition in the village of Cherni Osam (Regional History Museum - Lovech).

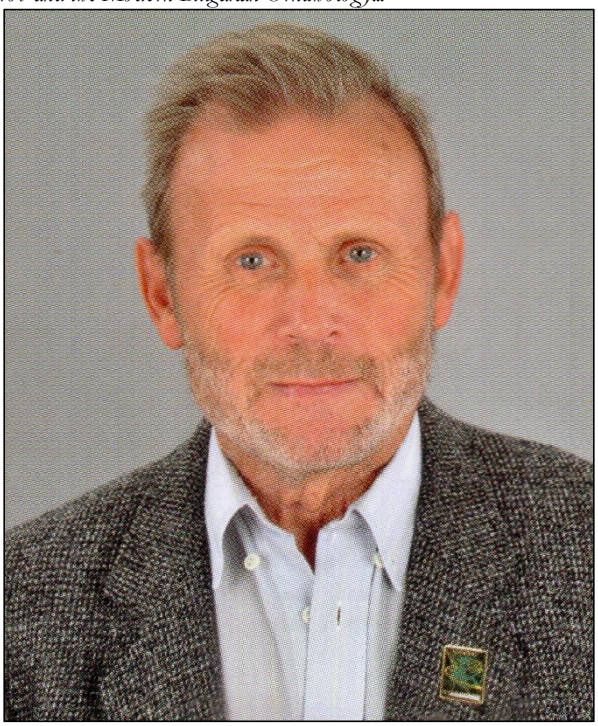

**Fig. 1.** Assoc. Prof. Dr. Tseno Petrov.

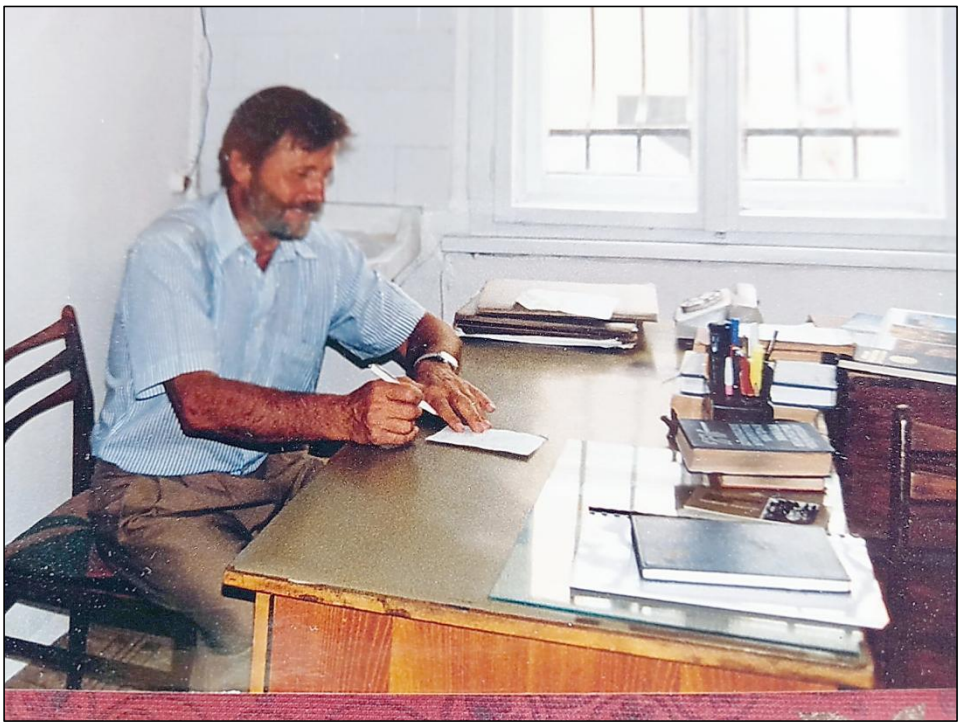

**Fig. 2.** Dr. Tseno Petrov at his office at the Natural History Museum in Plovdiv.

Tseno Petrov's scientific work is remarkable. He is the author of over 200 publications, half of which were published in specialized scientific editions. He has participated with over 20 reports in national and international forums (Fig. 3). He has participated also in dozens of field expeditions and research projects.

**Fig. 3.** Dr. Tseno Petrov as a participant of the Congress of BirdLife in Malaysia.

Dr. Petrov authored scenarios of dozens documentary TV popular-science films and radio-programs, mainly on environment conservation thematics (Mirkov, 2009).

It is visible that, most of his professional career was spent at the Natural History Museum in the city of Plovdiv, where he worked as a full-time ornithologist. From his first years at the museum, Ts. Petrov clearly stated his orientation towards the study of nesting biology and the distribution of birds in Southern Bulgaria. He thoroughly researched in ornithological terms such vast territories in the country as Sredna Gora, Dobrostanski Ridge (Asenovgrad District) and the "Karadzhov Kamak" locality in the Rhodope Mountains, the Western Rhodope Mountains, etc.

His first scientific publication ("On the biology of the bee-eater", 1973) is still a model for field studies of birds in Bulgaria.

Dr. Tseno Petrov's main contributions to ornithology are primarily in the field of ornithofaunistics of Southern Bulgaria, as well as in the ecology and biology of rare and protected bird species (Boev, 2022). His research on the white stork, the falcons, the imperial eagle, the oystercatcher and the stone curlew in Bulgaria occupies a significant part of his studies.

With his active nature conservation activity, Dr. Tseno Petrov stands among the most eminent Bulgarian conservationists. At least 10 nature protected territories have been declared after his scientifically grounded proposals for protection:

(1) National Landmark "Donkinata Gora" - nesting site of a pair of Imperial eagles - State Gazette, No. 35 /04.05.1979;

(2) Protected Area "Chinar Dere" - preservation of the natural site of eastern sycamore in the vicinity of the village of Topolovo, Plovdiv region - State Gazette, No. 105/ 1995;

(3) Protected Area "Anathema" – conservation of 24 species of protected plants and 7 species of protected animals in the vicinity of Asenovgrad - State Gazette, No. 112/2004;

(4) Protected Area "The 12 Pedunculate Oaks" - preservation of the nest site of 46 pairs of Gray herons in the area "Terena", in the land of the village Panicheri, Hisar municipality. State Gazette, No. 17 /27.02.1981;

(5) Protected Area "Field of Greek Juniper" - preserves Greek juniper in the vicinity of the village of Bachkovo, Plovdiv region. State Gazette, No. 6 / 2004;

(6) Protected Area "Vran Kamak" - preservation of a rock phenomenon in the surroundings of the village of Petrich, Panagyurishte region. State Gazette, No. 69/04.08.1995;

(7) Natural landmark "Slivovdol Waterfall" - preservation of a waterfall on the territory of State Hunting Farm "Lucky". State Gazette.

(8) Protected Area rock complex "Karadzhov Kamak" - preserves a rock phenomenon and habitat of protected animal species in the vicinity of the village Mostovo, neighbourhood Ryakata, Asenovgrad municipality. State Gazettep No. 81/2003;

(9) Protected Area "Belintash" - preserves a rock phenomenon and protected animal species in the vicinity of the village of Sini Vrah, Asenovgrad region. State Gazette, No. 6/2004;

(10) Extension of the "Lale Bair" Protected Area - preservation of habitat of the Rhodope tulip in the vicinity of Asenovgrad. State Gazette, No. 11/2004.

Ts. Petrov is one of the co-founders of the Bulgarian Society for the Protection of Birds (Fig. 4) and become one of its presidents (1997-2000) (Fig. 5). He authored essays of a number of bird species for the first (Botev & Peshev, 1985) and second (Golemansky, 2011) editions of the Bulgarian Red Data Book and the Atlas of breeding birds in Bulgaria (Iankov, 2011) (Fig. 6).

## Bibliography of publications of Assoc. Prof. Tseno Petrov in scientific and popular-science editions

### 1970

1. Petrov, Ts. 1970. Rare and disappearing birds. Otechestven glas, 8042/13.10.1970. (in Bulgarian).

### 1971

2. Petrov, Ts. 1971. A mountain defender. Otechestven glas, 8180/ 25.03.1971. (in Bulgarian).

**Fig. 4.** Dr. Tseno Petrov among the co-founders of the Bulgarian Society for the Protection of Birds, Biological Faculty of Sofia University "St. Kliment Ohridski", 06.06.1988.


**Fig. 5.** Dr. Tseno Petrov as president of the Bulgarian Society for the Protection of Birds.

**Fig. 6.** Dr. Tseno Petrov as a participant of the Second Red Data Book edition in Bulgaria meeting.

3. Petrov, Ts. 1971. The bee-eater - a useful or harmful bird. Otechestven glas. 28.10.1971. (in Bulgarian).

1972

4. Petrov, Ts. 1972. Hunters do not kill swans. Otechestven glas, 8454/13.02.1972. (in Bulgarian).
5. Petrov, Ts. 1972. A beautiful bird. Otechestven glas, 8603/08.08.1972. (in Bulgarian).

1973

6. Petrov Tz. 1973. On the biology and ecology of the Bee-eater (*Merops apiaster* L.) in the Plovdiv Region. Bulletin of the museums of South Bulgaria, 11: 65-88. (in Bulgarian, English and German summaries).

1975

7. [Petrov Ts.] Hristov, Ts. 1975. Helping storks. Zashtita na prirodata, 1: 11. (in Bulgarian).

8. Petrov, Ts. 1975. To help the storks. Zashtita na prirodata, 1: 11. (in Bulgarian).
9. Petrov Ts. 1975. On the nesting of the osustercatcher (*Haematopus ostralegus* L.) in Bulgaria. Ekologiya, 1: 84-86. (in Bulgarian).

**1976**

10. Petrov, Ts. 1976. One uninhabited nest. Otechestven glas, 9771/05.09.1976. (in Bulgarian).
11. Petrov, Ts. 1976. To the birds with attention. Otechestven glas, 9805/16.10.1976. (in Bulgarian).
12. Petrov, Ts. 1976. Useful diurnal and nocturnal birds of prey. Otechestven glas, 9829/11.13.1976. (in Bulgarian).

**1977**

13. Simeonov, S., Petrov, Tz. 1977. Ornithocoenological analysis of the nesting bird fauna in some broad-leaved forests of Bulgaria - Ann. Univ. Sofia, Faculty of Biology, Book 1, Zoology, 71:39-47. (In Bulgarian with German Summary)
14. Petrov Ts. 1977. A contribution to the study of distribution and nesting biology of the White Stork - *Ciconia ciconia*, in Plovdiv District. Bulletin of the museums of South Bulgaria,4: 37-47.

**1978**

15. Petrov Tz. 1978. A contribution to the study of the distribution and nest biology of the White Stork (*Ciconia ciconia* L.) in the region of Plovdiv. Bulletin of the museums of South Bulgaria, 4: 36-48. (in Bulgarian, English and French summaries).
16. Petrov Tz., Hauf, P. 1978. New record of Red-necked Phalarope (*Phalaropus lobatus*) in Bulgaria. Ornithological Invormative Bulletin, 3: 25-27. (in Bulgarian).
17. Simeonov S., Petrov, Ts. 1978. Ornithooenological analysis of the nest ornitofauna in some deciduous forests in Bulgaria. Annuaire de l'Université de Sofia "St. Kliment Ohridski". Faculté de Biologie, 71 (1) - Zoology: 39-47 (in Bulgarian, English summary).
18. Boev, N., Ts. Petrov 1978. Protection of nature and natural history museums. – Muzei i pametnitsi na kulturata, 3: 17-20. (in Bulgarian).
19. Petrov, Ts. 1978. A call for the white storks. Zashtita na prirodata, 5: 15. (in Bulgarian).
20. Petrov, Ts. 1978. Why do starlings spend the night in the city? Otechestven glas, 10207/11.02.1978 (in Bulgarian).
21. Petrov, Ts. 1978. Shall we allow the disappearance of the white stork. Otechestven glas, 10241/31.03.1978. (in Bulgarian).
22. Petrov, Ts. 1978. A new rare exhibit in the Natural History Museum – Plovdiv. Otechestven glas, 10417/02.12.1978. (in Bulgarian).

**1979**

23. Mitchev, T., Tz. Petrov 1979. Upon the distribution of the Imperial Eagle (*Aquila heliaca* Savigny) in Bulgaria. Bulletin of the museums of South Bulgaria, 5: 65-76.
24. Petrov Tz. 1979. New finds of the Isabelline Wheatear (*Oenanthe isabellina* Temmm.) and the Ural Owl (*Strix uralensis* Pall.) in Bulgaria. Bulletin of the museums of South Bulgaria, 5: 57-63. (in Bulgarian, English and French summaries).
25. Petrov, Ts. 1979. Until when will eagles be slaughtered in our country? Zashtita na prirodata, 11:7. (in Bulgarian).
26. Boev, N., Ts. Petrov 1979. Preparators or dermoplasty? - Muzei i pametnitsi na kulturata, 2: 44-46. (in Bulgarian).
27. Petrov, Ts. 1979. How long will the eagles be slaughtered in mass? Zashtika na prirodata, 11: 7. (in Bulgarian).

1980

28. Simeonov, S., Petrov Ts. 1980. Studies on the Food of the Imperial Eagle (*Aquila heliaca* Savigny), the Buzzard (*Buteo buteo* (L.)) and the Rough-Legged Buzzard (*Buteo lagopus* (Brunnich)) in Bulgaria. Ecologiya, 7: 19-32. (in Bulgarian, English summary).
29. Petrov Ts. 1980. Materials on the ornithofauna of the Eastern Stara Planina Mnts. in the region of Sinite Kamani above Sliven. Ornithological Invormative Bulletin, 76-8: 101-107. (In Bulgarian).
30. Petrov, Ts. 1980. The birds' paradise of Atanasovsko Lake. Komsomolska iskra, 3/21.01.1980 (in Bulgarian).
31. Petrov, Ts. Are the owners of the lodges intelligent? Echo, 1027/19.09.1980. (in Bulgarian).
32. Petrov, Ts. 1980. How long will the protective status of the "Dzhendema" reserve be ignored?, Otechestven glas, 1080/16.09.1980 (in Bulgarian).
33. Petrov, Ts. 1980. Red Data Book for Plovdiv District. Komsomolska iskra, 19/12.05.1980. (in Bulgarian).
34. Petrov, Ts. 1980. Museum problems. Komsomolska iskra, 25/16.06.1980, (in Bulgarian).
35. Petrov, Ts. 1980. Steps in the forest. Komsomolska iskra, 44/03.11.1980. (in Bulgarian).

1981

36. Petrov Tz. 1981. The Birds of Sredna Gora Mountain. Bulletin of the museums of South Bulgaria, 7: 9-49. (in Bulgarian, English and French summaries).
37. Petrov, Ts., 1981. Kalofer "Dzhendem". Zashtita na prirodata, 3: 10-11.
38. Petrov, Ts. 1981. Along the rocky sunny spots up near Vacha. Komsomolska iskra, 1/05.01.1981 (in Bulgarian).

1982

39. Petrov Tz. 1982. Ornithocenological Studies In Sredna Gora Mountain. Bulletin of the museums of South Bulgaria, 8: 21-41. (in Bulgarian, English and French summaries).

40. Petrov, Ts. 1982. Alert for "Izgoryaloto Gyune". Priroda i znanie, 4, 1981. (in Bulgarian).
41. Petrov, Ts. 1982. New exhibits. Otechestven glas, 04.03.1982 (in Bulgarian).

1983

42. Petrov Tz. 1983. Ornithological collection (Falconiformes, Strigiformes and Pelecaniformes) of the Natural Science Museum in Plovdiv. Bulletin of the museums of South Bulgaria, 9: 53-58. (in Bulgarian, English and French summaries).
43. Petrov Tz. 1983. Ornithological investigations of Sredna Gora. Institute of Zoology, Bulgarian Academy of Sciences, Authoreferat Ph. D. thesis, Sofia, 30 p. (in Bulgarian).
44. Petrov Tz. 1983. Ornithological investigations of Sredna Gora. Institute of Zoology, Bulgarian Academy of Sciences, Ph. D. thesis, Sofia, 154 p. (in Bulgarian).
45. Petrov, Ts. 1983. Forest park "Asenova Fortress" - its state and a condition and conceptual perspective for its utilization. Asenovgradski zov, 21/21.05.1983. (in Bulgarian).

1984

46. Mitchev, T., Tz. Petrov 1984. Nest distribution of the Grey Heron (*Ardea cinerea* L.) in Bulgaria. Bulletin of the museums of South Bulgaria, 10: 17-26.
47. Petrov Ts. 1984. The Lord of the Clouds. Otechestven Front, 11 879/18.05.1984. (in Bulgarian).
48. Petrov Tz. 1984. Exploring the nest ornithofauna in a forty year artificial plantation of white pine (*Pinus silvestris* L.) in Sashtinska Sredna Gora Mountain. Bulletin of the museums of South Bulgaria, 10: 27-30. (in Bulgarian, English and French summaries).
49. Petrov, Ts. 1984. Who do the birds bother? Otechestven glas, 18.02.1984. (in Bulgarian).
50. Petrov, Ts. 1984. The Lord of the Clouds. Otechestven front, 11879/25.05.1984. (in Bulgarian).
51. Petrov, Ts. 1984. The dear fence of ignorance. Otechestven front, 11879/25.05.1984 (in Bulgarian).
52. Petrov, Ts. 1984. How many storks are there in Pazardzhik District? September Banner, No. 75, 23.06.1984 (in Bulgarian).
53. Petrov, Ts. 1984.Will the wild boar among the rodents return? Komsomolska iskra, 19/ 07.05.1984. (in Bulgarian).
54. Petrov, Ts. 1984. Imperrial Eagle. Komsomolska iskra, 29/16.07.1984. (in Bulgarian).
55. Petrov, Ts. 1984. Oystercatcher. Komsomolska iskra", 32/06.03.1984. (in Bulgarian).
56. Petrov, Ts. 1984. Birds point to fortune, Anteni, 33/19.09.1984. (in Bulgarian).
57. Petrov, Ts. 1984. Storks without nests, Otechestven glas, 290/07.12.1984. (in Bulgarian).

58. Petrov, Ts. 1984. Lesser Kestrel. Komsomolska iskra, 50/10.12.1984. (in Bulgarian).

## 1985

59. Michev, T., Petrov, Ts. 1985. Imperial Eagle *Aquila heliaca heliaca* Savigny. In: Botev, B., Peshef, Ts. (Eds.) 1985. Red Data book of the People's Republic of Bulgaria. Volume 2. Animals. BAS, Sofia. 79.
60. Michev, T., Ts. Petrov and L. Profirov. 1985. Status, Breeding, Distribution, Numbers and Conservation of the White Stork in Bulgaria. – In: White stork status and Conservation, Walsrode, 14-19, 10, 1985, 137-143.
61. Mitchev, T., Tz. Petrov 1985. A contridution to the distribution of the Black Kite, *Milvus migrans* (Boddaert, 1783) in Bulgaria. International symposium "Protection of natural areas and the genetic fund they contain" - Project No 8 of the Programme "Man and Biosphere" (MAB) of UNESCO, 23-28.09.1985, Blagoevgrad, Bulgaria. Collection of Reports, Sofia, BAS, 1985, 164-177. (In Bulgarian, English summary).
62. Mitchev, T., Tz. Petrov 1985. Breeding distribution, number and protection of the Marsh Harrier, *Circus aeruginosus* (Linnaeus) in Bulgaria. International symposium "Protection of natural areas and the genetic fund they contain" - Project No 8 of the Programme "Man and Biosphere" (MAB) of UNESCO, 23-28.09.1985, Blagoevgrad, Bulgaria. Collection of Reports, Sofia, BAS, 1985, 306-313. (in Bulgarian, English summary).
63. Mitchev, T., Tz. Petrov 1985. Distribution and number of the Saker Falcon, *Falco cherrug* gray, 1834 in Bulgaria. International symposium "Protection of natural areas and the genetic fund they contain" - Project No 8 of the Programme "Man and Biosphere" (MAB) of UNESCO, 23-28.09.1985, Blagoevgrad, Bulgaria. Collection of Reports, Sofia, BAS, 1985, 314-324.
64. Petrov Ts. 1985. Sacrifice of the waters of... the man. Otechestven Front, 12 043/04.01.1985. (in Bulgarian).
65. Petrov, T., T. Michev. 1986. Regarding the determination of the conservation status of birds based on their occurrence and abundance. Bulletin of the museums from the South Bulgaria, 12: 43-48.
66. Petrov, Ts. 1985. *Burchinus oedicnemus* (L.). In: Botev, B., Peshef, Ts. (Eds.) 1985. Red Data book of the People's Republic of Bulgaria. Volume 2. Animals. BAS, Sofia. 113-114.
67. Petrov, Ts. 1985. *Falco naumanni* Fleicher. In: Botev, B., Peshef, Ts. (Eds.) 1985. Red Data book of the People's Republic of Bulgaria. Volume 2. Animals. BAS, Sofia. 92.
68. Petrov, Ts. 1985. *Haematopus ostralegus* L. In: Botev, B., Peshef, Ts. (Eds.) 1985. Red Data book of the People's Republic of Bulgaria. Volume 2. Animals. BAS, Sofia. 105-106.
69. Petrov, Ts. 1985. On the problem of composing red registers of districts in Bulgaria. International symposium "Protection of natural areas and the genetic fund they contain" - Project No 8 of the Programme "Man and Biosphere" (MAB) of UNESCO, 23-28.09.1985, Blagoevgrad, Bulgaria. Collection of Reports, Sofia, BAS, 1985, 252-256. (In Bulgarian).

70. Petrov, Ts. 1985. Ornithocenological studies in Dobrostan Hill (Western Rhodopes). Bulletin of the museums of South Bulgaria, 14: 25-45. (in Bulgarian, French summary).
71. Petrov, Ts., Ignatiev, I. 1985. White storks in the Plovdiv district. Zashtita na prirodata, 3:12. (in Bulgarian).
72. Petrov, Ts., Petrova, E. 1985. Results of the Common Stork (*Ciconia ciconia*) count in Plovdiv District in 1984. National Conference of Biology (Proceedings). Sections Entomology, Hydrobiology and Ornithology. Bulgarian Naturalists' Society, Sofia, 116-122. (in Bulgarian).
73. Petrov, Ts. 1985. Victims of the waters and . . . the man. Otechestven glas, 12043/04.01.1985. (in Bulgarian).
74. Petrov, Ts. 1985. Swans. Komsomolska iskra, 3/21.01.1985. (in Bulgarian).
75. Petrov, Ts. 1985. A view of the peak called Youth. Komsomolska iskra, 14/03.01.1985
76. Petrov, Ts. 1985. Near the fortress rocks. Otechestven glas, 17.04.1985. (in Bulgarian).
77. Petrov, Ts. 1985. We will protect the priceless wealth of the Suhoto Dere. Asenovgradski zov, 18/04.05.1985. (in Bulgarian).
78. Petrov, Ts. 1985. Red registers. Otechestven glas, 172/23.07.1985. (in Bulgarian).
79. Petrov, Ts. 1985. The banished living decoration. Otechestven glas, 12286/13.12.1985. (in Bulgarian).
80. Petrov, Ts. 1985. Against ecological color blindness, Otechestven glas, 257/30.10.1985. (in Bulgarian).
81. Petrov, Ts. 1985. The treasures of the reserve. Karlovska tribuna, 50/14.12.1985. (in Bulgarian).
82. Petrov, Ts. 1985. Landfills and the optimal collection of secondary raw materials. Otechestven glas, 304/25.12.1985. (in Bulgarian).
83. Petrov, Ts. 1985. White storks in the Plovdiv District. Priroda i znannie, 3. (in Bulgarian).

## 1986

84. Simeonov, S. Petrov, Ts. 1986. New materials on the diet of the long-eared owl (*Asio otus* L.) in the non-breeding period in Bulgaria. Ekologiya, 18: 27-32. (in Bulgarian).
85. Michev, T., Petrov, Ts., Profirov, L., Spiridonov, G. 1986. Contribution to the distribution and numbers of the Raven (*Corvus corax* L.) in Bulgaria during 1950-1984. - Ecology, BAS, 19: 27-35. (In Bulgarian with English Summary).
86. Michev, T., Petrov, Ts. 1986. About identification and the conservation status of birds based on their occurrence and abundance. – Izvestiya na muzeite ot Yuzhna Balgariaya, 12:43-48. (In Bulgarian with English Summary).
87. Petrov, Ts. 1986. Problems surrounding the Stard-Planind's leader. Otechestven glas, 1304/ 17.01.1986. (in Bulgarian).
88. Petrov, Ts. 1986. Rare species of our and the world's fauna. Otechestven glas, 7.01.1986. (in Bulgarian).
89. Petrov, Ts. 1986. Endangered species in the exhibition halls of the "Vertebrate Animals" department at the Plovdiv Natural History Museum, Otechestven glas, 10.05.1986. (in Bulgarian).

90. Petrov, Ts. 1986. Wild animals in danger, Otechestven glas, 22.051986. (in Bulgarian).
91. Petrov, Ts. 1986. Is the black stork black in Izgrev. Otechestven glas, 27.05.1986. (in Bulgarian).
92. Petrov, Ts. 1986. The eagle owls accuse. Otechestven glas, 05.08.1986. (in Bulgarian).
93. Petrov, Ts. 1986. Environmental protection problems in the Topolovski region. Topolovski vestnik, 06.10.1986. (in Bulgarian).
94. Petrov, Ts. 1986. Alone with the beautiful. Otechestven glas, 27.09.1986. (in Bulgarian).
95. Petrov, Ts. 1986. Suicide or murder of the owls. Zashtita na prirodata, 10-11: 69-71. (in Bulgarian).

## 1987

96. Michev T., Petrov, Ts. 1987. Contribution to the Breeding Distribution of the Black Kite, *Milvus migrans* (Boddaert, 1783) in Bulgaria. In: International Symposium on Project 8b-MAB 'Role of the wetlands in the conservation of the genetic fund', Srebarna, 8-12.10.1984. Collection of Scientific Works, Sofia, BAS: 164-177. (In Bulgarian with English Summary)
97. Mitchev, T., Tz. Petrov 1987. Birds of the Rhodopes. Bulgarian Union for the Protection of the Rhodopes. SD “Mari-90”. Sofia, 137 p. (in Bulgarian).
98. Mitchev, T., Tz. Petrov 1987. Monitoring of the ornithofauna using the atlas of nesting distribution of Bulgarian birds. In: Botev, B. (Ed.). First National Conference of the problems of biological monitoring, October, 22d-24th. Bulgarian Academy of Sciences, Committee for the Protection of Nature, Union of Scientific Workers (Branch town Plovdiv), Plovdiv. 178-183. (in Bulgarian. English summary).
99. Petrov Tz. 1987. Contribution to the bird fauna of the Rhodopi Mountain. Bulletin of the museums of South Bulgaria, 14: 47-49. (In Bulgarian with French Summary).
100. Petrov, Ts. 1987. The Common Stork (*Ciconia ciconia* (L.)) in the Pazardzhik District in 1978. – Savremenni postizheniya na balgarskata zoologiya. Sofia, Bulgarian Academy of Sciences. 167-170. (in Bulgarian).
101. Petrov, Ts. 1987. Expedition "Lynx" 86". Priroda i znanie, 3. (in Bulgarian).
102. Petrov, Ts. 1987. Swans in Plovdiv. Otechestven glas, 7.03.1987. (in Bulgarian).
103. Petrov, Ts. 1987. Does Plovdiv have a zoo? Otechestven glas, 17.04.1987. (in Bulgarian).
104. Petrov, Ts. 1987. Can we preserve the plane trees near Chinar Dere for future generations? Topolovski vestnik, 7/18.04.1987. (in Bulgarian).
105. Petrov, Ts. 1987. Again on the state and prospects for the protection of the natural resources of the Topolovsky region. Topolovsky vestnik, 9/16.05.1987. (in Bulgarian).
106. Petrov, Ts. 1987. Bulgarian ornithologists in Great Britain, Otechestven glas, 02.08.1987. (in Bulgarian).
107. Petrov, Ts. 1987. Who and how in Great Britain nurtures a valuable attitude towards nature, Komsomolska Iskra, 24.08.1987. (in Bulgarian).

108. Petrov, Ts. 1987. Help for the storks. Komsomolska Iskra, 14.12.1987. (in Bulgarian).

## 1988

109. Petrov, Ts. 1988. A contribution to the ornithofauna of the Rhodopes. Bulletin of the museums of South Bulgaria, 14: 47-50. (in Bulgarian, French summary).
110. Petrov, Ts. 1988. Contribution to the autumn migration of the white wagtail (*Motacila alba* L.) along the Chepelarska river valley. Ornithological Informative Bulletin, 23-24: 156-157. (in Bulgarian).
111. Petrov, Ts. 1988. Ornithocenological studies in Dobrostanski Rid (Western Rhodopes). - News of the Museums of Southern Bulgaria, 14: 25-45. (in Bulgarian, French summary).
112. Petrov, Ts. 1988. Guidelines for closer cooperation between the natural history museum and the school. - National conference "Creative relations museum - school", October 26-28, 1988, Shumen. Proceedings. (in Bulgarian).
113. Yankov, P., Michev, T., Petrov, Ts., Profirov, L. 1988. On updating the list of birds in the Red Book of Bulgaria. - National scientific session of young scientists, "Ecology and protection of the natural environment", 24-26.11.1988, Plovdiv. Proceedings. (in Bulgarian).
114. Petrov, Ts. 1988. Mount Botev is looking for its owner, Otechestven glas, 167/ 3.09.1988. (in Bulgarian).
115. Petrov, Ts. 1988. Vran Kamak peak - habitat of rare species. Komsomolska Iskra, 32/ 15.08.2988. (in Bulgarian).
116. Petrov, Ts. 1988. Shall we look to the future? Asenovgradski zov, 42/ 15.10.1988. (in Bulgarian).
117. Petrov, Ts. 1988. The environmental protection law is unknown, Otechestven glas, 199/ 19.10.1988. (in Bulgarian).
118. Petrov, Ts. 1988. Will the museum become an assistant? Komsomolska Iskra, 44/ 7.11.1988. (in Bulgarian).
119. Petrov, Ts. 1988. Rehabilitation for the hawks. Otechestven glas, 3/12.01.1988. (in Bulgarian).
120. Petrov, Ts. 1988. Chemistry for, chemistry against, us. Otechestven glas, 78/26.04.1988. (in Bulgarian).
121. Petrov, Ts. 1988. The bell waterfall. Otechestven glas, 100/27.05.1988. (in Bulgarian).
122. Petrov, Ts. 1988. Stork's nests are reported, Komsomolska iskra, 80/83.05.1988. (in Bulgarian).

## 1989

123. Michev,T., Petrov, Tz., Profirov, L., Iankov, P., Gavrailov, St. 1989. Distribution and Conservation Status of the Golden Eagle *Aquila chrysaetos* (L.), 1758 in Bulgaria. Bulletin of the Museums of Southern Bulgaria, 15:79-87. (In Bulgarian with French Summary).
124. Petrov Ts. 1989. Birds of Plovdiv and their problems. Zashtita na prirodata, 11: 30-31. (in Bulgarian).

125. Petrov, Ts. 1989. Expedition "Caucasus - Bearded vulture 1989". Zashtita na prirodata, 1:14-15.
126. Petrov, Ts. 1989. The birds in Dobrostansky Hill and its surroundings (Western Rhodopes) I. Bulletin of the museums of South Bulgaria, 15: 59-72. (in Bulgarian, French summary).
127. Petrov, Tz., Michev, T. 1989. Study on ornothofauna of the rock phenomenon Karadjov Kamak and its surroundings (Westwrn Rhodopes). Bulletin of the museums of South Bulgaria, 15: 73-78. (in Bulgarian, French summary).

1990

128. Petrov Ts. 1990. Expedition "Caucasus Lammergeier' 89". Zashtita na prirodata, 1: 14-15. (in Bulgarian).
129. Petrov, Ts. 1990. The birds in Dobrostansky Hill and its surroundings (Western Rhodopes) II. Bulletin of the museums of South Bulgaria, 16: 25-39. (in Bulgarian, French summary).

1991

130. Petrov, Tz., Jankov, P., Michev, T., Miltschev, B., Profirov, L. 1991. Distribution, numbers and measures for the protection of the Black Stork, *Ciconta nigra* (L.) in Bulgaria. Bulletin of the museums of South Bulgaria, 17: 25-32. (in Bulgarian, English summary).

1992

131. Petrov, T., P. Iankov, T. Michev, L. Profirov, K. Nyagolov 1992. Numbers, Distribution and Preservation of the Peregrine *Falco peregrinus* in Bulgaria. In: IV World Conference on birds of prey, Berlin, 10.-17.5.1992. Organized by the World Working Group on Birds of Prey and Owls (WWGBP) with financial support of the Berlin Government and the German Research Council (DFG). Abstracts. 29.

1993

132. Petrov, Ts. 1993. The white stork needs our help. Neophron, 3: (in Bulgarian).
133. Petrov, Ts. 1993. Year of the white stork in Europe. Neophron, 1: 20-21. (in Bulgarian).
134. Petrov, Ts., Jankov, P., Michev, T., Milchev, B., Profirov, L. 1993. Distribution, numbers and measures for the protection of the Black Stork in Bulgaria. 1st International Black Stork Conservation and Ecology Symposium. Program, Abstracts, Participants. 19-23 April 1993, Jũrmala, Latvia, 67.
135. Petrov, Tz., Iankov, P. 1993. Imperial Eagle Project - Bulgaria (1994 - 2004). BSPB, Plovdiv - Sofia. 6 p.
136. Petrov, Tz., P. Iankov, A. Darakchiev, K. Nikolov, T. Michev, L. Profirov, B. Milchev 1996. Status of the Imperial Eagle *Aquila heliaca* in Bulgaria in the period between 1890 and 1993. In: Meyburg. B-U. & R. D. Chancellor (Eds.).

Eagle Studies. World Working Group on Birds of Prey (WWGBP) Berlin, London & Paris, 429-434.

**1994**

137. Iankov P, Petrov, Tz., Michev, T., Profirov, L. 1994. Past and present Status of the Lesser Kestrel *Falco naumanni* in Bulgaria. - In: Meyburg, B.-U. & R.D. Chancellor eds. 1994. Raptor Conservation Today, WWGBP/ T Pica Press: 133-137

**1995**

138. Petrov, T., P. Iankov, Kolchakov, R., Michev, T., L. Profirov, K. Nyagolov 1995. Numbers, Distribution and Preservation of the Peregrine *Falco peregrinus* in Bulgaria. Bulletin of the museums of South Bulgaria, 21: 17-22. (in Bulgarian, English and Russian summaries).

**1996**

139. Iankov, P, Petrov, Tz., Michev, T., Profirov, L. 1996. Status of the Spotted Eagle (*Aquila clanga*) and the Lesser Spotted Eagle (*Aquila pomarina*) in the Mediterranean. In: Muntaner, J. and J. Mayol (Eds.). Biology and conservation of Mediterranean Raptors, Proceedings of the VI Congress on Biology and Conservation of Mediterranean Raptors, Palma de Mallorca, 22 - 25 September 1994. Madrid, SEO, Monografia 4: 77-81.

**1997**

140. Petrov, Ts. 1997. Pyaschnik Dam. In: Kostadinova, I. (ed.). Important Bird Areas in Bulgaria. Nature conservation series, Book 1, Sofia, BSPB: 59-60.
141. Petrov, Ts. 1997. Results of the census of the white stork (*Ciconia ciconia*) in the former Smolyan District in 1994-1995. In: Petrov, Ts. (rep. ed.). The white stork (*Ciconia ciconia*) in Bulgaria. BSPB, Nature Conservation Series, Book 2, Plovdiv, BSPB: 61-64.
142. Petrov, Ts. 1997a. The Imperial Eagle (*Aquila heliaca*) in the Eastern Rhodopi. Reports on Eastern Rhodopi Project, BSPB-BSBCP, V 3, Sofia. (In Bulgarian and English).
143. Petrov, Ts., D. Petrov. 1997. Results of the census of the white stork (*Ciconia ciconia*) in the former Yambol district in 1994-1995 In: Petrov, Ts. (rep. ed.). The white stork (*Ciconia ciconia*) in Bulgaria. BSPB, Nature Conservation Series, Book 2, Plovdiv, BSPB: 121-124.
144. Petrov, Ts., P. Iankov, D. Georgiev. 1997. Population status of the White Stork (*Ciconia ciconia*) in Bulgaria for the period of 1994/1995. – In: Ts. Petrov (Ed.-in Chief). The White Stork (*Ciconia ciconia*) in Bulgaria. Conservation Series, Book 2, BSPB, Plovdiv, 13-22 (In Bulgarian, English summary).
145. Petrov, Ts., P. Yankov, S. Stoychev. 1997. South Sakar. In: Kostadinova, I. (ed.). Important Bird Areas in Bulgaria. BSPB, Nature Conservation Series, Book 1, Sofia, BSPB: 83-84.

146. Petrov, Ts., P. Yankov. 1997. Derwentski Hills. In: Kostadinova, I. (ed.). Important Bird Areas in Bulgaria. BSPB, Nature Conservation Series, Book 1, Sofia, BSPB: 93-94.
147. Petrov, Ts., P. Yankov. 1997. Population status of the white stork (*Ciconia ciconia*) in Bulgaria in 1994-1995. In: Petrov, Ts. (rep. ed.). The white stork (*Ciconia ciconia*) in Bulgaria. BSPB, Nature Conservation Series, Book 2, Plovdiv, BSPB: 13-22.
148. Petrov, Ts., V. Kamenov, D. Damyanov, A. Antonov. 1997. Results of the white stork (*Ciconia ciconia*) census in the former Vratsa District in 1994-1995. In: Petrov, Ts. (Ed.). The white stork (*Ciconia ciconia*) in Bulgaria. BSPB, Nature conservation series, Book 2, Plovdiv, BSPB: 57-60.

**1999**

149. Petrov, Ts. 1999. At the Spanish Imperial Eagles. Za ptitsite. Esen 1999: 10. (In Bulgarian).
150. Petrov Ts. 1999. Imperial Eagle from Europe to Mongolia. Za Ptitsite, 2: 12-13. (in Bulgarian).
151. Petrov, Ts., Ts. Karafeizov. 1999. White stork nesting on power poles. Energetika, 5: 28-30. (In Bulgarian).
152. Petrov, Tz., Iankov, P., Georgiev, D. 1999. Population status of the White Stork (*Ciconia ciconia*) in Bulgaria in the years 1994/95. In: Schulz, H. (ed.) White Storks on the up? - In: Proceedings Int. Symp. White Stork, Hamburg 1996. Bonn, NABU: 241-247.

**2000**

154. Michev, T., Petrov, Tz. 2000. Birds of Rhodope Mnt. Bulgarian Union for the Protection of the Rhodopes. 122 p. (In Bulgarian)

**2002**

155. Petrov, Tz., 2002. The Imperial Eagle in Bulgaria. Za ptitsite, 1: 4. (In Bulgarian).
156. Petrov, Tz., Stoychev, St. 2002. National Action Plan for the Imperial Eagle (*Aquila heliaca*) in Bulgaria, 2002-2006. - In: Iankov, P. (ed.) Globally Threatened Bird Species in Bulgaria. National Action Plans. Part 1. Bulgarian Society for the Protection of Birds' Conservation Series, Book 4. BSPB-MOEW Sofia: 132-160. (In Bulgarian).
157. Petrov, Tz. 2002. Expert Report on Project Assessment of the existing bird diversity in the Western Rhodopi, Sofia, UNDP. 21 p. (In Bulgarian).

**2003**

158. Petrov, Tz., 2003. The Imperial Eagle in Bulgaria in 2003. Kupena, 21: 8. (In Bulgarian).

**2004**

159. Stoychev S, Ivanov, I., Petrov, Tz., Marin, S., Demerdzhiev, D., Gradev, G., Domuschiev, D. 2004. Status of the Eastern Imperial Eagle (*Aquila heliaca*) in Bulgaria between 1994 and 2002. In: Chancellor, R. D. & B.-U. Meyburg (eds). Raptors worldwide, WWGBP. Budapest: 653-660.

**2005**

160. Petrov, Ts. I. Hristov and I. Angelov 2005. Population Status of the White Stork (*Ciconia ciconia*) in Bulgaria for the Period of 2004/2005. In: Petrov Ts. (Ed.-in Chief). The White Stork (*Ciconia ciconia*) in Bulgaria. II. Conservation Series, Book 7, BSPB (In Bulgarian, English summary).

**2006**

161. Petrov T., D. Demerdzhiev, G. Popgeorgiev, L. Profirov, K. Velev, K. Dimitrova, D. Plachiyski. 2006. Birds of the Western Rhodopes. In: Beron P., (ed.) Biodiversity of Bulgaria. 3. Biodiversity of Western Rhodopes (Bulgaria and Greece) I. Pensoft & Nat. Mus. Natur. Hist., Sofia, 913-948.

**2007**

162. Barov, B., Iankov, P., Petrov, Ts., Stoychev, St., Stoynov, E., 2007. *Falco naumanni* Lesser Kestrel. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 174-175.
163. Daskalova, G., Petrov, Ts., Stoynov, E., Vasilev, V., 2007. *Corvus corax* (Common) Raven. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 588-589.
164. Ivanov, B., Stoychev, S., Stoynov, E., Petrov, P., Iankov, P., 2007. *Sitta neumayer* (Western) Rock Nuthatch. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 552-553.
165. Kovachev, A., Michev, T., Petrov, Ts. 2007. *Ardea cinerea* Grey Heron. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 78-79.
166. Michev, T., Petrov, Ts., Georgiev, D., Stoynov, E., Gerassimov, G. Kutsarov, I. 2007. *Ciconia nigra* Black Stork. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 82-83.
167. Petrov, Ts. 2007. The white stork (*Ciconia ciconia*) in Smolyan region in 2005. In: Petrov, Ts. (Ed.). The white stork (*Ciconia ciconia*) in Bulgaria, II. BSPB, 191-198
168. Petrov, Ts., A. Alexiev, V. Radeva, S. Velkov, Z. Milev. 2007. The white stork (*Ciconia ciconia*) in the Pazardzhik region in 2004-2005. - In: Petrov, Ts. (rep. ed.). The white stork (*Ciconia ciconia*) in Bulgaria, II. BSPB, Nature Conservation Series, Book 12, Plovdiv, BSPB: 155-164.

169. Petrov, Ts., D. Borisova, V. Spasova, M. Kurtev, S. Cheshmedjiev, P. Vantseva. 2007. The white stork (*Ciconia ciconia*) in Vratsa region in 2004. In: Petrov, Ts. (Ed.). The White Stork (Ciconia ciconia) in Bulgaria, II., BSPB, Nature Conservation Series, Book 12, Plovdiv, 101-112.
170. Petrov, Ts., Demerdzhiev, D., Popgeorgiev, G., Plachijski, D., Manchev, K., Ivanov, M. 2007. The White Stork (*Ciconia ciconia*) in Plovdiv District in 2004-2005. In: Petrov, Ts. (Ed.). The White Stork (*Ciconia ciconia*) in Bulgaria, II. Bulgarian Society for the Protection of Birds, Conservation Series, Book 12, BSPB, Plovdiv. 165-178. (in Bulgarian, English summary).
171. Petrov, Ts., Gigov, S., Gigov, A. Todorova, Y. Hristov, V. Koychev. 2007. The white stork (*Ciconia ciconia*) in Stara Zagora region in 2004-2004-2005. In: Petrov, Ts. (rep. ed.), The white stork (*Ciconia ciconia*) in Bulgaria, II. BSPB, Nature Protection Series, Book 12, Plovdiv, BSPB:179-190.
172. Petrov, Ts., Hristov I., Angelov I. 2007. The population of the White Stork (*Ciconia ciconia*) in Bulgaria in 2004-2005. In: Petrov, Ts. (Ed.). The White Stork (*Ciconia ciconia*) in Bulgaria, II. Bulgarian Society for the Protection of Birds, Conservation Series, Book 12, BSPB, Plovdiv. 13-23. (in Bulgarian, English summary).
173. Petrov, Ts., Hristov, I. Angelov, I., Michev, I., Georgiev, D., Kutsarov, I. 2007. *Ciconia ciconia* White Stork. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 84-85.
174. Petrov, Ts., Iankov, P., Mitev, I., 2007. *Tichodroma muraria* Wallcreeper. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 554-555.
175. Petrov, Ts., J. Hristov, I. Angelov. 2007. The population of the white stork (*Ciconia ciconia*) in Bulgaria in 2004-2005. In: Petrov, Ts. (Ed.). The white stork (*Ciconia ciconia*) in Bulgaria, II. Nature conservation series, Book 12, Plovdiv, BSPB, 13-24.
176. Petrov, Ts., P. Iankov. 2007. Dobrostan. In: Kostadinova, I., M. Gramatikov (eds.). Important Bird Areas in Bulgaria and Natura 2000. Bulgatian Sosiety for the Protection of Birds, Conservation Series, Book 11, Sofia, BSPB: 369-372.
177. Petrov, Ts., P. Iankov. 2007. Sredna Gora. In: Kostadinova, I., M. Gramatikov (eds.). Important Bird Areas in Bulgaria and Natura 2000. Bulgatian Sosiety for the Protection of Birds, Conservation Series, Book 11, Sofia, BSPB: 308-311.
178. Petrov, Ts., Stoychev, St., Boev, Z. 2007. *Haematopus ostralegus* (Eurasian) Oystercatcher. - In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 232-233.
179. Petrov, Ts., Stoynov, E., 2007. *Pyrrocorax graculus* (Yellow-billed) Alpine Chough. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 580-581.
180. Petrov, Ts., Tonchev, B., Demerdzhiev, D., Daskalova, G., Stoynov, E., Kurtev, M. 2007. *Aquila chrysaetos* Golden Eagle. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 166-167.

181. Ruskov, K., Tonchev, B., Petrov, Ts., Iankov, P., Stoychev, St., Daskalova, G. 2007. *Falco cherrug* Saker Falcon. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 186-187.
182. Shurulinkov, P., Stoychev, St., Gerassimov, G., Petrov, Ts., Daskalova, G. 2007. *Burhinus oedicnemus* Stone Curlew. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 238-239.
183. Stoychev, S., Petrov, Ts., Demerdzhiev, D., Georgiev, D., Stoynov, E., 2007. *Milvus migrans* Black Kite. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 124-125.
184. Stoychev, St., Petrov, Ts., Demerdzhiev, D., Tonchev, B., Daskalova, G., Stoynov, E., 2007. *Aquila heliaca* Imperial Eagle 2007. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 164-165.
185. Stoynov, E., Petrov, Ts., Tonchev, B., Ruskov, K., Hristov, H., Profirov, L. 2007. *Falco peregrinus* Peregrine Falcon. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 188-189.
186. Tonchev, B., Petrov, Ts., Stoychev, St., Stoynov, E., Velev, K. 2007. *Circaetus gallicus* Short-toed Eagle. In: Iankov, P. (ed.) 2007. Atlas of Breeding Birds in Bulgaria. Bulgarian Society of the Protection of Birds, Conservation Series, Book 10. Sofia, BSPB, 138-139.

## 2009

187. Demerdzhiev, D., Stoychev, S., Petrov, Tz., Angelov, I., Nedyalkov, N. 2009. Impact of Power Lines on Bird Mortality in Southern Bulgaria. - Acta zool. bulg., 61(2): 177185.

## 2011

188. Demerdzhiev, D., G. Gradev, S. Stoychev, I. Ivanov, Ts. Petrov and S. Marin 2011. Increase of the population of the Eastern Imperial Eagle (*Aquila heliaca*) in Bulgaria. Acta zool. bulg., Suppl. 3: 41-54.
189. Domuschiev, D., Ragyov, D., Michev, T., Stoyanov, G., Vatev, I., Petrov, Ts., Ruskov, K. 2011. Saker Falcon Falco cherrug Gray, 1834. In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 82.
190. Marin, S., Ivanov, I., Petrov, Ts., Stoychev, St. 2011. Black Kite *Milvus migrans* Boddaert, 1783. In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 258.
191. Michev, T., Petrov, Ts. 2011. Stone Curlew *Burhinus oedicnemus* (Linnaeus, 1758). In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 269.

192. Michev, T., Petrov, Ts., Nikolov, Hrr., Boev, Z. 2011.Grey Heron *Ardea cinerea* Linaeus, 1758. In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 248.
193. Michev, T., Petrov, Ts., Spasov, Sv. 2011. Marsh Harrier *Circus aeruginosus* (Linnaeus, 1758). In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 168.
194. Petrov Ts., Ivanov I., Marin S., Stoychev S., Demerdzhiev D. 2011. Imperial Eagle *Aquila heliaca* Savigny, 1809. In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 78.
195. Petrov, T. Boev, Z., Dalakchieva 2011. Eurasian Oystercatcher *Haematopus ostralegus* (Linnaeus, 1758). In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 87.
196. Petrov, Ts., Gradev, G., Kmetova, E., Hristov, Y., Michev, T. 2011. White Stork *Ciconia ciconia* (Linnaeus, 1785). In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 250.
197. Petrov, Ts., Nikolov, H., Darakchiev, A. 2011. Black Stork *Ciconia nigra* (Linnaeus, 1758). In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 249.
198. Petrov, Ts., Spiridonov, G., Domuschiev, D., Kurtev, M., 2011. Golden Eagle *Aquila chrysaetos* (Linnaeus, 1758). In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 265.
199. Stoyanov, G., Borisov, B., Antonov, A., Domuschiev, D., Petrov, Ts. 2011. Peregrine Falcon *Falco peregrinus* Tunstall, 1771. In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 173.
200. Stoyanov, G., Vatev, I., Ivanov, B., Petrov, Ts., Spasov, Sv. 2011. Western Rock Nuthatch Sitta neumayer Michahelles, 1830. In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 288. Stoyanov, G., Ivanov, B., Petrov, Ts. 2011. Wallcreeper *Tichodroma muraria* (Linnaeus, 1758). In: Golemanski, V. (Editor-in-Chief) 2011. Red Data book of the Republic of Bulgaria. Volume 2. Animals. IBER-BAS & MOEW, Sofia. 289.

## 2012

201. Stoychev, S., Demerdzhiev, D., Petrov Ts. 2012. Action plan for the conservation of the Eastern Imperial Eagle *(Aquila heliaca)* in Bulgaria. MOEW, Sofia, 73 pp.

## 2022

202. Demerdzhiev D, Boev Z, Dobrev D, Terziev N, Nedyalkov N, Stoychev S, Petrov T. 2022. Diet of Eastern Imperial Eagle (*Aquila heliaca*) in Bulgaria: composition, distribution and variation. Biodiversity Data. Journal 10: e77746. https://doi.org/10.3897/BDJ.10.e77746

203. Demerdzhiev, D., Boev, Z., Dobrev, D., Nedyalkov, N., Petrov, T. 2022. Does Temporal and Spatial Diet Alteration Lead to Successful Adaptation of the Eastern Imperial Eagle, a Top Predator? Diversity 2022, 14, 1000. https://doi.org/10.3390/d14111000

## Books Edited

1. Petrov, Ts. (ed.) 1997. The White Stork (*Ciconia ciconia*) in Bulgaria. Bulgarian Society for the Protection of Birds' Conservation Series, Book 2. BSPB, Piovdiv, Pigmalion. 160 p. (In Bulgarian with English Summary).
2. Petrov, Ts. (ed.) 2007. The White Stork (*Ciconia ciconia*) in Bulgaria II. Bulgarian Society for the Protection of Birds, Conservation Series. Book 12, Plovdiv, BSPB. 1-340. (In Bulgarian, with English Summary)

## References

Boev Z. 2022. History of the Bulgarian ornithology (A review of the research fields and achievements for 277 years with complete bibliography). *Bulletin of the Natural History Museum, Plovdiv,* Supplement 3: 1-55.

Botev B., T. Peshev (Eds.). 1985. *Chervena kniga na NR Balgariya. Tom 2. Zhivotni (Red Data Book of the People's Republic of Bulgaria. Volume 2. Animals)*. Publishing House of the Bulgarian Academy of Sciences), Sofia (in Bulgarian).

Golemanski V. (Ed.) 2011. *Red Data Book of the Republic of Bulgaria. Volume 2. Animals* . IBEI – BAS & MOEW, Sofia. 1-372.

Iankov P. (Ed.) 2007. *Atlas of Breeding Birds in Bulgaria. Bulgarian Society for the Protection of Birds,* Conservation Series, Book 10. Sofia, BSPB, 679 p.

Mirkov I. 2009. *On the birds of Bulgaria and their researchers. A bibliography 1950-2008.* Sofa, 232 p. (in Bulgarian).

List of reviewers, who participated in the peer-review process of Bulletin of the Natural History Museum – Plovdiv (Bull. Nat. Hist. Mus. Plovdiv), Online ISSN 2534-9635; Print ISSN 2534-9627 in 2023.

Adrian Marciszak – Uniwersytet Wrocławski, Zakład Paleozoologii, Wydział Nauk Biologicznych, Poland

Dick Mol – Natural History Museum Rotterdam, The Netherlands

Juan A. Amat – Department of Wetland Ecology, Estación Biológica de Doñana (EBD-CSIC), Seville, Spain

Jhih-Rong Liao – Department of Biological Sciences - Tokyo Metropolitan University, Japan

Reagan Joseph T. Villanueva – Jose Maria College of Medicine/University of Mindanao, Philipines

Stanimira Deleva – National Natural History Museum, BAS, Bulgaria/ University of Costa Rica, San Jose, Costa Rica

Milen Marinov – Ministry for Primary Industries, New Zealand

# BULLETIN OF THE NATURAL HISTORY MUSEUM – PLOVDIV
# INSTRUCTIONS FOR AUTHORS

## General information

Submissions to Bulletin of the Natural History Museum – Plovdiv (Bull. Nat. Hist. Mus. Plovdiv) accepts submissions of original studies in the field of palaeontology, natural history, geology and speleology, zoology, botany, ecology, biogeography, museology, history of natural science, information about museum collections, etc. *The Editorial Board reserve their right to reject publication of any manuscript that does not fit the aim and scope of the journal or does not comply with these instructions!*

## Manuscript submission

The following types of manuscripts are accepted: short research notes (up to 4 pages), research articles (4 to 10 pages) and review papers (10 to 20 pages). Short research notes are shorter submissions of a preliminary nature or those including new records or observed phenomenon, etc. Research articles should present significant original research in the various fields, mentioned above. Review papers should deal with topics of general interest or of contemporary importance, being synthetic rather than comprehensive in emphasis. Authors of Review papers should consult with the Editor before submission. The Editor may also invite review articles concerning recent developments in particular areas of interest. The Editor reserves the right to decide if a manuscript should be treated as a Short note or Research article.

The official language of the journal is English. It is recommended for the authors to consult the translation of their manuscripts with a native speaker, before sending. The journal does not provide any translations or language corrections. If the English translation is not good enough, the manuscript will be sent back to the author. Exceptions are possible, certain manuscript may be published in Bulgarian language, with extensive English summary.

All manuscripts must be written according to *International Code of Zoological Nomenclature* (IV edition, 1999) and *International Code of Nomenclature for algae, fungi, and plants* (2012). For the correct geographical names transcriptions, please see THIS article.

All scientific names (genus and species) must be written in *italic* font. When the name is written for the first time in the manuscript it must be written in full (including author, year, etc.). Between the author's name and the year, a comma should be placed (for example *Belgrandiella pussila* Angelov, 1959).

Manuscripts must conform strictly with the instructions for authors and must be sent to the Editor to the journal's e-mail. Incoming manuscripts are initially judged by the Editor. Manuscripts may be rejected without peer review if they do not comply with the instructions to authors or are beyond the scope of the journal. If the manuscript is acceptable, it will be forwarded to referees for evaluation. All manuscripts are peer-reviewed by 2 or 3 independent reviewers. After final edition and approval by the Editorial Board, the manuscript will be accepted for publication. The Editor reserves the right to make editorial changes. Authors agree, after the manuscript's acceptance, with the transfer of copyright to the publisher.

**Legal requirements**

Bulletin of the Natural History Museum – Plovdiv (BNHMP) follows the standards for Ethics and Publication Malpractice set by the Committee on Publication Ethics (COPE). Conformance to standards of ethical behavior is therefore expected of all parties involved: Authors, Reviewers, Editors, and the Publisher. Submission of a manuscript implies: that the work described has not been published previously (except in the form of an abstract, or as part of a published lecture, or thesis); that it is not under consideration for publication anywhere else; that its publication has been approved by all co-authors, if any, as well as by the responsible authorities – tacitly or explicitly – at the institute where the work has been carried out. The publisher will not be held legally responsible should there be any claims for compensation.

**Technical requirements**

The following formats are accepted: *.doc, *. docx or *.rtf. The text should be all with same font (with no bold font, no uppercase, except for abbreviations), no footnotes, no following intervals, no brakes and unnecessary formatting). The title, authors' names, address, abstract, key words, the chapters and the subchapters, also the references should be separated with a blank row. Italic font should be used only for the genus or the species names.

**Page and text formatting**

Page size should be 17.6x25.01 cm (ISO B5), margins 1.5 cm from left and right and 2 cm from top and bottom. Times New Roman font, 11pt, with single spacing. Do not use software for hyphenation, additional spaces and tabulators. In case of inserting a symbol, please use font Symbol. Pages should not be numbered and with no additional information in the header and footer.

**Manuscript formatting**

The manuscripts should conform to the following format:

*Title:* Provide a title that is concise, but also an informative synthesis of the study. Where appropriate, include mention of the family or higher taxon.

*Author(s):* Full first name(s), middle initials and surname(s). The corresponding author should be marked with the *-symbol.

*Affiliation:* As complete as possible. Also include postal address. E-mail address is given only for the corresponding author.

*Abstract:* Maximum length 300 words. The abstract should state briefly the objective of the research, the primary results and major conclusions, with no description of methods, discussions, references and abbreviations.

*Key words:* Usually 3–6 words suitable for information-retrieval system.

The standard order of sections should be: Abstract, Key words, Introduction, Material and Methods, Results, Discussion (or Results and Discussion), Conclusions (optional), Acknowledgements (optional) and References.

The *Introduction* has to explain the actuality of the researched problem and give the aim of the study. *Materials and Methods* have to provide sufficient information to permit repetition of the experiment and/or fieldwork. The technical description of study methods should be given only if such methods are new; otherwise a short presentation is enough. The *Results* section

must be a concise presentation of the finding of the study. Avoid presentation of the same information as text and/or figure and/or table. *Discussion* section should be separate from the results section at full length papers and should deal with the significance of the results and their relationship to the aims of the paper. Also include how the findings of the paper will change or influence the state of our knowledge about the topic at hand. In separate cases a joint section "Results and Discussion" is allowed, but not preferable. *Conclusions* should shortly describe the main contributions and recommendations of the study without including citations and statistics. In the *Acknowledgements* section all persons and organizations that helped during the study in various ways, as well as the organization that financed the study must be listed.

*Short Notes* (generally less than four-five manuscript pages) should be produced as continuous text, preceded by an abstract of no more than 150 words. Key words are also included.

*Tables:* The tables must not repeat information already presented in the figures or in the text. Each table must be self-explanatory and as simple as possible. No fold-outs (landscape oriented tables) are accepted. Tables must be numbered consecutively. They should be placed within the text at the desired position by the author(s). An explanatory caption, located on the top of the table, should be provided. No shading should be added to tables.

*Figures:* They must not repeat information already presented in the tables or in the text. Lines and letters in figures must allow to be enlarged or reduced without reduction in quality. They should conform to the size of the type area. Magnification should be shown by scale bars. Colour illustrations are accepted, but will appear only in the electronic version of the journal (PDF). The illustrations in the hardcopy printed version will be greyscale. All illustrations must be sharp, of high quality with at least 300 dpi. The following formats are acceptable: JPEG, GIF, TIFF, EPS. Figures must be numbered consecutively and should be provided with an explanatory legend below them. They must be placed within the text at the desired position by the author(s). All tables and figures must be referred to in the text! Please send all figures attached as separate files (with the same size and resolution) as well as in the text. If the figures are charts made with Excel, please provide the Excel file as well.

**Citations and formatting of the references list**

All references should be cited in the text in the following way: "Josifov (1996)" or "(Josifov, 1996)"; "Josifov & Kerzhner (1995)" or "(Josifov & Kerzhner, 1995)"; "Golemansky *et al.* (1993)" or "(Golemansky *et al.,* 1993)". Citations in brackets should be divided with semicolons and the author's name and the year of publication with comma (example: Carlin, 1992; Brooks & Carlin, 1992; Shapiro *et al.*, 1968). Where there are more than two authors "*et al.*" in *italic* font is added after the name of the first author.

References at the end of the paper should be listed in alphabetical order by the first author's family name and chronologically. If there is more than one work by the same author or team of authors in the same year, a, b, etc. is added to the year both in the text and in the list of references. Each citation in the text must be accompanied by a full reference in the list of references and vice versa. In case of papers written in other than Latin letters, if there is an English (or German, or French) title in the summary, it is recommended to be used. If there is

not such a summary, the author's names must be transcribed and the title of the paper must be translated into English and put in square brackets. If the name of the journal is also not in Latin letters it also should be transcribed (not translated). This should be noted in round brackets at the end of the paragraph, for instance: (In Bulgarian, English summary).

*Examples:*
*Article in Cyrillic, without summary in western language:*
Joakimoff D. 1899. Contribution to the insect fauna of Rila Mountain. *Periodichesko spisanie na Balgarskoto Knizhovno Druzhestvo,* 60: 858-884 (in Bulgarian).

*Article in Cyrillic, with summary in western language:*
Popov S. 1999. Species of family Tipulidae (Diptera) known to the fauna of Bulgaria till 1998. *Travaux Scientifiques de l'Universite de Plovdiv, Biologie, Animalia,* 35: 33-36 (in Bulgarian, English summary).

*Journal article:*
Theowald B., P. Oosterbroek. 1986. Zur Zoogeographie der westpalacarctischen Tipulidae. VII Die Tupilidae der Balkanhalbinsel (Diptera, Tipulidae). *Tijdschrift voor Entomologie,* 129(1): 1-13.

*Book:*

Evenhuis N.L. 1994. *Catalogue of the fossil flies of the world (Insecta: Diptera).* Backhuys Publishers, Leiden, 600 p.

*Book chapter:*

Krivosheina N.P. 1988. Family Diadocidiidae. *In:* Soos, A., L. Papp. (Eds.), *Catalogue of Palaerctic Diptera. Vol. 3. Ceratopogonidae - Mycetophilidae*. Akadeiai Kiado, Budapest, pp. 210-211.

*Internet site:*

Oosterbroek P. 2004. Fauna Europaea: Tipulidae. *In:* de Jong, H. (Ed.), *Fauna Europaea: Diptera: Nematocera. Fauna Europaea* version 1.3. Available at: http://www.faunaeur.org. (Accessed on 13 March 2022).

*Software:*

Statsoft Inc. 2004. STATISTICA (Data analysis software system), Vers. 7. Computer software. Available at: http://www.statsoft.com.

Garmin Ltd. 2007. MapSource, Vers. 6.12. Computer software. Available at: http://www.garmin.com.

**Unpublished theses (BSc, MSc, PhD, DSc) are not considered officially published scientific literary sources, therefore they are not allowed. If you absolutely must cite such a source, you may cite it as an exception as "personal communication".**

**Citing references that are still "in press" is also considered frown upon, but not forbidden. If possible, please avoid using such references.**

**Ethics**

The authors of articles that are based on experiments that caused injuries or death of animals should explain and justify the grounds of the study and state that the scientific results of the study is at least in trade-off with the sufferings caused. In the Materials and Methods section of the manuscript, the authors should detail as precisely the conditions of maintenance, transport, anesthesia, and marking of animals. When available, references should be added to justify that the techniques used were not invasive. When alternative non-harming techniques exist, but were not used, the manuscripts may not be considered for publication.

**Proofs and Reprints**

Proof will be sent to the first (or corresponding) author for checking (a PDF file) only once and it should be returned without delay. Corrections should be limited to typographical errors. No additional changes of the manuscript are allowed. Following publication, the first (or corresponding) author will be provided with electronic copy (PDF) of the article.

**E-mail: bnhm_plovdiv@abv.bg**