

В четвертом номере журнала "Российский Журнал Биологических Инвазий" за 2022 г. представлено 12 статей. Ниже представлены краткие аннотации этих работ.

ЗООПЛАНКТОН И ПИТАНИЕ РЯПУШКИ, ИНТРОДУЦИРОВАННОЙ В ОЗЕРО ВАШОЗЕРО (БАССЕЙН ОНЕЖСКОГО ОЗЕРА) - Ильмаст Н.В., Кучко Я.А. - В

статье представлены результаты исследований сезонной динамики планктонной фауны озера Вашозеро (южная Карелия) и особенностей питания ряпушки, интродуцированной в водоём из Онежского озера. По уровню количественного развития зоопланктона оз. Вашозеро можно отнести к переходному β -мезотрофному – α -евтрофному типу. Анализ питания ряпушки показывает, что её пищевой рацион на 95% состоит из планктонных ракообразных групп *Cladocera* и *Copepoda*, при этом, имея планктонный тип питания, ряпушка проявляет пластичность к использованию организмов бентоса.

СОСТАВ И УРОВЕНЬ АДАПТИВНОСТИ ГРИБНЫХ ПАТОГЕНОВ И ВИРУСОВ В ИНВАЗИОННЫХ ПОПУЛЯЦИЯХ *LUPINUS POLYPHYLLUS* LINDL. (FABACEAE) -

Келдыш М.А., Куклина А.Г., Червякова О.Н., Ткаченко О.Б. - В статье представлены экспериментальные данные о видовом составе грибных и вирусных патогенов в условиях вторичного ареала *Lupinus polyphyllus* Lindl. Впервые на *L. polyphyllus* диагностированы Tobacco mosaic virus, Bean yellow mosaic virus, Bean common mosaic virus и Pea enation mosaic virus. Обсуждаются вопросы, связанные с особенностями адаптивности вирусов к инвазионным видам растений. Подчеркивается превентивная роль переносчиков (Aphididae) в экспансии вирусов и расширении спектра растений хозяев (восприимчивых видов). Взаимодействие с переносчиками, включая неспецифические их виды, является одним из механизмов адаптивности вирусов, их экспансии в новые регионы и формирование новых патосистем с инвазионными видами растений. Сделан вывод, что на основе анализа трофических связей переносчиков возможен прогноз поиска наиболее эффективных вариантов вредных организмов для биоконтроля *L. polyphyllus*.

ЧУЖЕРОДНЫЕ СОСУДИСТЫЕ РАСТЕНИЯ РЕСПУБЛИКИ МОРДОВИЯ: СОВРЕМЕННЫЙ СОСТАВ И ЕГО ИЗМЕНЕНИЯ ЗА ПОСЛЕДНИЕ ДВА ДЕСЯТИЛЕТИЯ (2000–2020)- Письмаркина Е.В., Силаева Т.Б. - Первая

инвентаризация чужеродной флоры Республики Мордовия проведена в 2000 г. В статье приводятся сведения об изменениях в видовом составе, таксономической и типологической структурах чужеродной флоры региона, произошедшие за 20 лет. Зафиксировано обогащение флоры новыми видами, преимущественно за счёт видов, уходящих из культуры. Отмечено повышение роли транспортных путей в расселении чужеродных видов. Среди природных местообитаний относительную стабильность в заселении новыми чужеродными видами сохраняют фрагменты луговых степей, водоёмы и болота. Проведён анализ видовых списков 2000 и 2020 гг. на предмет изменения видами степени натурализации. Приводятся соответствующие примеры.

НОВАЯ НАХОДКА *APHIDOLETES APHIDIMYZA* ROND. (DIPTERA: СЕСИДОМУИДАЕ) В АРКТИЧЕСКОЙ ЗОНЕ МУРМАНСКОЙ ОБЛАСТИ-

Рак Н.С., Литвинова С.В. - Природная популяция *Aphidoletes aphidimyza* Rond. – новый вид для фауны Арктической зоны России; обнаружен в 2017 г. на территории Мурманской области в дендрарии Полярно-альпийского ботанического сада на растениях рода *Rosa* L. Переселению способствовала случайная интродукция энтомофага с посадочным материалом для пополнения коллекций. Образовалась самовоспроизводящаяся популяция за пределами естественного ареала.

ДИНАМИКА КОМПОНЕНТОВ ЛЕСНЫХ ЭКОСИСТЕМ ЧЕРНОМОРСКОГО ПОБЕРЕЖЬЯ КАВКАЗА НА ФОНЕ ГИБЕЛИ САМШИТНИКОВ В РЕЗУЛЬТАТЕ ИНВАЗИИ *CYDALIMA PERSPECTALIS* WALKER (LEPIDOPTERA, CRAMBIDAE) -

Рапопорт И.Б., Горобцова О.Н., Чадаева В.А., Темботов Р.Х., Гедгафова Ф.В., Улигова Т.С., Хакунова Е.М. - Рассмотрена ситуация, когда инвазия одного вида косвенно приводит к экосистемным последствиям большего масштаба. Работа проведена в реликтовой экосистеме Колхиды, флора и фауна которой сформировались более 15 миллионов лет назад. Исчезновение самшита вечнозелёного – эдификатора колхидских экосистем в краткосрочной перспективе не приводит к значимому изменению почвенных характеристик. Сукцессия растительных сообществ выражается в разрастании напочвенного покрытия аборигенных видов растений при активном вселении чужеродных видов. Сокращаются показатели семенного возобновления самшита, особенно на участках с низкой сомкнутостью древесного полога. Изучение распределения дождевых червей показывает общие топические предпочтения самшита и большинства видов крупных почвенных олигохет, предпочитающих затенённые станции и увлажнённые местообитания.

ИНВАЗИОННЫЙ ПОТЕНЦИАЛ РАСТЕНИЙ ЭКСПОЗИЦИИ ФЛОРЫ КАВКАЗА В ГЛАВНОМ БОТАНИЧЕСКОМ САДУ ИМ. Н.В. ЦИЦИНА РАН -

Соколова В.В., Хомутовский М.И., Виноградова Ю.К. - В статье представлены результаты изучения натурализации растений экспозиции флоры Кавказа в Главном ботаническом саду РАН (г. Москва). Для выявления признаков, способствующих потенциальному успеху инвазии, проведено сравнение натурализовавшихся и ненатурализовавшихся видов. Из преднамеренно интродуцированных в течение 76 лет 1246 таксонов успешно натурализовались 57 видов (4.5%), а реально «сбежали» за пределы экспозиции 12 видов (менее 1%). Расселению устойчивых неприхотливых растений способствовало ослабление ухода за коллекциями в 1990-х гг. После проведённой в 2020 г. ревизии ещё 17 видов перешли в фазу натурализации. Наибольшую степень натурализации проявили виды семейств *Аriaceae* и *Вogaginaceae*. Естественное возобновление отмечено у 440 видов, причём наибольшее количество натурализовавшихся таксонов (19%) относится к растениям, возобновляющимся как вегетативно, так и самосевом, тогда как среди размножавшихся только самосевом натурализовалось 16% видов, а среди распространяющихся вегетативным способом – только 6%. В наибольшей степени приспособились к условиям г. Москвы представители субальпийского высокоотравья и лесных сообществ Кавказа. Ни один вид, приуроченный к полупустыням, аридным редколесьям, нагорно-ксерофитным сообществам, степям, альпийским лугам, высокогорным скалам и осыпям и субтропическим лесам Колхиды и Талыша не стал инвазионным. Среди

натурализующихся растений преобладали короткокорневищные и длиннокорневищные многолетние травянистые растения. Не получило подтверждения распространённое мнение о трудности интродукции эндемичных растений. По доле натурализующихся видов они незначительно уступали широкоареальным видам, а по числу высокоинвазионных и инвазионных – превосходили их. Выявлен комплекс признаков, позволяющий прогнозировать высокую вероятность трансформации преднамеренно интродуцированных видов растений в инвазионные. Результаты анализа инвазионной активности видов Кавказа будут использованы для предотвращения введения в культуру агрессивных чужеродных растений и разработки научно обоснованного подхода к экспонированию растений.

ОБНАРУЖЕНИЕ ГРЯЗЕВОГО КРАБА *DYSPANOPEUS SAYI* (S. I. SMITH, 1869) (BRACHYURA: XANTHOIDEA: PANOPEIDAE) В АЗОВСКОМ МОРЕ -

Тимофеев В.А., Бондаренко Л.В. - В августе 2022 г. в прибрежной зоне п-ова Казантип (бух. Шелковица) на северном побережье Керченского п-ова и в районе Аршинцевской косы (г. Керчь) впервые в водах европейской части России был обнаружен грязевой краб *Dyspanopeus sayi* (S.I. Smith, 1869). Нативный ареал этого вида располагается по всему атлантическому побережью Северной Америки, а инвазионный охватывает прибрежные воды атлантического побережья Европы, северную часть Средиземного моря и западную часть Чёрного моря. Будучи обнаружен в Чёрном море у побережья Румынии в 2009 г., *D. sayi* за последние 10 лет значительно расширил область распространения в Азово-Черноморском бассейне. Наиболее вероятно распространение этого вида балластными водами судов, но нельзя исключить вариант колонизации из существующих районов вселения путём переноса личинок крабов с морскими течениями. Присутствие самок с икрой и разноразмерных особей краба может говорить о натурализации грязевого краба в прибрежных районах Азовского моря. *D. sayi* является активным видом-вселенцем, заселяющим переходные воды между континентальными водоёмами и морем. В связи с этим важно вести мониторинговые исследования распространения данного краба с целью прогноза последствий для местных видов и экосистем.

ОСОБЕННОСТИ РАСПРЕДЕЛЕНИЯ МЕТАЦЕРКАРИЙ ТРЕМАТОДЫ *APOPHALLUS MUEHLINGI* (JAGERSKIÖLD, 1899) У СЕГОЛЕТКОВ В ИНВАЗИВНОЙ ПОПУЛЯЦИИ *CLUPEONELLA CULTRIVENTRIS* (NORDMANN, 1840) ИЗ ГОРЬКОВСКОГО ВОДОХРАНИЛИЩА (БАССЕЙН ВЕРХНЕЙ ВОЛГИ) -

Тютин А.В., Медянцева Е.Н., Базаров М.И., Тютин В.А. - После успешной натурализации в Горьковском водохранилище в 2005–2015 гг. переднежаберного моллюска *Lithoglyphus naticoides* (C. Pfeiffer, 1828) и ассоциированных с ним трематод, наблюдается интенсивное распространение апофаллэза у рыб, населяющих данный водоём. Пресноводная форма черноморско-каспийской тюльки *Clupeonella cultriventris* (Nordmann, 1840) входит в список вторых промежуточных хозяев для трематоды *Apophallus muehlingi* (Jägerskiöld, 1899), вызывающей это заболевание. Цель исследования – изучение влияния расселения *C. cultriventris* на формирование крупных постоянных очагов апофаллэза в условиях Верхней Волги. Сравнивались данные по распространению заболевания в популяциях тюльки из Горьковского вдхр. и незарегулированного участка Нижней Волги (ниже каскада водохранилищ, координаты пелагических тралений от 47°08' с. ш., 47°17' в. д. до 46°51' с. ш., 47°41' в. д.). Выявлены высокие показатели встречаемости (P, %)

метацеркарий *A. muehlingi* на всей протяжённости Горьковского вдхр.: от наиболее северной точки у г. Рыбинска (58°01' с. ш., 39°06' в. д.) до приплотинного участка (56°41' с. ш., 43°21' в. д.). Установлено, что характер распределения метацеркарий *A. muehlingi* варьирует в различающихся по гидрологическим характеристикам участках водоёма. Для среднего участка водохранилища (переходный тип) значения встречаемости метацеркарий *A. muehlingi* в группах наиболее мелких сеголетков тюльки (с длиной тела до 45 мм) оказались близки к максимально возможным (30.00–94.49%). В верхнем участке (речной тип), данный показатель не превысил 24.39%. Для нижнего участка водохранилища (расширение озеровидного типа) зарегистрированы минимальные значения встречаемости метацеркарий (6.76–14.84%). Значения индекса обилия и коэффициента вариации интенсивности заражения у сеголетков с опережающим темпом роста и двухлетков тюльки указывают на более выраженную у них, по сравнению с мелкими сеголетками, агрегированность метацеркарий. В выборках сеголетков тюльки из Нижней Волги в 2020 г. не выявлено статистически значимых различий по встречаемости метацеркарий (13.33–18.11%) между размерными группами. Таким образом, хотя основными вторыми промежуточными хозяевами *A. muehlingi* служат различные виды рыб семейства Cyprinidae, в некоторых случаях присутствие в экосистеме водоёма *C. cultriventris* может существенно повышать вероятность распространения апофаллёза. В условиях Верхней Волги благодаря высокой миграционной активности крупных особей черноморско-каспийской тюльки возможно формирование сплошной зоны распространения апофаллёза, без чётко выраженных границ между отдельными очагами заболевания.

DISTRIBUTION, PLANT COMMUNITIES, AND ECOPHYSIOLOGY OF *CAKILE EDENTULA* (BRASSICACEAE), AN INVASIVE ALIEN SPECIES IN PRIMORYE TERRITORY, RUSSIAN FEDERATION - Chubar E.A., Burundukova O.L.

- We studied the distribution and relationship with the indigenous supralittoral species of the North Atlantic species *Cakile edentula* (Bigelow) Hook. along the eastern coast of Primorye Territory. The *C. edentula* annual community usually occupies sandy beaches and outer ribs of front dunes free of vegetation. This species is also associated with different plant communities of beaches and dunes: *Salsolietum komarovii*, *Elymo-Caricetum kobomugi*, *Elymo-Caricetum pumilae*, *Artemisio stellerianae-Leymetum mollis*, and *Leymo mollis-Glehnetum littoralis*. Furthermore, it forms short-lived communities with *Jacobea pseudoarnica*, *Lathyrus japonicus*, and *Rosa rugosa* in some parts of the coast, and also communities with *Phragmites australis* on salt marshes in the Tumen River estuarine zone. The functional traits of *C. edentula* leaves - volume of mesophyll cell, the number of chloroplasts per mm² of leaf surface, the ratio of the total surface area cells to the unit leaf area (Ames/A), the total number of chloroplasts per cell - were investigated. The high values of the integral parameters of *C. edentula* leaf mesophyll are quite comparable to those of desert halophytes and 1.5-4 times are higher than the values reported for several of the Northeast Asian coastal species such as *Artemisia stelleriana*, *Chorisis repens*, *Glehnia littoralis*, *Jacobea pseudoarnica*, *Lathyrus japonicus* et al. According to its ecological strategy, *C. edentula* can be attributed to ruderal-stress-tolerant (RS) species. This study was based on standard phytosociological and physiological methods with examination of quantitative leaf anatomy.

THE CYPRESS JEWEL BEETLE *LAMPRODILA FESTIVA* (LINNAEUS, 1767) (COLEOPTERA: BUPRESTIDAE) – A REAL THREAT TO THE RELICT JUNIPER

FORESTS OF THE BLACK SEA COAST OF THE CAUCASUS - Khachikov E.

A., Kazeev K. Sh., Poushkova S. V. - There are presented new materials on the distribution of the Cypress Jewel Beetle *Lamprodila (Palmar) festiva*, first discovered in natural stands of relict juniper forests in the vicinity of the villages Sukko and Bolshoi Utrish in the Abrau Peninsula of the Black Sea coast of the Caucasus.

A GROWING THREAT TO TIDAL FORESTS: INCURSION OF MANGROVE ECOSYSTEMS BY INVASIVE ALIEN SPECIES *ACACIA AURICULIFORMIS* A. CUNN. EX BENTH. (FABACEAE) - Sunanda Kodikara K. A., Ransaraa G.B.M., Madarasinghe S. K., Dissanayake N. P., Abeysinghe N.K., Prasangika K.D., Dahdouh-

Guebas F., Jayatissa L.P. - Mangrove forests are reported to be invaded by invasive alien species (IAS). This study was therefore aimed at studying the level of distribution of the IAS, *Acacia auriculiformis* A. Cunn. ex Benth. in mangrove ecosystems in the southern coast of Sri Lanka and assessing the risk to periphery of mangrove forest by considering the Rekawa mangrove forest as a model site. Growth performances of two mangrove species; *Rhizophora mucronata* and *Avicennia marina* in the presence of *Acacia* plants were also tested under three different competition levels; low, moderate and high. According to the results, infestation of *Acacia* plants was significant in the southern coast of Sri Lanka, particularly in Matara and Hambantota districts ($p < 0.05$). Species diversity determined as the Simpson diversity index was high (0.77) in the periphery of the Rekawa mangrove forest. Four true mangroves and two associates co-occurring with *A. auriculiformis* in the periphery could be observed during the field validation experiment. The highest seedling ($15.4 \pm 2.2 \text{ m}^{-2}$) and sapling ($11.2 \pm 2.8 \text{ m}^{-2}$) densities were reported for *A. auriculiformis* plants. Dominance, calculated as the importance value index of different species in the mangrove periphery varied from 18.0-120.6 and the latter highest was recorded for *Acacia* which has the highest relative density (42.1%) and the relative dominance (52.5%). The total leaf area of the *Rhizophora* plants grown in the high-competition level was significantly lower than that of the control plants while the dry weights at three different competition levels; were significantly higher ($p < 0.05$) than the control. This could be due to the higher root biomass allocation. In *Avicennia* plants, cumulative shoot height, total leaf area and dry weight of the plants grown at the high-competition level were significantly lower than that of the control plants ($p < 0.05$). *A. auriculiformis* plants grown with these true mangrove species better performed and did not show any significant deviation from the respective control plants. The level of survival of *Acacia* was significantly reduced at 25 psu ($p < 0.05$). Early intervention and serious scrutiny are much needed to reverse the possible impacts of IAS on mangrove forests and the need for forest conservation is emphasized.

SEASONAL AND INTERANNUAL DYNAMICS OF THE ABUNDANCE OF THE BLACK SEA ALIEN SPECIES *PSEUDODIAPTOMUS MARINUS* SATO, 1913 (COPEPODA, CALANOIDA, PSEUDODIAPTOMIDAE) IN THE CRIMEAN COASTAL WATERS: INFLUENCE OF THE TEMPERATURE FACTOR -Seregin S., Popova E.

-Seregin S., Popova E. - Observation on the occurrence of the Black Sea alien species *Pseudodiaptomus marinus* were initiated since this species was reported in the coastal waters of Crimea, in 2016. Current study is focused on the 170-500 μm microplankton fraction represented by nauplii and the first copepodite stages. These data were complemented by the mesoplankton fraction abundance contributed by copepodite stages II–V and adults. Samples were collected by plastic bottles at the sea surface and by Juday and Apstein plankton nets in the upper 10 m layer. Naupliar stages of *P. marinus* were observed during the first

three years after species invasion, in September, at the sea surface temperature range from 21.1 to 25.5 °C. From 2019 to 2020, specimens appeared in July, at temperatures from 25.8 to 26.0°C. The presence of specimens in samples has been observed by the end of November or December, at sea surface temperature of 13.1 or 8.6°C, respectively. The maximal abundance was observed in the inner part of the Sevastopol Bay. The correlation value of 0.7-0.9 was estimated between the abundance and sea surface temperature throughout the year. Inter-annual variations of the abundance were associated with an integrative indicator of temperature (in particular, the sum of active temperatures).

The fourth issue of the Russian Journal of Biological Invasions (2022) presents 12 articles. The brief summaries of these articles are presented below.

ZOOPLANKTON AND FEEDING OF VENDACE INTRODUCED TO LAKE

VASHOZERO, ONEGA LAKE BASIN - Ilmast N.V., Kuchko Ya.A. - The results of the study of the seasonal dynamics of the planktonic fauna of Lake Vashozero, South Karelia, and the feeding pattern of vendace introduced to this lake from Lake Onega are reported. Lake Vashozero is of β -mesotrophic – α -eutrophic type, as indicated by the abundance of zooplankton. Analysis of the feeding of vendace shows that the various planktonic groups of *Cladocera* and *Copepoda* make up 95% of its food ration. In spite of a planktonic type of feeding, vendace demonstrates flexibility to the use of benthic organisms.

THE ROLE OF BIOTIC FACTORS IN *LUPINUS POLYPHYLLUS* LINDL. (FABACEAE) INVASIVENESS LIMITATION -

Keldysh M.A., Kuklina A.G., Chervyakova O.N., Tkachenko O.B. - The article presents experimental data on the species composition of fungal and viral pathogens in the conditions of the secondary range of *Lupinus polyphyllus*. Tobacco mosaic virus, Bean yellow mosaic virus, Bean common mosaic virus and Pea enation mosaic virus were diagnosed on *Lupinus polyphyllus* for the first time. The issues related to the peculiarities of the adaptability of viruses to invasive plant species are discussed. The preventive role of vectors (*Aphididae*) in the expansion of pathogens and the widening of the spectrum of host plants (susceptible species) is emphasized. Interaction with vectors, including their non-specific species, is one of the mechanisms of virus adaptability, their expansion into new regions and the formation of new pathosystems with invasive plant species. It is concluded that based on the analysis of trophic connections of vectors, it is possible to prognosticate the search for the most effective variants of harmful organisms for the biocontrol of *L. polyphyllus*.

ALIEN VASCULAR PLANTS OF THE REPUBLIC OF MORDOVIA: MODERN COMPOSITION AND ITS CHANGES OVER THE PAST TWO DECADES (2000–2020)-

Pismarkina E.V., Silaeva T.B. - The first inventory of alien species in the Republic of Mordovia was in 2000. The article provides information on changes in the species composition, as well as the taxonomic and typological structures of the region's alien flora that have occurred for 20 years. The enrichment of the flora with new species was revealed. Introduction (cultivation) has become more significant for increasing the number of alien species. The role of the transport routes in the dispersal of alien species has increased. From natural habitats, fragments of meadow steppe, reservoirs and swamps were relatively stable in the colonization of new alien species. The analysis of the lists of species in 2000 and 2020 was carried out for changes in the degrees of naturalization. The corresponding examples of views are given in the article.

NEW FIND OF *APHIDOLETES APHIDIMYZA* ROND. (DIPTERA: CECIDOMYIIDAE) IN THE ARCTIC ZONE OF THE MURMANSK REGION - Rak N.S., Litvinova S.V. - Natural

population of *Aphidoletes aphidimyza* Rond. is a new species for the fauna of the Arctic zone of Russia. It was found in 2017 on the territory of the Murmansk region in the arboretum of the Polar-Alpine Botanical Garden on plants of the genus *Rosa* L. The invasion was facilitated by the accidental introduction of an entomophage with planting material for replenishment of collections. A self-reproducing population was formed outside the natural range.

DYNAMICS OF FOREST ECOSYSTEM COMPONENTS IN THE BLACK SEA COAST OF THE CAUCASUS AGAINST THE BACKGROUND OF BOXWOOD DESTRUCTION AS A RESULT OF *CYDALIMA PERSPECTALIS* WALKER (LEPIDOPTERA, CRAMBIDAE) INVASION -

Rapoport I.B., Gorobtsova O.N., Chadaeva V.A., Tembotov R.H., Gedgafova F.V., Uligova T.S., Khakunova E.M. - The situation when the invasion of one species indirectly leads to ecosystem consequences of a larger scale is considered. The work was carried out in the relict ecosystem of Colchis, the flora and fauna of which was formed more than 15 million years ago. Disappearance of boxwood, the edifier of Colchian ecosystems, in the short term has not led to a significant change in soil characteristics. The succession of plant communities was expressed by an increase in vegetation cover of native plant species under the active introduction of alien species. The rates of seed regeneration of boxwood decreased, especially in the areas with low density of tree canopy. The study of the distribution of earthworms showed the general topical preferences of boxwood and most species of large soil oligochaetes that prefer shaded stations and moistened habitats.

INVASIVE POTENTIAL OF CAUCASUS PLANTS IN THE TSITSIN BOTANICAL GARDEN OF THE RUSSIAN ACADEMY OF SCIENCES -

Sokolova V.V., Khomutovskiy M.I., Vinogradova Yu.K. - The results of alien plant's naturalization in the Caucasus flora exposition of the Main Botanical Garden of the Russian Academy of Sciences (Moscow) are presented. In order to identify the characters contributing to the potential success of invasion, the naturalized and nonnaturalized species were compared. Out of the 1246 taxa have been intentionally introduced for 76 years, 57 species (4.5%) showed the ability to naturalize, while 12 species (less than 1%) actually "escaped" from the culture. The dispersal of resistant unpretentious plants was facilitated by the weakening of collection care in the 1990s. After the revision carried out in 2020, another 17 species have successfully naturalized. Apiaceae and Boraginaceae showed the highest degree of naturalization. Self-reproduction was observed in 440 species, and the greatest number of naturalized taxa (19%) belonged to plants that were reproduced both by vegetative propagation and by self-seeding, while among those propagated only by self-seeding, 16% of species were naturalized and among those propagated vegetatively, only 6%. Plants of subalpine tall grasses and forest communities of the Caucasus were the most adapted to the conditions of Moscow. None of the species confined to semi-deserts, arid sparse forests, upland xerophytic communities, steppes, alpine meadows, high-altitude rocks and scree and subtropical forests of Colchis and Talysh became invasive. Short-rooted and long-rooted perennial herbaceous plants prevailed among the naturalized plants. The widespread opinion about the difficulty of introducing endemic plants was not confirmed. In terms of the proportion of naturalized species, they were insignificantly inferior to wide range species, and superior to them in terms of the number of highly invasive and invasive species. The complex of characters that can predict a high probability of transformation of intentionally introduced plant species into invasive ones has been revealed. The results of the analysis of invasiveness of Caucasian species will be used to prevent the introduction of aggressive alien plants and to develop a scientifically based approach to plant exhibiting.

FINDING OF THE MUD CRAB *DYSPANOPEUS SAYI* (S. I. SMITH, 1869) (BRACHYURA: XANTHOIDEA: PANOPEIDAE) IN THE SEA OF AZOV -

Timofeev V.A., Bondarenko L.V. - The mud crab *Dyspanopeus sayi* (S.I. Smith, 1869) was recorded in the waters of the European part of Russia in the coastal zone of the Kazantip Peninsula (Shelkovitsa bay) on the northern coast of the Kerch Peninsula and near the Arshintsevskaya Spit (Kerch) in August 2022 for the first time. The species natural geographic range is located along the entire Atlantic coast of North America and the invasion range includes the coastal waters of the Atlantic coast of Europe, the northern part of the Mediterranean Sea and the western part of the

Black Sea. Discovered in the Black Sea off the coast of Romania in 2009, *D. sayi* has significantly expanded its distribution area in the Azov-Black Sea basin for the past 10 years. The most likely spread of this species by anthropogenic means as a result of intake, transportation and discharge of ballast water by marine transport vehicles, but the option of colonization from existing areas of settlement by transfer of crab larvae with marine currents cannot be excluded. The presence of females with eggs and different-sized crab specimens may indicate the presence of already established populations of mud crab *D. sayi* in the coastal areas of the Sea of Azov. *D. sayi* is an active invasive species inhabiting transitional waters between continental water bodies and the sea. Therefore, it is important to monitor the distribution of this crab in order to predict consequences for local species and ecosystems.

DISTRIBUTION PATTERNS OF METACERCARIAE OF THE TREMATODA *APOPHALLUS MUEHLINGI* (JAGERSKIÖLD, 1899) IN UNDERYEARLINGS IN AN INVASIVE POPULATION OF *CLUPEONELLA CULTRIVENTRIS* (NORDMANN, 1840) FROM THE GORKY RESERVOIR (UPPER VOLGA BASIN) - Tyutin A.V., Medyantseva E.N., Bazarov M.I., Tyutin V.A.

- After the successful naturalization of the prosobranch mollusk *Lithoglyphus naticoides* (C. Pfeiffer, 1828) and a number of associated trematodes in the Gorky Reservoir (in 2005–2015) an intensive spread of apophallosis in fish of this water body has been observed. As one of the second intermediate hosts of the trematode causing this disease, *Apophallus muehlingi* (Jägerskiöld, 1899), a freshwater form of the Black Sea-Caspian kilka *Clupeonella cultriventris* (Nordmann, 1840) was recorded. The aim of the work is to study the consequences of dispersal of *C. cultriventris* for the formation of large permanent foci of apophallosis in the Upper Volga. For comparison, data on the spread of this type of "black-spot" disease in the populations of *C. cultriventris* from the Gorky Reservoir and an unregulated area of the Lower Volga (downstream the cascade of Volga reservoirs, pelagic trawl coordinates from 47°08'N, 47°17'E to 46°51'N, 47°41'E) were used. The high rates of occurrence of *A. muehlingi* metacercariae (the infection prevalence P, %) are recorded in the fall along the entire area of the Gorky Reservoir: from the northernmost site near Rybinsk (58°01'N, 39°06'E) to the dam area (56°41'N, 43°21'E). It is found that the distribution pattern of *A. muehlingi* metacercariae varies in the sections of the reservoir differing in hydrological characteristics. In the middle (transitional type) section of the reservoir the prevalence of *A. muehlingi* metacercariae in groups of the smallest Black Sea-Caspian kilka fingerlings (with a body length of up to 45 mm), is close to the maximally possible (30.00–94.49%). In the upper (river-type) section of the reservoir, the prevalence of metacercariae in this group of fish does not exceed 24.39%. The minimum values of this indicator are found in the lower (lake-type) section of the reservoir (6.76–14.84%). Judging by the values of the abundance index and the coefficient of variation in the infection intensity, the aggregation of metacercariae is more pronounced in the groups of faster growing underyearlings and the Black Sea-Caspian kilka yearlings as compared to the groups of the smallest fingerlings. In the Black Sea-Caspian kilka fingerlings samples from the Lower Volga in 2020 reveals no statistically significant differences between the infection prevalence values (13.33–18.11%) in the different size groups. Thus, although the main second intermediate hosts of *A. muehlingi* are various fish species of the Cyprinidae family, in some cases the presence of *C. cultriventris* in the water body ecosystem can significantly increase the likelihood of apophallosis spread. In conditions of the Upper Volga, due to the high migration activity of large individuals of the Black Sea-Caspian kilka, a continuous zone of apophallosis can form without clearly defined boundaries between the individual foci of disease.

DISTRIBUTION, PLANT COMMUNITIES, AND ECOPHYSIOLOGY OF *CAKILE EDENTULA* (BRASSICACEAE), AN INVASIVE ALIEN SPECIES IN PRIMORYE TERRITORY, RUSSIAN FEDERATION - Chubar E.A., Burundukova O.L.

- We studied the distribution and relationship with the indigenous supralittoral species of the North Atlantic

species *Cakile edentula* (Bigelow) Hook. along the eastern coast of Primorye Territory. The *C. edentula* annual community usually occupies sandy beaches and outer ribs of front dunes free of vegetation. This species is also associated with different plant communities of beaches and dunes: *Salsolietum komarovii*, *Elymo–Caricetum kobomugi*, *Elymo–Caricetum pumilae*, *Artemisia stellerianae–Leymetum mollis*, and *Leymo mollis–Glehnetum littoralis*. Furthermore, it forms short-lived communities with *Jacobea pseudoarnica*, *Lathyrus japonicus*, and *Rosa rugosa* in some parts of the coast, and also communities with *Phragmites australis* on salt marshes in the Tumen River estuarine zone. The functional traits of *C. edentula* leaves - volume of mesophyll cell, the number of chloroplasts per mm² of leaf surface, the ratio of the total surface area cells to the unit leaf area (Ames/A), the total number of chloroplasts per cell - were investigated. The high values of the integral parameters of *C. edentula* leaf mesophyll are quite comparable to those of desert halophytes and 1.5-4 times are higher than the values reported for several of the Northeast Asian coastal species such as *Artemisia stelleriana*, *Chorisis repens*, *Glehnia littoralis*, *Jacobea pseudoarnica*, *Lathyrus japonicus* et al. According to its ecological strategy, *C. edentula* can be attributed to ruderal–stress-tolerant (RS) species. This study was based on standard phytosociological and physiological methods with examination of quantitative leaf anatomy.

THE CYPRESS JEWEL BEETLE *LAMPRODILA FESTIVA* (LINNAEUS, 1767) (COLEOPTERA: BUPRESTIDAE) – A REAL THREAT TO THE RELICT JUNIPER FORESTS OF THE BLACK SEA COAST OF THE CAUCASUS - Khachikov E.

A., Kazeev K. Sh., Poushkova S. V. - There are presented new materials on the distribution of the Cypress Jewel Beetle *Lamprodila (Palmar) festiva*, first discovered in natural stands of relict juniper forests in the vicinity of the villages Sukko and Bolshoi Utrish in the Abrau Peninsula of the Black Sea coast of the Caucasus.

A GROWING THREAT TO TIDAL FORESTS: INCURSION OF MANGROVE ECOSYSTEMS BY INVASIVE ALIEN SPECIES *ACACIA AURICULIFORMIS* A. CUNN. EX BENTH. (FABACEAE) - Sunanda Kodikara K. A., Ransaraa G.B.M., Madarasinghe S. K., Dissanayake N. P., Abeyasinghe N.K., Prasangika K.D., Dahdouh-

Guebas F., Jayatissa L.P. - Mangrove forests are reported to be invaded by invasive alien species (IAS). This study was therefore aimed at studying the level of distribution of the IAS, *Acacia auriculiformis* A. Cunn. ex Benth. in mangrove ecosystems in the southern coast of Sri Lanka and assessing the risk to periphery of mangrove forest by considering the Rekawa mangrove forest as a model site. Growth performances of two mangrove species; *Rhizophora mucronata* and *Avicennia marina* in the presence of *Acacia* plants were also tested under three different competition levels; low, moderate and high. According to the results, infestation of *Acacia* plants was significant in the southern coast of Sri Lanka, particularly in Matara and Hambantota districts ($p < 0.05$). Species diversity determined as the Simpson diversity index was high (0.77) in the periphery of the Rekawa mangrove forest. Four true mangroves and two associates co-occurring with *A. auriculiformis* in the periphery could be observed during the field validation experiment. The highest seedling ($15.4 \pm 2.2 \text{ m}^{-2}$) and sapling ($11.2 \pm 2.8 \text{ m}^{-2}$) densities were reported for *A. auriculiformis* plants. Dominance, calculated as the importance value index of different species in the mangrove periphery varied from 18.0-120.6 and the latter highest was recorded for *Acacia* which has the highest relative density (42.1%) and the relative dominance (52.5%). The total leaf area of the *Rhizophora* plants grown in the high-competition level was significantly lower than that of the control plants while the dry

weights at three different competition levels; were significantly higher ($p < 0.05$) than the control. This could be due to the higher root biomass allocation. In *Avicennia* plants, cumulative shoot height, total leaf area and dry weight of the plants grown at the high-competition level were significantly lower than that of the control plants ($p < 0.05$). *A. auriculiformis* plants grown with these true mangrove species better performed and did not show any significant deviation from the respective control plants. The level of survival of *Acacia* was significantly reduced at 25 psu ($p < 0.05$). Early intervention and serious scrutiny are much needed to reverse the possible impacts of IAS on mangrove forests and the need for forest conservation is emphasized.

SEASONAL AND INTERANNUAL DYNAMICS OF THE ABUNDANCE OF THE BLACK SEA ALIEN SPECIES *PSEUDODIAPTOMUS MARINUS* SATO, 1913 (COPEPODA, CALANOIDA, PSEUDODIAPTOMIDAE) IN THE CRIMEAN COASTAL WATERS: INFLUENCE OF THE TEMPERATURE FACTOR -Seregin S., Popova E.

Observation on the occurrence of the Black Sea alien species *Pseudodiaptomus marinus* were initiated since this species was reported in the coastal waters of Crimea, in 2016. Current study is focused on the 170-500 μm microplankton fraction represented by nauplii and the first copepodite stages. These data were complemented by the mesoplankton fraction abundance contributed by copepodite stages II–V and adults. Samples were collected by plastic bottles at the sea surface and by Juday and Apstein plankton nets in the upper 10 m layer. Naupliar stages of *P. marinus* were observed during the first three years after species invasion, in September, at the sea surface temperature range from 21.1 to 25.5 °C. From 2019 to 2020, specimens appeared in July, at temperatures from 25.8 to 26.0 °C. The presence of specimens in samples has been observed by the end of November or December, at sea surface temperature of 13.1 or 8.6 °C, respectively. The maximal abundance was observed in the inner part of the Sevastopol Bay. The correlation value of 0.7-0.9 was estimated between the abundance and sea surface temperature throughout the year. Inter-annual variations of the abundance were associated with an integrative indicator of temperature (in particular, the sum of active temperatures).