



**ANNOTATION OF THE MATERIAL UNDER ART. 65 (1) OF THE REGULATIONS
FOR DEVELOPMENT OF THE ACADEMIC STAFF OF THE UNIVERSITY OF
PLOVDIV "PAISII HILENDARSKI", INCLUDING SELF-ASSESSMENT OF
CONTRIBUTIONS AND HABILITATION EXTENDED REFERENCE**

of Ch. Assist. Prof. Dr. Peter Stoykov Boyadzhiev

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in connection with participation in the announced in SG, no. 92 of 18.11.2022, competition for the occupation of an academic position "Associate Professor" in the field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.3. Biological Sciences (Zoology)

Since 1995, I have been a lecturer at the University of Plovdiv "Paisii Hilendarski" (PU) and part of the regular staff of the Department of Zoology, for which I present a certificate from the Human Resources Department of PU for 27 years of teaching experience on a basic employment contract. In 2003, I fill the academic position of "Chief Assistant Professor" of Zoology of invertebrates. I defended my doctorate degree in scientific specialty 01.06.14 Entomology in 2005, for which I present the original and copies of the diploma to the relevant sets of documents for the competition.

For participation in the competition for the academic position "Associate Professor" in the field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.3. Biological Sciences (Zoology) I present the following activities:

- 23 scientific publications that are referenced and indexed in world-renowned scientific information databases (Web of Science and Scopus), with a total impact factor: 9.073 and a total SJR: 6.679. All presented scientific publications are co-authored and in English. In eight of them I am the lead author;

- 40 citations in similar type of scientific publications;

- three teaching aids as a co-author by direction and specialty of the announced competition, with originals attached to the sets of documents for reviewers.

- five graduates who successfully defended their diplomas in the relevant field of the competition. My teaching contribution to them, under my supervision or in collaboration with colleagues, is mainly related to training graduate students to carry out: collection of zoological

material, laboratory processing, mounting, determination and interpretation of the obtained results for the purposes of their diploma thesis.

- participation in 2 scientific projects;
- and participation in the administrative activities of the Faculty of Biology (PU).

The specified scientific and teaching activities were not used in previous procedures (for academic position “Chief Assistant Professor” and for scientific degree “Doctor”).

In Table 1, I indicate the coverage of the minimum national required number of points by group of scientific-metric indicators for the academic position “Associate Professor” in professional direction 4.3 Biological sciences and their corresponding implementation. Their detailed description and implementation are presented in the “Reference for compliance with the minimum national and additional faculty requirements”, supplemented by the relevant references and service notes attached to the reviewers kits.

Table 1. Minimum national required number of points by groups of scientific-metric indicators and their respective implementation.

Metrics group	Content	Associate Professor – number of points	Performance – number of points
„A“	indicator 1	50	50
„B“	sum of points from indicators 3 and 4	100	124 (from indicator „4“)
„Г“	sum of points from indicators 5-10	200	210 (from indicator „7“)
„Д“	sum of points from indicator 11	50	80
	Total:	400	464

ANNOTATION OF SCIENTIFIC PUBLICATIONS

Publication 1 (Boyadzhiev & Todorov, 2013) presents a study of a new species of the genus *Stepanovia* Kostjukov (Hymenoptera: Eulophidae: Tetrastichinae). *Stepanovia rosae* Boyadzhiev & Todorov, sp. n. is described and illustrated. The new species was reared from galls of *Diplolepis rosae* (Linnaeus) (Cynipidae) on *Rosa dumalis* Bechstein, *R. agrestis* (Savi), *R. micrantha* Smith and *R. canina* Linnaeus (Rosaceae). A key to the species of the genus *Stepanovia* is presented.

Publication 2 (Boyadzhiev & Triapitsyn, 2007) presents a new distinctive species of the genus *Entedonophale* Girault (Hymenoptera: Eulophidae: Entedoninae). *Entedonophale bulgarica* Boyadzhiev & Triapitsyn sp. n. is described from the mountains of Southwestern and Southeastern Bulgaria. The European species *E. carbonaria* (Erdos) is recorded in the Nearctic region (USA). An identification key for both sexes of Palaearctic species of the genus *Entedonophale* is presented.

Publication 3 (Boyadzhiev et al., 2022) presents a new species of the genus *Stepanovia* Kostjukov (Hymenoptera, Eulophidae, Tetrastichinae). *Stepanovia rosaeformis* Boyadzhiev & Antov sp. n. is described and illustrated. The species was reared from galls of *Diplolepis rosae* (Linnaeus) (Cynipidae), grown on *Rosa* spp. (Rosaceae). A key for determination of the species of the genus *Stepanovia*, trophically related to gall-forming Cynipidae (Hymenipyera), is also presented.

Publication 4 (Boyadzhiev et al., 2012) presents the results of the empirical experience in creating a universal model of a microscopic manipulator. Three modifications are described and detailed schematics are presented of the mechanical devices for the observing of prepared and mounted biological objects, including insects. They allow movement of the observed object at a point with three degrees of rotational freedom. Movements are provided by three intersecting axes in the field of view of the stereomicroscope at all magnifications. The main improvement in them is the positioning of the guide knobs for rotation of two of the axes next to each other, which allows faster and safer manipulation of the studied object. Another of their advantages is the ability to rotate the studied object with minimal focusing and repositioning. The described schemes allow to easily reach a precession deviation at the intersection of the axes of the order of 0.5 mm in the process of assembling the manipulators.

In **Publication 5** (Boyadzhiev et al., 2017) a study of the species composition of egg parasitoids of *Thaumetopoea solitaria* (Freyer, 1838) (Lepidoptera: Notodontidae) in Bulgaria is presented. The study was conducted in 2010-2015 in 6 sites in the Eastern Rhodopes, with collected material from 424 egg batches of the pine processionary moth with a total of 52628 eggs in them, laid on *Pistacia terebinthus* L., 1753 (Anacardiaceae). Out of the 281 egg parasitoids found, 3 species of the genus *Ooencyrtus* Ashmead, 1900 (Hymenoptera: Encyrtidae) were found: *O. masii* Mercet, 1921, *O. pityocampae* (Mercet, 1921) and *Ooencyrtus* sp. nr. *indefinitus* Myartseva, 1982, The dominant species among them was *O. masii*, and the least represented, with two female individuals, was *O. pityocampae*. In *Ooencyrtus* sp. nr. *indefinitus*, the sex ratio ♀♀:♂♂ is almost 1:1, while in *O. masii* females predominate. In laboratory conditions, the period of emerging of the parasitoids is within 41 days, as in *O. masii* and *O. sp. nr. indefinitus*, a similarity is observed in the dynamics of the appearance of imaginal forms.

Publication 6 (Boyadzhiev et al., 2017) presents a new species of the genus *Stepanovia* Kostjukov (Eulophidae: Tetrastichinae). *Stepanovia fructirosae* sp. n. is described and illustrated. The species was reared from galls of *Diplolepis fructuum* (Hymenoptera: Cynipidae) from Northeastern Turkey and is morphologically close to *S. rosae* Boyadzhiev & Todorov. An identification key to known species of the genus *Stepanovia*, is presented.

Publication 7 (Boyadzhiev et al., 2015) presents the results of a study of egg parasitoids of the pine processionary moth *Thaumetopoea pityocampa* (Lepidoptera: Notodontidae) in Bosnia and Herzegovina. In the course of the experiment, the hyperparasitoid *Baryscapus transversalis* Graham, 1991 (Hymenoptera: Eulophidae) was reared from material collected from black pine *Pinus nigra* in the Borachko Lake area. During the period 3.XI.-22.XI.2013, 80 specimens of *B. transversalis* were reared in laboratory conditions from 38 egg clusters, with a total of 8515 eggs. The established sex ratio of adult parasitoids is 3:1 in favor of females. *B. transversalis* is reported as a new species to the fauna of Bosnia and Herzegovina.

Publication 8 (Boyadzhiev et al., 2020) presents a survey of egg parasitoids of the pine processionary moth (*Thaumetopoea pityocampa*) in the Eastern Rhodopes. The research is based on 180 egg batches of the moth, collected in a black pine plantation *Pinus nigra* in the area of the Fotinovo Village. As a result, *Eupelmus vladimiri* Fusu, 2017 (Hymenoptera: Eupelmidae) is recorded for the first time in a trophic relationship with this host. In the period 19-20 March 2019, 72 male specimens of *E. vladimiri* were reared from 17 egg batches of *T. pityocampa*. In addition to *E. vladimiri*, the parasitoids *Ooencyrtus*

pityocampae (Mercet, 1921) (Encyrtidae), *Baryscapus servadeii* (Domenichini, 1965), *Baryscapus transversalis* Graham, 1991, *Pediobius bruchicida* (Rondani, 1872) (Eulophidae) and *Anastatus bifasciatus* (Geoffroy, 1785) (Eupelmidae), were established. The share of *E. vladimiri* is about 5% of the egg parasitoid complex of the pine processionary moth.

Publication 9 (Dobrev et al., 2020) presents our studies on the parasitoid complex of *Leucoptera sinuella* (Reutti) (Lepidoptera: Lyonetiidae) in two localities near the Stryama River, in the central part of southern Bulgaria, conducted in 2018. The larvae and pupae of *L. sinuella* were collected periodically in poplar (*Populus* spp.) plantations and studied under laboratory conditions. As a result, four species of Eulophidae were identified: *Baryscapus endemus* (Walker), *Chrysocharis pentheus* (Walker), *Cirrospilus pictus* (Nees) and *Pediobius bruchicida* (Rondani). Three species of them (*B. endemus*, *C. pentheus* and *P. bruchicida*) were established for the first time in the parasitoid complex of *L. sinuella*. The most common species was *B. endemus* (86.1%), followed by *P. bruchicida* (9.7%), *C. pictus* (2.8%) and *C. pentheus* (1.4%). Host mortality caused by the parasitoids in different samples varied between 0 and 76.7%, with a mean value of 10.0%.

Publication 10 (Georgiev et al., 2002) presents a study of the parasitoid complex of *Paraphytomyza populi* (Kltb.) (Diptera: Agromyzidae) in Sofia, in 1997. From collected poplar leaves on stump shoots with larvae and pupae of *P. populi* were eleven species of parasitoids reared and identified in the laboratory: *Chorebus albipes* (Haliday) (Hymenoptera, Braconidae), *Pediobius metallicus* (Nees), *Danuviella subplana* Erdos, *Chrysocharis nephereus* (Walker), *Chrysocharis pubicornis* (Zetterstedt), *Diglyphus crassinervis* Erdos, *Diglyphus isaea* (Walker), *Diglyphus albiscapus* Erdos, *Cirrospilus diallus* Walker, *Cirrospilus pictus* (Nees) and *Elasmus* sp. (Hymenoptera, Eulophidae). Six species (*D. crassinervis*, *D. isaea*, *D. albiscapus*, *C. diallus*, *C. pictus* and *Elasmus* sp.) have been recorded as new parasitoids of *P. populi*. The genus *Danuviella* was found for the first time in Bulgaria. Five species (*C. albipes*, *P. metallicus*, *D. subplana*, *D. crassinervis* and *D. albiscapus*) are new records for the fauna of the country, too. The total mortality of *P. populi* caused by parasitoids was 19.1 % and 49.0 % for the overwintering and the summer generations, respectively. *P. metallicus* was the most important in reducing the pest number.

Publication 11 (Georgiev et al., 2012) presents a study of parasite-host relationships from material collected from *Pistacia terebinthus* L. (Anacardiaceae) near the town of Ivaylovgrad, Eastern Rhodopes, in March 2010. In laboratory conditions, 3 female specimens of the parasitoid *Habrolepis montenegrina* (Westwood, 1837) (Hymenoptera: Encyrtidae) were reared from 8 larvae of the host *Epidiaspis gennadii* (Leonardi, 1898) (Hemiptera: Diaspididae). Thus we report both species as new to the fauna of Bulgaria, and *E. gennadii* as the first known host of the parasitoid *H. montenegrina*.

Publication 12 (Georgiev et al., 2004) presents the results of a study of xylophages in the stems and branches of the goat willow *Salix caprea* L. (Salicaceae) and their parasitoids, during the period 1998–2003 in Bulgaria. Seven species of xylophages of *S. caprea* were found: *Agrilus lineola lineola* Redtenbacher (Coleoptera: Buprestidae), *Aromia moschata* (Linnaeus), *Oberea oculata* (Linnaeus), *Saperda populnea* (Linnaeus), *Saperda similis* Laicharting (Coleoptera: Cerambycidae), *Synanthedon formicaeformis* (Esper) (Lepidoptera: Sesiidae) and *Rhabdophaga clavifex* (Kieffer) (Diptera: Cecidomyiidae). Six species of parasitoids were reared from

them: *Dolichomitus mesocentrus* (Gravenhorst), *Dolichomitus populneus* (Ratzeburg) (Hymenoptera: Ichneumonidae), *Stephanus serrator* (Fabricius) (Hymenoptera: Stephanidae), *Aprostocetus metra* (Walker), *Euderus caudatus* (Thomson) (Hymenoptera: Eulophidae) and *Billaea irrorata* (Meigen) (Diptera: Tachinidae). *D. populneus*, *E. caudatus* and *B. irrorata* are related to *S. populnea*; *D. mesocentrus* and *S. serrator* with *S. similis*; *A. metra* with *R. clavifex*. Two parasitoids (*A. metra* and *E. caudatus*) are reported as new for the fauna of Bulgaria. New parasitoid–host relationships were established for the first time in this study: *D. mesocentrus* – *S. similis* and *S. serrator* – *S. similis*.

Publication 13 (Mirchev et al., 2014) presents the results of a study of egg parasitoids of *Thaumetopoea solitaria* (Lepidoptera: Notodontidae) on the pistachio *Pistacia terebinthus* L. (Anacardiaceae). The study was conducted in the period 2010-2012, based on 215 egg clusters of *T. solitaria* containing 26,453 eggs from the region of Eastern Rhodopes. The article reports for the first time as egg parasitoids of *T. solitaria* the following chalcidoides: *Anastatus bifasciatus* (Hymenoptera: Eupelmidae), *Ooencyrtus pityocampae* and *Ooencyrtus* sp., close to *O. masii* and *O. ascalaphi* (Hymenoptera: Encyrtidae). The new data expand the host range of the polyphagous parasitoids *O. pityocampae* and *A. bifasciatus*. The main part of the parasitoids emerged after hibernation. Their survival is about 80%, and their impact on the host - within 2.9-21.5%.

Publication 14 (Mirchev et al., 2012) presents a study of the influence of entomophages on the density of the pine processionary moth *Thaumetopoea pityocampa* (Denis & Schiffermüller) (Lepidoptera: Notodontidae) in its egg stage near Ivaylovgrad, in a forest of *Pinus nigra* Arnold, 1785 (Pinaceae). 85 egg batches of the moth containing 22349 eggs from three generations laid in 2009-2011 were studied. The average number of eggs in the clusters was the largest for the generation from 2011 – 279.5, and in the previous two generations it was about 10% lower. Entomophages – parasitoids and predators – were the most significant for the reduction in the density of the processionary moth, with about 30% of eggs parasitized and less than 1% destroyed by predators. From the first group, we determined five species of parasitoids: *Ooencyrtus pityocampae* (Mercet) (Encyrtidae), *Baryscapus servadeii* (Domenichini), *Baryscapus transversalis* Graham, *Pediobius bruchicida* (Rondani) (Eulophidae) and *Anastatus bifasciatus* (Fonscolombe) (Eupelmidae). All *A. bifasciatus* were male, except for 1 female from the 2010 generation and 4 females from the 2011 generation. All *O. pityocampae* and *B. servadeii* were female, and *P. bruchicida* and *B. transversalis* were represented by both sexes. The first two species – *O. pityocampae* and *B. servadeii* – are most abundant, whose number were about 80% of all parasitoids of the processionary moth. The survival of the moths in the egg stage, expressed as a percentage of hatched caterpillars, is between 60 and 75%.

Publication 15 (Mirchev et al., 2011) presented *Pediobius bruchicida* (Rondani) (Hymenoptera: Eulophidae) as an egg parasitoid of *Thaumetopoea pityocampa* (Denis & Schiffermüller) (Lepidoptera: Notodontidae). The studied material was reared from 153 egg batches of the pine processionary moth containing 32,731 eggs and collected in 1995-2010, in plantations of black pine *Pinus nigra* from four sites in the country, located in the valley of the river Struma, in the Sredna Gora Mts and in the Eastern Rhodopes. Survival of *P. bruchicida* in laboratory conditions was quite high – 80.1%, but

the impact of the parasitoid on the host was not significant and varied between 0.02 and 0.32%. The study is also valuable in that *P. bruchicida* is reported for the first time to the fauna of Bulgaria.

Publication 16 (Mirchev et al., 2015) presents a study of the structure and survival in 38 egg batches of *Thaumetopoea pityocampa* (Denis and Schiffermüller, 1775) (Lepidoptera: Notodontidae) containing 8514 eggs, from Bosnia and Herzegovina. The material was collected on 21.IX.2013 from a forest of *Pinus nigra* Arnold in the area of the Borachko Ezero Lake. The average number of eggs in clusters was 224, and the percentage of successfully hatched eggs was 72.1%. Parasitoids and predators are the most significant regulators of the numbers of the processionary moth in the egg stage. Four main egg parasitoids of *T. pityocampa* have been recorded: *Ooencyrtus pityocampae* (Encyrtidae), *Baryscapus servadeii* (Eulophidae), *Anastatus bifasciatus* (Eupelmidae) and *Trichogramma* sp. (Trichogrammatidae). In the course of the research, the hyperparasitoid *Baryscapus transversalis* (Eulophidae) was also found. *O. pityocampae* proved to be the dominant species, outnumbering all other species. High host mortality caused by egg parasitoids has also been recorded. Under laboratory conditions, the emergence dynamics of the four major parasitoids show clearly distinguishable periods of imagination.

Publication 17 (Todorov et al., 2014) presents a study of the species of the families Eulophidae and Pteromalidae (Hymenoptera: Chalcidoidea) on the territory of the Vitosha Mts. Faunistic information is provided for 78 species of chalcidoidea, of which 4 species are from the Eulophidae family. All representatives are newly reported to the fauna of Bulgaria. For 2 species of eulophids and 9 species of pteromalids, the localities in Bulgaria are the most southerly in their areals. One species, *Gastrancistrus clavellatus* Graham (Pteromalidae), is recorded for the first time in continental Europe. Four plant associations for 5 species of pteromalids are also presented.

Publication 18 (Todorov et al., 2012) presents a study of the gall community of *Diplolepis rosae* (Hymenoptera: Cynipidae) from the Vitosha Mts. The galls of the cynipid wasp support an insect community that consists of cyprily parasitoids and inquilines. The article presents data on the sex ratio and community structure of the insects reared by these galls, and similar research is being conducted for the first time in Bulgaria. For the Vitosha population, 43.10% of the *Diplolepis rosae* individuals obtained were males, the highest number for the entire dataset found so far for this species in Europe. Including the gall-maker, the reared insect community consists of 11 species, including eulophid *Stepanovia* sp. near *eurytomae*. A tenthredinid *Cladius pectinicornis* (with 1 individual only) and three eulophid individuals of *Colpoclypeus florus* are supposed to be accidental inhabitants in the galls volume. The most abundant parasitoid species is *G. stigma* with 19.12% of all reared insects, followed by *P. bedeguaris* (17.74%) and *O. mediator* (13.59%).

Publication 19 (Toshova et al., 2018) presents a study of the lime leaf miner *Phyllonorycter issikii* (Kumata) (Lepidoptera: Gracillariidae) in Bulgaria. It is natural to the region of East Asia and has recently invaded a significant part of Europe. In 2015-2016, leaves of *Tilia cordata* (Malvaceae) infected with *Ph. issikii* were collected in two public parks in Sofia. A total of eleven eulophid parasitoids (Hymenoptera: Eulophidae) belonging to three subfamilies – Entedoninae, Eulophinae and Tetrastichinae, and one braconid species (Hymenoptera: Braconidae) were recorded. In addition, an unidentified

species of Ichneumonidae was reared. The tetrastichin *Minotetrastichus platanellus* (Mercet) was found to be the most abundant in the samples, comprising 76.88% of the parasitoids reared from larval and pupal stages of *Ph. issikii*. Followed by the eulophines *Sympiesis gordius* (Walker) (6.53%) and *S. sericeicornis* (Nees) (6.03%). Three new host-parasitoid associations were identified: *Ph. Issikii* - *Pnigalio incompletus* (Boucek) and *Ph. issikii* – *M. platanellus*. The entomopathogenic fungi *Beauveria bassiana* (Balsamo-Crivelli) Vuillemin and *Metarhizium anisopliae* (Metschnikoff) Sorokin (Ascomycota: Hypocreales) were isolated for the first time from dead larvae and pupae of *Ph. issikii*. Based on the presented observations, it is assumed that the lime leaf miner can perform up to three generations per year in Bulgaria.

Publication 20 (Triapitsyn et al., 2008) presents the study of a short-winged female *Entedonomphale carbonaria* (Erdös) (Hymenoptera: Eulophidae: Entedoninae) in Bulgaria. This allowed the authors to make a positive conclusion about its conspecificity with the North American species *E. kaulbarsi* (Yoshimoto), which has a short-winged female identical to the short-winged female from Bulgaria, as well as a fully winged male identical to the male of *E. carbonaria* from Europe (Triapitsyn, 2005). The publication also includes taxonomic notes on another, little known species of the genus *Entedonomphale* Girault, *E. postmarginalis* (Shafee, Rizvi & Khan), comb. n. from *Entedonastichus* Girault. This species was originally described from India as *Euderomphale postmarginalis* Shafee, Rizvi & Khan (Shafee et al. 1988) and later transferred to *Entedonastichus* by Hayat et al. (2005).

Publication 21 (Yefremova et al., 2011) presents a review of species of the genus *Diglyphus* Walker (Hymenoptera: Eulophidae) in Turkey. *Diglyphus begini* Ashmead and *D. sabulosus* Erdös are established as new to the fauna of Turkey. The species *Diglyphus sensilis* Yefremova sp. n. is described. New associations with the hosts *Liriomyza sativae* Blanchard and *Chromatomyia horticola* Goureau were established for three species, and 10 species of *Diglyphus* from Turkey are keyed.

Publication 22 (Efremova et al., 2010) presents a study of the males of *Neotrichoporoides bulgaricus* Graham, 1987. The species is described from a single female, the holotype of the species. The paper presents a new diagnosis with a redescription of the holotype, supplemented by a description of males based on two specimens caught from the type locality of the species.

Publication 23 (Efremova et al., 2017) describes *Omphale rodopiensis* sp. n. (Hymenoptera: Eulophidae: Entedoninae) from the Rhodope Mts. The paper diagnosed, described and illustrated a new species belonging to the group of species of the genus *Omphale* Haliday having 3-4 admarginal setae and a bare radial cell on the forewings. The identification keys for distinguishing them are also presented.

HABILITATION EXTENDED REFERENCE, INCLUDING SELF-ASSESSMENT OF CONTRIBUTION

Insects of the family Eulophidae, like most other representatives of the superfamily Chalcidoidea (Hymenoptera), are small parasitoid species ranging in size from 0.8 to 7 mm. Their larvae are predominantly entomophages with an ectoparasitic or endoparasitic type of development, although there are some that develop on other arthropods or have switched to phytophagy for the second time. A considerable number of secondary parasitoids have also been found. Adult insects usually feed on flower nectar and pollen and are found en masse on flowering plants or on food plants of their hosts.

My study of Eulophidae, as well as some representatives of the families Encyrtidae and Eupelmidae, is aimed at studying the species composition, host relationships, seasonal dynamics, vertical distribution and ranges of species and is a natural continuation of my thesis on acquiring the educational and scientific degree "Doctor".

The study and publication of the new results took place with the kind participation of colleagues from the Department of Zoology (PU), colleagues from the Forest Research Institute at the Bulgarian Academy of Sciences (BAS), the Institute of Biodiversity and Ecosystem Research (BAS), other colleagues and friends, incl. and from abroad, for which I am sincerely grateful. The material presented in the articles is deposited in the collection of the Department of Zoology (PU). Some of the type specimens of the newly described species are also deposited in other collections that are freely available for research.

The contributions received and the results of the scientific publications submitted for the competition can be grouped into the following areas:

- Taxonomic – description of new species of the Eulophidae family, supplemented by key tables to distinguishing them from morphologically close representatives; taxonomic notes and redescription of poorly studied species;
- Methodological – development and description of specialized devices and methods of work suitable for studying small insect species and other biological objects;
- Faunistic – expansion of knowledge about the biological diversity of the Eulophidae family and other representatives of the superfamily Chalcidoidea (Hymenoptera) in Bulgaria and neighboring countries, supplemented with practical observations of their biology and ecology.

The first two areas are substantiated in the habilitation extended reference with publications for the competition under Group „Б“, Indicator „4“, and the third - with publications from Group „Д“, Indicator „7“.

In the publications presented for the competition, a total of one new genus from family Eulophidae for the fauna of Bulgaria, as well as 12 species of Eulophidae and 2 species of Encyrtidae new to the fauna of Bulgaria, 4 species new to science from the family Eulophidae were described and 17 new "host-parasitoid" associations, were established. One species of the family Eulophidae was identified as new to the Nearctic, two species of Eulophidae were identified as new to the fauna of Turkey, and one species to the fauna of Bosnia and Herzegovina. Streamlined models of a screen-

sweeping entomological net and a mechanical microscope manipulator are described, as well as a modification of the method for studying the wing interference pattern.

TAXONOMIC STUDIES

Family Eulophidae

Publication 1 (Boyadzhiev and Todorov, 2013) describes the species *Stepanovia rosae* Boyadzhiev & Todorov sp. n., reared from galls of *Diplolepis rosae* (Linnaeus) (Hymenoptera, Cynipidae) on four species of wild briar. A key to the species of the genus *Stepanovia* Kostjukov is presented.

My contribution in Publication 1 is mainly in the identifying, illustrating and describing of *S. rosae*.

Publication 2 (Boyadzhiev and Triapitsyn, 2007) describes *Entedonomphale bulgarica* Boyadzhiev & Triapitsyn sp. n. from the South Bulgaria. A key to Palaearctic species of the genus *Entedonomphale* is presented.

My contribution in Publication 2 consisted mainly of collecting the material by “screen-sweeping” method with a rationalized model of the entomological net illustrated in the publication, extracting the eulophids from the ethyl alcohol-fixed samples, discovering the new species, and establishing contact with Dr. Serguei V. Triapitsyn, Department of Entomology, University of California (USA), for confirmation of determination and help with description.

Publication 3 (Boyadzhiev et al., 2022) describes *Stepanovia rosaeformis* Boyadzhiev & Antov sp. n. reared from galls of *Diplolepis rosae* (Cynipidae) from the Vitosha Mts. A key to known species of the genus *Stepania* Kostjukov trophically associated with the gall-forming Cynipidae (Hymenoptera) is presented.

My contribution in Publication 3 consists mainly in the identification, illustration and description of *S. rosaeformis*.

In **Publication 6** (Boyadzhiev et al., 2017) the species *Stepanovia fructirosae* Boyadzhiev, Yefremova & Tozlu sp. n., reared from galls of *Diplolepis fructuum* (Hymenoptera: Cynipidae), from Northeastern Turkey, is described. Keys are presented to distinguish it from the morphologically close species *S. eurytomae* (Nees), *S. rosae* Boyadzhiev & Todorov and *S. kubanica* (Kostjukov).

My contribution to publication 6 is mainly in the identification, illustration and description of *S. fructirosae*.

In **Publication 20** (Triapitsyn et al., 2008) a short-winged female of *Entedonomphale carbonaria* (Erdős) (Hymenoptera: Eulophidae: Entedoninae) captured together with a winged female of the same species from the region of Augusta Reservoir (Montana, Bulgaria), are presented. With this study, *E. kaulbarsi* (Yoshimoto) is synonymized with *E. carbonaria*. The publication also includes taxonomic notes on *E. postmarginalis* (Shafee, Rizvi & Khan), comb. n.

My contribution to Publication 20 is mainly expressed in the laboratory processing of the material and the initial study of the co-caught short-winged and winged female specimens of *E. carbonaria* from the Augusta Dam area (Montana), carried out by the junior author in the publication Graduate Student Anton Antonov, and establishing contact with Dr. Serguei V. Triapitsyn, Department of Entomology, University of California (USA), for confirming the determination and further assistance.

Publication 21 (Yefremova et al., 2011) reviews the species of the genus *Diglyphus* Walker (Hymenoptera: Eulophidae) in Turkey. *Diglyphus begini* Ashmead and *D. sabulosus* Erdös are reported as new to the fauna of Turkey. The species *Diglyphus sensilis* Yefremova sp. n. is described. New associations were established for *Liriomyza sativae* Blanchard (Diptera, Agromyzidae) with *D. chabrias* (Walker), *D. crassinervis* Erdös and *D. minoicus* (Walker). New associations were also established for the agromysid *Chromatomyia horticola* Goureau with *D. chabrias* and *D. crassinervis*. A key to ten Turkish species of the genus *Diglyphus* is presented.

My contribution to Publication 21 consists of laboratory processing and initial study of some of the material, as well as establishing contact with Dr. Zoya Efremova (Ulyanovsk State Pedagogical University named after I. N. Ulyanova, Ulyanovsk, Russia) (USPU) for confirmation of identification and further assistance.

Publication 22 (Yefremova et al., 2010) presents a description of males of *Neotrichoporoides bulgaricus* Graham, 1987, based on two male specimens collected from the type locality of the species. The species is described from a single female, the holotype of *N. bulgaricus*. The work presents a new diagnosis and redescription of the holotype, supplemented by a detailed description of the males.

My contribution to Publication 22 is expressed in the preliminary planning, collecting and processing of new material from the type locality of the species, initial research, illustration of male specimens, and establishing contact with Dr. Zoya Efremova and Dr. Ekaterina Egorenkova (USPU) for further assistance.

Publication 23 (Yefremova et al., 2017) describes *Omphale rodopiensis* sp. n. (Hymenoptera: Eulophidae: Entedoninae) from the Rhodopes and keys for differentiation are presented. The work also describes a new modification of the method for preparing the wings of small insects for WIP research.

My contribution to Publication 23 is expressed in the recognition, collection and processing of part of the material, primary research, illustration of captured specimens and establishing contact with Dr. Zoya Efremova and Dr. Ekaterina Egorenkova (USPU) for further assistance. In the work, I have also described a new modification of the method of preparing the wings of small insects for the study of their WIP (wings interference pattern).

METHODOLOGICAL CONTRIBUTIONS

Development and description of rationalized devices and working methods

Publication 2 (Boyadzhiev and Triapitsyn, 2007) presents a scheme of a modified entomological net for collecting small insects. This collecting method is referred as “screen sweeping”. With the presented modification, the newly described species *Entedoomphale bulgarica* Boyadzhiev & Triapitsyn was caught and all my subsequent collections in the wild were carried out. They are similarly designated in the respective articles. For example, in Publications 22 and 23, we describe the males of *Neotrichoporoides bulgaricus* Graham and females of *Omphale rodopiensis* Yefremova, Yegorenkova & Boyadzhiev sp.n., caught by the same method.

Publication 4 (Boyadzhiev et al., 2012), presents three modifications of mechanical manipulators for observation under stereo- and binocular microscopes. With them, a precession deviation at the intersection of the axes of the order of 0.5 mm is easily achieved, which, together with the location of the two drive knobs next to each other, allows a quick and safe study of the observed objects.

My contribution to Publication 4 consisted in the preliminary planning, construction, illustrating and describing the modifications of the presented manipulators.

Publication 23 (Yefremova et al., 2017) presents a new modification of the method for studying the interference pattern of wings, applied to some insects as an additional argument in the identification process. The new modification ensures repeatability of observation and safe storage of wings prepared on the same pin on which the studied insect is mounted.

My contribution to Publication 23 is an illustration and explanation of the modified method for preparing small insect wings to study their WIP (Wing Interference Pattern).

FAUNISTIC STUDIES

Family Eulophidae

In **Publication 2** (Boyadjiev and Tryapitsyn, 2007), in addition to the description of *Entedonomphale bulgarica* Boyadzhiev & Triapitsyn sp. n. from Bulgaria, information is presented for the species *E. carbonaria* (Erdös), established for the first time in the Nearctic (Sandlake, Oregon, USA).

In **Publication 7**, the species *Baryscapus transversalis* Graham, 1991 from the Boracko Ezero Lake area is listed as new to the fauna of Bosnia and Herzegovina, and data on its biology are presented.

My contribution to Publication 7 is mainly expressed in the initial determination of the extracted material and establishing contact with Dr. Ekaterina Egorenkova (Ulyanovskiy gosudarstvenny pedagogicheskiy universitet imeni I.N. Ulyanova, Ulyanovsk, Russia) to confirm the determination.

Publication 8 (Boyadzhiev et al., 2020) reported the egg parasitoids *Baryscapus servadeii* (Domenichini, 1965), *Baryscapus transversalis* Graham, 1991, and *Pediobius bruchicida* (Rondani, 1872) (Eulophidae) for the region of Eastern Rhodopes. The species were reared in laboratory conditions from egg batches of the pine processionary moth (*Thaumetopoea pityocampa*).

My contribution in Publication 8 is mainly expressed in determining the species affiliation to the parasitoids and their comparison with certain material from previous studies available in the collection of the Department of Zoology (PU).

Publication 9 (Dobrev et al., 2020) reported *Baryscapus endemus* (Walker), *Chrysocharis pentheus* (Walker), *Cirrospilus pictus* (Nees) and *Pediobius bruchicida* (Rondani) for the region of the Stryama River, in the central part of southern Bulgaria. The species were reared from the larvae and pupae of *Leucoptera sinuella* (Reutti) (Lepidoptera: Lyonetiidae) periodically collected in poplar (*Populus* spp.) stands. *B. endemus*, *C. pentheus* and *P. bruchicida* were established for the first time in the parasitoid complex of *L. sinuella*.

My contribution in Publication 9 consisted of the determination of the parasitoids and their comparison with certain material from previous studies available in the collection of the Department of Zoology (PU).

Publication 10 (Georgiev and Boyadzhiev, 2002) reported *Pediobius metallicus* (Nees), *Danuviella subplana* Erdös, *Chrysocharis nephereus* (Walker), *C. pubicornis* (Zetterstedt), *Diglyphus crassinervis* Erdös, *D. isaea* (Walker), *D. albiscapus* Erdös, *Cirrospilus diallus* Walker, *C. pictus* (Nees) and *Elasmus* sp. (Hymenoptera, Eulophidae) for the Sofia region. The species were derived from larvae and pupae of *Paraphytomyza populi* (Kltb.) (Diptera: Agromyzidae). The genus *Danuviella* Erdös was discovered for the first time in Bulgaria. Four species of eulophids (*Pediobius metallicus*, *Danuviella subplana*, *Diglyphus crassinervis* and *D. albiscapus*) were established as new to the fauna of the country. Six species (*Diglyphus crassinervis*, *D. isaea*, *D. albiscapus*, *Cirrospilus diallus*, *C. pictus* and *Elasmus* sp.) were recorded as new parasitoids of *P. populi*.

My contribution in Publication 10 is expressed mainly in the determination of the parasitoids of the family Eulophidae and the comparison of some of them with certain material from previous studies deposited in the collection of the Department of Zoology (PU).

In **Publication 12** (Georgiev et al., 2004) *Aprostocetus metra* (Walker) and *Euderus caudatus* (Thomson) were reported as new to our fauna. The two species were reared from xylophages in the stems and branches of the goat willow *Salix caprea* L. (Salicaceae) from two mountainous regions in Western Bulgaria, at an altitude of 800 (above the village of Kokalyane) and 950 m (above the village of Gorni Lom). In the course of the experiment *E. caudatus* was reared from the eggs of *Saperda populnea* (Linnaeus) (Coleoptera: Cerambycidae) and *A. metra* from the larva of *Rhabdophaga clavifex* (Kieffer) (Diptera: Cecidomyiidae).

My contribution in Publication 12 is mainly expressed in the determination of the two species of parasitoids, *Aprostocetus metra* and *Euderus caudatus* (Hymenoptera, Eulophidae).

Publication 14 (Mirchev et al., 2012) reports *Baryscapus servadeii*, *B. transversalis*, *Pediobius bruchicida* (Eulophidae), one species of Encyrtidae and Eupelmidae for the Ivaylovgrad region, with notes on their biology and ecology. The parasitoids were reared from eggs of *Thaumetopoea pityocampa* (Denis & Schiffermüller) (Lepidoptera: Notodontidae) collected from black pine *Pinus nigra* Arnold (Pinaceae).

My contribution in Publication 14 consists in determining the egg parasitoids of the three Chalcidoidea families and comparing them with reared material from previous studies.

Publication 15 (Mirchev et al., 2011) reports *Pediobius bruchicida* (Rondani) (Hymenoptera: Eulophidae) as a new species to the fauna of Bulgaria. The material was reared from eggs of *Thaumetopoea pityocampa* (Denis & Schiffermüller) (Lepidoptera: Notodontidae), laid on *Pinus nigra*, from localities in Sredna Gora, Eastern Rhodopes and valley of the Struma River. The publication provides data on the survival of the parasitoid in laboratory conditions and its impact on the host.

My contribution in Publication 15 is the determination of the egg parasitoid *P. bruchicida*.

Publication 16 (Mirchev et al., 2015) reported *Baryscapus servadeii* and *B. transversalis* (Eulophidae) for the Boracko Lake area in Bosnia and Herzegovina reared from the eggs of *Thaumetopoea pityocampa* (Denis and Schiffermüller) laid on *Pinus nigra*. The publication reports three more species of Chalcidoidea reared from the same host, with data on their biology and ecology.

My contribution in Publication 16 is expressed in establishing the species affiliation to the reared parasitoids and their comparison with similar material from Bulgaria, deposited in the collection of the Department of Zoology (PU).

Publication 17 (Todorov et al., 2014) reported *Chrysocharis mediana* Förster, *Aprostocetus zoilus* (Walker), *Oomyzus tanaceti* (Graham) and *Tetrastichus clito* (Walker) as new to the fauna of Bulgaria. The species were established for the Vitosha region and are part of a more extensive study of the eulophid and pteromalid fauna of the massif, part of which are presented in Publications 1 and 18.

My contribution in Publication 17 is the determination of the species of the family Eulophidae. Other results of the studies of eulophids and pteromalids of the Vitosha Mts are presented in Publication 1 and Publication 18.

Publication 18 (Todorov et al., 2012) reported *Colpoclypeus florus* (Walker) and *Stepanovia* sp. near *eurytomae* (Nees) (Eulophidae) as new to the fauna of Vitosha Mts. The presented result is part of a study of the *Diplolepis rosae* (Hymenoptera: Cynipidae) gall community from Vitosha. The article presents an in-depth study of the structure and phenology of this community, as well as the life history and sex ratio of the gall-maker and reared parasitoids and inquiline. Correlations between insects in the community and the influence of some environmental factors on community structure are analyzed and discussed. A later study of the representative of the genus *Stepanovia* Kosyukov showed us the presence of significant differences from *S. eurytomae* and allowed us to consider this species new to science. Description of *Stepanovia rose* Boyadzhiev and Todorov, sp. is presented in publication 1.

My contribution to Publication 18 is mainly the identification of species of the family Eulophidae.

Publication 19 (Toshova et al., 2018) reported *Chrysocharis laomedon* (Walker), *C. pentheus* (Walker), *Elachertus inunctus* Nees, *Pediobius saulius* (Walker), *Prigalio incompletus* (Bouček), *Sympiesis acalle* (Bouček & Askew), *S. gordius* (Walker), *S. sericeicornis* (Nees), *Aprostocetus* (*Aprostocetus*) sp., *Minotetrastichus platanellus* (Mercet) and *Oomyzus sokolowskii* (Kurdjumov) for the region of Sofia. The species were reared from larvae and pupae of *Phyllonorycter issikii* (Kumata) (Lepidoptera: Gracillariidae), on leaves of *Tilia cordata* (Malvaceae). Thus, for *Ph. issikii* three new “host-parasitoid” associations were established, with *P. incompletus*, *M. platanellus* and *O. sokolowskii*, respectively. In the samples, *M. platanellus* was found to be the most abundant (76.88%) of the parasitoids, followed by *Sympiesis gordius* (6.53%) and *S. sericeicornis* (6.03%).

My contribution to Publication 19 is mainly the identification of species of the family Eulophidae.

Family Encyrtidae

Publication 5 reports *Ooencyrtus* sp. nr. *indefinitus* Myartseva, *O. masii* Mercet and *O. pityocampae* (Mercet) for the region of Eastern Rhodopes. The parasitoids were

reared from eggs of *Thaumetopoea solitaria* 1982 (Lepidoptera, Notodontidae) laid on *Pistacia terebinthus* (Anacardiaceae). The publication presents additional information on the biology and ecology of these three species of encyrtids. The possibility that the species *Ooencyrtus* sp., close to *O. indefinitus*, is new to science is not excluded.

My contribution to Publication 5 consisted mainly of identifying encyrtid parasitoids and establishing contact with Dr. John Noyes, Natural History Museum, London (UK), and Dr. Serguei V. Triapitsyn, Department of Entomology, University of California (USA), for confirming the determination. We do not exclude the possibility that *O. sp. nr. indefinitus* is a new species for science. For this reason I have deposited specimens of both sexes in the collections of the British Museum and the University of California.

Publication 8 (Boyadzhiev et al., 2020) reports on the egg parasitoid *Ooencyrtus pityocampae* (Mercet) for the region of Fotinovo Village (Eastern Rhodopes). The species was reared from the eggs of *Thaumetopoea pityocampa*. The paper also reports five more species of Chalcidoidea reared from the same host, with data on their biology and ecology.

My contribution in Publication 8 is mainly expressed in determining the species affiliation to the parasitoids.

In **Publication 11** (Georgiev et al., 2012), the species *Habrolepis montenegrina* (Westwood, 1837) is listed for the Ivaylovgrad region, Eastern Rhodopes. The parasitoid was reared under laboratory conditions from larvae of *Epidiaspis gennadii* (Leonardi) (Hemiptera: Diaspididae) from *Pistacia terebinthus* (Anacardiaceae). Both insect species are reported as new to the fauna of Bulgaria. *E. gennadii* is reported to be the only known host of *H. montenegrina*.

My contribution to Publication 11 was to define the parasitoid to generic level and establishing contact with Dr. John Noyes, Natural History Museum, London (UK), for clarifying the species affiliation to the encyrtid.

Publication 13 (Mirchev et al., 2014) reports new trophic relationships of the egg parasitoids *Ooencyrtus pityocampae*, *Ooencyrtus* sp. (Hymenoptera: Encyrtidae) and one species of family Eupelmidae with the *Thaumetopoea solitaria* (Freyer) (Lepidoptera: Notodontidae). The material was collected on the pistachio *Pistacia terebinthus* L. (Anacardiaceae) from the region of the Eastern Rhodopes. A later study of material from the same host, from six localities in the Eastern Rhodopes, is presented in Publication 5.

My contribution in Publication 13 is expressed mainly in the determination of the parasitoids of the genus *Ooencyrtus*, their comparison with material reared from Bulgaria from other hosts and establishing contact with Dr. John Noyes, Natural History Museum, London (UK), and Dr. Serguei V. Triapitsyn, Department of Entomology, University of California (USA), for assistance in the determination.

Publication 14 (Mirchev et al., 2012) reports *Ooencyrtus pityocampae* (Encyrtidae), three species of the family Eulophidae and one of the family Eupelmidae for the Ivaylovgrad region (Eastern Rhodopes), with notes on their biology and ecology. The parasitoids were reared from eggs of *Thaumetopoea pityocampa* (Denis & Schiffermüller) (Lepidoptera: Notodontidae) collected from black pine *Pinus nigra* Arnold (Pinaceae).

My contribution in Publication 14 consists in determining the egg parasitoids of the three Chalcidoidea families and comparing them with reared material from previous studies.

Publication 16 (Mirchev et al., 2015) reports the parasitoid *Ooencyrtus pityocampae* (Encyrtidae) for the region of Boracko Lake in Bosnia and Herzegovina, reared from the eggs of *Thaumetopoea pityocampa* (Denis and Schiffermüller) from *Pinus nigra* Arnold. The publication reports four more Chalcidoidea species reared from the same host, with data on their biology and ecology.

My contribution in Publication 16 is expressed in establishing the species affiliation to the reared parasitoids and their comparison with similar material from Bulgaria, deposited in the collection of the Department of Zoology (PU).

Family Eupelmidae

Publication 8 (Boyadzhiev et al., 2020) reports the species *Eupelmus vladimiri* for the region of the eastern Rhodopes. The material was reared from a new host, the pine processionary moth *Thaumetopoea pityocampa*. The biology and ecology of the species and its close representatives are discussed in the publication. Based on the presented material, we hypothesize that females, like other parasitoids, can selectively lay fertilized or unfertilized eggs depending on the size and quality of the host, and that the eggs of *T. pityocampa* are not completely suitable for it.

My contribution in Publication 8 is mainly expressed in determining of the species affiliation of the parasitoids, including *E. vladimiri*, and directing its comparison with already reared material from Bulgaria, carried out by Dr. Miroslav Antov, Department of Zoology (PU), co-author in the publication. In the initial determination, I directed attention to the study of the interference pattern of the wings of the eupelmid, which is species-specific for the representatives of the genus and can successfully be applied as an additional argument for accurate identification.

Publication 13 (Mirchev et al., 2014) reports new trophic relationships of the egg parasitoids *Anastatus bifasciatus* (Hymenoptera: Eupelmidae) and two other species of the family Encyrtidae with the processionary moth *Thaumetopoea solitaria* (Freyer) (Lepidoptera: Notodontidae) on pistachio *Pistacia terebinthus* L. (Anacardiaceae) from the region of Eastern Rhodopes.

My contribution in Publication 13 is expressed mainly in the determination of the parasitoid *A. bifasciatus* and its comparison with material reared from Bulgaria from other hosts.

Publication 14 (Mirchev et al., 2012) reports *Anastatus bifasciatus*, three species of Eulophidae and one of Encyrtidae for the area of Ivaylovgrad, with notes on their biology and ecology. The parasitoids were reared from eggs of *Thaumetopoea pityocampa* (Denis & Schiffermüller) (Lepidoptera: Notodontidae) collected from black pine *Pinus nigra* Arnold (Pinaceae).

My contribution in Publication 14 consists in determining the egg parasitoids of the three Chalcidoidea families and comparing them with reared material from previous studies.

Publication 16 (Mirchev et al., 2015) reports the parasitoid *Anastatus bifasciatus* (Eupelmidae) for the region of Boracko Lake in Bosnia and Herzegovina, reared from the eggs of *Thaumetopoea pityocampa* (Denis and Schiffermüller) from *Pinus nigra*

Arnold. The publication reports four more Chalcidoidea species reared from the same host, with data on their biology and ecology.

My contribution in Publication 16 is expressed in establishing the species affiliation to the reared parasitoids and their comparison with similar material from Bulgaria, deposited in the collection of the Department of Zoology (PU).

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(for participation in the competition for the academic position "Associate Professor")

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