FOLIA CRYPTOGAMICA ESTONICA

Editio Societatis Investigatorum Rerum Naturae Academiae Scientiarum R. P. S. S. Estoniae.
Cons. ed.: A. Raitviir (mycologia et ed. princ.), J. Toom (algologia), H. Trass (lichenologia).
Hariduse 3, 202400 Tartu, R. P. S. S. Estoniae.

ВИДООБРАЗОВАНИЕ САПРОБОВ И ЭВОЛЮЦИОННЫЕ НАПРАВЛЕНИЯ ВОДОРОСЛЕЙ

Я. ТООМ

J. Toom. Origin of species of saprobes and evolutionary trends of algae. — The author has tried to correlate the data on the probability of the origin of species of saprobes with those on the general trends of their evolution. For this end, the data collected on the variability of 325 species of saprobes were treated by statistical methods. The probability of the origin of species of phyla *Euglenophyta* (degree of variability of species is 2.9). *Cyanophyta* (2,7), *Bacillariophyta* (2,6) and *Conjugatophyta* (2,3) is higher in comparison with those of *Chrysophyta* (0,6), *Chlorophyta* (0,8) and *Pyrrophyta* (0,9). The probability of the origin of species of other phyla cannot be ascertained because of the small amount of data available. It seems that the probability of the origin of species of saprobes is relatively closely connected with the data on the average saprobity of algae and with the evolutionary trends of algae. In this respect, our data are in good accordance with A. Vaga's scheme on the evolution of algae. The conclusions arrived at need be proved experimentally.

Распределение сапробов по биотопам подчиняется определенным закономерностям (Тоом, 1967; 1967а; 1969). Было установлено (Тоом, 1968; 1969а), что направление изменения сапробности довольно хорошо коррелируется с данными схем А. В. Топачевского (1962) об эволюции типов размножения и типов строения водорослей. Результаты статистического анализа сапробности водорослей (Тоом, 1972) хорошо совпадают и со схемой А. Вага (Eichwald, Trass, 1963) об эволюционных направлениях отделов водорослей. Все перечисленные закономерности фиксировались в эволюции на базе видообразования.

На основе вышесказанного, основными целями настоящей статьи являются: (1). Сравнение вероятности видообразования сапробов разных отделов водорослей. (2). Установление сопряженности между вероятностью видообразования сапробов и эволюционными направлениями водорослей.

Методика. В распоряжении автора была литература о сапробности 325 видов водорослей (список использованных материалов см. Тоом, 1972). Количество внутривидовых таксонов было установлено просмотром многочисленных отечественных и зару-

Fol. Crypt. Est.	Fasc. 3	p. 17—24	Tartu. 1973

бежных определителей и монографий и материалов альгологической иконотеки Кафедры систематики растений и геоботаники Тартуского государственного университета.

Для характеристики вероятности видообразования сапробов в отделе использовалось соотношение количества внутривидовых таксонов и количества видов.

Результаты и выводы. В альгологии наименование внутривидовых таксонов имеет обычно конвенциональный характер: в одних группах выделяются только формы, в других преимущественно разновидности. Поэтому можно считать целесообразным при статистической обработке данных о внутривидовых таксонах количество форм и разновидностей, входящих в состав видов, объединить.

Подразделения вида представляют собой определенный этап эволюции, тот материал, который в дальнейшем может привести к образованию новых видов. Разумеется, далеко не все внутривидовые таксоны оказываются способными к следующему эволюционному шагу, не развиваются в виды. Многие из них в течение неопределенного времени так и остаются в положении внутривидового таксона и потом вымирают. Тем не менее можно предполагать, что относительное количество внутривидовых таксонов, хотя в первом приближении, характеризует вероятность видообразования в данной группе. Исходя из вышесказанных соображений наш материал позволяет сделать следующие обобщения.

1. Сапробы отделов *Euglenophyta* (соотношение количества внутривидовых таксонов и количества видов 2,9), *Cyanophyta* (2,7), *Bacillariophyta* (2,6) и *Conjugatophyta* (2,3) имеют предпосылки для бурного видообразования.

2. Вероятность видообразования сапробов в отделах *Chrysophyta* (0,6), *Chlorophyta* (0,8) и *Pyrrophyta* (0,9) сравнительно низкая.

3. О вероятности видообразования сапробов в остальных отделах водорослей данных для достоверных выводов мало.

Настоящие данные о вероятности видообразования сапробов хорошо совпадают со схемой А. Вага (Eichwald, Trass, 1963) об эволюционных направлениях отделов водорослей. При этом наблюдаются следующие тенденции:

1. В эволюционном направлении водорослей с преобладанием зеленых пигментов вероятность видообразования сапробов в настоящее время уменьшается.

2. В эволюционном направлении водорослей с преобладанием желтокоричневых пигментов вероятность видообразования сапробов повышается.

Исходя из описанных закономерностей и результатов ридит-анализа сапробности водорослей (сравн. Тоом, 1972) можно предполагать, что в пределах отдельных эволюционных направлений повышению средней сапробности сопровождается тенденция повышения вероятности видообразования.

Вышеприведенные выводы являются первоначальными. Они зависят от использованной литературы, от достоверности границ внутривидовых таксонов изученных видов. Поэтому настоящие результаты требуют обширной проверки.

ЛИТЕРАТУРА

Тоом Я. В. 1967. Культивирование водорослей на некоторых отходах пищевой промышленности. Автореф. канд. биол. н. Тарту. — Тоом Я. В. 1967a. Про сапробність планктонних та бентосних водоростей. Укр. бот. ж., 24, 4 : 29—32. — Тоом Я. В. 1968. Типы строения и сапробность водорослей. Изв. АН ЭССР, 17, 4 : 382—384. — Тоом Я. В. 1969. Сапробність грунтових водоростей. Укр. бот. ж., 26, 2: 82—84. — Тоом Я. В. 1969a. Типы размножения и сапробность водорослей. Изв. АН ЭССР, 18, 1 : 62—65. — Тоом Я. В. 1972. Сапробность и эволюционные направления водорослей. Fol. Crypt. Est., 1: 5—8. — Топачевский А. В. 1962. Вопросы цитологии, морфологии и филогении водорослей. Киев. — Eichwald K., Trass H. 1963. Professor August Vaga elu ja looming. TRÜ Toimet., 136. Bot.-alased Tööd, 6 : 4—37.

LICHEN SENSITIVITY TO THE AIR POLLUTION AND INDEX OF POLEOTOLERANCE (I. P.)

H. TRASS

Х. Трасс. Чувствительность лишайников к загрязненности воздуха и индекс полеотолерантности. В статье описывается индекс полеотолерантности, впервые опубликованный автором в 1968 г. (Trass, 1968, 1968a, 1971) и приводятся новые данные, характеризующие различную чувствительность видов лишайников к загрязненности воздуха.

1. Introduction. Lichenologists and ecologists have been taking interest in lichens as the indicators of the air pollution degree for a number of decades. Numerous papers have been published in which lichens are used to distinguish between the so-called «lichen zones»; the lichen floras of many large, medium-sized and small towns have been investigated. But up to the latest times autecological method was chiefly applied in these investigations. The reaction of different lichen species to the atmospheric environment of varying levels of pollution was studied, while no attention was paid to species groupings, lichen synusia, and the facts obtained in the course of the studies were not subjected even to a modest statistical analysis. Investigating the Estonian lichen vegetation the author reached a conclusion (Trass, 1968, 1968a) that epiphytic lichen groupings constitute a synusial series subjected to definite ecological and phytocoenological regularities in settlements and towns, in large as well as in small ones. The series is in its essence a continuum. It is, however, not a structureless and amorphous continuum, but that consisting of definite nodum-combinations which can be distinguished as synusial taxa — federations, unions and societies. It was just the research of the urban lichen vegetation that convinced the author of the necessity to combine autecological studies with synecological ones. Knowledege of the reaction of each individual species to the polluted environment as well as the studies of the association regularities of different species serves as a basis for the investigations of urban lichen vegetation.

The data obtained in Estonia have lately been supplemented with research materials from the towns of other Union Republics (Leningrad, Pskov, Kiev, Sverdlovsk, etc.) as well as from abroad (Helsinki, Turku, Rostock, Halle).

The present report gives a short survey of the methods in carrying out the research.

2. Sample technique. The chief preconditions for the application of lichen synusia in indication the air pollution are, on the one hand, the sufficient number of lichen-coenological samples, and, on the other hand, their preciseness. Lichen coenological samples were taken at different expositions and heights of a tree (or any other substratum). It was not the exposure to the cardinal points, but that to the chief pollutant that was considered to be essential. E. g., while describing the synusia of road-side trees samples were taken from the side facing the roadway as well as from the opposite side of the tree. At least two descriptions must be given of both sides of the tree (à 2×6 dm) — at the base and at a height of 1.2—1.4 m. Thus there will be four descriptions for each tree. Descriptions, as many as possible, should be given of the sample plot with one uniform ecological condition (the degree of pollution) and should comprise trees of all different age-groups and species. Describing the lichen synusia in trees of some avenue, it is necessary to pick up trees in a longer section of the avenue (e. g., each second, fifth, tenth, etc. tree) as well from both sides of the avenue (the influence of the prevailing direction of the wind!). Each description should include, first of all, the general description — site of occurrence (street, park, etc.), tree species, girth, height. Afterwards each square is described, cover degree and vitality of different species are determined.

3. Cover degrees. In the sample square the quantitative share of each species is estimated in the 10-degree scale: *1* — the thallus of the species covers 1—3%, *2* — 3—5%, *3* — 5—10%, *4* — 10—20%, *5* — 20—30%, *6* — 30—40%, *7* — 40—50%, *8* — 50—65%, *9* — 65—80%, *10* — 80—100% of the sample area.

4. Vitality. The influence of a definite ecological factor (air pollution in the present case) on lichens can be evident not only from their presence, absence or different cover degree, but also from their vitality changes. For the purpose of indicating the vitality changes two characteristics were observed in each species — (1) fruiting bodies (apothecia, perithecia), their presence or absence (fertility or sterility), abundance and condition, and, (2) the condition of the thallus (large, strong, healthy or stunted, decaying, siling). The simplest vitality scale is as follows: f1 — fertile, abundantly developed thallus, f2 — fertile, normally developed thallus, f3 — fertile, stunted thallus, s1 — sterile, abundantly developed thallus, s2 — sterile, normally developed thallus, s3 — sterile, stunted thallus.

5. Species levels of poleotolerance. On the basis of the data, obtained chiefly in the Estonian S.S.R., on the frequency, vitality and cover degree of lichen species in towns of different size, in their different parts, settlements and natural landscapes, the species were grouped according to their sensitivity to the polluted atmospheric environment. The applied scale of poleotolerance contains 10 degrees (1—10), while each species is characterized by the highest level in case of which the species occurs with normal vitality. Naturally each species can also be described with the help of its poleotolerance range. E. g., the latter is 1—5(7) for *Hypogymnia physodes*, i. e., the species occurs with normal vitality 1—5 and with depressed vitality (stunted) up to level 7.

On the basis of the level of human influence different landscapes and sites can be grouped as follows: (1) natural landscapes without any influence of culture (large forested areas and bogs lying far from settlements, etc.), (2) sites under only slight human influence (large forested areas situating close to the settlements, forest meadows, mires), (3) sites under moderate influence of culture (settlements, small towns, cemeteries, parks, etc. in the vicinity of large towns), (4) sites under strong human influence (towns of medium size, peripheral parts of large towns), (5) sites under very strong influence of culture (parks located in the central part of large towns, industrial centres, etc.).

Below we shall give a brief survey of each level with a few species occurring —

1. only in natural landscapes and vegetation unaffected by culture — *Lecanactis abietina, Menegazzia pertusa, Mycoblastus sanguinarius;*

2. chiefly in natural landscapes, rarely in landscapes under weak influence of culture — *Lecanora coilocarpa, Letharia divaricata, Ochrolechia androgyna, Parmeliopsis aleurites;*

3. equally in natural landscapes and in those under weak influence of culture — *Alectoria jubata, Cetraria chlorophylla, Hypogymnia tubulosa, Lecidea tenebricosa, Opegrapha pulicaris, Pertusaria pertusa, Usnea comosa;*

4. in natural landscapes and in those under weak influence of culture, rarely in landscapes under moderate influence of culture — *Alectoria implexa, Platismatia glauca, Cetraria pinastri, Graphis scripta, Lecanora leptyrodes, Lobaria pulmonaria, Opegrapha diaphora, Parmelia subaurifera, Parmeliopsis ambigua, Pseudevernia furfuracea, Usnea dasypoga;*

5. equally in natural landscapes as well as in those under weak and moderate influence of culture — *Caloplaca pyracea, Hypogymnia physodes, Lecania cyrtella, Lecanora chlarotera, L. rugosa, L. subfuscata, L. subrugosa, Lecidea limitata, Parmelia aspera, P. olivacea, Physcia aipolia, Psora scalaris;*

6. abundantly in landscapes under moderate influence of culture, rarely in natural landscapes and in areas under weak influence of culture — *Arthonia radiata, Caloplaca aurantiaca, Evernia prunastri, Lecanora allophana, L. carpinea, L. chlarona, L. pallida, L. symmictera, Parmelia acetabulum, P. exasperatula, Pertusaria discoidea, Ramalina farinacea, Rinodina exigua, Usnea hirta;*

7. up to the landscapes under moderate influence of culture, rarely in landscapes under strong influence of culture — *Caloplaca vitellina, Candelariella vitellina, C. xantho-*

stigma, Parmelia conspurcata, P. sulcata, P. verruculifera, Pertusaria amara, Phlyctis agelaea, Physcia ascendens, P. nigricans, P. tenella, Ramalina fraxinea;

8. equally in landscapes under moderate and strong influence of culture — *Anaptychia ciliaris, Caloplaca cerina, Candelaria concolor, Phlyctis argena, Physconia pulverulenta, Ramalina pollinaria;*

9. abundantly in sites under strong influence of culture — *Physconia grisea, Xanthoria candelaria, X. polycarpa;*

10. up to the landscapes under very strong influence of culture (with low degree of cover and depressed vitality) — *Lecanora conizaeoides, L. hageni, Physcia orbicularis, Xanthoria parietina, Lepraria aeruginosa.*

The species of groups 1—3 are hemerophobous, those of groups 4—6 are hemeradiaphorous and those of groups 7—10 are hemerophilous.

A comparatively large amount of material (over 1000 lichen-coenological samples, herbariums, literature) has been used for compiling the present scale as well as for the determination of the occurrence of species in different groups. But still the scale is (1) at least somewhat subjective and several species presented to illustrate definite levels may in the course of further studies and on the basis of new data appear to occur in other levels as well, (2) geographically limited (Estonia), as it has become evident that species may in different general ecological (climatic) conditions be of different poleotolerance.

6. Index of poleotolerance. On the basis of the data on the floristic composition of lichen synusia, the poleotolerance levels of species and cover degrees the index of poletolerance (I. P.) for each synusia can be determined using a simple formula:

$$\text{I. P.} = \sum_{i=1}^{n} \frac{a_i \cdot c_i}{C_i}$$

where n stands for the number of species, a_i — for the poleotolerance level of the i-th species, c_i — for the cover degree of the given species, C_i — for the sum of the cover degree of the species forming the synusia. Thus we get as "weighted average" I. P. It fluctuates between 0 and 10; the bigger the I. P. data, the greater is the share of poleotolerant species in the synusia.

We should like to stress that in order to get a statistically more confident picture of the air pollution in different sites on the basis of the I. P. of lichen synusia it is necessary to take samples in great numbers.

As to the relation of I. P. to the so-called "lichen zones", we shall state on the basis of preliminary data, that I. P. for the so-called "lichen desert" may even be 0 (if completely devoid of lichens) or (if only solitary stunted individuals occur) nearly 10. I. P. for the struggle zone is 7—10, 4—7 for the mixed zone and below 4 for the normal zone.

7. I. P. and annual average levels of SO_2. It has been generally ascertained that sulphur dioxide is for lichens one of the most toxic component parts of the polluted air. Therefore much attention has been devoted to this compound in lichenological papers, as sulphur dioxide limits the growth and spreading of lichens (Gilbert, 1969, 1970, Hawksworth, Rose, 1970, LeBlanc, 1971, Brodo, 1972).

Preliminary data on the I. P. correlations with the air SO_2 content are as follows:

I. P. 1—2 — practically devoid of SO_2; forests, bogs, etc. lying far from settlements and towns.

I. P. 2—5 — SO_2 0,01—0,03 mg/m³; forests situating close to the towns, parks in small towns and settlements, etc.

I. P. 5—7 — SO_2 0,03—0,08 mg/m³; parks, cemeteries, avenues, etc. in the suburbs of small and medium towns.

I. P. 7—9 — SO_2 0,08—0,1 mg/m³; parks, avenues, etc. in the central parts of small and medium towns.

I. P. >9 — SO_2 0,1—0,3 mg/m³; parks, avenues, cemeteries etc. in the suburbs of large towns.

In "lichen desert" (completely devoid of lichens) the pollution is: $SO_2 > 0.3$ mg/m³.

8. Mapping. One of the main practical results of the studies of lichens in urban areas is the compilation of distribution maps of different species and their groupings and the evaluation of the level of the air pollution on the basis of these maps. Recently comparatively precise methods for compiling maps of different scales have been elaborated, particularly on the basis of the Index of Atmospheric Purity (I. A. P.).

At present a number of vegetation maps of urban lichens are being compiled in the Estonian S.S.R. on the basis of I. P. The values of the latter have been divided into 5 classes, the distributional area of each of the classes is represented on the map either in different colour or by conditional signs. Preliminary data show that such maps represent quite well the locations of the areas with different air pollution level on the territory of towns.

REFERENCES

B r o d o, I. M. 1972. Lichens and cities. In: Internat. Symp. on Identif. and Measur. of Environm. Pollutants, B. Westley (Ed.). Nat. Res. Council, p. 325—328. Ottawa. — G i l b e r t, O. L. 1969. The effect of SO_2 on lichens and bryophytes around Newcastle upon Tyne. In: Air pollution. Proceedings of the first European Congress on the influence of air pollution on plants and animals, p. 223—235. Wagenningen. — G i l b e r t, O. L. 1970. A biological scale for the estimation of sulphur dioxide air pollution in England and Wales using epiphytic lichens. Nature (Gr. Brit.) **227**, 5254 : 145—148. — L e B l a n c, F. 1971. Possibilities and methods for mapping air pollution on the basis of lichen sensitivity. Mitt. Forstlichen Bundes-Versuchsanstalt Wien **92** : 103—126. — T r a s s, H. 1968. Analysis of the lichen-flora of Estonia (in Russian). Dr. Biol. Thesis. 84 pp. Tartu. — T r a s s, H. 1968a. An index for the utilization of lichen groups to determine air pollution (in Estonian, English summary). Eesti Loodus, **11**, 10 : 628. — T r a s s, H. 1971. On the poleotolerance of lichens (in Russian, English summary). Materials of the 6th Symposium of the Baltic Republics on Mycology and Lichenology **1** : 66—70. Riga.

THE GENUS SOLENOPEZIA

A. RAITVIIR

А. Райтвийр. Род *Solenopezia*. — Обсуждается систематическое положение рода *Solenopezia* и делается вывод, что он является монотипичным родом, которого нельзя считать синонимным близких ему таксонов гиалосцифовых грибов (*Trichopezizella, Belonidium*).

The genus *Solenopezia* was erected by Saccardo (1889) with the following diagnosis: "Ascomata sesilia, minuta, urceolata, urceolato-oblonga, rarius hemisphaerica, ceracea, extus villosa vel pilosa, brunnea vel laeticoloria. Asci typice octospori, parphysati. Sporidia ovoidea, oblonga vel subfusoidea, 1-septata, hyalina."

The genus was introduced for 8 species among which the first one, *S. solenia* (Peck) Sacc., was selected as the type of the genus by Nannfeldt (1932). The remaining 7 original species have evidently nothing common with *S. solenia*, except, probably, the general appearance.

The genus *Solenopezia* has, however, not been generally recognized and was regarded as a synonym of *Lachnum* (Nannfeldt, 1932) or *Lachnella* (Seaver, 1951). Dennis (1963) has transferred it into *Dasyscyphus* but suggested affinities to *Perrotia* and I have included it on the basis of published descriptions into *Belonidium* (Raitviir, 1971).

Due to the courtesy of Dr. K. Dumont (The New York Botanical Garden) and Dr. J. H. Haines (The New York State Museum) I had an opportunity to study the Peck's type collection of *Peziza solenia* and some additional material of this species.

In the result of investigations made a conclusion was drawn that *Solenopezia* is a good, probably monotypic, genus different from all other Hyaloscyphaceous genera.

Solenopezia Sacc. Syll. Fung. 8:477 (1899).

Apothecia sessile, minute, urceolate or hemisphaerical, externally densely covered by short hairs. Hairs cylindrical with more or less swollen clavate tips, brown with pigmented walls and content, the latter turning violaceous and dissolving in KOH, thick-walled, multiseptate, smooth, with oily or resinous content within apical cells. Ectal excipulum of hyaline to light smoky-brown prismatic cells with firm walls. Medullary excipulum thin, consisting of loosely interwoven slender hyphae. Asci cylindric-clavate, pore amyloid. Spores ellipsoid-fusoid, one — or two-celled. Paraphyses cylindrical with pointed tips, not exceeding the asci.

Type species: *Peziza solenia* Peck, 25th Rep. NY State Museum 99 (1873).

The genus shows some affinities to *Belonidium* and *Trichopezizella*, but its hairs are rather different from those characteristic to these genera. Dennis (1963) has described the hairs as "cylindrical or slightly clavate ... wall moderately thick, brown below, becoming hyaline towards the tip ..." There are, indeed, such hairs present on the apothecia, but the majority of hairs have very characteristic swollen tips, slightly constricted at the septa, outstandingly thick-walled and with resinous content in cells (Fig. 1). The prismatic-celled ectal excipulum is also different from the corresponding structures in *Belonidium* and *Trichopezizella*.

There is a single species:

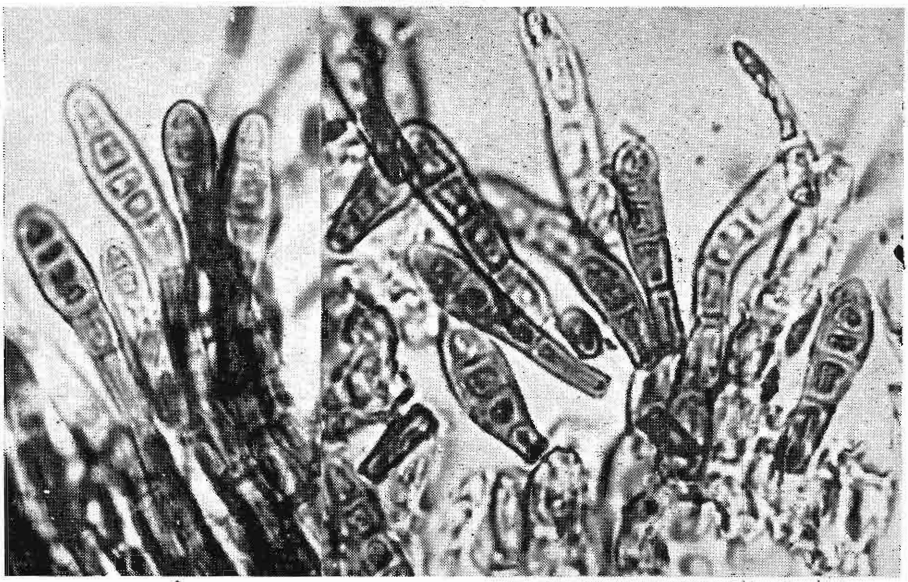

Fig. 1. Hairs of *Solenopezia solenia* in Meltzer's reagent. ×1150.

Solenopezia solenia (Peck) Sacc. Syll. Fung. 8:477 (1899).

Peziza solenia Peck, 25th Rep. NY State Museum 99 (1873); *Lachnella solenia* (Peck) Seaver, N. Amer. Cup-fungi (Inoperculates) 260 (1951); *Dasyscyphus solenia* (Peck) Dennis, Kew Bull. **17**(2): 364 (1963); *Belonidium solenia* (Peck) Raitv., Scripta Mycologica **1** : 50 (1970).

Apothecia sessile, urceolate to hemisphaerical, 0.3—0.5 mm in diam., externally dark brown, with whitish margin and cream-coloured hymenium. Hairs cylindrical, mostly with clavate tips, 50—**66—100**—110×2.5—**3.0—3.3**—3.8 μ, apically 4.0—**4.6—5.5**—5.8 μ broad, closely septate, constricted at septa in swollen tips, dark brown with pigmentation located in thick walls as well as in cell content, turning dark violaceous and dissolving in KOH or Meltzer's reagent. The apical cells contain pieces of resinous matter. Ectal excipulum of hyaline to light smoky-brown prismatic cells, 8.3—13.3×5—8.3 μ. Asci cylindric-clavate, 73—**80—83**—95×5—**6.6—7.5**—8.3 μ. Spores ellipsoid-fusoid, one- or two-celled, containing 2 or 4 oil drops, 11.6—**13.4—15.1**—16.6×3.0—**3.1—3.3**—3.7 μ. Paraphyses cylindrical, slender, pointed, not exceeding the asci.

On dead herbaceous stems.

Specimens examined: 4 collections from New York, U.S.A., including Peck's type specimen on dead stems of *Eupatorium ageratoides*, in damp shady places, Watkin's Glen, September (1871?).

No septate spores were seen, but evidently they may become 1-septate as figured by Seaver (1951). Seaver's illustration is quite adequate, but, unfortunately, he does not indicate the inner structure of hairs. All microscopic measurements were found to be longer than indicated by Seaver (1951) and Dennis (1963). Seaver reported this species also from rotten wood, but it is evidently a mistake.

REFERENCES

Dennis, R. W. G. 1963. A Redisposition of Some *Hyaloscyphaceae*. Kew. Bull. **17**, 2 : 319—379. — Nannfeldt, J. A. 1932. Studien über die Morphologie und Systematik der nicht-lichenisierten inoperculaten Discomyceten. Nova Acta Soc. Sci. Upsal. 4, **8**, 2. — Raitviir, A. Synopsis of the *Hyaloscyphaceae*. Scripta Mycologica **1**. — Seaver, F. J. 1951. North American Cup-Fungi (Inoperculates). N. Y.

Криптогамные листы Эстонии. На русском и английском языках. Редакционно-издательский совет Академии наук Эстонской ССР. Таллин, ул. Сакала, 3. Редактор Э. Пармасто. Сдано в набор и подписано к печати 15. 03. 73. Бумага 70×100/16. Печатных листов 0,5. Учетно-издательских листов 0,8. Тираж 500. № заказа 775. МВ 02146. Типография им. Х. Хейдеманна. Тарту, ул. Юликооли, 17/19. III.
Цена 8 коп.