



UDK: 574:581.5/1:581.8:57.017.64

Nurbek KUCHKAROV,
O'zbekiston Milliy universiteti dotsenti, PhD
E-mail: n.kuchkarov686@gmail.com

O'zMU professori, b.f.d T.Raximova taqrizi asosida

OSMOTIC PRESSURE OF CELLULAR JUICE OF KALANCHOE LACINIATA AND KALANCHOE DAIGREMONTIANA LEAVES

Annotation

This article examines leaf sap concentration and osmotic pressure in *Kalanchoe laciniata* and *Kalanchoe daigremontiana* plants grown in Tashkent. It also provides information on the specific characteristics of their adaptation to the environment.

Key words: *Kalanchoe laciniata*, *Kalanchoe daigremontiana*, concentration, osmotic pressure, air temperature, relative air humidity, soil temperature, soil moisture, leaf blade.

ОСМОТИЧЕСКОЕ ДАВЛЕНИЕ КЛЕТОЧНОГО СОКА ЛИСТЬЕВ KALANCHOE LACINIATA И KALANCHOE DAIGREMONTIANA

Аннотация

В данной статье исследованы показатели концентрации клеточного сока листьев и осмотического давления у растений *Kalanchoe laciniata* и *Kalanchoe daigremontiana* в условиях города Ташкента. Освещены сведения о специфических особенностях их адаптации к окружающей среде.

Ключевые слова: *Kalanchoe laciniata*, *Kalanchoe daigremontiana*, концентрация, осмотическое давление, температура воздуха, относительная влажность воздуха, температура почвы, влажность почвы, листовая пластинка.

KALANCHOE LACINIATA VA KALANCHOE DAIGREMONTIANA O'SIMLIKLARI BARG HUJAYRA SHIRASINING OSMOTIK BOSIMI

Аннотация

Ushbu maqolada *Kalanchoe laciniata* va *Kalanchoe daigremontiana* o'simliklarining Toshkent shahri sharoitida barg hujayra shirasining konsentratsiyasi va osmotik bosimi ko'rsatkichlari o'rganilgan bo'lib, vegetatsiya davomida ushbu ko'rsatkichning o'zgarishi, muhitga moslashish xususiyatlarining o'ziga xos ekanligi to'g'risidagi ma'lumotlar keltirilgan.

Kalit so'zlar: *Kalanchoe laciniata*, *Kalanchoe daigremontiana*, konsentratsiya, osmotik bosim, havo harorati, havoning nisbiy namligi, tuproq harorati, tuproq namligi, barg plastinkasi.

O'simlik hujayra shirasining osmotik bosimi N.A.Gusev usulida refraktometrda dastlab eritma konsentratsiyasini aniqlash bilan boshlandi [1]. Osmotik bosimni aniqlashda quyidagi formulalar asosida hisoblashlar amalga oshirildi (1-jadval).

1-jadval

Barg hujayra shirasining konsentratsiyasi va osmotik bosimini hisoblashda foydalaniladigan formulalar

$C_{\%} = \frac{m_1}{m_2} \cdot 100$	$C_{\%}$ – eritmaning % konsentratsiyasi m_1 – erigan moddaning massasi, g. m_2 – eritmaning massasi, g
$n = \frac{m}{M}$	n – modda miqdori, birligi mol yoki gramm-molekula, g/mol m – berilgan modda massasi yoki erigan moddaning massasi M – berilgan modda molekulyar massasi
$C_M = \frac{n}{V}$	C_M – molyar konsentratsiya n – modda miqdori, g/mol V – hajm
$P = RTC_i$	P – bosim, atm. R – universal gaz doimiysi, 0,08207 T – temperatura +273 °C + havo harorati °C C_M – molyar konsentratsiya i – izotonik koeffitsent
$Mr(C_{12}H_{22}O_{11}) = 342 \text{ g/mol}$	Saxaroza

Olingan natijalar asosida erigan moddaning (saxaroza) massasi aniqlab olindi. Shundan so'ng erigan moddaning (saxaroza) miqdori (g/mol) aniqlandi va molyar konsentratsiyasi hisoblab topildi. Universal gaz doimiysi $R = 0,08207$, T – temperatura +273 °C + havo harorati °C, C_M – molyar konsentratsiya, i – izotonik koeffitsent ko'rsatkichlari asosida P – bosim, atm. aniqlandi.

Kalanchoe laciniata o'simligi vegetatsiyasining birinchi yili (2023 y.) aprel oyida havoning harorati maksimal +24,5 °C, tuproq harorati o'rtacha +20,0 °C, tuproq namligining o'rtacha ko'rsatkichi (0-60 sm.) 20,9±0,18 %, barg plastinkasining harorati o'rtacha +22,5 °C bo'lganda – barg hujayra shirasining konsentratsiyasi 3,7±0,10 % va osmotik bosimi 3,1±0,17 atm., may oyida havoning harorati +29,7 °C, tuproq harorati +28 °C, tuproq namligi 20,0±0,64 %, barg plastinkasining harorati +27,5 °C bo'lganda – konsentratsiya 4,5±0,17 % va osmotik bosimi 4,2±0,17 atm., iyunda havoning harorati +36,5 °C, tuproq harorati +37,0 °C, tuproq namligi 14,1±0,60 %, barg plastinkasining harorati +34,3 °C bo'lganda – konsentratsiya 5,7±0,10 % va osmotik bosimi 5,4±0,34 atm., iyulda havoning harorati +38,2 °C, tuproq harorati +38,0 °C, tuproq namligi 13,5±0,39 %, barg plastinkasining harorati +35,9

°C bo'lganda – konsentratsiya $6,5 \pm 0,43$ % va osmotik bosimi $6,5 \pm 0,34$ atm., avgustda havoning harorati $+34,4$ °C, tuproq harorati $+33,0$ °C, tuproq namligi $14,3 \pm 0,53$ %, barg plastinkasining harorati $+32,2$ °C bo'lganda – konsentratsiya $7,8 \pm 0,17$ % va osmotik bosimi $7,4 \pm 0,43$ atm., sentabrda havoning harorati $+28,4$ °C, tuproq harorati $+25,0$ °C, tuproq namligi $13,1 \pm 0,56$ %, barg plastinkasining harorati $+26,4$ °C bo'lganda – konsentratsiya $5,5 \pm 0,17$ % va osmotik bosimi $5,2 \pm 0,26$ atm. ekanligi aniqlandi (2-jadval).

Vegetatsiya davrining ikkinchi (2024 y.) yilining aprel oyida havoning harorati maksimal $+22,6$ °C, tuproq harorati o'rtacha $+19,0$ °C, tuproq namligining o'rtacha ko'rsatkichi (0-60 sm.) $18,1 \pm 0,69$ %, barg plastinkasining harorati $+21,9$ °C bo'lganda – barg hujayra shirasining konsentratsiyasi $3,6 \pm 0,10$ % va osmotik bosimi $3,2 \pm 0,52$ atm., may oyida havoning harorati $+27,1$ °C, tuproq harorati $+23,0$ °C, tuproq namligi $19,1 \pm 0,38$ %, barg plastinkasining harorati $+25,8$ °C bo'lganda – konsentratsiya $4,4 \pm 0,17$ % va osmotik bosimi $3,9 \pm 0,70$ atm., iyunda havoning harorati $+35,5$ °C, tuproq harorati $+35,0$ °C, tuproq namligi $14,7 \pm 0,86$ %, barg plastinkasining harorati $+33,8$ °C bo'lganda – konsentratsiya $5,3 \pm 0,17$ % va osmotik bosimi $5,0 \pm 0,62$ atm., iyulda havoning harorati $+36,3$ °C, tuproq harorati $+37,0$ °C, tuproq namligi $13,2 \pm 0,43$ %, barg plastinkasining harorati $+34,7$ °C bo'lganda – konsentratsiya $6,5 \pm 0,10$ % va osmotik bosimi $6,4 \pm 0,10$ atm., avgustda havoning harorati $+35,6$ °C, tuproq harorati $+34,0$ °C, tuproq namligi $11,8 \pm 0,55$ %, barg plastinkasining harorati $+33,4$ °C bo'lganda – konsentratsiya $6,8 \pm 0,17$ % va osmotik bosimi $6,4 \pm 0,60$ atm., sentabrda havoning harorati $+28,8$ °C, tuproq harorati $+24,0$ °C, tuproq namligi $13,0 \pm 0,87$ %, barg plastinkasining harorati $+26,4$ °C bo'lganda – konsentratsiya $5,2 \pm 0,43$ % va osmotik bosimi $4,9 \pm 0,69$ atm. ekanligi aniqlandi (3-jadval).

2-jadval

O'simliklar barg hujayra shirasining konsentratsiyasi va osmotik bosimi (atm.) (2023 y.)

№	Turlar nomi	IV	V	VI	VII	VIII	IX
5-25-kunlar $C_{12}H_{22}O_{11}$ kons.							
1	<i>Kalanchoe laciniata</i>	$3,7 \pm 0,10$	$4,5 \pm 0,17$	$5,7 \pm 0,10$	$6,5 \pm 0,43$	$7,8 \pm 0,17$	$5,5 \pm 0,17$
2	<i>Kalanchoe daigremontiana</i>	$5,7 \pm 0,17$	$6,6 \pm 0,10$	$8,2 \pm 0,34$	$8,5 \pm 0,26$	$10,5 \pm 0,43$	$7,8 \pm 0,43$
Osmotik bosim (atm.)							
1	<i>Kalanchoe laciniata</i>	$3,1 \pm 0,17$	$4,2 \pm 0,17$	$5,4 \pm 0,34$	$6,5 \pm 0,34$	$7,4 \pm 0,43$	$5,2 \pm 0,26$
2	<i>Kalanchoe daigremontiana</i>	$5,2 \pm 0,52$	$6,3 \pm 0,43$	$8,5 \pm 0,60$	$8,2 \pm 0,69$	$10,2 \pm 0,36$	$7,2 \pm 0,43$

Vegetatsiya davrining uchinchi (2025 y.) yilining aprel oyida havoning harorati maksimal $+23,0$ °C, tuproq harorati o'rtacha $+21,0$ °C, tuproq namligining o'rtacha ko'rsatkichi (0-60 sm.) $19,5 \pm 0,56$ %, barg plastinkasining harorati $+20,0$ °C bo'lganda – barg hujayra shirasining konsentratsiyasi $3,8 \pm 0,36$ % va osmotik bosimi $3,5 \pm 0,26$ atm., may oyida havoning harorati $+29,0$ °C, tuproq harorati $+24,0$ °C, tuproq namligi $19,8 \pm 0,39$ %, barg plastinkasining harorati $+23,5$ °C bo'lganda – konsentratsiya $4,6 \pm 0,17$ % va osmotik bosimi $4,2 \pm 0,52$ atm., iyunda havoning harorati $+32,0$ °C, tuproq harorati $+34,0$ °C, tuproq namligi $14,0 \pm 0,55$ %, barg plastinkasining harorati $+31,0$ °C bo'lganda – konsentratsiya $5,0 \pm 0,51$ % va osmotik bosimi $4,6 \pm 0,36$ atm., iyulda havoning harorati $+40,0$ °C, tuproq harorati $+42,0$ °C, tuproq namligi $13,2 \pm 0,43$ %, barg plastinkasining harorati $+32,2$ °C bo'lganda – konsentratsiya $6,4 \pm 0,10$ % va osmotik bosimi $6,1 \pm 0,26$ atm., avgustda havoning harorati $+34,6$ °C, tuproq harorati $+35,0$ °C, tuproq namligi $13,2 \pm 0,53$ %, barg plastinkasining harorati $+30,0$ °C bo'lganda – konsentratsiya $7,6 \pm 0,17$ % va osmotik bosimi $7,4 \pm 0,51$ atm., sentabrda havoning harorati $+27,8$ °C, tuproq harorati $+24,0$ °C, tuproq namligi $13,9 \pm 0,69$ %, barg plastinkasining harorati $+24,2$ °C bo'lganda – konsentratsiya $6,5 \pm 0,51$ % va osmotik bosimi $6,2 \pm 0,36$ atm. ekanligi aniqlandi (4-jadval).

3-jadval

O'simliklar barg hujayra shirasining konsentratsiyasi va osmotik bosimi (atm.) (2024 y.)

№	Turlar nomi	IV	V	VI	VII	VIII	IX
5-25-kunlar $C_{12}H_{22}O_{11}$ kons.							
1	<i>Kalanchoe laciniata</i>	$3,6 \pm 0,10$	$4,4 \pm 0,17$	$5,3 \pm 0,17$	$6,5 \pm 0,10$	$6,8 \pm 0,17$	$5,2 \pm 0,43$
2	<i>Kalanchoe daigremontiana</i>	$6,3 \pm 0,26$	$6,8 \pm 0,17$	$8,5 \pm 0,60$	$9,5 \pm 0,43$	$10,0 \pm 0,43$	$8,8 \pm 0,17$
Osmotik bosim (atm.)							
1	<i>Kalanchoe laciniata</i>	$3,2 \pm 0,52$	$3,9 \pm 0,70$	$5,0 \pm 0,62$	$6,4 \pm 0,10$	$6,4 \pm 0,60$	$4,9 \pm 0,69$
2	<i>Kalanchoe daigremontiana</i>	$5,8 \pm 0,10$	$6,2 \pm 0,17$	$8,1 \pm 0,26$	$9,1 \pm 0,17$	$9,8 \pm 0,10$	$8,2 \pm 0,17$

Hujayra shirasining osmotik bosimi (2023 y.) *Kalanchoe laciniata* o'simligida $3,1 \pm 0,17$ atm. eng past ko'rsatkich aprel oyiga to'g'ri kelgan bo'lsa, eng maksimal daraja avgust oyida $7,4 \pm 0,43$ atm. ni tashkil etgan. Mavsum davomidagi diapazon $4,3$ atm. ekanligi aniqlandi. Keyingi (2024) yilda eng past osmotik bosim aprel oyida $3,2 \pm 0,52$ atm. ni tashkil etgan bo'lsa, maksimal daraja iyul-avgust oylarida $6,4 \pm 0,10$ atm. ekanligi aniqlandi. Diapazon $3,2$ atm. ni tashkil etgan. Vegetatsiya davrining (2025) yilida eng past osmotik bosim aprel oyida $3,5 \pm 0,26$ atm. ni tashkil etgan bo'lsa, maksimal daraja avgust oyida $7,4 \pm 0,51$ atm. ekanligi qayd etildi. Diapazon $3,9$ atm. ekanligi aniqlandi.

Kalanchoe daigremontiana o'simligi vegetatsiyasining birinchi yili (2023 й.) aprel oyida havoning harorati maksimal $+24,5$ °C, tuproq harorati o'rtacha $+20,0$ °C, tuproq namligining o'rtacha ko'rsatkichi (0-60 sm.) $20,9 \pm 0,18$ %, barg plastinkasining harorati o'rtacha $+23,4$ °C bo'lganda – barg hujayra shirasining konsentratsiyasi $5,7 \pm 0,17$ % va osmotik bosimi $5,2 \pm 0,52$ atm., may oyida havoning harorati $+29,7$ °C, tuproq harorati $+28$ °C, tuproq namligi $20,0 \pm 0,64$ %, barg plastinkasining harorati $+28,3$ °C bo'lganda – konsentratsiya $6,6 \pm 0,10$ % va osmotik bosimi $6,3 \pm 0,43$ atm., iyunda havoning harorati $+36,5$ °C, tuproq harorati $+37,0$ °C, tuproq namligi $14,1 \pm 0,60$ %, barg plastinkasining harorati $+35,2$ °C bo'lganda – konsentratsiya $8,2 \pm 0,34$ % va osmotik bosimi $8,5 \pm 0,60$ atm., iyulda havoning harorati $+38,2$ °C, tuproq harorati $+38,0$ °C, tuproq namligi $13,5 \pm 0,39$ %, barg plastinkasining harorati $+36,5$ °C bo'lganda – konsentratsiya $8,5 \pm 0,26$ % va osmotik bosimi $8,2 \pm 0,69$ atm., avgustda havoning harorati $+34,4$ °C, tuproq harorati $+33,0$ °C, tuproq namligi $14,3 \pm 0,53$ %, barg plastinkasining harorati $+33,4$ °C bo'lganda – konsentratsiya $10,5 \pm 0,43$ % va osmotik bosimi $10,2 \pm 0,36$ atm., sentabrda havoning harorati $+28,4$ °C, tuproq harorati $+25,0$ °C, tuproq namligi $13,1 \pm 0,56$ %, barg plastinkasining harorati $+27,6$ °C bo'lganda – konsentratsiya $7,8 \pm 0,43$ % va osmotik bosimi $7,2 \pm 0,43$ atm. ekanligi aniqlandi (2-jadval).

4-jadval

O'simliklar barg hujayra shirasining konsentratsiyasi va osmotik bosimi (atm.) (2025 y.)

№	Turlar nomi	IV	V	VI	VII	VIII	IX
5-25-kunlar $C_{12}H_{22}O_{11}$ kons.							
1	<i>Kalanchoe laciniata</i>	$3,8 \pm 0,36$	$4,6 \pm 0,17$	$5,0 \pm 0,51$	$6,4 \pm 0,10$	$7,6 \pm 0,17$	$6,5 \pm 0,51$
2	<i>Kalanchoe daigremontiana</i>	$6,7 \pm 0,17$	$7,5 \pm 0,43$	$7,8 \pm 0,17$	$8,6 \pm 0,51$	$9,5 \pm 0,34$	$8,5 \pm 0,51$
Osmotik bosim (atm.)							
1	<i>Kalanchoe laciniata</i>	$3,5 \pm 0,26$	$4,2 \pm 0,52$	$4,6 \pm 0,36$	$6,1 \pm 0,26$	$7,4 \pm 0,51$	$6,2 \pm 0,36$
2	<i>Kalanchoe daigremontiana</i>	$6,1 \pm 0,34$	$6,9 \pm 0,52$	$7,3 \pm 0,26$	$8,6 \pm 0,17$	$9,1 \pm 0,34$	$7,9 \pm 0,17$

Vegetatsiya davrining ikkinchi (2024 й.) yilining aprel oyida havoning harorati maksimal $+22,6^{\circ}\text{C}$, tuproq harorati o'rtacha $+19,0^{\circ}\text{C}$, tuproq namligining o'rtacha ko'rsatkichi (0-60 sm.) $18,1\pm 0,69\%$, barg plastinkasining harorati $+22,6^{\circ}\text{C}$ bo'lganda – barg hujayra shirasining konsentratsiyasi $6,3\pm 0,26\%$ va osmotik bosimi $5,8\pm 0,10\text{ atm.}$, may oyida havoning harorati $+27,1^{\circ}\text{C}$, tuproq harorati $+23,0^{\circ}\text{C}$, tuproq namligi $19,1\pm 0,38\%$, barg plastinkasining harorati $+26,3^{\circ}\text{C}$ bo'lganda – konsentratsiya $6,8\pm 0,17\%$ va osmotik bosimi $6,2\pm 0,17\text{ atm.}$, iyunda havoning harorati $+35,5^{\circ}\text{C}$, tuproq harorati $+35,0^{\circ}\text{C}$, tuproq namligi $14,7\pm 0,86\%$, barg plastinkasining harorati $+34,5^{\circ}\text{C}$ bo'lganda – konsentratsiya $8,5\pm 0,60\%$ va osmotik bosimi $8,1\pm 0,26\text{ atm.}$, iyulda havoning harorati $+36,3^{\circ}\text{C}$, tuproq harorati $+37,0^{\circ}\text{C}$, tuproq namligi $13,2\pm 0,43\%$, barg plastinkasining harorati $+35,2^{\circ}\text{C}$ bo'lganda – konsentratsiya $9,5\pm 0,43\%$ va osmotik bosimi $9,1\pm 0,17\text{ atm.}$, avgustda havoning harorati $+35,6^{\circ}\text{C}$, tuproq harorati $+34,0^{\circ}\text{C}$, tuproq namligi $11,8\pm 0,55\%$, barg plastinkasining harorati $+34,3^{\circ}\text{C}$ bo'lganda – konsentratsiya $10,0\pm 0,43\%$ va osmotik bosimi $9,8\pm 0,10\text{ atm.}$, sentabrda havoning harorati $+28,8^{\circ}\text{C}$, tuproq harorati $+24,0^{\circ}\text{C}$, tuproq namligi $13,0\pm 0,87\%$, barg plastinkasining harorati $+27,2^{\circ}\text{C}$ bo'lganda – konsentratsiya $8,8\pm 0,17\%$ va osmotik bosimi $8,2\pm 0,17\text{ atm.}$ ekanligi aniqlandi (3-jadval).

Vegetatsiya davrining uchinchi (2025 й.) yilining aprel oyida havoning harorati maksimal $+23,0^{\circ}\text{C}$, tuproq harorati o'rtacha $+21,0^{\circ}\text{C}$, tuproq namligining o'rtacha ko'rsatkichi (0-60 sm.) $19,5\pm 0,56\%$, barg plastinkasining harorati $+21,3^{\circ}\text{C}$ bo'lganda – barg hujayra shirasining konsentratsiyasi $6,7\pm 0,17\%$ va osmotik bosimi $6,1\pm 0,34\text{ atm.}$, may oyida havoning harorati $+29,0^{\circ}\text{C}$, tuproq harorati $+24,0^{\circ}\text{C}$, tuproq namligi $19,8\pm 0,39\%$, barg plastinkasining harorati $+24,6^{\circ}\text{C}$ bo'lganda – konsentratsiya $7,5\pm 0,43\%$ va osmotik bosimi $6,9\pm 0,52\text{ atm.}$, iyunda havoning harorati $+32,0^{\circ}\text{C}$, tuproq harorati $+34,0^{\circ}\text{C}$, tuproq namligi $14,0\pm 0,45\%$, barg plastinkasining harorati $+32,5^{\circ}\text{C}$ bo'lganda – konsentratsiya $7,8\pm 0,17\%$ va osmotik bosimi $7,3\pm 0,26\text{ atm.}$, iyulda havoning harorati $+40,0^{\circ}\text{C}$, tuproq harorati $+42,0^{\circ}\text{C}$, tuproq namligi $13,2\pm 0,43\%$, barg plastinkasining harorati $+33,5^{\circ}\text{C}$ bo'lganda – konsentratsiya $8,6\pm 0,51\%$ va osmotik bosimi $8,6\pm 0,17\text{ atm.}$, avgustda havoning harorati $+34,6^{\circ}\text{C}$, tuproq harorati $+35,0^{\circ}\text{C}$, tuproq namligi $13,2\pm 0,53\%$, barg plastinkasining harorati $+31,3^{\circ}\text{C}$ bo'lganda – konsentratsiya $9,5\pm 0,34\%$ va osmotik bosimi $9,1\pm 0,34\text{ atm.}$, sentabrda havoning harorati $+27,8^{\circ}\text{C}$, tuproq harorati $+24,0^{\circ}\text{C}$, tuproq namligi $13,9\pm 0,69\%$, barg plastinkasining harorati $+25,3^{\circ}\text{C}$ bo'lganda – konsentratsiya $8,5\pm 0,51\%$ va osmotik bosimi $7,9\pm 0,17\text{ atm.}$ ekanligi aniqlandi (4-jadval).

Hujayra shirasining osmotik bosimi (2023 y.) *Kalanchoe daigremontiana* o'simligida $5,2\pm 0,52\text{ atm.}$ eng past ko'rsatkich aprel oyiga to'g'ri kelgan bo'lsa, eng maksimal daraja avgust oyida $10,2\pm 0,36\text{ atm.}$ ni tashkil etgan. Mavsum davomidagi diapazon $5,0\text{ atm.}$ ekanligi aniqlandi. Keyingi (2024) yilda eng past osmotik bosim aprel oyida $5,8\pm 0,10\text{ atm.}$ ni tashkil etgan bo'lsa, maksimal daraja avgust oyida $9,8\pm 0,10\text{ atm.}$ ekanligi aniqlandi. Diapazon $4,0\text{ atm.}$ ni tashkil etgan. Vegetatsiya davrining (2025) yilida eng past osmotik bosim aprel oyida $6,1\pm 0,34\text{ atm.}$ ni tashkil etgan bo'lsa, maksimal daraja avgust oyida $9,1\pm 0,34\text{ atm.}$ ekanligi qayd etildi. Diapazon $3,0\text{ atm.}$ ekanligi aniqlandi.

ADABIYOTLAR

1. Гусев Н.А. Некоторые методы исследования водного режима растений. – Ленинград: Всесоюзное ботаническое общество, 1969. – С. 38.