[1,2]*G.B. Tanabekova*, [2,3*]*R.V. Jashenko*
[1]*Al-Farabi Kazakh National University, Almaty, Kazakhstan, tanabekova.guli@gmail.com*
[2*]*Institute of Zoology SC MSHE RK, Almaty, Kazakhstan, roman.jashenko@zool.kz**
[3]*Tethys Scientific Society, Almaty, Kazakhstan*

DAMAGE TO THE SIEVERS APPLE TREE BY A ROSEATE LEAFWORM IN THE ILEY AND ZHETYSU ALATAU

Abstract

The article provides information on damage to the Sievers apple tree by roseate leafworm in the territory of the Iley and Zhetysu Alatau. Based on the results of the work, maps of the distribution and influence of the roseate leafworm Archips rosana L. have been developed on the territory of the Ile-Alatau and Zhongar-Alatau GNPP. It is worth noting the need to study the distribution and influence of the roseate leafworm Archips rosana L., since this species causes significant harm to the Sivers apple tree in these territories. The main purpose of the study is to identify the degree of damage to the roseate leaf worm Archips rosana L. to apply a timely control measure against this pest of the Sievers apple tree. In the Iley Alatau, namely, in the Aksai and Talgar branches, there is a stronger damage rate than in the branches of the Zhetysu Alatau. It was revealed that the roseate leafworm has a strong degree of harmfulness in the Aksai forestry of the Aksai branch, the Soldatsai forestry of the Talgar branch and the Issyk forestry of the Turgen branch, however, its harmfulness in the genetic reserve "Kuznetsovo Gorge" of the Turgen branch is noticeably lower. The relevance of the study lies in the fact that over the past few decades the range of this species has significantly decreased, this is explained by state and economic needs, genetic and environmental pollution of wild populations, as well as the development of dangerous pests around the area.

Keywords: *roseate leafworm, Sievers apple tree, Iley Alatau, Zhetysu Alatau.*

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A. Yakovlev[1], Ye.Sarkynov[1], A.Meshyk[2], Zh.Zhakupova[1], Zh.Yussupov[1]*

[1]*Kazakh National Agrarian Research University, Almaty, Kazakhstan*
[2]*Brest State Technical University, Brest, Belarus*
(E-mail: alexandr.yakovlev@kaznaru.edu.kz, yerbol.sarkynov@kaznaru.edu.kz, omeshik@mail.ru, zhakupova.zhanar@kaznaru.edu.kz,501419@kaznaru.edu.kz)

THEORETICAL FOUNDATIONS FOR THE HYDROTHERMAL METHOD OF WATER LIFTING FROM WATERCOURSES

Abstract

The most affordable type of water supply, which does not require high costs, are land-based water supply sources - natural and artificial, most of which can use the kinetic energy of moving water as an energy source to power alternative pumping units operating using energy-saving and environmentally friendly water lift technology, which makes it possible to increase the efficiency of mechanization of water supply for household and household needs of agricultural the consumer.

The methodology of developing the theoretical foundations for the hydraulic ram method of water lifting from watercourses is presented, on the basis of which the results of theoretical studies on the technological process of an improved hydraulic ram pumping unit for watering pastures and irrigation of land plots are given, developed at the Kazakh National Agrarian Research University when performing research on applied research and the IRN-DP21682075 project "Pumping units for lifting water from watercourses powered by water energy" through the Joint-Stock Company "Science Foundation" of the Ministry of Science and Higher Education of the Republic of Kazakhstan (grant agreement for the commercialization of scientific results and (or) scientific and technical activities No. 102 dated 11/10/2023).

Theoretical formulas are given for determining the main technological and technical parameters of an improved hydraulic ram pumping unit: pressure, supply, power consumption and efficiency and internal diameters of the through holes of the receiving part, the supply pipeline, the discharge valve, the shock valve and the water lifting pipeline.

Key words: Development methodology, hydraulic ram method of water lifting, hydraulic ram pumping unit, watercourse, research, technological and technical parameters.

Introduction

Currently, in Kazakhstan and foreign countries, due to the shortage of a traditional energy source (fuel) in the fuel and energy system and in order to save it, as well as reduce the rate of environmental degradation, they are coming to use renewable energy sources (wind, water and solar), including in the agricultural water supply system, mainly for the use of water energy in watercourses [1, 2].

The problem of effective water supply using natural energy resources of water in modern conditions is promising and relevant, the solution of which is rationally carried out from watercourses by pumping units using mainly a hydraulic ram method of water lifting, the designs of which, according to the technical solution, are simple and reliable in operation and do not worsen the ecology of the environment.

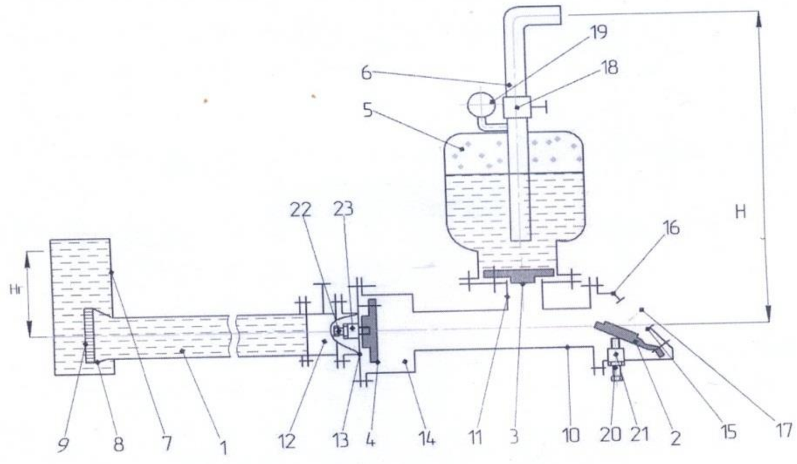
In this area, research has been conducted at NAO KazNARU, as a result of which an improved design and technological scheme of a hydraulic ram pumping unit for irrigation of land and irrigation of pastures has been substantiated, in relation to which, in order to develop the necessary standard sizes of experimental and prototype pumping units, theoretical foundations are needed to determine their main technological and technical parameters, to which this article is devoted.

A hydraulic ram pumping unit refers to a type of installation in which the kinetic energy of moving water is used to create pressure and supply. The principle of operation is based on the creation of a hydraulic shock in the water lifting system from the periodic closing and opening of the shock valve in the supply pipeline, from which the pressure in it increases cyclically, and water is pumped through the discharge valve into the air cap and supplied to the consumer through the water lifting pipeline [3-5].

Methods and materials

The methodology for developing the theoretical foundations for the hydrothermal method of water lifting from watercourses was to determine the analytical dependencies between the main input and output parameters of the hydraulic ram method of water lifting in a hydraulic ram pumping unit.

Theoretical studies of the hydroponic method of water lifting were carried out taking into account the developed design and technological scheme of an improved hydraulic ram pumping unit (Figure 1).



1 – supply pipeline; 2,3,4 - shock, discharge and non-return elastic valves; 5 - air cap; 6 - water supply pipeline; 7 - feeding jumper; 8 - the receiving part of the supply pipeline; 9 - lattice grid; 10 – the chamber of the supply pipeline; 11 - pressure valve support seat; 12 - device for starting and stopping the hydraulic shock process (gate valve); 13 – check valve seat; 14 – check valve body; 15 - shock valve seat; 16 – impact valve body; 17 - through hole of the shock valve seat; 18 - the valve; 19 – manometer; 20,22 - thrust screw; 21,23 - bushing; Hг,H - creating a hydraulic drop and the height of the water lift; Q, $Q_{сб}$, $Q_{ну}$ – total water consumption, water discharge and pumping unit supply; $D_{п}$, , $D_{птр}$, $D_{ук}$, $D_{нк}$, $D_{втр}$ – internal diameters: intake filter, supply pipeline, impact valve, discharge valve and water lifting pipeline; $\upsilon_{п}$, $\upsilon_{птр}$,$\upsilon_{з}$, $\upsilon_{втр}$, $\upsilon_{зб}$ – water velocity: in the intake filter, the supply pipeline, in the pressure pipeline when the shock valve is closed, in the water lifting pipeline and in the discharge opening of the shock valve seat; $L_{тр}$– pressure pipe length

Figure 1 - Design and technological diagram of an improved hydraulic ram pumping unit of KazNARU design

The research methodology consisted in using the law of continuity of the flow of water in the receiving part and the feed pipeline, in using the Bernoulli equation [6] for the inlet and outlet sections of the receiving part and the feed pipeline and the theory of Zhukovsky N.E. on direct hydraulic shock in a closed water pipeline [7].

The research was aimed at determining the analytical dependencies between the input and output parameters of a hydraulic ram pumping unit during the technological process of its steady-state operation.

The main input parameters of the hydraulic ram method of water lifting are: water flow and created pressures in a hydraulic ram pumping unit: from the use of geometric and high-speed pressure, from hydraulic shock; the main output parameters of a hydraulic ram pumping unit are: head of a hydraulic ram pumping unit, supply, useful and expended power and efficiency of a hydraulic ram pumping unit.

To determine the specified main output parameters of a hydraulic ram pumping unit, the following functional dependencies were considered:

$$H_{ну} = f(H_{н}, H_{гу}), \quad (1)$$

$$H_{н} = f(H_{г}, \upsilon_{птр}, \upsilon_{п}, h_{\upsilon п}, g), \quad (2)$$

$$H_{гу} = f(\upsilon_{птр}, \upsilon_{з}, L_{тр}, t_{зф}, g), \quad (3)$$

$$Q_{ну} = f(Q, Q_{сб}) = f(\upsilon_{птр}, \upsilon_{сб}, D_{птр}, D_{ук}), \quad (4)$$

$$N_п = f(Q_{ну}, \upsilon_п, \rho, g), \quad (5)$$

$$N_{ну} = f(Q, \upsilon_п, \rho, g), \quad (6)$$

$$\eta_{ну} = f(N_п, N_{ну}) = f(Q, Q_{ну}, H_г, \upsilon_п, g), \quad (7)$$

$H_н$, $H_{гу}$ – the pressure created in the pumping unit from the use of: geometric and high-speed pressure, pressure from hydraulic shock, m;

$H_г$ - geometric pressure, m;

$\upsilon_{птр}$,$\upsilon_п$- the speed of water in the feed pipeline and its receiving part, m/s;

$h_{vп}$ - pressure loss in the receiving part and feed line, m;

g – acceleration of gravity m/s^2;

$L_{тр}$– pressure pipe length, m;

$\upsilon_з$ - the average velocity of water in the pressure line when the shock valve is closed ($\upsilon = f(t_{зф})$), m/s;

$t_{зф}$ - the actual closing time of the impact valve, s;

ρ - the density of the raised water, kg/m^3;

Q, $Q_{сб}$ – the total water consumption of the pumping unit and for discharge through the through hole of the shock valve seat, m^3/s;

$D_{птр}$, $D_{ук}$ - internal diameters of the feed pipe and the opening of the shock valve seat, m.

Результаты и обсуждение

Theoretical studies were carried out on the basis of the use of the law of continuity of the flow of movement of raised water in feed and water lifting pipes, the law of the hydraulic shock process in feed pipes and an air cap, as well as the use of the Bernoulli equation in the technological process of water lifting, as a result, refined theoretical prerequisites for alternative hydraulic ram technology of water lifting from watercourses are given.

As a result of theoretical studies based on functional dependencies (1)–(7), formulas for determining the main technological and technical parameters of an improved hydraulic ram pumping unit are given: pressure, supply, power consumption and efficiency and internal diameters of the through holes of the receiving part, the supply pipeline, the discharge valve, the shock valve and the water lifting pipeline [8].

The created head of a hydraulic ram pumping unit is determined by the formula:

$$H_{ну} = H_н + H_{гу}, \text{ m} \quad (8)$$

$H_н$– own head of the hydraulic ram pumping unit, m:

$$H_н = H_г + \frac{1}{2g} \cdot \left({\upsilon_{птр}}^2 - \upsilon_п^2 \right) + h_{vп} \text{ , m} \quad (9)$$

$H_г$ - geometric pressure, m;

g - acceleration of gravity m/s^2;

$\upsilon_{птр}$,$\upsilon_п$- the speed of water in the supply pipeline and its receiving part, m/s;

$h_{vп}$ - pressure loss in the receiving part and feed line, m:

$$h_{vп} = \sum_{i=1}^{n} \zeta_i \cdot \frac{v_{mi}^2}{2g} + \sum_{i=1}^{n} \lambda_{tpi} \cdot \frac{L_{тр}}{d_i} \cdot \frac{v_{di}^2}{2g}, \text{ m,} \quad (10)$$

ζ_i - the coefficient of local resistance in the receiving part and the feed line;

υ_{mi} - water velocity in places that create local resistance, m/s;

υ_{di} - water velocity in pipelines of different diameters, m/s;

λ_{tpi} - coefficient of friction in pipelines;

$L_{\text{тр}}$ - the length of the pipeline of different diameters, m;

$H_{\text{гу}}$ - pressure generated by hydraulic shock from the impact valve, m:

$$H_{\text{гу}} = \frac{1}{g} \cdot \left(\upsilon_{\text{птр}} - \upsilon_{3}\right) \frac{2L_{\text{тр}}}{t_{3\text{ф}}} \quad , \text{m} \tag{11}$$

υ_{3}- the average velocity of water in the pressure line when the shock valve is closed, m/s:

$$\upsilon_{3} = (\upsilon_{\text{п}} + \upsilon_{\text{птр}})/2, \text{ m/s} \tag{12}$$

$\upsilon_{\text{птр}}, \upsilon_{\text{п}}$ - the speed of water in the supply pipeline and its receiving part, m/s;

$t_{3\text{ф}}$ - the actual closing time of the impact valve (according to experimental data in open pipelines t_3=0,1 … 0,3s), s;

$L_{\text{тр}}$– pressure pipe length, m.

When replacing $H_{\text{гу}}$ from the formula (11) and, expressing a through Q, formula (8), by definition, will take the following form:

$$H_{\text{ну}} = H_{\text{н}} + \frac{1}{g} \cdot \left(\frac{4Q}{\pi \cdot {D_{\text{птр}}}^2} - \upsilon_{3}\right) \frac{2L_{\text{тр}}}{t_{3\text{ф}}} \quad , \text{m} \tag{13}$$

Q - total water consumption of a hydro turbine pumping unit, m3/s;

$D_{\text{птр}}$ – the inner diameter of the supply pipeline, m.

Supply of a hydraulic ram pumping unit $Q_{\text{ну}}$ it is determined by the formula:

$$Q_{\text{ну}} = Q - Q_{\text{сб}} = Q\left(1 - \frac{t_{\text{сб}}}{t_{\text{ц}}}\right), \text{m}^3/\text{s} \tag{14}$$

Q, $Q_{\text{сб}}$– the total water consumption of the hydraulic ram pumping unit and for discharge through the through hole of the shock valve seat, m^3/s:

$$Q_{\text{ сб}} = Q \cdot \frac{t_{\text{сб}}}{t_{\text{ц}}}, \text{m}^3/\text{s} \tag{15}$$

$t_{\text{сб}}$, $t_{\text{ц}}$ – the time of water discharge through the hydraulic shock valve per cycle and the cycle time of the hydraulic shock process, s:

$$t_{\text{сб}} = t_{\text{ц}} - t_{\text{н}} \text{ , s} \tag{16}$$

$$t_{\text{ц}} = \frac{60}{n} \quad , \quad \text{s} \tag{17}$$

n - switching frequency of the shock valve, min^{-1};

$t_{\text{н}}$ – time of injection of the raised water into the air cap container, s.

Useful power N_n, Power consumed $N_{\text{ну}}$ and the efficiency $\eta_{\text{ну}}$ of a hydraulic ram pumping unit is determined by the formulas:

$$N_n = 9{,}81 \cdot Q_{\text{ну}} \cdot H_{\text{ну}}, \text{ kW,} \tag{18}$$

$$N_{\text{ну}} = 9{,}81 \cdot Q \cdot \left(H_{\text{г}} + \frac{\upsilon_{\text{п}}^2}{2g}\right), \text{ kW,} \tag{19}$$

$$\eta_{\text{ну}} = \frac{Q_{\text{ну}} \cdot H_{\text{ну}}}{Q \cdot (\text{Н}_{\text{г}} + \frac{\upsilon_{\text{п}}^2}{2g})} \quad (20)$$

9,81 = ρ·g·10^{-3} – conversion factor of dimension W to kW;
ρ - water density, kg/m^3 (ρ = 1000 kg/m^3);
g - acceleration of gravity, m/s^2 (g = 9,81 m/s^2).

Internal diameters of the receiving part passageways $D_{\text{п}}$, the supply pipeline $D_{\text{птр}}$, discharge valve $D_{\text{нк}}$, impact valve $D_{\text{ук}}$ and the water lifting pipeline Dвтр, A hydraulic ram pumping unit is determined by engineering formulas [8-10]:

$$\text{Dп} = \left(\frac{4Q}{\upsilon_{\text{п}} \cdot \mu \cdot \pi}\right)^{1/2}, \text{ m} \quad (21)$$

$$\text{Dптр} = \left(\frac{4Q}{[\upsilon_{\text{птр}}] \cdot \mu \cdot \pi}\right)^{1/2}, \text{ m} \quad (22)$$

$$\text{Dнк} = \left(\frac{4Q_{\text{н}}}{\upsilon_{\text{н}} \cdot \mu \cdot \pi}\right)^{1/2}, \text{ m} \quad (23)$$

$$\text{Dук} = \text{Dптр} = \left(\frac{4Q}{[\upsilon_{\text{птр}}] \cdot \mu \cdot \pi}\right)^{1/2}, \text{ m} \quad (24)$$

$$\text{Dвтр} = \left(\frac{4Q_{\text{ну}}}{[\upsilon_{\text{втр}}] \cdot \mu \cdot \pi}\right)^{1/2}, \text{ m} \quad (25)$$

$\upsilon_{\text{п}}$, $[\upsilon_{\text{птр}}]$,$\upsilon_{\text{н}}$, $[\upsilon_{\text{втр}}]$ - the velocity of the watercourse water in the intake filter, the permissible velocity of water in the supply pipeline, the velocity of water injected through the discharge valve into the air cap container and the permissible velocity of water in the water lifting pipeline, m/s;

μ- the flow rate through the holes of the through sections in the hydraulic system;

Q,$Q_{\text{н}}$,$Q_{\text{ну}}$,- the total water consumption of the hydraulic ram pumping unit, the supply during the injection of water into the tank of the air cap and the supply of the hydraulic ram pumping unit, m^3/s:

$$Q_{\text{н}} = Q_{\text{ну}} \cdot \frac{t_{\text{ц}}}{t_{\text{н}}}, \text{ m}^3/\text{s} \quad (26)$$

$t_{\text{н}}$ – time of water injection through the discharge valve into the air cap container, s (determined experimentally).

Conclusions

The performed analytical dependences of the technological process of the hydraulic ram method of water lifting from watercourses are the basis for substantiating and calculating parameters when developing the necessary standard sizes of an improved hydraulic ram pumping unit.

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А. А. Яковлев[1], Е.С.Саркынов[1]*, О.П.Мешик[2], Ж.З. Жакупова[1], Ж.Е.Юсупов[1]

[1] Қазақ ұлттық аграрлық зерттеу университеті,
Алматы қаласы, Қазақстан
[2]Брест мемлекеттік техникалық университеті, Брест, Беларусь
(E-mail: alexandr.yakovlev@kaznaru.edu.kz, yerbol.sarkynov@kaznaru.edu.kz, omeshik@mail.ru, zhakupova.zhanar@kaznaru.edu.kz,501419@kaznaru.edu.kz)

СУ АҒЫНДАРЫНАН СУ КӨТЕРУДІҢ ГИДРОТЕРМИЯЛЫҚ ӘДІСІ БОЙЫНША ТЕОРИЯЛЫҚ НЕГІЗДЕР

Аңдатпа

Жоғары шығындарды қажет етпейтін сумен жабдықтаудың ең қолжетімді түрі жер үсті сумен жабдықтау көздері болып табылады - табиғи және жасанды, олардың көпшілігі энергия үнемдейтін және экологиялық таза су көтергіш технологиясы бойынша жұмыс істейтін баламалы сорғы қондырғыларын іске қосу үшін қозғалатын судың кинетикалық энергиясын энергия көзі ретінде пайдалана алады, бұл ауыл шаруашылығының тұрмыстық және тұрмыстық қажеттіліктері үшін сумен жабдықтауды механикаландырудың тиімділігін арттыруға мүмкіндік береді. тұтынушы.

Су ағындарынан су көтерудің гидротаран әдісі бойынша теориялық негіздерді әзірлеу әдістемесі келтірілген , оның негізінде жайылымдарды суландыруға және жер учаскелерін суаруға арналған жетілдірілген гидротаран сорғы қондырғысының технологиялық процесі бойынша теориялық зерттеулер нәтижелері Берілген, ҚазҰАЗУ-да қолданбалы зерттеулер бойынша ҒЗЖ орындау кезінде және ИРН-DP21682075 "Су ағындарынан суды көтеруге арналған сорғы қондырғылары" жобасы бойынша әзірленген Қазақстан Республикасы Ғылым және жоғары білім министрлігі "Ғылым қоры" Акционерлік қоғам желісі бойынша (10.11.2023 ж. № 102 шарт).

Жетілдірілген гидротаран сорғы қондырғысының негізгі технологиялық және техникалық параметрлерін анықтау бойынша теориялық формулалар берілген: қысым, су

беру, жұмсалған қуат және тиімділік және қабылдау бөлігінің өту тесіктерінің ішкі диаметрлері, қоректендіру құбыры, айдау клапаны , соққы клапаны және су көтергіш құбыр.

Кілт сөздер. Әзірлеу әдістемесі, суды көтерудің гидротаран әдісі, гидротаран сорғы қондырғысы, су ағыны, зерттеу, технологиялық және техникалық параметр.

А. А. Яковлев[1], Е.С.Саркынов[1]*, О.П.Мешик, Ж.З. Жакупова[1], Ж.Е.Юсупов[1]

[1]Казахский национальный аграрный исследовательский университет, город Алматы, Казахстан
[2]Брестский государственный технический университет, Брест, Беларусь
(E-mail: alexandr.yakovlev@kaznaru.edu.kz, yerbol.sarkynov@kaznaru.edu.kz, omeshik@mail.ru, zhakupova.zhanar@kaznaru.edu.kz,501419@kaznaru.edu.kz)

ТЕОРЕТИЧЕСКИЕ ОСНОВЫ ПО ГИДРОТАРАННОМУ СПОСОБУ ВОДОПОДЪЁМА ИЗ ВОДОТОКОВ

Аннотация

Наиболее доступным видом водоснабжения, не требующим больших затрат, являются наземные источники водоснабжения - естественные и искусственные, большинство из которых могут использовать кинетическую энергию движущейся воды в качестве источника энергии для приведения в действие альтернативных насосных агрегатов, работающих по энергосберегающей и экологически чистой технологии водоподъемников, позволяющей повысить эффективность механизации водоснабжения для бытовых и хозпотребительских нужд сельскохозяйственного потребителя.

Приведена методика разработки теоретических основ по гидротаранному способу водоподъёма из водотоков, на основании которой даны результаты теоретических исследований по технологическому процессу усовершенствованной гидротаранной насосной установки для обводнения пастбищ и орошения земельных участков, разработанной в Казахском национальном аграрном исследовательском университете при выполнении научно-исследовательских работ по прикладным исследованиям и по проекту ИРН-DP21682075 «Насосные установки для подъёма воды из водотоков с приводом от водной энергии» по линии Акционерного общества «Фонд науки» Министерства науки и высшего образования Республики Казахстан (договор о предоставлении гранта на коммерциализацию результатов научной и (или) научно-технической деятельности № 102 от 10.11.2023 г).

Даны теоретические формулы по определению основных технологических и технических параметров усовершенствованной гидротаранной насосной установки: напора, подачи, затраченной мощности и КПД и внутренних диаметров проходных отверстий приёмной части, питающего трубопровода, нагнетательного клапана, ударного клапана и водоподъёмного трубопровода.

Ключевые слова. Методика разработки, гидротаранный способ водоподъёма, гидротаранная насосная установка, водоток, исследование, технологический и технический параметр.