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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 21046-2024

Replacing GB/T 21046-2007

Neopyropia yezoensis

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0 Foreword

The document replaces GB/T 21046-2007. Compared with that edition, and besides structural adjustment and editorial change, the main technical changes are: the scientific name was changed; the taxonomic position was changed; the morphological and structural characteristics of the thallus were changed; the life cycle was added; meiosis was deleted; biochemical genetic characteristics were deleted; molecular genetic characteristics were added; isoenzyme testing was deleted; molecular genetic testing was added; and rules of judgement were added.

The document was proposed by the Ministry of Agriculture and Rural Affairs and is under the administration of the National Technical Committee on Fisheries Standardization (SAC/TC 156).

The publication history of the document and of the document it replaces is: first published in 2007 as GB 21046-2007, converted in 2017 to the recommended standard GB/T 21046-2007; the present edition is the first revision.

In the printed change list the ten items carry the letters a) to j) placed after the text of each item rather than before it, so that the first item is unlettered and every letter trails the item it belongs to.

1 Scope

The document lays down the scientific name and classification, the main morphological and structural characteristics, the reproductive characteristics and the cytogenetic and molecular genetic characteristics of *Neopyropia yezoensis* (Ueda) L.-E. Yang & J. Brodie, 2020, describes the corresponding test methods and lays down rules of judgement.

It applies to the germplasm testing and identification of *Neopyropia yezoensis*.

2 Normative references

The document contains no normative references.

3 Terms and definitions

3.1 thallus - the gametophyte generation, formed by the germination of conchospores or archeospores. Note: it is the object of cultivation and harvesting.

3.2 conchocelis - the sporophyte generation, formed by the germination of carpospores. Note: it is divided into free-living conchocelis and shell-boring conchocelis, which are respectively the objects of germplasm conservation and of seedling rearing during cultivation.

3.3 carpospore - the spore released when a vegetative cell of the thallus develops into a carpogonium which, after fertilization, divides to form a carposporangium containing several cells.

3.4 conchospore - the spore released when the vegetative filaments of the conchocelis grow and develop into sporangial branches in which, on maturity, each cell divides once to form a conchosporangium.

3.5 archeospore - the single spore released by each monosporangium formed by the transformation of a vegetative cell of the thallus. Note: the archeospore is haploid, germinates directly into a thallus and is the asexual reproductive spore of *Neopyropia yezoensis*.

4 Name and classification

4.1 Scientific name: *Neopyropia yezoensis* (Ueda) L.-E. Yang & J. Brodie, 2020.

4.2 Taxonomic position: phylum Rhodophyta; class printed in the original as Bangiopyceae; order Bangiales; family Bangiaceae; genus *Neopyropia* L.-E. Yang & J. Brodie, given as equal to *Porphyra* C. Agardh.

5 Main morphological and structural characteristics

5.1 Thallus. Membranous; the frond is ovate or elongate-ovate, with an umbilicate, rounded or cordate base. The marginal cells are regularly arranged and the outer margin is smooth and without teeth. The frond is attached to the substrate by rhizoidal filaments extending downward from the basal cells. The colour of the frond is bluish purple or blackish purple-red. The length of the frond is generally 14 cm to 30 cm and may exceed 1 m under cultivation. The plant is monoecious. Male and female reproductive cells are mixed together, and the areas where the spermatangia form often appear as white stripes, which is one of the important characteristics of the species. The outline is shown in Figure 1, keyed 1 rhizoid, 2 frond, 3 striped spermatangial area. The thallus is one cell layer thick; the frond is 30 μm to 50 μm thick and each cell contains 1 centrally placed stellate chromatophore.

5.2 Conchocelis. Filamentous, with irregular branching. Its growth and development pass through three stages, namely vegetative filaments, sporangial branches, that is swollen filaments, and conchospores, shown in Figure 2. The vegetative filaments are slender; the filament cells are 2 μm to 4 μm wide and 10 μm to 80 μm long. The cells of the sporangial branches are 10 μm to 15 μm wide and 12 μm to 17 μm long, and approach equal length and width as they near maturity. The conchocelis can bore into shells or other objects containing calcium carbonate and grow there, or it can grow suspended in seawater. The filaments are mostly bluish black and turn bluish brown at the mature stage. Figure 2 is keyed 1 vegetative filaments, 2 sporangial branches, 3 formation of conchospores.

6 Reproductive characteristics

6.1 Life cycle. The sexual life cycle is a heteromorphic alternation of generations between the conchocelis ($2n$) and the thallus (n). The asexual life cycle is a thallus-generation cycle carried on through archeospores. The life cycle is shown in Figure 3, keyed 1 thallus; 2 archeospore; 3 thallus seedling germinated from an archeospore; 4 spermatangium; 5 spermatium; 6 carpogonium; 7 zygote; 8 carposporangium; 9 carpospore; 10 vegetative filaments; 11 conchosporangial branch; 12 formation and release of conchospores; 13 conchospore; 14 thallus seedling germinated from a conchospore.

6.2 Sexual reproduction. When the thallus enters the mature stage, the vegetative cells of the front and marginal areas of the frond develop into carpogonia and spermatangial mother cells. The spermatangial mother cell is the male reproductive cell; through repeated division it forms a spermatangium containing 128 or 64 spermatangial cells, with the division formula male $A4B4C8$ or male $A2B4C8$, and each spermatangial cell releases 1 spermatium. The carpogonium is the female reproductive cell; after fertilization it divides to form a carposporangium, and the mature carposporangium contains 16 carpospores, with the division formula female $A2B2C4$. The carpospores escape and germinate into conchocelis. The conchocelis grows through vegetative filaments and develops conchosporangial branches, forming conchosporangia which, on maturity and division, release conchospores that germinate into thalli.

6.3 Asexual reproduction. The vegetative cells at the front of the thallus are transformed into monosporangia, each of which produces only one archeospore; the archeospore escapes and germinates into a new thallus.

7 Cytogenetic characteristics

The chromosome number is n equal to 3 and $2n$ equal to 6.

8 Molecular genetic characteristics

The clause gives a reference base sequence of the *rbcL* gene, stated to be 635 bp long and printed in blocks of ten bases with running position numbers.

In the extracted text the block running to position 140 is repeated, so the printed sequence does not run to 635 positions without duplication; the base sequence is therefore not reproduced here.

The intraspecific K2P (Kimura 2-parameter) genetic distance is less than 1 %.

9 Test methods

9.1.1 Thallus. The thallus is spread flat on herbarium paper and examined visually in daylight. The stellate chromatophore and the height of the cell lumen are examined under the microscope.

9.1.2 Conchocelis. Bland fluid, made of 10 % nitric acid, 95 % ethanol and 0.5 % chromic acid in the ratio 4 to 3 to 3, is used to dissolve the shell until no more bubbles are given off; the layer of filaments growing on the inner side of the shell is scraped off, spread flat on a slide, covered with a cover glass and examined under the microscope.

9.2 Reproductive characteristics are examined under the microscope.

9.3 Cytogenetic testing is carried out by the method of Annex A.

9.4 Molecular genetic testing is carried out by the method of Annex B.

10 Rules of judgement

10.1 Where the test results conform to Clause 5, the species can be identified.

10.2 In the following cases further clauses are to be tested and the species judged on the whole of the results: where Clause 5 cannot be tested or cannot give a certain identification, Clause 7 or Clause 8 is tested in addition; where a third party asks for all or part of Clause 6 to be tested; and where a full-item test is carried out. As in the foreword, the letters a), b) and c) of this list are printed after the text of each item rather than before it.