

## РЕЗЮМЕТА НА НАУЧНИТЕ ТРУДОВЕ

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**Величкова, К.** 2007. Изследвания върху морфологичната изменчивост и таксономия на род *Tetrastrum* CHODAT (Chlorophyta, Chlorococcales). Автореферат на Дисертация. Тракийски Университет – Стара Загора, Аграрен факултет, 38 с.

**Резюме:** Таксономията на род *Tetrastrum* е проблематична и спорна поради недостатъчния брой използвани морфологични белези за таксономични характеристики. Целта на дисертацията е да се проучи и анализира таксономично важната изменчивост на род *Tetrastrum* в природата и в клонални култури. Нашата цел е въз основа на наблюдаваните резултати да се посочат конкретни таксономични решения. Настоящото изследване се базира на клонални и синхронни култури на пет вида от рода: *T. staurogeniaeforme* (SCHRÖD.) LEMM., *T. triangulare* (CHOD.) Kom., *T. komarekii* HIND., *T. heteracanthum* (NORDST.) CHOD. and *T. punctatum* (SCHM.) AHLSTR. & TIEFF. Основните задачи са изследване на амплитудата на изменчивост в клонални култури при различни условия на култивиране: екстензивно култивиране; интензивно култивиране в условията на различни по състав и концентрация хранителни среди; температурен градиент; синхронни култури и в природни материали. Допълване морфологичната характеристика на видовете, класификация на таксономичните белези според тяхната стабилност и тежест. Таксономично обсъждане и изводи, както и изготвяне на ключ за определяне на таксони на род *Tetrastrum*. За първи път видове от рода се изследват в клонални култури при различни условия. Вариационната мплитуда е създадена за клетъчни структури използвани като важни таксономични белези в природни материали и култури. Установената вариабилност е сравнена с данните на други автори. Морфологичната характеристика на изследваните видовете е допълнена по отношение на размерите и видът на ценобиите, деленето и начина на формиране на дъщерните ценобии. За първи път е направена класификация на видовете ценобии и тяхното присъствие беше изследвано в клонални култури, като се установи че тя не зависи от изходния тип ценобии. С висока тежест подходящи за разграничаване на отделните видове се оказаха дълбината и мястото на разполагане на шиповете, както и наличието или отсъствието на пиреноид и като допълнителни наличие на синценобии и типа на ценобия. Установено беше, че структурата на шипчетата е стабилна в клоналните култури и е подходящ белег за разграничаване на различните видове и някои междувидови таксони. Приета е таксономичната самостоятелност на 11 вида, като е изгoten ключ за определянето им. Въз основа на установената стабилност на белега дълбината на шипчетата на два вида беше подкрепен таксономичния статус на три вътревидови таксона.

1. **Velichkova, K.,** Kiryakov, I. 2005. The morphological variability of *Tetrastrum staurogeniaeforme* (SCHRÖD.) LEMM. in the nature – In: GRUEV, B., NIKOLOVA, M. & DONEV, A. (eds), Proc. Balkan Sci. Conf. Biol. Part 1, 19 – 21 May 2005, Plovdiv, 257-265.

**Abstract:** We investigated natural materials from different deposits of *Tetrastrum staurogeniaeforme* (SCHRÖD.) LEMM. Characterized are different types of

coenobia and is analyzed their distribution in percentage for the different deposits. The size of coenobia and the length of the spines are biometrical studied.

**Keywords:** *Tetrastrum staurogeniaeforme*, variability, biometry

2. **Velichkova, K.**, Kiryakov, I. 2006. Morphological variability in clonal cultures of *Tetrastrum staurogeniaeforme* (Chlorophyta, Chlorococcales). – *Phytologia Balcanica*, 12 (2):165-168.

**Abstract:** The variability of taxonomic features, such as number and length of the spines and shape of the coenobium, of *Tetrastrum staurogeniaeforme* was studied. Clone cultures, with a specific initial coenobium were used. The influence of nutritive solutions in different concentrations on intensive cultivating was investigated.

**Keywords:** clone cultures, morphology, taxonomy, *Tetrastrum*, variability

3. **Velichkova, K.** 2009. Morphological variability in clonal cultures of *Tetrastrum heteracanthum*. – In: Ivanova, D. (ed.), Plant, fungal and habitat diversity investigation and conservation. Proceedings of IV Balkan Botanical Congress, Sofia, 20–26 June 2006. Pp. 97–101. Institute of Botany, Sofia. ISBN 978-954-9746-14-3.

**Abstract:** The variability of taxonomical features such as length and number of spines and shape of the coenobium of *Tetrastrum heteracanthum* was studied. Clonal cultures, with species specific initial coenobium, were used. The variability in clonal cultures was traced at three different temperatures. The influence of nutritive solutions with different concentrations was investigated by intensive cultivating.

**Keywords:** clone cultures, morphology, taxonomy, *Tetrastrum*, variability

4. **Velichkova, K.**, Kiryakov, I. 2007. Morphological variability of clonal cultures of *Tetrastrum triangulare* and *Tetrastrum komarekii* (Chlorophyta, Chlorococcales). – *Phytologia Balcanica* 13 (1): 35-40.

**Abstract:** Variability of some diagnostic features, such as pyrenoids, syncoenobia, and type and size of coenobia of two species of the genus *Tetrastrum*, *T. triangulare* and *T. komarekii*, were studied in extensive and intensive cultures. Clone cultures with a specific initial coenobium for both species were used. Variability in clone cultures was traced out at three different temperatures. The influence of nutritious solutions with different concentrations was investigated by intensive cultivation. The presence of a pyrenoid is the main diacritical feature for the two species, as it was observed in all *T. triangulare* cells, but not in *T. komarekii* cells. Development of syncoenobia can be used as an additional diacritical feature. Regarding the coenobia size in our cultures, *T. komarekii* has shown by about 1/3 smaller size than *T. triangulare*.

**Keywords:** clone cultures, morphology, taxonomy, *Tetrastrum*, variability

5. **Величкова, К.** 2004. Лишеи. В: Стоева, М. (редактор), Биологичното разнообразие в ПП „Сините камъни”. СД „Контраст”, Богомилово, 137-156.

**Резюме:** Лишеите са важна част от биоразнообразието на Природен парк „Сините камъни“ и поради това направихме таксономично проучване на лишайната флора, систематичен, екологичен и хорологичен анализ, а също така регистрирахме и количественото присъствие на лишеите в различните райони на парка. При проучване на лишеите в Природния парк е използван маршрутния метод, като нашите маршрути следваха туристическите пътеки в Парка. За изследването са събрани над 230 пробы от различни фитоценози. При определяне на видовете са използвани морфологичният и анатомичният методи, характерът на субстрата и цветните реакции, които лишайните киселени дават с някои реагенти. Събранны и обработени материали се отнасят общо към 54 вида от 17 рода и 10 семейства. О тях 19 вида се отнасят към групата на корестите лишеи, 21 към листовидните и 14 към храстовидните (от които 9 вида са лишеи с два талуса).

6. **Velichkova, K.**, I. Sirakov, I. Kiryakov. 2011. Macrophytes in the Reservoir-cooler "Ovcharitsa". Ecology and future, vol. X, No 1–2: 33-34.

**Abstract:** In the reservoir-cooler "Ovcharica" 24 species of macrophytes were established, of which there were 9 hydrophytes and 15 hygrophytes. This is the first material regarding macrophytes in this area. In the working process we found a new habitat of rare and protected species: *Trapa natans*.

**Keywords:** hydrophytes, hygrophytes, species composition, "Ovcharica"

7. **Velichkova, K.**, D. Pavlov, D. Ninova. 2011. Effect of experimentally polluted water on the stomatal characteristics on the leaves of two varieties of *Triticum aestivum* L. grown on different soil types. Agricultural science and technology, vol. 3, No 3, pp 265 – 268.

**Abstract:** Two varieties of wheat were grown on different soil types (chernozem carbonate and humus-carbonate). The influence of experimentally polluted water was investigated on the stomatal characteristics on the leaves of the two varieties, and copper, ammonium and magnesium sulfate had inhibitory effect. Wheat variety "Yantar" had greater dimensions of the stomata, than variety "Sadovo" in the same soil. Variety "Sadovo" grown on carbonate chernozem had larger stomata compared to the same in humus-carbonate soil.

**Keywords:** polluted water, soil, stomata, *Triticum aestivum*

8. Kiryakov, I., **Velichkova, K.**, Dragieva, K. 2011. Species composition and distribution of genus *Tribonema* (Xanthophyceae) in Bulgaria. Phytologia Balcanica 17 (3): 273-277.

**Abstract:** The article offers an overview of the studies of genus *Tribonema* (Xanthophyceae) in Bulgaria in various aspects: list of species, chorology and ecology. According to the literary sources and unpublished data, 15 species of *Tribonema* have been reported for Bulgaria, four of which are documented for the first time in the country.

**Keywords:** algae, Bulgaria, *Tribonema*, Xanthophyceae

9. **Velichkova, K.**, D. Pavlov, D. Ninova. 2012. Effect of experimentally polluted water on the morphological characteristics of the leaves of two varieties of *Triticum aestivum* L. grown on different soil types. Agricultural science and technology, vol. 4, No 2, pp 166 – 171.

**Abstract:** Two varieties of wheat were grown on different soil types (Calcic chernozem and Rendzina). The influence of experimentally polluted water was investigated on the morphological characteristics of the leaves of the two varieties. Manganese and ammonia have positive effect, while diluted concentrations of copper and magnesium have negative impact. The biggest changes in the morphological characteristics have been observed in the length of the leaves. Sadovo variety is more resistant to the impact of pollutants and has better performance which is important for the agricultural practice.

**Keywords:** polluted water, soil, leaves, *Triticum aestivum*

10. **Величкова, К.** 2012. Биоиндикация за качеството на водите около района на АТЗ – Стара Загора чрез хидропоници от тревисти растения. Екология и бъдеще, Год.XII, №1: 24-28.

**Abstract:** The study included 4 types of herbaceous plants that were significant to agricultural practice: *Triticum aestivum* L. variety “Sadovo”, *Zea mays* L. variety “Pioner”, *Hordeum vulgare* L. variety “Obzor”, *Helianthus annuus* L. variety “Albena”. These species were irrigated with waters contaminated to varying degrees around the area of ATZ “Stara Zagora”. It was found that the strongest inhibition of growth processes in early ontogenesis corresponded to the strongest degree of water pollution. Regarding the variability of features – the biggest changes in morphological characteristics were observed in length of root.

**Keywords:** water pollution, *Triticum aestivum*, *Zea mays*, *Hordeum vulgare*, *Helianthus annuus*

11. **Величкова, К.** 2012. Въздействието на води около района на АТЗ – Стара Загора върху морфологичните показатели на тревисти видове в начални фази на онтогенезата. Екология и бъдеще, Год.XII, №1: 29-32.

**Abstract:** The study included three types of herbaceous plants that were significant to agricultural practice – *Zea mays* L. variety “Pioner” and “Kneja”, *Triticum aestivum* L. variety “Sadovo”, *Sinapis alba* L. These species were watered with polar degrees of water pollution and reported their effect on morphological parameters of growth and some structural parameters. It was found that inhibition of growth processes in early ontogenesis was observed in heavily contaminated water, and stimulatory effect had slightly polluted water. Regarding the variability of features – the biggest changes in morphological characteristics were observed in length of root and length of leaves.

**Keywords:** water pollution, *Triticum aestivum*, *Zea mays*, *Sinapis alba*

12. Sirakov, I., **Velichkova, K.**, Nikolov, G. 2012. The effect of algae meal (*Spirulina*) on the growth performance and carcass parameters of rainbow trout (*Oncorhynchus mykiss*). *J. BioSci. Biotech.*, SE/ONLINE: 151-156.

**Abstract:** The effect of algae meal (*Spirulina spp.*) on the growth performance and carcass parameters of rainbow trout (*Oncorhynchus mykiss*) were studied. Algae meal was used as supplementary feed. One experimental diet – consisting of 10% Spirulina’s meal + basal diets (10% SD) – was used in the trial and compared to a control diet – a basal diet (BD) with 0% algae. The initial size of rainbow trout from the control group was 14.95 g, whereas the group fed with experimental feed was at 14.66 g. They were stocked in semi-closed RAS at a density of 26 pcs/m<sup>3</sup>. The fish were acclimatized in the RAS for two weeks. The duration of the trial was 35 days. The weight gain, condition factor and average daily growth of rainbow trout fed with 10% SD were higher than those from the group fed with feed without algae

supplement, but the differences were not statistically proven ( $p>0.05$ ). The fish fed with experimental feed showed better weight of eviscerated fish, consumable yield and carcass weight compared with the carcass parameters showed from fish fed with BD, but difference was statistically proven ( $p<0.05$ ) just for consumable yield.

**Keywords:** spirulina meal, rainbow trout, supplement, growth, carcass parameters

13. **Velichkova, K.**, Sirakov, I., Georgiev, G. 2012. Cultivation of *Botryococcus braunii* strain in relation of its use for biodiesel production. *J. BioSci. Biotech.*, SE/ONLINE: 157-162.

**Abstract:** Microalgae are reported as the potential resources to produce lipid from their biomass cell. The *Botryococcus braunii* strain was studied by using two media - BBM and 3N-BBM - and its potential for biodiesel production was established. The experiment was performed at room temperature, using fluorescent light at a photoperiod of 15/9h light and dark cycle. The duration of the experiment was 25 days. The biomass was evaluated by measuring dry weight, optical density, chlorophyll, carotenoids and total lipids. The received results showed that the maximum vegetative growth was reached after approximately 21 days of incubation. The maximum growth rate during this period was 1.84 g/l dry weight in 3N-BBM medium. The lipid content which we received from the examined strain was 25.2% in 3N-BBM medium.

**Keywords:** *Botryococcus*, biomass, biofuel, media

14. **Velichkova, K.**, Sirakov, I. 2013. The Usage of Aquatic Floating Macrophytes (*Lemna* and *Wolffia*) as Biofilter in Recirculation Aquaculture System (RAS). *Turkish Journal of Fisheries and Aquatic Sciences*, 13: 101-110 (IF=0,591\*).

**Abstract:** Conventional water treatment in recirculation aquaculture systems (RAS) is a limited technology to answer the challenges of so called "sustainable aquaculture". This is why new and innovative technologies need to be invented and introduced in RAS. The aim of the conducted study was to determine the possible advantages of using two macrophytic plants – *Lemna minor* and *Wolffia arrhiza* and their quality as biological filter in a RAS for the cultivation of fingerlings from common carp. The temperature, dissolved oxygen, pH and conductivity were measured daily with a portable combined meter and with a probe appropriate for the parameters in the newly constructed control and experimental RAS (with floating macrophytes as a biological filter). Ammonium, nitrite, nitrate, total nitrogen and phosphorus were measured spectrophotometrically. At the end of the trial the fish were weighed and individual weight gain, specific growth rate and FCR (feed conversion ratio) were calculated. The utilization of two macrophytes (*Lemna* and *Wolffia*) in their quality as a biofilter in RAS increased dissolved oxygen in the water, significantly decreased the quantity of total dissolved solids, ammonia, nitrite, orthophosphate as well as total phosphorus in water, and significantly increased the growth of the cultivated carp's fingerlings.

**Keywords:** *Lemna*, *Wolffia*, biofilter, RAS, water quality, carp's fingerlings.

15. **Velichkova K**, Sirakov I, Georgiev G. 2013. Cultivation of *Scenedesmus dimorphus* strain for biofuel production. Agricultural science and technology, vol. 5, No 2, pp 181–185.

**Abstract:** Microalgae have several advantages, including higher photosynthetic efficiency as well as higher growth rates and higher biomass production compared to other energy crops.

The *Scenedesmus dimorphus* strain was studied by using two media – BBM and 3N-BBM, and its potential for biofuel production was established. The temperature varied between 25 – 27°C during the experiment. Fluorescent light was used to assure optimal light condition and a photoperiod of 15/9h light and dark cycle was maintained. The duration of the experiment was 25 days. Dry weight, optical density, chlorophyll, carotenoids and total lipids were measured for the biomass evaluation. The received results showed that the maximum vegetative growth was reached after approximately 16 days of incubation. The maximum growth rate during this period was  $1.690 \text{ mg.l}^{-1}$  dry weight in 3N-BBM medium, and in BBM medium –  $0.960 \text{ mg.l}^{-1}$ . The lipid content which we received from the examined strain was 21.6% in BBM medium, and in 3N-BBM – 18.5%.

**Keywords:** biofuel, biomass, media, *Scenedesmus dimorphus*

16. **Velichkova, K.,** Kiryakov, I. 2013. Types and division of the coenobia of genus *Tetrastrum* (Chlorophyta, Chlorococcales). *Phytologia Balcanica* 19 (1): 17-21.

**Abstract:** The aim of this study was to investigate shape variability in clone cultures of *Tetrastrum staurogeniaeforme*, *T. triangulare*, *T. komarekii*, and *T. heteracanthum* coenobia. Clone cultures with a species-specific initial coenobium were used. The influence of different nutrient solutions was investigated by intensive cultivation. For each of the investigated species, five coenobia with different shape were observed. In addition to the observed different types of coenobia formation, it was found that the most pronounced type can differ from the initial coenobium. Division of cells and formation of young coenobia were traced out in synchronous cultures. It was found out that the daughter coenobium shape was not always identical to that of the mother coenobium.

**Keywords:** clone cultures, morphology, *Tetrastrum*, variability

17. Киряков, И., **Величкова, К.,** Сираков, И. 2013. Придружаващи и масово развиващи се видове и групи при род *Scenedesmus* MEYEN (Chlorophyta, Chlorococcales). *Science & Technologies: Nautical & Environmental studies*, Volume III, Number 2, 19-24.

**Abstract:** The species from genus *Scenedesmus* are widespread and have important role in the lives of freshwater. To clarify the ecological characteristics of the environment in which they develop were analyzed the accompanying them algae species, which show a high degree of persistence, and the species that grow massively with taxa of the genus *Scenedesmus*. For 18 species of the genus *Scenedesmus* were examined samples taken from 17 pools of fish farm in Plovdiv. Five algal groups were identified in the analysis of the accompanying species in genus *Scenedesmus*.

**Keywords:** ecology, saprobic, *Scenedesmus*

18. Kirjakov, I., **Velichkova, K.** 2013. *Wolffia globosa* (Roxburgh) Hartog et Plas (Lemnaceae): a new species in Bulgarian flora. *Journal of Biological and Scientific Opinion*. Vol 1 (4): 356-357.

**Abstract:** *Wolffia globosa* is one of the smallest flowering plants on the Earth. We discovered *W. globosa* in a vegetation season unusual for our latitudes – the winter of 2010. The species was discovered in a little pond near the town of Hisar – Plovdiv district, Bulgaria. The plant was together with two other species of *Lemnaceae* - *Lemna gibba* and *L. minuta* in a community with the following aquatic plants: *Thypa stenopilla*,

*Raniunculus aquatilis*, *Alisma plantago-aquatica* and algae - *Spirogyra* sp. ster., *Tribonema* sp.

**Keywords:** distribution, invasive species, new data, *Wolffia globosa*

19. Sirakov, I., **Velichkova, K.**, Beev, G., Staykov, J. 2013. The influence of organic carbon on bioremediation process of wastewater originate from aquaculture with use of microalgae from genera *Botryococcus* and *Scenedesmus*. Agricultural science and technology, vol. 5, No 4, pp 443 – 447.

**Abstract:** Advantages of using algae for wastewater treatment include: low operational cost, possibility of recycling assimilated nitrogen and phosphorus within the algae biomass as a fertilizer, accumulated biomass for biofuel. Our purpose was to study the influence of organic carbon on bioremediation process of wastewater originate from aquaculture with use of microalgae from genera *Botryococcus* and *Scenedesmus*. Algae cultivation was initiated in a bioreactor of 500 ml Erlenmeyer flask containing 250 ml wastewater. The experiment was conducted in variants without any organic carbon sources and the other with organic carbon source – glucose (1,125g.l<sup>-1</sup>). Light regime was adjusted at 15:9 h light:dark cycle in an illumination incubator until the end of experiment. The temperature was kept between 25 and 27°C. The pH varied between 6.5 and 7.5 and by this reason it was not adjusted. Species grown in wastewater with added glucose showed a better cleansing effect compared with the same grown in wastewater without any carbon sources. Better growth indicators and faster absorption of wastewater compounds was observed in *S. dimorphus*.

**Keywords:** aquaculture, biomass, *Botryococcus braunii*, organic carbon sources, *Scenedesmus dimorphus*, wastewater

20. Kirjakov, I., **Velichkova, K.** 2014. A new species *Chlamydomonas Ehrenberg* (Chlamydomonadales, Chlorophyta) from Bulgaria. Journal of Biological and Scientific Opinion. Vol 2 (2): 141-143.

**Abstract:** The genus *Chlamydomonas* is one of the largest green algal genera. In a temporary street puddle of melting snow in the trodden soil in Plovdiv, Bulgaria we came across a "blooming" caused by a mass developed species *Chlamydomonas pumilioniformis*, *Chlamydomonas asymmetrica* var. *triangularis*, *Clamydomonas* sp., *Euglena viridis*, *Pandorina charkoviensis*. Among them was dating a species with „H"-shaped chloroplast, and particularly with its annular pyrenoid located in the crosspiece of the chloroplast and with its coarse papilla. The new species *Chlamydomonas cyclopyrenoidosa* spec. nova was described and compared with related algae.

**Keywords:** Chlorophyta, *Chlamydomonas*, new taxa

21. **Velichkova, K.** 2014. Phytoplankton Composition in Fish Ponds Near to Stara Zagora, Bulgaria. Ecology and future, vol. XIII, No. 1–2, 62-65.

**Abstract:** The phytoplankton composition of three fish ponds near Stara Zagora was studied. A total of 100 species, varieties and forms belonging to 55 genera of Cyanophyceae, Chlorophyta, Zygnemophyta, Euglenophyta, Bacillariophyta, Pyrrophyta, Xanthophyta were established. The number of taxa tends to increased from July – August.

**Keywords:** fishponds, phytoplankton, species composition

22. Kiryakov, I., **Velichkova, K.** 2014. Taxonomic Composition of Cenoses on *Myriophyllum spicatum* L. and *Gongrosira calcifera* W. Krieger in the Veleka River, Bulgaria. *Ecology and future*, vol. 13, No. 1–2, 66-69.

**Abstract:** Cenoses on *Myriophyllum spicatum* and *Gongrosira calcifera* at the river Veleka were studied. The community was widespread only in point III and IV of river Veleka. Taxonomic composition of cenoses on *M. spicatum* was relatively wide – a total of 65 species and intraspecific taxa. The majority of the species was diatoms (70%). The second and third largest spreads were the green algae (14%) and algae from Zygnemophyta (12%). Moreover in cenoses were established and two types of blue-green algae. Taxonomic composition of cenoses with dominant *G. calcifera* was not rich. We found that the coenoses were characteristic of slow-flowing, calcareous waters with s-mesosaprobic conditions.

**Keywords:** cenoses, *Gongrosira calcifera*, *Myriophyllum spicatum*, saprobity

23. Kiryakov, I., **Velichkova, K.** 2014. Algae Cenoses with Dominate *Cladophora glomerata* (Linnaeus) Kutzing in the Veleka River. *Ecology and future*, vol. 13, No. 1–2, 70-73.

**Abstract:** We studied cenoses on *Cladophora glomerata* in Veleka River. The community is spread across the four points of Veleka. Taxonomic composition of cenoses is rich – a total of 73 species and intraspecific taxa. The majority of the species are diatoms (82%). Roughly equal shares have green algae and blue-green (respectively 8% and 7%). Least presented Zygnemophyta (3%). More than half of the points for each bioindicators species are indicators of s-mesosaprobic conditions.

**Keywords:** cenoses, *Cladophora glomerata*, saprobity

24. Sirakov, I., **Velichkova, K.** 2014. Bioremediation of Wastewater Originate from Aquaculture and Biomass Production from Microalgae Species - *Nannochloropsis oculata* and *Tetraselmis chuii*. *Bulg. J. Agric. Sci.*, 20: 66-72.

**Abstract:** The cultivation of microalgae in wastewater leads to the removing of nutrients and at the same time, produces biomass which can be further exploited as a biofuel. At the same time, *Tetraselmis* sp. and *Nannochloropsis* sp. have a high nutritional value, and for this reason they have been widely used as a food supply in the aquaculture industry for hatchery grown herbivores. The aim of current study was to compare the biomass accumulation of two microalgae species *Nannochloropsis oculata* and *Tetraselmis chuii* cultivated in wastewater originate from recirculation aquaculture system (RAS) and explore their abilities for nitrogen and phosphorus compound removal. A bioreactor consisted of 500 ml Erlenmeyer flasks, containing 250 mL of wastewater from semi closed recirculation aquaculture system. The cultures were maintained at room temperature (25-27°C) under a fluorescent light with a light:dark photoperiod of 15 h: 9 h, with sterile air containing 2% (v/v) CO<sub>2</sub>. Optical density, chlorophyll and carotenoids were measured for the biomass evaluation for a 10 days growth period. In our study *N. oculata* removed 78.4% of total nitrogen and 92% of nitrate. At the end of experiment for *T. chuii* cultivation in wastewater, phosphorus decreased by 79%, which was by 26.7% higher, compared to that of the phosphorus removal rate of *N. oculata*.

**Keywords:** biomass, *Nannochloropsis oculata*, *Tetraselmis chuii*, RAS, wastewater

- 25.** **Velichkova, K.**, Sirakov, I., Stoyanova, S. 2014. Biomass production and wastewater treatment from aquaculture with *Chlorella vulgaris* under different carbon sources. Scientific Bulletin. Series F. Biotechnologies, Vol. XVIII, 83-88.

**Abstract:** Algae are sustainable sources of biomass for fuel, food, feed and essential for their growth are light, CO<sub>2</sub>, and inorganic nutrients like nitrogen and phosphorous. The aim of our study was to explore the effect of different carbon sources on biomass accumulation in microalgae *Chlorella vulgaris* and its ability to remove N and P compounds during its cultivation in aquaculture wastewater. Microalgae cultivation was initiated in bioreactor from 500 ml Erlenmeyer flask containing 250 ml wastewater from semi closed recirculation aquaculture system. The cultures were maintained at room temperature (25–27°C) on a fluorescent light with a light:dark photoperiod of 12 h: 12 h. The microalgae were cultivated in wastewater with two different carbon sources: carbon dioxide (2%, v/v), and sodium bicarbonate (NaHCO<sub>3</sub>) (1.125 g.l<sup>-1</sup>). The growth of strain was checked for 96 hours period. In our study *C. vulgaris* showed better growth in wastewater from aquaculture with bicarbonate utilization as carbon source during the experiment.

**Keywords:** aquaculture, biomass, carbon sources, *Chlorella vulgaris*, wastewater.

- 26.** Kirjakov, I., **Velichkova, K.** 2014. A new species *Eudorina Ehrenberg* (Volvocaceae, Chlorophyta) from Bulgaria. Journal of Biological and Scientific Opinion. Vol 2 (4): 267-268.

**Abstract:** From a small ephemeral basin in Plovdiv (Bulgaria) were found and described a new species of the genus *Eudorina* (Chlorophyta, Volvocales) - *E. plurivacuolata* sp. nov. The closest to the newly described species are *Eudorina unicocca* and *Eudorina elegans*.

**Keywords:** *Eudorina*, Chlorophyta, new taxa

- 27.** Kirjakov, I., **Velichkova, K.** 2014. A new species *Chlorogonium Ehrenberg* (Haematococcaceae, Chlorophyta) from Bulgaria. Journal of Biological and Scientific Opinion. Vol 2 (5): 298-299.

**Abstract:** The species of genus *Chlorogonium* are unicellular with spindle-shaped or strongly elongated along flagella axis. Based on distinctive morphological characters we describe a new species *Chlorogonium marii* sp. nov. from fishponds in Plovdiv - Bulgaria. Description and comparison with related taxa are given.

**Keywords:** *Chlorogonium*, Chlorophyta, new taxa

- 28.** **Velichkova, K.** 2014. Effect of different nitrogen sources on the growth of microalgae *Chlorella vulgaris* cultivation in aquaculture wastewater. Agricultural science and technology, vol. 6, No 3, 337 – 340.

**Abstract:** Nitrogen is one of the most important limiting nutrients and nitrogen control is critical for the intensive cultivation of algae. The aim of the present study was to explore the effect of different nitrogen sources on biomass accumulation in microalgae *C. vulgaris* during its cultivation in aquaculture wastewater. Microalgae cultivation was initiated in bioreactor from 500 ml Erlenmeyer flask containing 250 ml wastewater from fish-ponds „Getov” – Pleven, Bulgaria. The cultures were kept at room temperature (25–27°C) at fluorescent light with a light:dark photoperiod of 12:12 h. The experiment was conducted in variants with

urea ( $1.125\text{g.l}^{-1}$ ) and ammonium nitrate ( $1.125\text{ g.l}^{-1}$ ). The growth of the strain was checked for a 96-hour period. In the present study *C. vulgaris* showed better growth in wastewater from aquaculture with urea utilization as nitrogen source thanas a source of nitrogen ammonium nitrate.

**Keywords:** aquaculture, biomass, *Chlorella vulgaris*, nitrogen sources, wastewater

29. **Velichkova, K.**, Kiryakov, I.2014. Algae cenoses with dominate *Homoeothrix varians* Geitler and *Homoeothrix crustaceae* Woronichin in the Veleka River, Bulgaria. Agricultural science and technology, vol. 6, No 4, 460-464.

**Abstract:** The cenoses with dominate *Homoeothrix varians* and *Homoeothrix crustaceae* in the Veleka River, Bulgaria were studied. The communities were distributed in the four points of the Veleka River. The composition of cenoses with dominant *H. varians* includes a total of 82 species and intraspecific taxa. Most of them are diatoms (90%). On the second place are blue-green algae (6%), to which it belongs and the dominant species. The rest of the species are green algae – Chlorophyta. About 43% of all established species in cenoses are bioindicators on degree of saprobity. Cenoses with dominant *H. crustaceae* were developend mainly on rocks in river rapids. We found that coenoses were characteristic of slow-flowing, calcareous waters with β-mesosaprobic conditions.

**Keywords:** cenoses, *Homoeothrix crustaceae*, *Homoeothrix varians*, saprobity

30. Stoyanova, S., Nikolov, G., **Velichkova, K.**, Atanasoff, A., Mumun, S. 2014. Local Monitoring Program for Invasion of Zebra Mussel (*Dreissena polymorpha*) in the Dam Lake Zhrebchevo, Bulgaria. Turkish Journal of Agricultural and Natural Sciences. Special Issue: 2, 915-918.

**Abstract:** Zebra mussels (*Dreissena polymorpha*) are bivalve mollusks approximately 1 to 5 cm long that live in freshwater lakes. They have invaded many Bulgarian freshwater ecosystems in recent decades. Because of their ability to settle on almost any substrate, zebra mussels cause severe damage to closed water systems, RAS and intensive fish farming systems. In order to assess the status of the mussel population in the lake in the area of the Forest group fish farm, the distribution, extent of colonization, abundance, biomass and size-frequency, structure of post-settlement stages were studied in 2012 and 2013. The purpose of this management plan is to identify the spread of zebra mussel colonies in the Zhrebchevo Dam Lake. Zebra mussels in Zhrebchevo Dam lake are category 2+, and 3+ according to the existing classification of abundance, population belongs to the class 6 and hydrochemical parameters have values close to the optimal development of invasive mussels.

**Keywords:** dam, invasion, zebra mussel, monitoring program

31. Stoyanova, S., **Velichkova, K.**, Nikolov, G., Atanasoff, A., Sirakov, I. 2014. Oxygen uptake in a freshwater air-breathing fish with macrophytes. Turkish Journal of Agricultural and Natural Sciences. Special Issue: 1, 915-918.

**Abstract:** In the cultivation of various fish species in aquaculture is an important to have enough dissolved oxygen available for fish respiration. This oxygen can be produced by the photosynthesis of aquatic plants and algae. The purpose of this study is to investigate the influence of two macrophytes *Myriophyllum spicatum* and *Lemna minor* on uptake of oxygen in the feeding of perch. The experimental part was consisted of three tanks with Perca

fluviatilis - as one without macrophytes (like a control) and the other two with macrophytes (*Lemna minor*, *Myriophyllum spicatum*). Oxygen uptake rate was measured at water temperature  $23\pm1^{\circ}\text{C}$ . The measurement of pH, dissolved oxygen and temperature was made with a portable combined meter. The mean oxygen uptake rate is better in the cultivation of *Perca fluviatilis* with *Lemna minor*.

**Key words:** *Lemna minor*, *Myriophyllum spicatum*, oxygen uptake, *Perca fluviatilis*

32. **Velichkova, K.**, Sirakov, I., Staykov, J. 2014. Integrated use of two microalgal species for the treatment of aquaculture effluent and biomass production. Environmental Engineering and Management Journal (IF=1.258\*, 2014) (под печат).

**Abstract:** One of the main challenges for the development of biomass algal system production is the high operational and capital costs for these technologies. A great opportunity to overcome these challenges may however exist in the integration of wastewater treatment with algal biomass production. The algae are used for treatment of industrial wastewater, for purification of effluent originating from livestock production, while the studies concerning the use of algae species for the treatment of aquaculture effluent are very few. The aim of our research was to compare the nitrogen and phosphate removal efficiency and the growth of two microalgae species – *Scenedesmus dimorphus* and *Botryococcus braunii*, cultivated in the wastewater, originating from freshwater aquaculture production. A laboratory bioreactor was used for algae cultivation. It consisted of 500 ml Erlenmeyer flasks, containing wastewater from semi closed recirculation aquaculture system. Light regime was adjusted at 15:9 h light: dark cycle, the air was enriched with CO<sub>2</sub> up to 1% and the water temperature was kept between 25 and 27°C. Samples for water chemical analysis and growth measurement were taken at the beginning of the trial, at the 24<sup>th</sup>, 96<sup>th</sup> and the 168<sup>th</sup> hour after the start of the experiment. A better removal efficiency of nitrogen compound from wastewater originate from aquaculture was determined for *B. braunii* and the concentration of ammonia, nitrite, nitrate and total nitrogen decreased at the end of trial by 50%, 84.4%, 63.1% and 61.5% respectively. A better phosphate removal efficiency (77.8%) and better growth rate were found for *Sc. dimorphus* when aquaculture effluent was used as a growing media.

**Keywords:** aquaculture, *Botryococcus braunii*, *Scenedesmus dimorphus*, wastewater treatment

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Изготвил: .....  
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