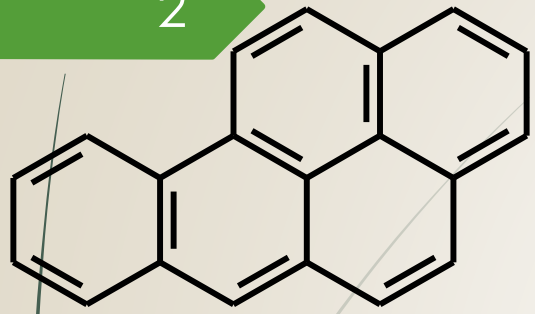
Effect of benzo(a)pyrene on the morphometric characteristics of tomato plants (Solanum Lycopersicum) under the conditions of a model experiment

Barbashev Andrey
Master of the Department of Soil Science and Land Resources Assessment
Southern Federal University

Actuality



benzo[a]pyrene (BaP)

Possesses the strongest carcinogenic and mutagenic activity; very toxic.

Properties:

- melting point: 179 °C;
- boiling point: 495 °C;
- density: 1.24 g/cm^3;
- carcinogen and class I mutagen danger;
- molecular weight 252.3

The main marker of ecosystem pollution with polycyclic aromatic hydrocarbons (PAHs) is benzo (a) pyrene (BaP). The content of BaP is subject to mandatory control throughout the world in all natural environments.The relevance of comprehensive studies of the behavior of BaP in soils and plants is due to the increased danger and scale of contamination of the soil and vegetation cover with this compound.

Object	MPC BaP
Grain	0,001 ng/g
Plant	0,005 ng/g
Food products	0,001 ng/g
Soils	0,02 ng/g
Drinking water	0,000001 ng/g

Purpose of work

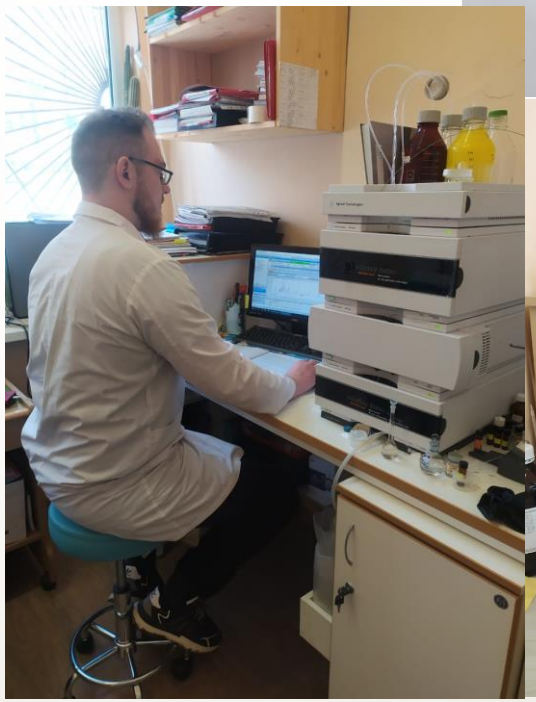
To evaluate the study of benzo(a)pyrene on the morphometric characteristics of tomato plants (Solanum Lycopersicum) in a model experiment

Object and methods

The studies were carried out under the conditions of a vegetation experiment. The soil was sifted through a sieve with a diameter of 1 mm and placed in 2 kg pots in 4 L pots. A BaP solution in acetonitrile was added to the soil surface based on the creation of a pollutant concentration in the soil of 400 ng/g, which corresponds to 20 MPC BaP. The original uncontaminated soil was used as a control. The soil was sown with tomato plants (Solánum lycopérsicum) of the early maturing variety White filling 241. The experiment was repeated three times.

Extraction of BaP from plants with subcritical water

1. Sampling of plants
2. Sample preparation
3. 2g of sample
4. Treatment with subcritical water
5. Extraction conditions
6. Temperature 250°C
7. Time 40 min.
8. The pressure is 55 atm.
9. Chromatographic analysis of HPLC (Agilent 1260)



Calculation of the accumulation coefficient and the acropetal coefficient

Accumulation coefficient:

$$\frac{C_{root}}{C_{soil}}$$

Acropetal coefficient:

$$\frac{C_{stem}}{C_{root}}$$

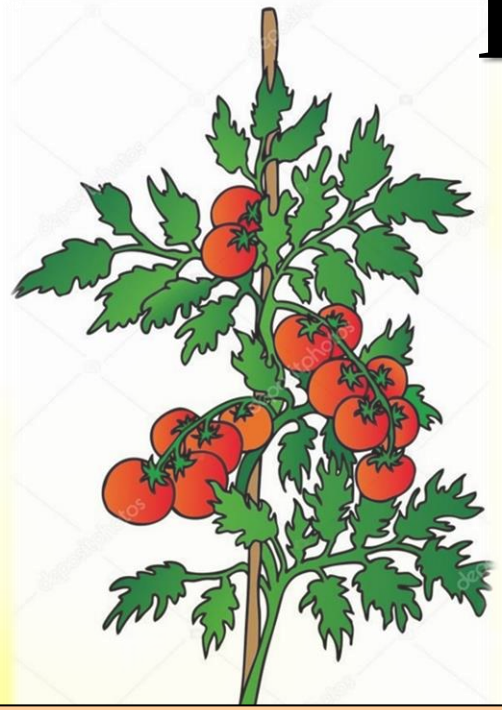
where:

C_{root} - PAH content in the root;

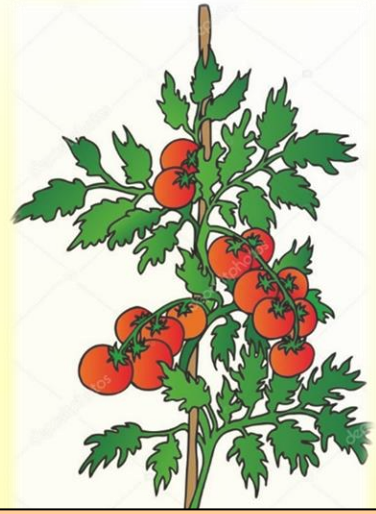
C_{soil} - PAH content in the soil;

C_{stem} _ PAH content in the stem.

Experience scheme



Control

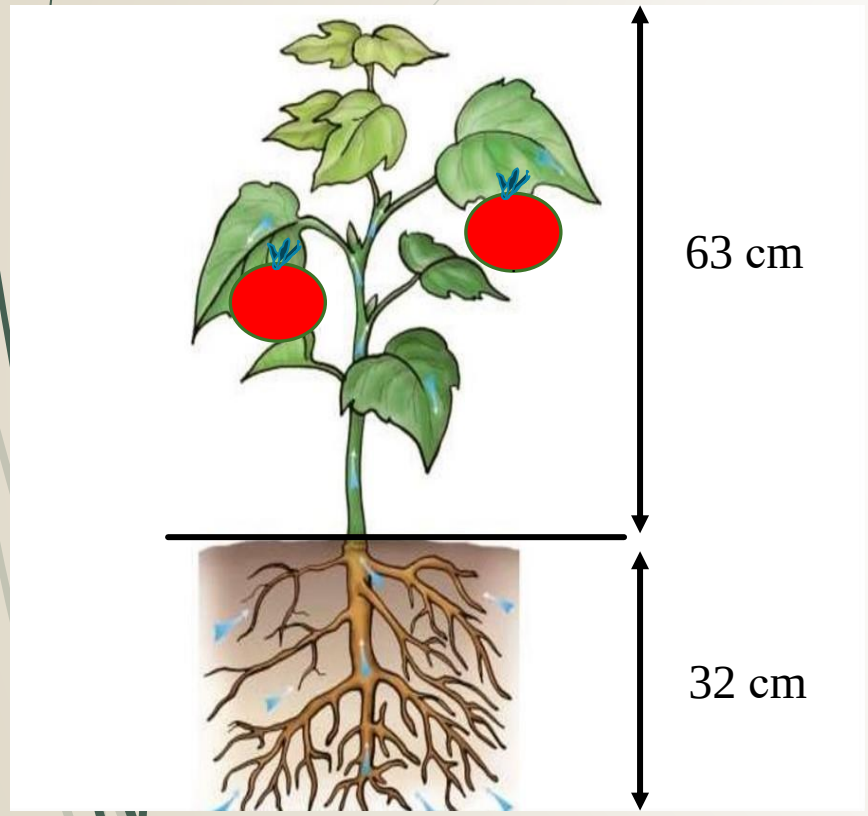


Benzo[a]pyrene

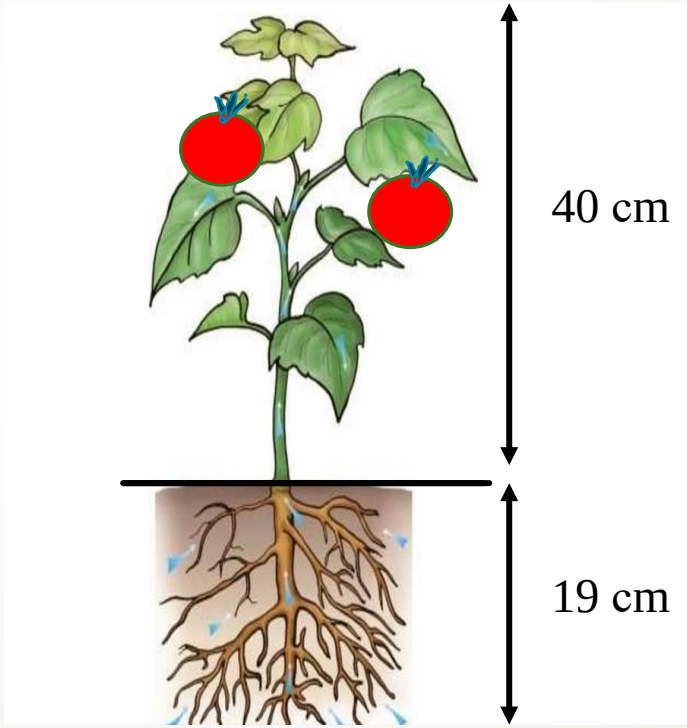
20 MPC
60 MPC

*MPC of benzo[a]pyrene (BaP) = 20 ng/g

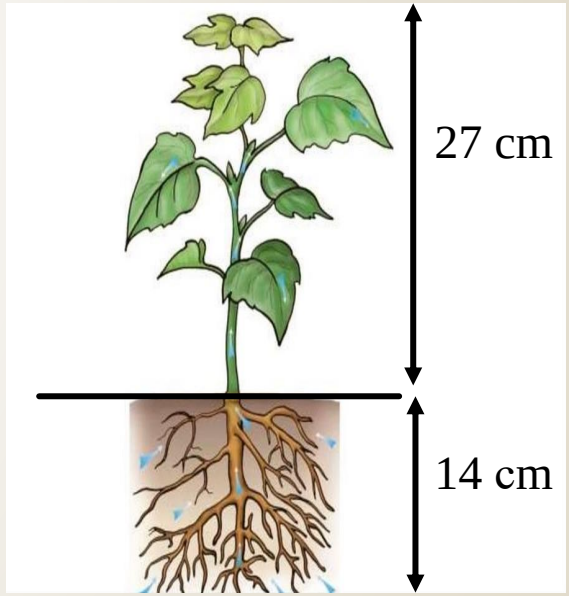
Morphobiometric indicators of tomato plants



Control

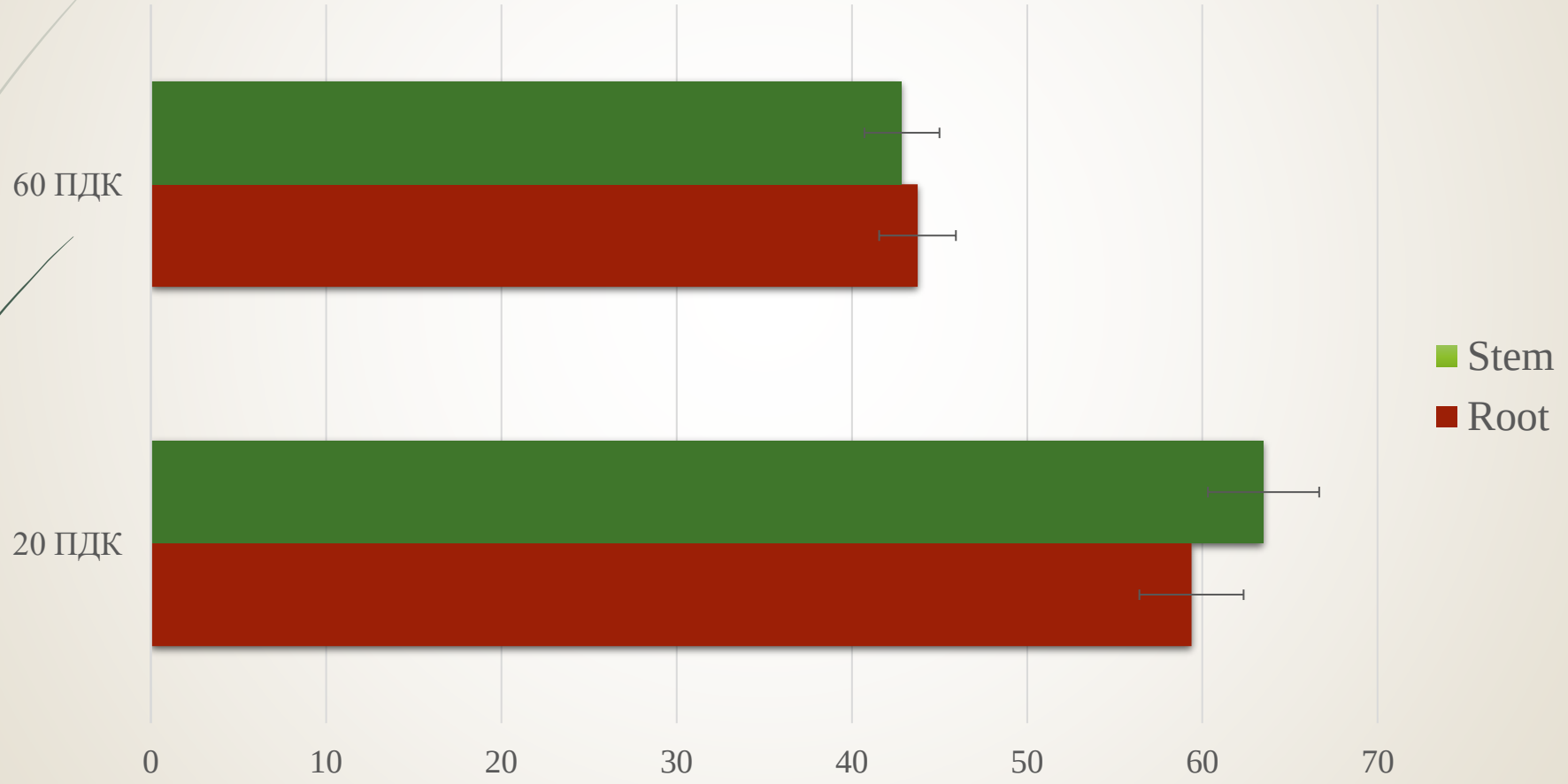


20 MPC

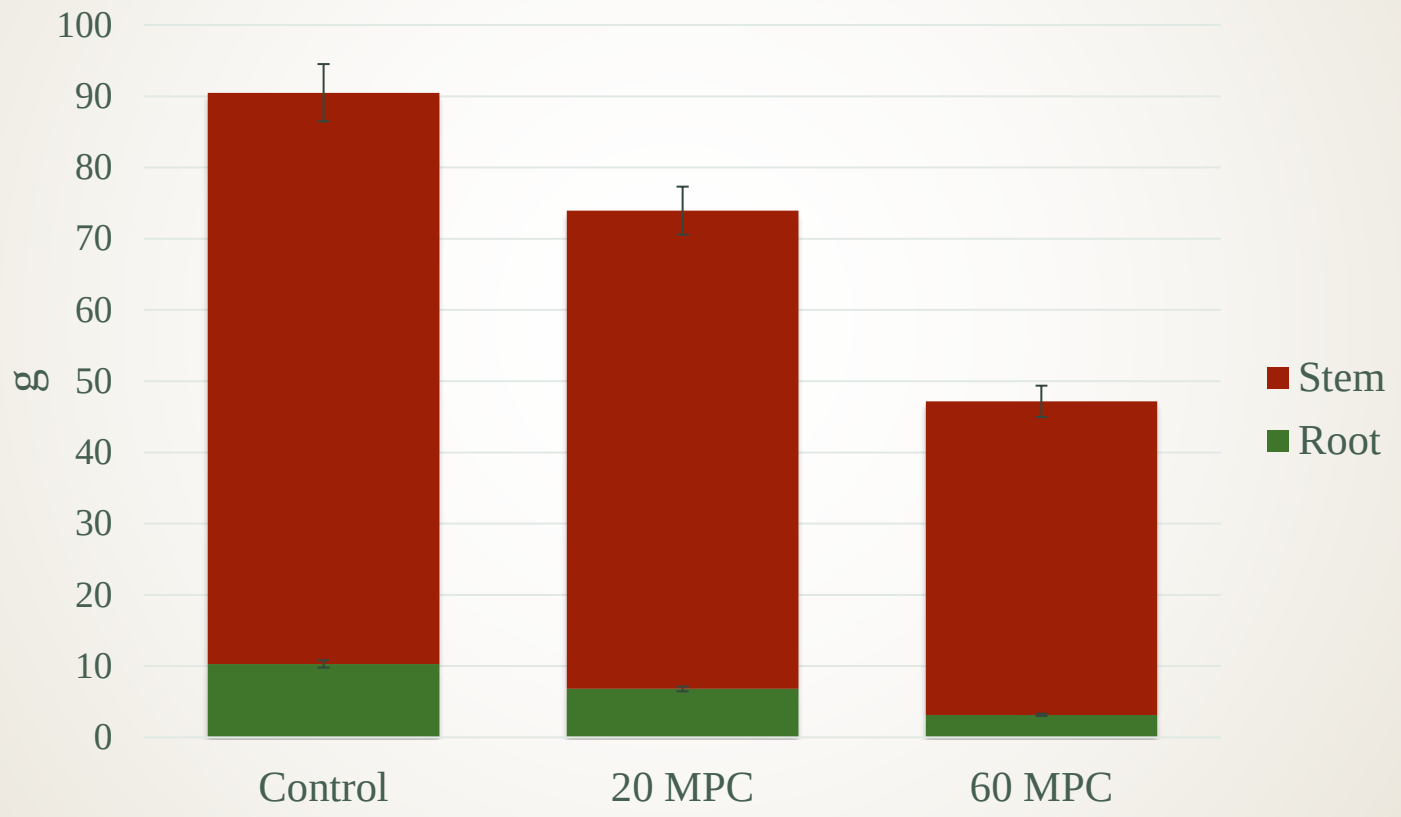


60 MPC

Morphobiometric indicators of tomato plants,% of control

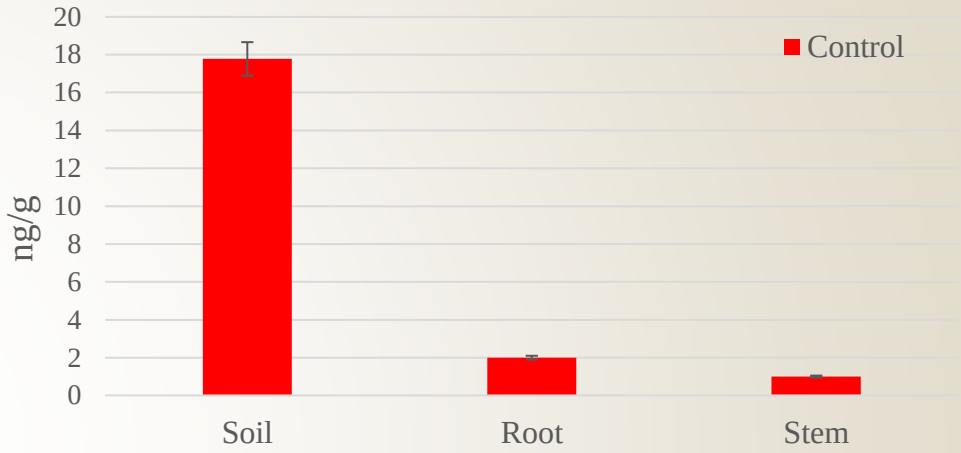


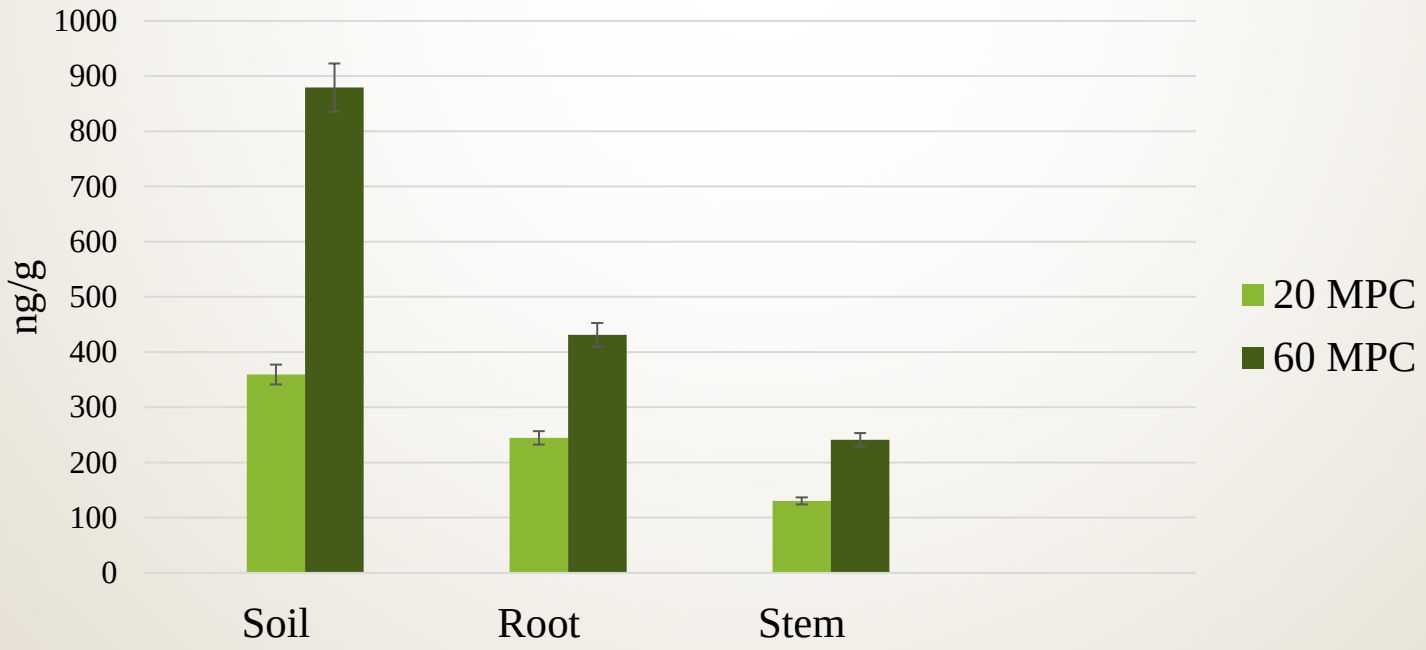
Mass of roots and stems of tomato plants



BaP content in soil and tomato plants

	Accumulation coefficient	Acropetal coefficient
Control	0,11	0,50
20 MPC	0,68	0,53
60 MPC	0,49	0,56





Conclusion

Thus, the effect of BaP on the morphobiometric characteristics of tomato plants was studied under the conditions of a model vegetative experiment with soil pollution of 20 and 60 MPC pollutants. The data obtained indicate the absence of stable barrier functions in tomato plants in relation to BaP, which leads to increased accumulation of the toxicant and, consequently, inhibition of plant growth and development.

Thank you for your attention!

Southern Federal University
Academy of Biology and Biotechnology D.I. Ivanovsky
Laboratory for Environmental Monitoring of Soils
barbashev@sfedu.ru
Rostov-on-Don
2022