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Twenty-seventh edition of the collection was prepared in the context of Russian military aggression against Ukraine, that has been going on for more than four months. It included content on criminalistics, forensic science theory, as well as works on practical issues of various classes, species, and subspecies of forensic science related to military topics and compensation for damages.

Our authors are representatives of forensic science institutions, institutions of higher education, law enforcement agencies of Ukraine and abroad.

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Theory and Practice of Forensic Science and Criminalistics: War Challenges

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Now you have opportunity to get acquainted with the 27th issue of the Theory and Practice of Forensic Science and Criminalistics research paper collection. This is the second issue that Editorial Board issues during Russian war against Ukraine. Co-founders of the research paper collection are National Scientific Center «Hon. Prof. M. S. Bokarius Forensic Science Institute» and Yaroslav Mudryi National Law University for 22 years have adhered to scientific publication periodicity and even war is not able to interfere with this noble cause.

Centuries of trials embedded in the pages of world history, did not deprive Ukrainian people of their inflexibility, strength of spirit and ripples, on the contrary, they overwhelmed the nation. Despite numerous misfortunes that Ukrainian statehood suffered on the way of its establishment, Ukrainians overcame all obstacles and with even greater inspiration and double power restored the state in all directions: socio-political, legislative and legal, industrial and economic, cultural and educational and scientific ones. Science always plays a leading role in progress of any country, prominent scientists of each State are known and respected around the world and Ukrainian scientists are no exception to this rule.

In wartime, domestic science is focused on the main thing: innovative and technological development for sake of victory

This article is translation of the original Ukrainian content, which source is available at the link: <https://khrife-journal.org/index.php/journal> (translated by Andriy Bublikov). The author acknowledges translation as corresponding to the original.

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and restoration of Ukraine. Therefore, Ukrainian scientific community accepts challenges of wartime with dignity: it promptly responds to urgent requests and solves urgent problems even during the war with Russian invaders. Currently, Ukraine and Ukrainians are defending not only their independence or the choice of a European, civilized path; currently there is a large-scale war for the very existence of our State, for the right of its citizens to national identity. In any sovereign, democratic, social and legal state, for formation of a conscious civil society and ensuring the legal development of the country, important level is occupied by a developed legal science that main purpose is to conduct research on State-legal issues and develop proposals for improving legal regulation of social relations. In wartime, legislation changes, new urgent issues arise that require immediate resolution regarding administrative procedures and temporary relocation of persons, work of businesses and local self-government bodies, rights and obligations of various categories of citizens.

Editorial Board members of the collection, despite any obstacles and currently also the challenges of wartime, steadfastly adhere to world standards and requirements for scientific journals. In particular, number of bibliographic and reference databases where our edition is indexed increases from issue to issue that has a positive effect on content dissemination published in collection to world scientific environment.

Currently, the Theory and Practice of Forensic Science and Criminalistics collection is indexed in 21 online abstract and citation databases: Academic Research Index (ResearchBib), Academic Scientific Journals Indexing, Academic Search Engine «RefSeek», Bielefeld Academic

Search Engine (BASE), Central and Eastern European Online Library (CEEOL), CiteFactor, CORE, Crossref, Directory of Open Access Scholarly Resources (ROAD), Directory of Research Journals Indexing (DRJI), ERIH PLUS, Eurasian Scientific Journal Index (ESJI), Google Scholar, Index Copernicus International, International Scientific Indexing (ISI), Polska Bibliografia Naukowa, WorldCat and the Register of Scientific Publications of Ukraine. Full-text online versions of the collection are available on Internet on the platforms of the V. I. Vernadskyi National Library of Ukraine, libraries of forensic science institutions of Ministry of Justice of Ukraine, higher education institutions of Ministry of Internal Affairs of Ukraine, etc. The collection is indexed on the DOI® System.

The pages of the Theory and Practice of Forensic Science and Criminalistics research paper collection contain summaries of theoretical and practical best practices on current issues of forensic science and criminalistics. The thematic publication orientation covers modern forensic and legal issues of forensic science; urgent issues of criminal procedure and criminalistics; organization peculiarities of forensic science support in Ukraine; scientific intelligence in the field of forensic research, technology, methods and methods of forensic examinations; current applied developments regarding the conduct of certain types of forensic examinations; overview information about the practice of foreign legal proceedings and forensic expertology, etc.

The articles in this issue deserve special attention, where authors solve legal issues of criminal procedure, criminalistics and forensic science appeared at the time due to the war in Ukraine. Researches on judicial practice, legal reforms, issue

of ensuring fundamental human rights and freedoms in wartime, compliance with norms of international law, all this is studied by scientists in a new light and in new realities.

The article opening traditional section with research content, authored by **Oksana Kaplina**, Doctor of Law, Professor and Doctor of Laws, **Svitlana Sharenko**, Doctor of Law, Docent is devoted to criminal procedural aspect of compensation issues of for damage caused to a citizen as a result of armed aggression. This article discusses compensation issues of for damage caused to Ukraine by Russian armed aggression that are relevant not only for law enforcement practice in particular but for the State in general. Launched on February 24, 2022 by Russia against Ukraine, it is unprecedented in scale (compared to Second World War and the rest of the wars of the 20th–21st centuries), cruel in essence, unjust in purpose, a full-scale war that aggressors tried to hide from the whole world under the name of "special military operation", has already caused and every day continues to cause massive destruction and damage to housing and other property of citizens of Ukraine, who justly seek to compensate for the damage caused. The article provides data from the Office of the UN High Commissioner for Human Rights, the Kyiv Institute of Economics and the Prosecutor General's Office that testify to the scale of this tragedy for Ukraine. Within the framework of initiated criminal proceedings, damages are compensated by filing a civil lawsuit. However, specifics of grounds of claimed lawsuit presuppose occurrence of certain risks for the victim, issues of law enforcement and exercise of powers by investigator and prosecutor. In particular, difficulties can lie in impossibility of conducting

an inspection of the scene negatively affecting determination of caused damage. Determining caused damage as a result of destruction or destruction of a person's home or other possessions is problematic one, as this requires a significant number of forensic examinations, and the scale of destruction postpones obtaining the results of such forensic examinations for an indefinite period. As a result of the conducted research, scientists formulated proposals regarding compensation procedure for caused damage, as well as proposed appropriate changes and additions to current criminal procedural legislation.

The next article in research paper section is an article by **Mykhaylo Shepitko**, Doctor of Law, Senior Researcher, in which the author examines a topic relevant for the present time in Ukraine, current state of investigation of war and other crimes caused by Russian aggression against our state. The scientist draws attention to national, foreign and international nature of investigation of such crimes indicating their scale and complexity. The research purpose is determined by beginning of Russia aggressive, unprovoked, large-scale war against Ukraine and the need to bring to justice the persons responsible for its initiation.

Particular attention is paid to the urgent need for Ukraine to ratify and implement the Rome Statute of the International Criminal Court in order to avoid complications with assessment of socially dangerous actions in accordance with the Criminal Code of Ukraine and requirements of International Criminal Court and in order to create a legal basis for bringing the aggressor to criminal responsibility. In this context, domestic criminal procedural legislation needs changes that will facilitate implementation

of investigative and legal actions in martial law conditions, as well as introduction of electronic justice (in particular, the use of video communication and provision of information while transmitting and collection of evidence data).

The article by **Larysa Derecha**, PhD in Biology, Senior Researcher, **Oleksandr Borzov** and **Florin Rusitoriu** Forensic Expert of National Institute of Forensic Expertise (NIFE) (Romania) is devoted to actual issue of developing a methodology for forensic biology to determine taxonomic affiliation of animal hair using modern research methods providing new opportunities for such forensic examinations. Application of proposed methods contributes to identification of additional objective criteria in the case of a comparative research of material evidence of animal hair helping to solve a larger number of issues raised while appointment of a forensic biological examination. The authors substantiated possibility of establishing taxonomic affiliation of animal hair using instrumental and microscopic methods, in particular, a scanning electron microscope, allowing forensic biologists to study surfaces of objects of animal origin with both significant linear dimensions and microparticles in a wide range of magnifications (from 10× up to more than 200,000×), providing a resolution of up to 10–9 m. Obtaining a general image of the surface and selecting appropriate areas for detailing (at the maximum possible magnifications) does not require significant readjustment of the device. Significant depth of field provides detailed images of various surfaces with developed relief (cracks; traces of mechanical damage; morphological signs of periodically reproduced surface structures). The proposed method of

researching animal hair will significantly expand possibilities of forensic examination of mentioned objects: it will reduce the time and increase accuracy of conducting such research, as well as make possible to supplement illustrative content (for example, microphotographs of hair cuticles of commonly encountered animal species).

Content by **Oleksandr Kolomiitsev** PhD in Technology, Leading Researcher, **Viktor Sapielkin**, PhD in Medicine, PhD and **Pavel Giverts**, ballistics professional (Ballistics Laboratory of the Israel Police) and **Oleksandr Herman** Senior Researcher is devoted to a very relevant topic during the war, research on striking properties of caliber bullets .22 Long Rifle, as well as fragments of such bullets after ricocheting from various types of surfaces. Experimental researches made possible to identify specifics and conditions under which fragmentation of monolithic small-bore bullet occurs, as well as to determine flight speed of bullets and their fragments after impact-contact interaction with obstacles of various types. Special attention is paid to research on nature of interaction of bullets and their fragments after ricocheting with a viscoelastic medium imitating biological human body tissues. It has been established that energy concept of damage to a biological target and the criteria for its evaluation while research striking properties of bullets after ricochet have limited application, since it is not always possible to accurately determine the initial conditions of hitting both the bullets themselves and their individual fragments. Obtained results of experimental researches and natural tests made it possible to form an alternative criterion for assessing the severity of bodily injuries that a person suffered as a result of being hit by small-caliber lead

bullets after ricocheting. It is the length of the wound channel caused by a bullet or its fragments as a result of their impact on the human body after ricocheting. A calculation method for calculating wound channel length of is proposed, that can be used in forensic expert practice to determine potential harm to human life and health.

The section of the collection with case notes examines current issues of modern science: it begins with an article by **Olena Aleksandrenko**, PhD in Law, Docent, devoted to importance and possibilities of applying forensic analysis to investigation of crimes. Positive examples from investigative practice have proven effectiveness and availability of mentioned method. At the same time, the author cites shortcomings and peculiarities of using the method of forensic analysis in investigation. This research paper emphasizes the need for a comprehensive solution to the issue of methodical support for the use of forensic analysis by all interested state bodies with involvement of necessary scientific potential for conducting relevant research and preparing practical recommendations in order to ensure proper conditions for effective detection and investigation of crimes.

The research paper by **Alla Klimchuk**, Senior Researcher, **Olha Bui**, PhD in Chemistry, Leading Forensic Expert, **Olga Pashkova**, Leading Forensic Expert, in cooperation with **José Manuel Colodrás**, forensic expert of the National Police of Spain is dedicated to research on grape and fruit and berry wines and detection of their falsification. The authors note that at the research beginning on unknown liquids, it is first of all necessary to determine nature of the object research that is possible only if its specifics are

identified. For this purpose, researchers compiled a list of organic acids present in grape and fruit-berry wines and ways of determining such acids; indicated signs of adulteration of wines by adding dyes and proposed methods for detecting possible adulteration. Since one of requirements for forensic science is mandatory confirmation of analysis results by at least two reliable methods, the article examines options for research on some synthetic dyes using the method of thin-layer chromatography and IR spectroscopy.

In the following article, **Nataliya Panchenko**, **Irina Hordiienko** and **Olga Grek** discussed the issue of forensic economics on fuel accounting in Armed Forces of Ukraine that is extremely important and relevant in current conditions. From the first day of invasion, Russian invaders purposefully destroyed Ukrainian industrial (in particular, oil refining) and social infrastructure. Not only ordinary citizens felt shortage of fuel in Ukraine. In fact, our State has to build a new infrastructure for supply of oil products through western borders from scratch. Therefore, effective resolution of the use issues of fuel by military units of Armed Forces of Ukraine in circumstances of Russian aggression can directly affect combat capability of our State.

In the article, author noted peculiarities of accounting and movement of military property that are characteristic of the rules for receiving, accounting, issuing and writing off material assets in Armed Forces of Ukraine and provided a fairly detailed list of legal regulations that forensic economists should be guided by in their professional activities while accounting for military property.

In his article, **Artem Koshkarov**, Senior Researcher, Graduate Student examines issues related to determination

of a technical malfunction of a vehicle braking system while road accident analysis. Specifics of preparation and appointment of road accident analysis of technical condition of vehicles aimed at clarifying the technical condition of the brake system of vehicles, preparation of initial data and research objects are outlined. Theoretical provisions and practical recommendations on specific expertise while research on technical condition of the brake system of vehicles and detection of malfunctions have been formulated; causal relationship between the driver's actions and the documented malfunctions of the vehicle's brake system, etc. is determined.

The authors of another research paper, **Olha Brendel, Kostiantyn Nikulin** (both – Ukraine) and **Elvira Aslanovi** PhD in Philology (Georgia) investigated possibilities of video and audio analysis for evidence formation in case of investigation of crimes related to human trafficking. In conditions of the war that is raging on territory of Ukraine as a result of Russian aggression, socially dangerous and global problem of human trafficking and aggravation of various types of people exploitation has gained considerable relevance. The co-authors considered common mistakes while obtaining evidence by investigation subjects that lead to the loss of a significant part of such evidence at the stage of the trial. The main attention is focused on specifics and modern possibilities of video and audio analysis while investigation of such crimes; it is considered in detail what information from investigated records and for what purpose investigative bodies use in cases related to human trafficking. The authors carefully analyzed the tasks solved by video and audio analysis and their role in law enforcement activities for further use in court proceedings. On the basis of

researched content, attention was focused on the results of forensic examinations that make possible to solve relevant issues regarding qualification of the facts and circumstances of committed crimes in the field of human trafficking and human exploitation, as well as on strengthening evidence base in the case. They proposed a number of requirements that should be followed for the proper preparation of materials for further video and audio analysis.

The content by **Arsen Baghdasaryan**, scientist from Armenia is devoted to research on fingerprints and palms using the Projectina Docustat DS-210 and Regula 4305 special devices. The author singled out and described specifics of technological research on fingerprints and palms, carefully analyzed the methodical approach that enables forensic research without damaging integrity of the paper medium on which the prints are left. The article presents conducted research results focusing on effectiveness of using the Projectina Docustat DS-210 and Regula 4305 devices in forensic practice.

Editorial Board of the Theory and Practice of Forensic Science and Criminalistics research paper collection is grateful to authors of the content sent for publication who adhere to appropriate level of formal and ethical requirements for submitting scientific articles for publication. The mentioned norms are determined by standards of the quality of research paper and the rules of their presentation, generally accepted in the world scientific community, in particular, publishing principles of the Publishing Ethics Resource Kit (PERK), Elsevier recommendations, Committee on Publication Ethics (COPE), Ethical Code the Ukrainian scientist, as well as work experience of foreign and

Ukrainian professional communities, scientific organizations, editorial boards and publishing houses. We appreciate the contribution of each scientist to development of the Theory and Practice of Forensic Science and Criminalistics research paper collection by providing

legal support for forensic activity, we jointly build and strengthen foundation of supremacy of law of modern and future Ukraine.

We invite everyone to cooperate!

Together we will win!

Glory to Ukraine!

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Issues of Compensation for Damages Caused to a Citizen as a Result of Armed Aggression: Criminal and Procedural Aspects

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^b Formal analysis.

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Current issues of reparation for damages caused to Ukraine by Russia armed aggression: a full-scale war, unprecedented (compared to the Second World War and the rest of the wars of the 21st century) in scope, cruel in essence, genocidal in purpose, devastating in means and consequences are considered. One of consequences of war and war crimes committed by Russian aggressors starting from February 24, 2022, is massive destruction and damage to housing and other property of Ukrainian citizens. Within framework of initiated criminal proceedings, damages are compensated by filing a civil lawsuit. However, specifics of the grounds of such a lawsuit cause the occurrence of certain risks for the victim, as well as problems with law enforcement and the exercise of their powers by investigators and prosecutors. In particular, difficulties may lie in the impossibility of inspecting the scene of the incident, which will ultimately negatively affect the determination of the amount of damage caused (calculation of the material equivalent of the damage). Determining the amount of damage caused as a result of the destruction or destruction of housing is also problematic, as it often requires the appointment of

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an expert opinion, while the scale of the destruction within the state makes it impossible to conduct such an expert opinion in a reasonable time. Attention is focused on the issues of establishing the person who should be responsible for the claim, or the civil defendant. Possibility of overcoming the jurisdictional immunity of Russia as a defendant in the declared civil lawsuits was also considered. Conducted research made it possible to formulate proposals on mechanism of compensation for the damage caused, as well as on improvement of current criminal procedural legislation of Ukraine.

Keywords: compensation for damage in criminal proceedings; civil claim in criminal proceedings; damage caused by criminal offense; victim; civil defendant.

Research Problem Formulation

On February 24, 2022, Russia launched a full-scale war against Ukraine, unprecedented (compared to the Second World War and other wars of the 21st century) in scale, cruel in essence, genocidal in purpose, devastating in means and consequences; they brutally and improperly tried to hide under the name “military operation”. The scale of this tragedy for Ukraine is evidenced by the data of the Office of the United Nations High Commissioner for Human Rights (hereinafter referred to as OHCHR UN): 4,634 dead civilians in the period from February 24 to 24:00 on June 21. However, OHCHR believes that the real number is much higher, as it is difficult to obtain information from places of intense hostilities, and many reports require confirmation. In addition, there is no reliable information about the dead in Mariupol (Donetsk region), Izium (Kharkiv region), Popasna (Luhansk

region), from where reports of numerous civilian casualties have been received to this day. These data are subject to further verification and do not belong to the above statistics. According to confirmed UN data, 1,780 men, 1,194 women, 148 boys and 131 girls died, while the gender of 41 children and 1,340 adults cannot yet be ascertained¹.

OHCHR UN notes that since war beginning, more than 8 million people have left Ukraine. The largest number of refugees left for Poland, more than 4 million Ukrainians. Ukrainian citizens are hiding from the war in Romania, Moldova, Slovakia, Hungary, and the rest of Europe.

Since the beginning of the Russian invasion, almost a third of Ukrainians have forcibly left their homes: more than 7.7 million people have been internally displaced due to the war. This is the biggest displacement crisis in the world today. The UN estimates that 15.7 million people are in urgent need of humanitarian assistance and protection².

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- 1 Війна в Україні забрала життя щонайменше 4634 цивільних, 5769 поранено / Інформаційне агентство Інтерфакс Україна. 22.06.2022. URL: <https://ua.interfax.com.ua/news/general/840932.html> (date accessed: 22.05.2022).
 - 2 Україна. Квітень 2022 року. UNHCR. The UN Refugee Agency : щоміс. інформ. бюл. URL: https://www.unhcr.org/ua/wp-content/uploads/sites/38/2022/06/Ukraine-Monthly-Operational-Update-April-2022_UKR.pdf (date accessed: 02.06.2022).

The losses of the Ukrainian economy are also horrifying. According to the Kyiv Institute of Economics, as of June 8, the direct losses of the Ukrainian economy from damage and destruction of residential and non-residential buildings and infrastructure are equal to 103.9 billion dollars (3 trillion UAH). We should note that this number takes into account the complete destruction of the relevant objects.

At the beginning of June, as a result of the war of Russia against Ukraine: 44.8 million m² of residential buildings were lost (39,379 million dollars); 23.9 thousand km of roads were damaged (30,034 million dollars); 11 airports and 12 military airfields (6,817 and 468 million dollars, respectively); 656 health care institutions (1,147 million dollars); 305 bridges (1,692 million dollars); 1,177 institutions of higher and secondary education (1,127 million dollars); 111 administrative buildings (607 million dollars); 668 kindergartens (576 million dollars); 141 religious buildings (81 million dollars); 203 cultural buildings (270 million dollars); 20 shopping centers (345 million dollars); 28 oil depots (227 million dollars). The pride of Ukrainian aircraft construction, the world's largest and most powerful the Antonov An-225 Mriya transport aircraft has been destroyed³.

The war takes lives of Ukrainians, destroys their homes, the usual

infrastructure all components of happy life before the war.

However, the key task of law enforcement agencies is to record every fact of war crimes and bring to justice those responsible for solving the war and specific war crimes. As of June 23, 2022, 19,086 crimes of aggression and war crimes; 9,396 crimes against national security were entered into the Unified Register of Pre-trial Investigations. A pre-trial investigation is underway into the so-called main case of aggression of Russian Federation, in which 623 persons representatives of military and political leadership of the aggressor country were reportedly suspected⁴.

Among the criminal proceedings initiated, 18,383 were initiated under Art. 438 *Violation of the law of war* of the Criminal Code of Ukraine⁵.

Many residents of Ukraine have suffered the destruction of their housing, sometimes it is not just destroyed, but destroyed and is not subject to restoration. Adjacent or household buildings, cars, household plots, etc. have been destroyed. Hosts are beginning to claim damages for armed aggression.

Already on 20.03.2022, the Cabinet of Ministers of Ukraine (hereinafter referred to as the *CabMin*) adopted Resolution *On Approval of the Procedure for Determining Damage and Damage Caused to Ukraine as a Result of the Armed Aggression of the Russian Federation* № 326⁶, dated on 26.03.2022 —

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- 3 «Росія заплатить» / damaged.in.ua. Проект зі збору, оцінки й аналізу інформації про матеріальні втрати України від війни з Росією / Kyiv School of Economics. URL: <https://kse.ua/ua/russia-will-pay> (date accessed: 02.06.2022).
 - 4 Злочини, вчинені в період повномасштабного вторгнення РФ/ Офіц. сайт Офісу Генпрокурора. URL: <https://www.gp.gov.ua> (date accessed: 02.06.2022).
 - 5 Кримінальний кодекс України від 05.04.2001 р. № 2341-III (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/2341-14#Text> (date accessed: 22.05.2022).
 - 6 Про затвердження Порядку визначення шкоди та збитків, завданих Україні внаслідок збройної агресії Російської Федерації : Постанова КМУ від 20.03.2022 р. № 326 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/326-2022-%D0%BF/ed20220512#Text> (date accessed: 22.05.2022).

Resolution On Collection, Processing and Accounting of Information on Damaged and Destroyed Immovable Property as a Result of Combat Acts, Terrorist Acts, Sabotage Caused by the Military Aggression of the Russian Federation № 380. This Resolution approves the Procedure for Submitting Information Notice on Damaged and Destroyed Immovable Property as a Result of Combat Acts, Terrorist Acts, Sabotage Caused by the Military Aggression of the Russian Federation ⁷. A draft law on compensation for damage caused to the victim as a result of the armed aggression of the Russian Federation ⁸ has been developed and submitted to the Verkhovna Rada of Ukraine for consideration. Fixing any destruction and future compensation for damage caused by aggression is one of the priority tasks of the state.

Taking into account the fact that the damage was caused due to commission of war crimes, the question arises about the possibility of compensating it to the victims within the framework of criminal proceedings.

Analysis of Essential Researches and Publications

As we can see, one of the ways to protect the property and personal non-property rights and legitimate interests of the victims, violated as a result of the commission of a criminal offense or other socially dangerous act, is compensation (compensation) for the damage caused. Such compensation is an international legal standard established in the following documents: International Covenant on Civil and Political Rights ⁹; European Convention on the Compensation of Victims of Violent Crimes dated on 1983 ¹⁰; Declaration of Basic Principles of Justice for Victims of Crime and Abuse of Power 1985 ¹¹; Recommendations Rec (2006)8 of the Committee of Ministers of the Council of Europe to member states on assistance to victims of crimes¹²; Resolutions (77)27 of the Committee of Ministers of the Council of Europe on compensation to victims of crime (September 28, 1977); Recommendations N R(85)11 of the

- 7 Про збір, обробку та облік інформації про пошкоджене та знищене нерухоме майно внаслідок бойових дій, терористичних актів, диверсій, спричинених військовою агресією Російської Федерації : Постанова КМУ від 26.03.2022 р. № 380 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/380-2022-%D0%BF/ed20220526#Text> (date accessed: 02.06.2022).
- 8 Проект закону про відшкодування шкоди, завданої потерпілому внаслідок збройної агресії Російської Федерації від 17.05.2022 р. № 7385. URL: http://w1.c1.rada.gov.ua/pls/zweb2/webproc4_1?pf3511=74243 (date accessed: 02.06.2022).
- 9 Міжнародний пакт про громадянські і політичні права : прийнят. Генасамблеєю ООН 16.12.1966 р. ; ратифік. Указом Президії ВР УРСР від 19.10.1973 р. № 2148-VIII. URL: https://zakon.rada.gov.ua/laws/show/995_043#Text (date accessed: 02.06.2022).
- 10 European Convention on the Compensation of Victims of Violent Crimes (ETS No. 116) : Strasbourg, 24.XI.1983 / Council of Europe Portal. URL: <https://rm.coe.int/1680079751> (date accessed: 02.06.2022).
- 11 Declaration of Basic Principles of Justice for Victims of Crime and Abuse of Power : Resol. ad. by the Gen. Assembly 29 Nov. 1985. No. 40/34. URL: <http://www.un-documents.net/a40r34.htm> (date accessed: 02.06.2022).
- 12 Рекомендація Rec (2006) 8 Комітету Міністрів Ради Європи державам-членам щодо допомоги потерпілим від злочинів : ухвал. Ком. Міністр. Ради Європи 14.06.2006 р. на 967-му засід. заступ. міністр. URL: https://issuu.com/uccg/docs/12_rec_2006__8_of_coe_ukr (date accessed: 02.06.2022).

Committee of Ministers of the Council of Europe to member states on the position of the victim within the framework of criminal law and proceedings (June 28, 1985); Directive of the Council of the European Union 2004/80/EC on compensation to victims of crimes (April 29, 2004); Directive 2012/29/EU of the European Parliament and of the Council of the European Union on establishing minimum standards for the rights, support and protection of victims of crime and many others¹³.

Considering this international community approach, as well as requirements of the Constitution of Ukraine (Article 3), according to which a person, his life and health, honor and dignity, inviolability and security are recognized in Ukraine as highest social values and affirmation and guarantee of rights and human freedoms are determined by the content, direction and main duty of the state¹⁴, domestic legislator provided in the Criminal Procedural Code of Ukraine¹⁵ a set of norms aimed at ensuring compensation for damage caused by a criminal offense, in particular, the introduction of the institution of civil action in criminal proceedings.

Civil claim issues of application and consideration in criminal proceedings and compensation for the damage caused to victim were devoted to research papers as well-known domestic scientists (Yu. P. Alenin, S. A. Alpert, O. A. Banchuk, I. V. Hloviuk, V. H. Honcharenko, M. I. Hoshovskyi, Yu. M. Hroshevyi, Yu. O. Hurdzhi, O. P. Kuchynska,

L. M. Loboiko, V. T. Maliarenko, M. M. Mykhieienko, V. T. Nor, D. P. Pysmennyi, M. A. Pohoretskyi, V. O. Popeliushko, L. D. Udalova, V. P. Shybiko, M. Ye. Shumylo), as such young scientists (I. A. Vorobiova, S. V. Davydenko, M. I. Demura, O. R. Mala, D. Yu. Kavun, Kh. R. Kakhnych, N. S. Kravchenko, A. M. Stebeliev, I. I. Tataryn et al.).

However, mentioned authors left aside the issue of compensation for damage caused to a citizen by the armed aggression of any state.

Article Purpose

Analysis of means of compensation for damage caused by the armed aggression of the Russian Federation against Ukraine; determination of possible risks from the statement of civil claim within the framework of criminal proceedings; identification of problems of enforcement (for example, due to inability to inspect the scene); calculation of the amount of damages caused by military actions; identification of the person who should be responsible for the claimed claim, or civil defendant. Authors also consider the purpose of the article to be the development of proposals for effective compensation mechanism and improvement of criminal procedural legislation.

Main Content Presentation

It should be noted that Criminal Procedural Code of Ukraine of Ukraine provides for

13 Банчук О. А., Дмитрієва І. О., Малишев Б. В., Саїдова З. М. Відшкодування потерпілим від насильницьких злочинів: європейські стандарти і зарубіжне законодавство : збірник / за заг. ред. О. А. Банчука. Київ, 2015. С. 34—112.

14 Конституція України : Закон України від 28.06.1996 р. № 254к/96-ВР (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/254k/96-vp#Text> (date accessed: 02.06.2022).

15 Кримінальний процесуальний кодекс України від 13.04.2012 р. № 4651-VI (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

several ways to compensate for damage caused by a criminal offense or other socially dangerous act: 1) voluntary (compensation) — Part 1 of Art. 127; 2) compulsory (compensation), in particular: a) under a civil lawsuit — Part 2 of Art. 127, Art. 128 and 129; b) with a pledge to execute a sentence in terms of property penalties (Part 11 of Art. 182); c) at the expense of the State Budget of Ukraine (Part 3 of Art. 127, Part 1 of Art. 130); d) criminal law restitution (Parts 1 and 5 of Part 9, Part 11 and 12 of Art. 100); e) under the right of retroactive claim (Part 2 of Art. 130) ¹⁶.

One of the most modern and common ways of compensating the victim in criminal proceedings is a claim form. At the same time, in recent years, in the legal literature, scholars have tried to provide arguments in favor of the opinion that institution existence civil lawsuit in criminal proceedings is inappropriate (noting that the “joint process” does not correspond to the nature and essence of the criminal process), despite its exclusively humane orientation. Gaps in regulatory regulation necessitated the need to formulate similar constructions of articles of criminal procedural legislation to norms of civil procedural legislation. Since in criminal proceedings the guilt of a person in committing a crime (and in causing damage) is proved by the bodies that conduct the process, and in civil proceedings each party is obliged to prove the circumstances to which it

refers, in civil proceedings for such proof the parties submit much more efforts, perform their functions more diligently than parties to criminal proceedings. The bodies of the pre-trial investigation are forced to be distracted from the answer to the main question of the investigation about the guilt of the person to prove the extent of caused damage, ensure the rights and legal victim interests or civil plaintiff, identify, collect documents to confirm ownership rights, etc. All this significantly lengthens the period of pre-trial investigation, sometimes causing controversial situations. In the case of a poor quality pre-trial investigation (in part of proving a civil claim) by a person who, in fact (given his position) is interested only in bringing the guilty to criminal responsibility, leads to the court leaving the civil claim without consideration, and the victim is forced to file a claim in the order of civil proceedings with the hope of compensating for damages caused by a criminal offense. In addition, scientists note: sometimes a judge (as an expert in the field of criminal justice), considering a civil lawsuit, does not delve into the material aspect, considering the subject of the lawsuit superficially. Even a well-versed prosecutor who supports the state prosecution in court is not always able to refute the arguments of the defense side regarding the civil lawsuit, and in case the lawsuit is left without consideration, he does not challenge this decision in the appeal procedure ¹⁷.

16 Кримінальний процесуальний кодекс України ... URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

17 Кахнич Х. Р. З'єднаний процес як спосіб захисту прав потерпілого від злочину у кримінальному судочинстві : дис. ... канд. юрид. наук. Львів, 2013. С. 27—28 ; Титова В. Н. Проблемы реализации норм уголовно-процессуального законодательства о возмещении ущерба, причиненного преступлением : монография. Москва, 2013. С. 4—5 ; Шадрин В. С. Обеспечение прав личности при расследовании преступлений. Москва, 2000. 232 с.

We should note that scientists have expressed similar opinions recently, when the legal relations related to the rights to own, use and dispose of property have become significantly more complicated, the property volume that can be owned by a person has increased significantly and its value has increased the number of types of economic activities and economic relations have become more complicated. The victims file civil claims for compensation for moral damage, which is very difficult to calculate and is sometimes the topic of disputes between the civil plaintiff and the person responsible for damage caused by criminal offense.

However, such scientific trends are negative. The current Criminal Procedural Code of Ukraine is constantly criticized for insufficient attention to the mechanisms for protecting the rights of the victim, because depriving the victim of the right to compensate for the damage caused by a criminal offense will amount to several steps backwards compared to the existing procedure, since without such compensation, the tasks of criminal proceedings declared in Art. 2 of the Criminal Procedural Code of Ukraine cannot be considered solved ¹⁸.

Advantages of submitting, considering and resolving a civil claim in a criminal proceeding are obvious. Since the size of the damage often affects the legal qualification of the crime and the degree of punishment, the determination of the size of the damage requires the comprehensiveness and completeness of the investigation of all the circumstances of the criminal proceedings (Part 2, Article 9 of the Criminal Procedural Code of Ukraine ¹⁹), it

is easier to prove the existence of grounds and the size of the civil claim (because the type and the amount of the damage caused belongs to the circumstances that are subject to investigation in each criminal proceeding and which are enshrined in Clause 3, Part 1, Article 91, Clause 6, Part 1, Article 505 of Criminal Procedural Code of Ukraine ²⁰ and the subjects of proof are mainly not the victim (civil plaintiff) and investigator and prosecutor). Only in the event that the victim supports the accusation in private prosecution cases or when the prosecutor refuses to support the accusation, the victim becomes the subject of proof of a civil claim (Part 1 of Article 92, Articles 338 and 340, Chapter 36 of the Criminal Procedural Code of Ukraine ²¹). Consideration of a civil lawsuit within the framework of criminal proceedings significantly accelerates compensation for the damage caused, since a civil lawsuit is: a) an effective means of eliminating the negative consequences of an illegal act as soon as possible; b) a universal way of restoring violated property and personal non-property rights and legal interests of individuals. The combined process saves time and state funds, eliminates the need to consider the same circumstances twice in criminal and civil proceedings and the victim is not forced to experience the events of a criminal offense twice, which would be required by proof in each type of process. Equally important is the exemption of the civil plaintiff from paying the court fee (as opposed to the civil process). In order to protect the rights and legal interests of victims who have been harmed by a criminal offense and who, due to their physical condition or

18 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

19 Ibid.

20 Ibid.

21 Ibid.

financial situation, underage, advanced age, incapacity or limited capacity, are unable to defend their rights on their own, a civil lawsuit may also be brought by the prosecutor (para. 3 Part 1 of Article 1311 of the Constitution of Ukraine²²; Part 12 of Part 2 of Article 36, Part 3 of Article 128 of the Criminal Procedure Code of Ukraine²³; Part 2 of Part 1 of Article 2, Article 23 of the Law of Ukraine: *On the Prosecutor's Office*²⁴). The declared civil lawsuit stimulates pre-trial investigation bodies in criminal proceedings to take measures to ensure the declared lawsuit and future compensation for damage: for example, to seize property (clause 4, part 2, article 170 of the Criminal Procedural Code of Ukraine²⁵).

Thus, as mentioned above, a civil lawsuit in criminal proceedings can be one form of compensation for damage caused, in particular, by Russian aggression.

The following actions of an investigator, prosecutor can be considered as means of ensuring compensation for damage caused by criminal offense: 1) independent detection of a criminal offense or acceptance of a statement about its commission from an injured person, entering information into Unified Register of Pre-Trial Investigations; 2) acceptance of an application to involve a person in criminal proceedings as a victim; 3) explaining to the victim his right to file a civil lawsuit in criminal proceedings; 4) accepting a statement of claim from a person who was harmed by a criminal offense; 5) proving nature and extent of

the damage; 6) establishing and involving in criminal proceedings a person guilty of a criminal offense or a person responsible for damage caused by a guilty person; 7) application of measures to ensure criminal proceedings to ensure the declared civil claim.

However, it is worth noting some sensitive points related to the filing, proof and consideration of a civil claim in criminal proceedings in the event of harm caused by armed aggression.

The first problem is the impossibility (in particular, due to military actions) in accordance with Art. 214 of the Criminal Procedural Code of Ukraine²⁶ to inspect destroyed or destroyed as a result of shelling, aerial bombardment, etc. housing or other property after submitting a statement about the commission of a crime.

As you can see, the scene inspection is carried out with an important procedurally significant goal to discover and record information about the circumstances of the commission of a criminal offense (Part 1 of Article 237 of the Criminal Procedural Code of Ukraine²⁷). This is the only investigative action that is carried out before the information is entered into Unified Register of Pre-Trial Investigations, or (in lack of access to Unified Register of Pre-Trial Investigations) the investigator, prosecutor, decides to initiate criminal proceedings. The inspection itself is an investigative (research) action acquiring key importance, since (as an urgent) it has

22 Конституція України URL: <https://zakon.rada.gov.ua/laws/show/254к/96-вр#Text> (date accessed: 02.06.2022).

23 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

24 Про прокуратуру : Закон України від 14.10.2014 р. № 1697-VII (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/1697-18#Text> (date accessed: 02.06.2022).

25 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

26 Ibid.

27 Ibid.

a local purpose: 1) to record the fact of a committed criminal offense; 2) directly examine and record the destroyed home and/or other personal property; 3) find out the previous reasons for the destruction or destruction of housing or other property.

On the basis of information recorded while the inspection, information is obtained about the circumstances of the commission of the criminal offense affecting the decision to enter information into Unified Register of Pre-Trial Investigations, the preliminary legal criminal offense qualification with article indication (article par) on criminal liability and find out other circumstances necessary for pre-trial investigation.

Combat operations can make it impossible or significantly difficult to inspect the scene. Certainly,, it is possible to fill in the gaps of the scene first inspection during a repeated and additional inspection. However, the vulnerability of this approach lies in the fact that most often the victims are already starting to restore the house and/or farm buildings that makes impossible to record in detail the destruction extent and determine the damage caused by the crime in case of a repeat inspection.

Without delving into detailed consideration of the issues of conducting the scene inspection during hostilities (since this is the subject of a separate research), we note that a high-quality inspection, correct recording of the destruction with the obligatory professional involvement and implementation of photo and video recording will ensure an objective reflection of committed criminal offense, will make possible to detect and record details that are weakly visible and invisible under visual observation, as well as destruction in the dynamics that will

contribute to objective determination of the damage caused to victim.

Impossibility of the investigator, prosecutor, to go to the scene of committed war crime leads to the fact that victims try to independently record the premises, buildings, structures, etc., that were damaged and/or destroyed as a result of hostilities (hitting means of destruction, explosions, fires, etc.). Current criminal procedural legislation does not prohibit such recording. According to the Criminal Procedural Code of Ukraine, victim has the right to submit evidence in support of his statement (clause 3, part 2, article 56 of the Criminal Procedural Code of Ukraine), as well as to submit evidence to the investigator, prosecutor, investigating judge, court throughout the entire criminal proceedings (clause 3, part 1 Article 56 of the Criminal Procedural Code of Ukraine)²⁸. In addition, the facts of destruction, destruction of homes, buildings, etc. are recorded by representatives of domestic and/or foreign mass media, creating photo and video documents. However, their inclusion in the materials of criminal proceedings is extremely vulnerable and may cause problems with evaluation, recognition as inadmissible as evidence: since they were collected by non-professional participants in criminal proceedings.

As it is known, the order of criminal proceedings and resolution of its tasks is ensured by criminal procedural form: a set of legally established legal procedures, conditions, guarantees, which observance contributes to achievement of tasks of criminal proceedings. Within the framework of the criminal procedural form, the Criminal Procedural Code of Ukraine provides for a system of means by which criminal procedural evidence is carried out (collection (consolidation), verification and

28 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

evaluation of evidence). The prosecuting party collects evidence by “conducting investigative (search) actions and covert investigative (search) actions, demanding and receiving from state authorities, local self-government bodies, enterprises, institutions and organizations, officials and individuals things, documents, information, expert opinions, conclusions of audits and reports of inspections, conducting other procedural actions” (Part 2 of Article 93 of the Criminal Procedural Code of Ukraine)²⁹. In view of the principle of publicity, the prosecutor and the investigator are obliged within their competence to start a pre-trial investigation in case of detection of signs of a criminal offense (except for cases when criminal proceedings can be started only at the request of the victim) or in case of receipt of a statement (notification) about the commission of a criminal offense, as well as take all the measures prescribed by law to determine the event of a criminal offense and the person who committed it (Art. 25 of the Criminal Procedural Code of Ukraine)³⁰. Therefore, it is the investigator, the prosecutor, who is obliged to conduct an inspection of the scene of the incident after submitting a statement or directly detecting a committed criminal offense, to record it in accordance with the requirements of the criminal procedural form.

Criminal Procedural Code of Ukraine stipulates that the obligation to prove the circumstances provided for in Art. 91 of the Criminal Procedure Code of Ukraine, entrusted to the investigator and prosecutor. The victim proves such circumstances in

exceptional circumstances, if he supports the prosecution in the case of a private prosecution, or the prosecutor refused to support the public prosecution (Article 92 of the Criminal Procedural Code of Ukraine)³¹. Regarding civil claimant, the law provides for the rights and obligations established in the Criminal Procedure Code of Ukraine for the victim in the part that concerns the civil claim (part 3 of Article 61 of the Criminal Procedure Code of Ukraine)³². At the same time, for a clear representation of the procedural status of the latter, a systematic interpretation of a number of norms of Criminal Procedural Code of Ukraine is necessary.

As you know, the circumstances to be proven are outlined in Art. 91 Criminal Procedural Code of Ukraine³³. From the declared civil claim proof, only three can be singled out among such circumstances: 1) criminal offense (time, place, method and other circumstances of the commission of the criminal offense); 2) guilt of the accused in committing a criminal offense, form of guilt, motive and purpose of the criminal offense; 3) type and amount of damage caused by a criminal offense. However, it is worth agreeing with domestic scientists that this state of regulation in the Criminal Procedural Code of Ukraine of relations with the proof of a civil claim does not contribute to their proper implementation by the bodies of pre-trial investigation, since proving all the circumstances necessary for making a correct decision on a civil claim in criminal proceedings is a guarantee of its fair solution³⁴.

29 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

30 Ibid.

31 Ibid.

32 Ibid.

33 Ibid.

34 Аленін Ю., Пожар В. Цивільний позов у кримінальному провадженні: особливості доказування та вирішення. *Право України*. 2014. № 10. С. 117.

Unfortunately, Criminal Procedural Code of Ukraine of Ukraine does not establish the of proof topic in a civil lawsuit: it is much broader than the circumstances that are subject to proof and are contained in Art. 91 Criminal Procedural Code of Ukraine ³⁵. The special (or local) subject of proof for a civil claim contains the following elements: 1) event of a criminal offense that caused damage (time, place, method and other circumstances of committing such an offense); 2) presence of damage from this offense and its specific type; 3) direct cause-and-effect relationship between the offense and the damage caused by it; 4) the fault of the person who committed the offense in causing damages; 5) a person who was harmed by an offense; 6) person who will be materially responsible for the declared civil claim; 7) amount of damages to be compensated.

Despite the fact that the obligation to prove the circumstances provided for in Art. 91 of the Criminal Procedural Code of Ukraine, entrusted to the investigator and prosecutor, when submitting a statement (or a lawsuit), the victim and/or civil plaintiff is obliged to indicate the damage caused by the criminal offense. The content of a civil lawsuit is not determined by criminal procedural legislation. At the same time, Part 4 of Art. 128 of the Criminal Procedural Code of Ukraine stipulates that form and content of the statement of claim should meet the requirements for claims filed in civil proceedings ³⁶ According to Art. 175 of Civil Procedural Code of Ukraine ³⁷ in the claim statement, the plaintiff sets

out his claims regarding the subject of the dispute and their justification. The claim statement is submitted to the court in writing, it is signed by the plaintiff, or his representative, or another person who is granted the right to apply to the court in interests of another person. Among other things, claim statement should contain: 1) claim *price*, if the claim is subject to a monetary assessment; 2) *reasonable calculation* of amounts charged or disputed; 3) content of claims (method(s) of protecting rights or interests provided for by law or contract, or other method(s) of protecting rights and interests that do not contradict the law and that plaintiff asks the court to determine in the decision); 4) statement of circumstances by which the plaintiff substantiates his claims; indication of evidence to confirm these circumstances (clauses 3, 4 and 5 of part 3 of Article 175 of the Civil Procedural Code of Ukraine) ³⁸. If a civil plaintiff files a lawsuit for the recovery of monetary funds for damage caused by a crime, he must indicate the amount that, in his opinion, the court should recover (clause 1, part 1, article 176 of Civil Procedural Code of Ukraine ³⁹.

If proving the fact of crime commission causing the emergence of criminal-legal relations, is entrusted to the investigator, prosecutor, then claim topic (substantive legal claim for compensation for damage caused by a war crime) must be confirmed by the civil plaintiff. Thus, it can be stated that civil defendant should assist the investigator, prosecutor in clarifying circumstances that are subject to proof,

35 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

36 Ibid.

37 Цивільний процесуальний кодекс України від 18.03.2004 р. № 1618-IV (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/1618-15/ed20220101#Text> (date accessed: 02.06.2022).

38 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

39 Ibid.

that is, he is the one who provides the documents that confirm the claim price and the right to property ownership, etc. However, sometimes this is quite difficult to do if the situation is complicated by destruction of property ownership documents together with the housing.

Thus, in accordance with the requirements of Clause 6, Part 2 of Art. 242 of Criminal Procedural Code of Ukraine ⁴⁰, the investigator or prosecutor is obliged to provide forensic examination to determine the amount of material damages, if the victim cannot calculate them and has not provided a document confirming the amount of such damage. Therefore, most often, determining the amount of damage from destruction or destruction of a person's home or other property is possible only by appointing and conducting construction and technical, commodity and other types of expertise. The need to apply expert knowledge in these extremely complex situations is obvious. The scale of the destruction within the state, significant number of proceedings that requiring forensic examination, significantly reduce efficiency and speed of the process of compensation for the damage caused by a civil claim within the framework of criminal proceedings.

We will note one nuance that is important for filing and resolving a civil lawsuit. A person who has been harmed by a war crime has the right, during criminal proceedings, *"submit a civil lawsuit against the suspect, accused, or against a natural or legal person who, by law, is civilly liable for the damage caused by the actions of the suspect, the accused"* before the start of the trial. (Part

1 of Article 128 of the Criminal Procedural Code of Ukraine) ⁴¹. In this context, let's consider two possible options. Some criminal proceedings have been initiated against specific persons - prisoners of war, who have been notified of the suspicion of committing war crimes (for some of them, indictments have already been sent to the court, even several verdicts have been issued, according to which they were found guilty). In such cases, within the framework of criminal proceedings, a civil action can be brought against a specific suspect or accused. However, even if the guilt of such a person in committing a crime (in particular, provided for in Article 438 of Criminal Code of Ukraine ⁴²) is proven, the execution of the court decision is impossible in the part of the civil lawsuit due to the lack of property of prisoners of war.

In another case, despite the significant number of initiated criminal proceedings and significant damage caused by the violation of war law, it is difficult to determine the person guilty of committing this and other crimes that indefinitely postpones legitimate expectations of the victim who seeks compensation.

It is logical to assume that during hostilities, aggressor state is responsible for the damage caused by the actions of the military. In this aspect, we note that issue of the procedural status of a civil defendant in criminal proceedings cannot be called sufficiently researched in domestic criminal procedural science. If the starting point is that the civil defendant can be a person who, by law, bears civil responsibility for the damage caused by the criminally illegal actions (inaction)

40 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

41 Ibid.

42 Кримінальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/2341-14#Text> (date accessed: 02.06.2022).

of the suspect, the accused or an insanity committed a socially dangerous act and against whom a civil lawsuit has been filed in according to the procedure provided by the Criminal Procedural Code of Ukraine, then to find out who exactly can be a civil defendant, one should refer to the norms of civil legislation.

From the norms of the Civil Code of Ukraine⁴³ the following groups of individuals and legal entities can be singled out, which may bear civil liability for the damage caused: 1) parents (adoptive parents) or guardians (citizens or a corresponding educational, medical institution, institution of social protection of the population etc., which by law is the guardian of a minor suspect, accused; Articles 1178, 1179 of the Civil Code of Ukraine); 2) guardian of a person recognized as incapable, or a legal entity, is obliged to supervise him, if they do not prove that the damage was not caused by their fault (Article 1184 of the Civil Code of Ukraine); 3) legal or natural persons – owners of the source of increased danger, with which the suspect, the accused caused harm to the victim (Article 1187 of the Civil Code of Ukraine); 4) insurance company in which the suspect, accused has insured his liability under mandatory insurance, in the event of an insured event during crime commission (Article 979 of Civil Code of Ukraine and Article 7 of Law of Ukraine: *On Insurance*⁴⁴); 5) legal or natural persons, if the suspect, the accused (who was their employee) caused damage during the performance of his labor (official, official) duties (Article 1172 of the Civil Code of Ukraine).

Therefore, civil defendant is an independent participant in criminal proceedings, involved in it in the presence of legal grounds, due to which he bears civil responsibility for the actions of the suspect. However, in Part 1 of Art. 79⁴⁵ of Law of Ukraine: *On Private International Law* stipulates judicial immunity, according to which the filing of a lawsuit against a foreign state, the involvement of a foreign state in the case as a defendant or a third party, the seizure of property belonging to a foreign state and located on its territory of Ukraine, use of other means of securing a claim and enforcement of such property in relation to such property is possible only with the consent of the competent authorities of the relevant State, unless otherwise stipulated by an international treaty of Ukraine or the law of Ukraine. In this way, immunity of a foreign state from civil liability is ensured.

It is clear that domestic criminal procedural and civil legislation was adopted in peacetime and is designed to be applied to peacetime legal relations. In addition, responsibility for committed war crimes is provided for by the norms of international law which turned out to be completely imperfect. Such a situation requires a new toolkit, in particular, aimed at reparation for damage caused by war crimes. Ukraine should develop and implement such a compensation mechanism, through radical changes and additions to current legislation regulations, creating new compensation paradigm.

We believe that we should not neglect any opportunity aimed at restoring the

43 Цивільний кодекс України від 16.01.2003 р. № 435-IV (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/ru/435-15/ed20220507> (date accessed: 02.06.2022).

44 Про страхування : Закон України від 07.03.1996 р. № 85/96-ВР (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/85/96-%D0%B2%D1%80/ed20220615#Text> (date accessed: 02.06.2022).

45 Про міжнародне приватне право : Закон України від 23.06.2005 р. № 2709-IV (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/2709-15#Text> (date accessed: 29.06.2022).

violated victim rights and capable of a real result. As is clear from the above approach and the risks that may befall the victim whose home and other property is destroyed and/or damaged, criminal proceedings are a rather complex and long-term way to restore justice and compensate for the damage caused. However, the victim rights (civil plaintiff) should be protected in the most effective way. Within the framework of criminal proceedings, **two mechanisms** of such protection can be proposed.

Extraordinary situation where Ukraine found itself due to the war, started by the Russian Federation, necessitates search for non-traditional ways of solving it. In particular, we suggest that in case of impossibility to establish the specific person who caused the damage in criminal proceedings, find guilty the civil defendant, i.e. the Russian Federation. Since the damage was caused by war crimes committed by combatants serving in the armed forces of the aggressor country and carrying out its orders, the aggressor state should bear civil responsibility for the damage caused by.

On April 14, 2022, judicial panel of the Third Judicial Chamber of the Civil Court of Cassation of the Supreme Court expressed a rather important position ⁴⁶ for the formation of law enforcement practice in case № 308/9708/19: *“Feature of the legal status of the state as a subject of international relations is its immunity, which is based on the general principle of international law equal over equal has no power and jurisdiction. However,*

a necessary condition for observing this principle is mutual recognition of the country’s sovereignty, so when the Russian Federation denies the sovereignty of Ukraine and commits a war of aggression against it, there is no obligation to respect and observe the sovereignty of this country. <...> “After the start of the war in Ukraine in 2014, the court of Ukraine, considering a case in which the Russian Federation is identified as the defendant, has the right to ignore the immunity of this country and consider cases of compensation for damage caused to an individual as a result of armed aggression of the Russian Federation, based on a lawsuit filed specifically against of this foreign country” ⁴⁷. In this way, the Supreme Court of Ukraine created a precedent that should be supported and developed in law enforcement practice, and later enshrined in legislation, because impunity, as it turned out, causes tragic consequences. We should also note that we are only at the beginning of the difficult journey of recovering damages. However, the existing problem should be solved in the legal field, guided by the principles of legality and the rule of law, gradually creating compensatory mechanisms; changing international and national legislation regulations with the help of international legal institutions and judicial institutions.

The second mechanism is related to the creation of the State Compensation Fund. At one time, the Interdepartmental Working Group of the Ministry of Justice developed a draft law on compensation at the expense of the state for material

46 Невядомський Д. Грааль імунітету агресора. Ключ до розв’язання проблеми компенсацій від Росії слід шукати в області правової науки. *Закон і бізнес*. 23.06.2022. URL: <https://zib.com.ua/ua/151862.html> (date accessed: 29.06.2022).

47 Постанова Верховного Суду України від 14.04.2022 р. у справі № 308/9708/19, провадження № 61-18782св21. URL: https://supreme.court.gov.ua/userfiles/media/new_folder_for_uploads/supreme/zakonodastvo/Rish_sud_imun.pdf (date accessed: 29.06.2022).

damage to individuals who suffered from a crime ⁴⁸, while preparing the ratification of the European Convention on the Compensation of Victims of Violent Crimes ETS № 116 (1983) ⁴⁹. Implementing the provisions of the Convention, the draft law proposed the following mandatory conditions for compensating the victim or members of his family: 1) commission of a crime resulting in damage to the victim's health; 2) initiation of a criminal case; 3) lack of information about the person who committed the crime or information about the whereabouts of identified person who committed the crime in criminal case for more than six months from the day the natural person was recognized as a victim; 4) availability of information in criminal case about insolvency of the person who committed the crime; 5) impossibility of compensating damages at the expense of guilty persons or other sources has been established by the court. According to this project, the right to compensation for damage at the expense of the state should arise from the victim not in all cases, but only in the case when the damage caused to him by the crime is significant, that is, the amount of which exceeds five times the minimum wage. The draft law also *limited the maximum* amount of compensation.

Introduction of such a mechanism of compensation by the state for damage

caused by a violent crime did not deprive the victim right to apply to the court to recover damage from the person who committed the crime in civil proceedings.

Compensation of damage to the victim at the expense of the state would be one of the types of social assistance, an important guarantee of basic human rights, which is responsibility of the social, legal State.

In the end, the project under consideration was not adopted, in particular, due to the following arguments: 1) such compensation, given the number of crimes committed will be too burdensome for the State Budget; 2) it is difficult to prevent abuses; 3) damage caused only in the case of serious and especially serious crimes, etc. should be compensated.

For the purpose of guaranteed and accurate execution of court decisions on compensation to victims of crime at the expense of the state, the draft law provided for the creation of a special Victim Fund in Ukraine (Art. 16 ⁵⁰) at the expense of part of the State Budget revenues from the payment of state duty and the rest of the budget revenues related to the activities of law enforcement agencies, as well as other revenues of the State Budget. It was from this Fund that compensation was planned under the current Law of Ukraine: *On the Procedure of Compensation of Damage Caused to a Citizen by Illegal Actions of Inquest, Pre-Trial Investigation, Office of Public Prosecutor and Judicial Bodies* ⁵¹.

48 Проект закону про відшкодування за рахунок держави матеріальної шкоди фізичним особам, які потерпіли від злочину, від 27.10.2010 р. № 7303. URL: http://w1.c1.rada.gov.ua/pls/zweb2/webproc4_2?pf3516=7303&skl=7 (date accessed: 29.06.2022).

49 Статус Европейской конвенции о возмещении ущерба жертвам насильственных преступлений ETS № 116 (Страсбург, 24.11.1983 г.). URL: https://zakon.rada.gov.ua/laws/show/994_541#Text (date accessed: 02.06.2022).

50 Проект закону про відшкодування за рахунок держави URL: http://w1.c1.rada.gov.ua/pls/zweb2/webproc4_2?pf3516=7303&skl=7 (date accessed: 29.06.2022).

51 Про порядок відшкодування шкоди, завданої громадянину незаконними діями органів, що здійснюють оперативно-розшукову діяльність, органів досудового розслідування, прокуратури і суду : Закон України від 01.12.1994 р. № 266/94-ВР (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/266/94-вр#Text> (date accessed: 02.06.2022).

Despite progressiveness of approaches mentioned above, the legislators have not created a mechanism for implementing the right to compensation for victims of violent crimes. However, its foundations are laid in the current criminal procedural and civil legislation. In particular, you should refer to Art. 1177 of Civil Code of Ukraine: “Reparation (compensation) of damage to a natural person who suffered from a criminal offense”⁵², according to which damage caused to a natural person who suffered from a criminal offense is compensated in accordance with the law⁵³. In Part 3 of Art. 127 of Criminal Procedural Code of Ukraine “Reparation (compensation) of damage to the victim” stipulates: “*Damage caused to the victim as a result of a criminal offense shall be compensated to him at the expense of the State Budget of Ukraine in the cases and in the manner prescribed by law*”⁵⁴ [emphasis added].

Consequently, national legislation has a basis for building a mechanism of compensation for damage (caused, in particular, by armed aggression of Russian Federation against Ukraine) at the expense of a specially created State fund.

Funding for such a fund can come from various sources (both due to charitable contributions from foreign states and private individuals, and due to funds from confiscation, special confiscation, reparation, complementation, etc.): however, first of all, it should be filled at the aggressor State expense.

Conclusions

The performed research makes possible to formulate such conclusions. The armed aggression of the Russian Federation caused casualties among the civilian population, as well as mass destruction and destruction of property and other property of residents of Ukraine. Currently, the State is creating a number of mechanisms aimed at compensating (compensating) for the damage caused by armed aggression.

Filing a civil claim in criminal proceedings initiated due to the commission of a war crime is one of the means to compensate for the damage caused to the victim. This is determined by the legal nature of the civil lawsuit combining public and private principles due to the fact that the subject of the civil lawsuit is directly related to the committed crime, as well as due to the fact that it is the state bodies that are tasked with determining the type and amount of damage caused a criminal offense. At the same time, the filing of a civil claim for compensation for damage caused by armed aggression is preceded by a number of factors that inhibit the mechanism of compensation: difficulty of properly recording the fact of destruction, especially in the conditions of hostilities; problems with calculating the amount of such damage, which requires time and labor due to the appointment of appropriate examinations; mostly: missing a person against whom a civil claim can

52 Цивільний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/ru/435-15/ed20220507> (date accessed: 02.06.2022).

53 The article refers to compensation of damage caused by the destruction, destruction of housing and other possession of a person as a result of armed aggression. Attention should be paid to the fact that the legislation provides (however not implemented) opportunities for compensation from mechanisms under consideration for damage caused by mutilation, other damage to health or death as a result of armed aggression. Such bases are also laid in Art. 1207 of the Civil Code of Ukraine.

54 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

be filed. However, we believe that every opportunity should be used to restore the victim rights.

In order to optimize procedural procedure for compensation for damage caused by war crimes, we consider it expedient to: 1) supplement the current criminal procedural and civil legislation with norms according to which aggressor State should be involved as a civil defendant in order to hold it responsible for the damage caused by its military staff; 2) create a state fund to compensate for the damage caused by war crimes.

In order to implement the proposed mechanism, we consider it appropriate to make the following changes and additions to the current Criminal Procedural Code of Ukraine of Ukraine.

1. Part 1 of Article 62: *Civil Defendant* after the first sentence shall be supplemented with the second sentence as follows: "In case of damage caused by war crimes or the crime of aggression against Ukraine, the civil defendant may be recognized as the aggressor State".

2. Part 1 of Art. 91: *Circumstances to be proved in criminal proceedings* after paragraph 7, add a new paragraph with the following content:

"The fact of the armed aggression of the Russian Federation against Ukraine cannot be proven".

3. Part 10 of Art. 100: *Storage of physical evidence and documents and resolution of the issue of special confiscation* shall be amended as follows:

"10. While resolving the issue of special confiscation, issue of returning money, valuables and other property to the owner (legal owner) and/or compensation for damage caused by a criminal offense must first be resolved. Special confiscation is applied only after the prosecution proves in a court of law that the owner (legal owner) of money, valuables and other

property knew about their illegal origin and/or use, *except for property, valuables, money and other material assets belonging to physical or legal entities persons of the aggressor state of the Russian Federation*. Such property, money, valuables, other material assets are subject to special confiscation in any case. In the event that the guilty person does not have property that can be levied, except for property that is subject to special confiscation, the damages caused to the victim, the civil plaintiff, are compensated at the expense of funds from the sale of the confiscated property, and the remaining part is transferred to the State ownership".

4. Relevant parts of Art. 170: *Property Seizure* should be amended as follows:

a) Part 2:

Property Seizure is allowed to ensure:

1) preservation of physical evidence;

2) special confiscation;

3) confiscation of property as a type of punishment or measure of a criminal legal nature against a legal entity;

4) compensation for damage caused as a result of a criminal offense (civil lawsuit) or recovery from a legal entity with illegal benefits.

5) *compensation for damage caused by armed aggression and temporary occupation of the territory of Ukraine by the Russian Federation*";

b) Part 10:

"10. Seizure may be imposed in accordance with the procedure established by this Code on movable or immovable property, money in any currency in cash or in non-cash form, in particular, funds and valuables held in bank accounts or in custody at banks or other financial institutions, expenditure transactions, securities, property, corporate rights, virtual assets, in which respect of decision of investigating judge, the court determines the need for seizure of property.

Property cannot be seized if it is owned by a bona fide acquirer, except for the seizure of property for the purpose of ensuring the preservation of material evidence or property belonging to natural or legal persons of the aggressor state of the Russian Federation”.

5. Part 4 of Art. 173: *Decision on Property Seizure* should be amended as follows:

“4. If the petition is granted, the investigating judge shall apply the least burdensome method of property seizure. The investigating judge, the court is obliged to apply such a method of seizure of property that will not lead to the suspension or excessive restriction of the lawful business activities of a person, or other consequences that significantly affect the interests of others. *This requirement does not apply to property owned by individuals or legal entities of the aggressor State of Russian Federation”.*

6. Part 11 of Art. 182: *Pledge* is proposed to read as follows:

“11. The pledge that has not been turned into the state income shall be returned to the suspect, accused, pledgor after the termination of this preventive measure. At the same time, the pledge made by the suspect, accused, may be fully or partially applied by the court for the execution of the sentence in terms of property penalties. The pledge taken by the pledgor may be applied by the court for the execution of the sentence in terms of property penalties only with his consent. *The pledge made in criminal proceedings initiated under Articles 109–114¹, 258-258⁵, 260, 261, 437-442 of the Criminal Code of Ukraine shall be applied by the court for execution of the sentence in terms of property penalties without the consent of the pledgor”.*

Проблеми відшкодування збитків, завданих громадянинові внаслідок збройної агресії: кримінальний процесуальний аспект

Оксана Капліна, Світлана Шаренко

Розглянуто актуальні проблеми відшкодування збитків, завданих

Україні збройною агресією Росії — повномасштабною війною, безпрецедентною (порівняно із Другою світовою та рештою війн ХХІ ст.) за розмахом, жорстокою за сутністю, геноцидною за метою, нищівною за засобами й наслідками. Одними з наслідків воєнних і військових злочинів, скоєних рашистськими агресорами починаючи з 24.02.2022 р. , є масові руйнування та пошкодження житла й іншого майна громадян України. У межах розпочатих кримінальних проваджень завдані збитки відшкодовують шляхом заявлення цивільного позову. Утім, специфікою підстав такого позову зумовлено виникнення певних ризиків для потерпілого, а також проблем із правозастосуванням і реалізацією слідчим та прокурором їхніх повноважень. Зокрема, складнощі можуть полягати в неможливості оглянути місце події, що зрештою негативно вплине на визначення розміру завданих збитків (розрахунок матеріального еквівалента шкоди). Проблемним також є визначення суми шкоди, завданої в результаті руйнування чи знищення житла, оскільки найчастіше це потребує призначення експертизи, водночас масштабність руйнувань у межах держави унеможлиблює проведення таких експертиз у розумні строки. Увагу акцентовано на проблемах установлення особи, яка має нести відповідальність за заявленим позовом, або цивільного відповідача. Також розглянуто можливість подолання юрисдикційного імунітету Росії як відповідача за заявленими цивільними позовами. Проведене дослідження дало змогу сформулювати пропозиції щодо механізму відшкодування завданої шкоди, а також щодо вдосконалення чинного кримінального процесуального законодавства України.

Ключові слова: відшкодування шкоди в кримінальному провадженні; цивільний позов у кримінальному провадженні; шкода, завдана кримінальним правопорушенням; потерпілий; цивільний відповідач.

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Problems of Russian Aggression Investigation against Ukraine

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Current state of investigation of military, war and other crimes caused by Russian aggression against Ukraine is studied, legal and procedural issues of their investigation are outlined. Attention is drawn to the national, foreign and international nature of the investigation of such crimes, which indicates their scale and complexity. Issues that arisen due because of conducting of hostilities on Ukrainian territory and their consequences were also considered (danger of investigative actions, lack of qualified personnel, the existence of a significant number of refugees and temporarily displaced persons, etc.). The purpose of tis research is related to beginning of the unprovoked large-scale war of Russian Federation against Ukraine and the need to bring to criminal responsibility the persons responsible for its resolution, which involves the investigation of war, military and other crimes on the territory of Ukraine and requires the solution of certain urgent problems. Particular attention is paid to Ukrainian unsuccessful attempts to ratify and implement the Rome Statute of the International Criminal Court, which can complicate the assessment of socially dangerous actions in accordance with the Criminal Code of Ukraine and the requirements of the International Criminal Court and hinder the creation of a legal basis for bringing the aggressor to criminal responsibility. In this context, the criminal procedural legislation needs changes that will facilitate the conduct

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of investigative and judicial actions under martial law conditions, as well as the introduction of electronic justice in Ukraine (in particular, the use of video communication and the provision of information during the transmission and collection of convincing data).

Keywords: Russian aggression; war crimes; military offense; investigation; Rome Statute of the International Criminal Court; criminalistics.

Research Problem Formulation

On February 24, 2022, Russian Federation, supported by Republic of Belarus, launched aggressive unprovoked large-scale war against Ukraine. This aggression was a continuation of Russian Federation invasion that occupied the Autonomous Republic of Crimea and certain parts of Donetsk and Luhansk regions on 26.02.2014.

The Rome Statute of the International Criminal Court ¹ (hereinafter referred to as ICC), despite long-term attempts to ratify and implement it, is still not part of the legislation of Ukraine ² but it is crucial in creating the legal basis for bringing the aggressor to criminal responsibility. It should be noted that attempts to ratify the Rome Statute nevertheless contributed to the adoption of the draft Law of Ukraine «On Amendments to Certain Legislative Acts of Ukraine Regarding Implementation of International Criminal and Humanitarian Law» (reg. No. 2689) but the President of

Ukraine has not yet signed it ³. At the same time, the application of the Rome Statute has not only important scientific, but also practical legal significance for the law enforcer in Ukraine, which is due to the recognition of the jurisdiction of the ICC in Ukraine, as well as a preliminary study of the situation and a pre-trial investigation that has been ongoing since 2014.

Therefore, the legal basis of the war, military and other crimes committed by the Russian military on the territory of Ukraine is related to the prospect of the development of criminal legislation, which, unfortunately, should be recognized as imperfect. At the same time, the criminal procedural legislation of Ukraine is developing quite actively, adapting to the remote implementation of functions, as well as simplifying certain pre-trial investigation procedures. Currently, the need to create new forensic methods, investigation algorithms and conduct separate investigative actions in wartime is relevant. It is worth remembering that pre-

1 Римський статут міжнародного кримінального суду: затв. 17.07.1998 р.; чинний для України з 01.07.2002 р. (зі змін. та допов.). URL: https://zakon.rada.gov.ua/laws/show/995_588#Text (date accessed: 29.04.2022).

2 Шепітько М. Кримінально-правовий захист діяльності Міжнародного кримінального суду. Римський статут Міжнародного кримінального суду: проблеми імплементації до національного законодавства України : мат-ли дискус. панелі IV Харківськ. міжнар. юрид. форуму (Харків, 25.09.2020). Харків, 2021. С. 108–110.

3 Прийнято Закон «Про внесення змін до деяких законодавчих актів України щодо імплементації норм міжнародного кримінального та гуманітарного права» / Офіц. сайт Верховної Ради України. URL: <https://www.rada.gov.ua/news/Povidomlennya/208710.html> (date accessed: 29.04.2022).

trial investigations of events in Ukraine are carried out by both domestic and foreign specialists (especially those countries to which refugees from Ukraine have arrived and persons who are granted temporary protection). There are also prospects for such an investigation by international criminal courts (tribunals).

Analysis of Essential Researches and Publications

Given ongoing aggressiveness of Russian invasion of Ukraine, research on this problem is certainly more forward-looking. At the same time, publications on the problems of pre-trial investigation in general and war crimes in particular with attempts to bring to criminal responsibility those guilty of aggression against other states and the execution of justice (justice) against them were already published. Therefore, an important basis for this study is the work of specialists in constitutional and international law: A. Antonov, Yu. Barabash, O. Zadorozhnyi, O. Serdiuk and V. Steshenko ⁴. In historical context, basic researches were research papers of H. Gross and R. Reiss.

Thus, *Manual for forensic investigators as a system of criminalistics* by Hans Gross became impetus for development of criminalistics, creation of certain algorithms and rules for investigating crimes ⁵ and Rodolphe Reiss made an invaluable contribution to solving the problem recording war and war crimes committed in World War I by the Austro-Hungarian Empire during its invasion of Serbia ⁶ (reminiscent of Russian aggression against Ukraine).

In the context of the investigation of the attack of the Russian Federation on Ukraine, current studies of modern forensic scientists: D. Franhez, V. Zhuravel, O. Kliuiev, E. Kurapka, B. Lindav, V. Lukashevych, He. Malevski, E. Simakova-Yefremian and V. Shepitko ⁷. We should note that in modern conditions, works that demonstrate the ability of forensic science and criminalistics to respond to specific challenges of the time have become important. At the time, there was a need for forensic methods and separate algorithms of actions during investigation of war crimes and war crimes, as well as the active use of innovative methods of investigation for this purpose.

- 4 Antonov A. Russia's Aggression Against Ukraine. State Responsibility, Individual Responsibility and Accountability. *Scrutinizing Ukraine's Application at the ICJ, Ukraine's Acceptance of the ICC's Jurisdiction Pursuant to Art. 12(3) of the Rome Statute and the Role of the UN Human Rights Monitoring Mission*. Master's thesis. Odense, 2018. 120 p. ; Barabash I., Serdiuk O., Steshenko V. Ukraine in European human rights regime: Breaking path dependence from Russia. *The EU in the 21st Century: Challenges and Opportunities for the European Integration Process*. 2020. Pp. 247–270. DOI: [10.1007/978-3-030-38399-2_14](https://doi.org/10.1007/978-3-030-38399-2_14) (date accessed: 29.04.2022) ; Задорожний О. Анексія Криму — міжнародний злочин : монографія. Київ, 2015. 576 с.
- 5 Гросс Г. Руководство для судебных следователей как система криминалистики. Москва, 2002. 1088 с.
- 6 Reiss R. A. Report Upon the Atrocities Committed by the Austro-Hungarian Army During the First Invasion of Serbia. London, 1916. Pp. VII—VIII.
- 7 Frangež D., Lindav B. The Science of Criminal Investigation between Theory and Practice in Slovenia. *Journal of Criminal Investigation and Criminology*. 2019. № 70. Pp. 141—161 ; Шепітько М. Зазнач. твір ; Шепітько В., Шепітько М. Доктрина криміналістики та судової експертизи: формування, сучасний стан і розвиток в Україні. *Право України*. 2021. № 8. С. 12—27. DOI: [10.33498/louu-2021-08-012](https://doi.org/10.33498/louu-2021-08-012) (date accessed: 29.04.2022) ; Журавель В. Механізм злочину як категорія криміналістики. *Journal of the National Academy of Legal Sciences of Ukraine*. 2020. № 27 (3). С. 142—154. DOI: [10.37635/jnalsu.27\(3\).2020.142-154](https://doi.org/10.37635/jnalsu.27(3).2020.142-154) (date accessed: 29.04.2022).

Article Purpose

In connection with the unprovoked large-scale war of Russia against Ukraine, to investigate the possibilities of bringing to justice those responsible for its solution, as well as to find out the peculiarities of the investigation of war, military and other crimes committed on the territory of Ukraine, that requires solving certain urgent issues.

Main Content Presentation

Taking into account development of hostilities in Ukraine (starting with the Revolution of Dignity and Occupation of the Autonomous Republic of Crimea and parts of Donetsk and Luhansk regions), Verkhovna Rada of Ukraine on 25.02.2014 adopted a Statement⁸, and on 04.02.2015 — Resolution⁹ in the form of a statement to the ICC on Ukrainian recognition of its jurisdiction to commit crimes against humanity by senior state officials during peaceful protests in the period of

21.11.2013–22.02.2014 and war crimes by senior officials of Russian Federation and heads of terrorist organizations DPR and LPR caused especially grave consequences and mass killings of Ukrainian citizens.

In the period 2016–2019, ICC ISS Prosecutor's office provided annual reports on the events at the Independence Square in Kyiv, Crimea and Eastern Ukraine¹⁰. On December 14, 2020, this report referred to the completion of a preliminary study of the situation in Ukraine during 2020 and published a decision on compliance with the criteria for initiating an investigation in terms of subject jurisdiction, admissibility and interests of justice¹¹.

In addition to the statements of the Verkhovna Rada of Ukraine regarding the recognition of the jurisdiction of the ISS, Art. 8 of the Association Agreement between Ukraine, on the one hand, and the European Union, the European Atomic Energy Community and their member states, on the other hand (as amended on 27.06.2014)¹², refers to the *obligation* of Ukraine and the European Union to

8 Про визнання Україною юрисдикції Міжнародного кримінального суду щодо скоєння злочинів проти людяності вищими посадовими особами держави, які призвели до особливо тяжких наслідків та масового вбивства українських громадян під час мирних акцій протестів у період з 21 листопада 2013 року по 22 лютого 2014 року : Заява ВР України до Міжнар. кримін. суду від 25.02.2014 р. № 790-VII. URL: <https://zakon.rada.gov.ua/laws/show/145-19#Text> (date accessed: 29.04.2022).

9 Про Заяву Верховної Ради України «Про визнання Україною юрисдикції Міжнародного кримінального суду щодо скоєння злочинів проти людяності та воєнних злочинів вищими посадовими особами Російської Федерації та керівниками терористичних організацій “ДНР” та “ЛНР”, які призвели до особливо тяжких наслідків та масового вбивства українських громадян» : Постанова ВР України від 04.02.2015 р. № 145-VIII. URL: <https://zakon.rada.gov.ua/laws/show/790-18#Text> (date accessed: 29.04.2022).

10 International Criminal Court Report on Preliminary Examination Activities 2016. *A First Printed Criminalist*. 2016. № 13. Pp. 125–135 ; 2017. *Ibid*. 2017. № 15. Pp. 87–95 ; 2018. *Ibid*. 2018. № 17. Pp. 98–108 ; 2019. *Ibid*. 2019. № 19. Pp. 130–138.

11 Отчет о действиях по предварительному изучению ситуаций в 2020 году / International Criminal Court. URL: <https://www.icc-cpi.int/sites/default/files/itemsDocuments/2020-PE/2020-pe-report-ukr-rus.pdf> (date accessed: 29.04.2022).

12 Association Agreement between Ukraine, on the one hand, and the European Union, European Atomic Energy Community and their Member States, on the other hand : rat. of the declarations. Law of Ukraine No. 1678-VII dated on September 16, 2014 (as amended and supplemented). https://zakon.rada.gov.ua/laws/show/984_011#Text (date accessed: 29.04.2022)

cooperate in order to strengthen peace and international justice through the *ratification and implementation* of the Rome Statute of ICC dated on 1998 and related documents. This effectively means that Ukraine has made an additional commitment in the future to ratify the Rome Statute within the framework of cooperation with the European Union.

Despite the Russian aggression and numerous crimes by the occupiers, the Verkhovna Rada of Ukraine not only appealed to the ICC, but also recognized its jurisdiction in this part. It should be noted that this international legal body (according to the report of the ICC Prosecutor's Office) has taken under its jurisdiction the crimes that fall under the Rome Statute and that have been committed on the territory of Ukraine since November 21, 2013 (according to the declaration of the Verkhovna Rada of Ukraine). Thanks to this, Ukrainian lack of ratification of the Rome Statute has to some extent been overcome, although the need for such ratification grows day by day.

It should be mentioned about the specificity (complementarity) of the jurisdiction of the ICC, which complements the national bodies of criminal justice. For example, O. Senatorova clarifies that direct translation of Rome Statute from English (without using the Russian version) from the official portal of the Verkhovna Rada of Ukraine testifies to the auxiliary nature of «*national criminal jurisdiction*»¹³. This means that the national criminal jurisdiction is not exempted from the duties of the state bodies of Ukraine regarding the legal assessment (qualification) of committed crimes and bringing the guilty to criminal responsibility. If the national

jurisdiction will not be able to achieve justice and bring the guilty persons to criminal responsibility, then the ICC together with its legal basis (Rome Statute) will help to carry out justice.

The events surrounding the Euromaidan, the Autonomous Republic of Crimea and parts of Donetsk and Luhansk regions are already the subject of the ICC investigation, which has reached preliminary conclusions¹⁴: the ISS Prosecutor's Office has already offered its proposals for the preliminary qualification of criminal offenses committed in the period 2014–2020.

Thus, the ICC Prosecutor's Office studied several forms of possible actions and considered the context of the international armed conflict and the occupation of Crimea and various possible legal qualifications of the armed conflict in eastern Ukraine. In particular, I found reasonable grounds to believe that on February 26, 2014, *in the period preceding the occupation and/or in the context of the occupation of the territory of Crimea, the following crimes were committed*:

- *intentional homicide* (subclause (a) (i) of clause 2 of Article 8);
- *tortures* (sub-paragraph (a)(ii) of paragraph 2 of Article 8);
- *violation of human dignity* (subclause (b)(xxi) clause 2 of Art. 8);
- *unlawful deprivation of liberty* (s.c. (a)(vii) art. 8, para. 2);
- *coercion of protected persons to serve in the armed forces of the enemy state* (subclause (a)(v) of clause 2 of Article 8);
- *intentional deprivation of the protected persons' rights to a fair*

13 Сенаторова О. Юрисдикція Міжнародного кримінального суду щодо ситуації збройного конфлікту в Україні. *Римський статут Міжнародного кримінального суду ...* . С. 61–62.

14 Отчет о действиях URL: <https://www.icc-cpi.int/sites/default/files/itemsDocuments/2020-PE/2020-pe-report-ukr-rus.pdf> (date accessed: 29.04.2022).

and normal trial (subsection (a)(vi) clause 2 of Article 8);

- *movement of certain parts of occupied territory population outside this territory (regarding movement of prisoners within the framework of criminal proceedings of persons and prisoners; subclause (b)(viii) of clause 2 of Art. 8);*
- *seizure of the enemy's property, when such seizure is not due to an urgent military need (regarding private property and cultural property; subclause (b)(xiii) of clause 2 of Art. 8)*¹⁵.

In addition, the ISS Prosecutor's Office emphasizes that in considering the available information on alleged crimes under Art. 7 of the Rome Statute, reasonable grounds have been found to believe that the actions that can be qualified as crimes took place in the period preceding **occupation of Crimea** and during this occupation, namely:

- *murder (sub-paragraph (a) of paragraph 1 of Article 7);*
- *deportation or forcible transfer of population (regarding the movement of persons in custody within the framework of criminal proceedings, and prisoners; subclause (d) of clause 1 of Art. 7);*
- *imprisonment or other cruel deprivation of physical liberty (subclause (e) of clause 1 of Article 7);*
- *torture (subclause (f) of clause 1 of Article 7);*
- *persecution of any identified group or community on political grounds (s.c. (h) Art. 7 (1));*
- *enforced disappearance of persons (s.c. (i) art. 7, para. 1).*

In addition, in 2019, the office of the Prosecutor of the ISS concluded that there were reasonable grounds to believe that at least the following war crimes were committed from April 30, 2014 onwards in the context of the armed conflict **in Eastern Ukraine**:

- *intentional attacks on civilians and civilian objects (s. (b) (i) — (ii) or (e)(i) Art. 8 (2));*
- *intentionally striking protected buildings (subclause (b) (ix) or (e) (iv) of clause 2 of Article 8);*
- *intentional homicide or murder (clauses (a)(i) or (c)(i) clause 2 of Article 8);*
- *torture and inhuman or degrading treatment (s.c. (a)(ii) or (c)(i) art. 8, para. 2);*
- *lust for human dignity (s.c. (b)(xxi) or (c)(ii) art. 8, para. 2);*
- *rape and other forms of sexual violence (art. 8, para. 2 (b) (xxii) or (e) (vi)).*

In addition, if the conflict were international in nature, there would be reasonable grounds to believe that the following war crimes were committed:

- *intentionally committing attacks resulting in damage to civilians and civilian objects manifestly incompatible with the expected military advantage (non-dimensional attacks; subclause (b) (iv) of clause 2 of Article 8);*
- *unlawful deprivation of liberty (s.c. (a)(vii) art. 8, para. 2)*¹⁶.

The analysis of the obtained evidence which made it possible to qualify certain acts as criminal and to start an investigation of the ISS, opens up prospects for further cooperation of this body with Ukrainian

15 It goes on to refer to the norms of the Rome Statute. See: Rome Statute. URL: https://zakon.rada.gov.ua/laws/show/995_588#Text (date accessed: 29.04.2022).

16 Отчет о действиях П. 278—281. URL: <https://www.icc-cpi.int/sites/default/files/itemsDocuments/2020-PE/2020-pe-report-ukr-rus.pdf> (date accessed: 29.04.2022).

lawyers regarding armed Russian aggression.

Thus, starting from 24.02.2022, the Office of the Prosecutor General of Ukraine registered as of 23.04.2022:

- 1) 7,999 *crimes of aggression and war crimes* (among which: *violations of the laws and customs of war* (Art. 438 of the Criminal Code (hereinafter referred to as *Criminal Code of Ukraine*) – 7,759; *planning, preparation, initiation and waging of an aggressive war* (Art. 437 of Criminal Code of Ukraine) – 48; *war propaganda* (Art. 436 of Criminal Code of Ukraine) – 11, *others* – 181);
- 2) 3,760 *crimes against national security* (among them: *violations of the territorial integrity and inviolability of Ukraine* (Article 110 of Criminal Code of Ukraine) – 2,417, *treason* (Article 111 of the Criminal Code of Ukraine) – 647, *sabotage* (Article 113 of the Criminal Code of Ukraine) – 60, *others* – 636).

In the so-called main criminal proceedings against the Russian aggression, 620 suspects were recorded, among them representatives of the military

and political leadership of the Russian Federation (ministers, deputies, military command, officials, etc.)¹⁷.

In order to accumulate evidence in these criminal proceedings, it is necessary to collect it in a timely and correct manner and use it to restore justice and the administration of justice. The activities of the justice authorities in gathering evidence of war crimes committed in Ukraine are important not only for national justice systems, but also for the international criminal justice system already operating in Ukraine. As of today, 41 states have appealed to the ISS, the jurisdiction of which was recognized by Ukraine, regarding the need to investigate war crimes¹⁸; this significantly contributed to the beginning of such activities in Ukraine¹⁹. Moreover, in these conditions, it is important to coordinate activities between national and international justice systems²⁰.

In this context, the statement of the President of Ukraine V. Zelenskyy on «*creation of a special mechanism of justice in Ukraine for investigation and trial of each crime of the occupiers*» became relevant

17 Офіс Генерального прокурора / Офіц. сайт. URL: <https://www.gp.gov.ua> (date accessed: 29.04.2022).

18 Statement of ICC Prosecutor, Karim A. A. Khan QC, on the Situation in Ukraine: Additional Referrals from Japan and North Macedonia; Contact portal launched for provision of information / Official site of ICC. URL: <https://www.icc-cpi.int/news/statement-icc-prosecutor-karim-aa-khan-qc-situation-ukraine-additional-referrals-japan-and-north-macedonia> (date accessed: 29.04.2022).

19 Ірина Венедіктова та Прокурор Міжнародного кримінального суду побували на місцях вчинення воєнних злочинів РФ на Київщині / Офіц. сайт Офісу Генпрокурора. URL: <https://www.gp.gov.ua/ua/posts/irina-venediktova-ta-prokuror-miznarodnogo-kriminalnogo-sudu-pobuvali-na-misctsyah-vcinennya-vojennix-zlociniv-rf-na-kiyivshhini> (Date accessed: 29.04.2022).

20 Creation of separate International Courts on the situation in Ukraine is not excluded. Thus, on April 28, 2022, the Parliamentary Assembly of the Council of Europe called for the creation of an ad hoc International Criminal Tribunal to prosecute those responsible for the crime of aggression against Ukraine. E.g., PACE calls for the setting up of an ad hoc international criminal tribunal to hold to account perpetrators of the crime of aggression against Ukraine. Official site of Parliamentary Assembly of the Council of Europe. URL: <https://pace.coe.int/en/news/8699/pace-calls-for-the-setting-up-of-an-ad-hoc-international-criminal-tribunal-to-hold-to-account-perpetrators-of-the-crime-of-aggression-against-ukraine> (date accessed: 29.04.2022).

(03.04.2022) ²¹. This special mechanism is related to the need to establish special investigative teams at both the interstate and international levels. The system of law enforcement agencies of Ukraine is in a rather difficult situation, because it is necessary to:

- 1) record a huge amount of probative information;
- 2) carry out procedural actions under pre-war criminal procedural mechanisms;
- 3) provide necessary number of professionals to perform these tasks (they are lacking due to the fulfillment of the duty to defend the state, violation of the oath, lack of qualifications, etc.);
- 4) carry out criminal prosecution in default of or death of perpetrators or eyewitnesses of crimes;
- 5) ensure that investigative teams have access to the scene (which is not possible due to hostilities, occupation or mines).

It is worth noting that intensity of the commission of crimes, some of their facts give grounds to argue about the signs of committing the most serious crimes, that is, genocide, giving the disclosure of these facts in the form of an international public response. Thus, on April 14, 2022, the Verkhovna Rada of Ukraine adopted the Statement «On the Commitment of Genocide by the Russian Federation in Ukraine» ²² that was the result of the opening by law enforcement agencies of proceedings regarding the facts of violence against the civilian population after the liberation of territorial communities of Kyiv oblast, in Mariupol and other cities,

statements of official representatives of the aggressor country on the denazification and destruction of the Ukrainian people, as well as the prohibition of the Ukrainian language and the destruction of Ukrainian-language books.

Obviously, collection, recording, classification and legal evaluation of ; probative information requires its special protection at various stages. Thus, the collection of ; probative information is complicated a priori due to the involvement of a significant number of law enforcement officers with different levels of knowledge and different motivations (in particular, there can be opposition and a desire to destroy this information). A significant number of problems can cause information to be deprived of the status of evidence due to the loss of the carriers of such information (masses of refugees and displaced persons, destruction of storage servers due to hacker attacks, etc.). Recording of information carried out by law enforcement agencies and public organizations of other countries is certainly important and necessary, but it can be biased and dangerous in nature - by suggesting events that did not happen or falsely believing the people who turned to them in the futility of official procedures. It should be noted that today law enforcement agencies are only at the initial stage of collecting such information, but the possibility of correct interpretation and classification of committed crimes will depend on its proper processing.

In this context, the interaction not only of representatives of Ukrainian, foreign, interstate and international justice bodies,

21 Володимир Зеленський ініціює створення спеціального механізму, який допоможе притягнути до відповідальності осіб, причетних до злочинів проти українського народу / Офіц. сайт Президента України. URL: <https://www.president.gov.ua/news/volodimir-zelenskij-iniciyuye-stvorenniya-specialnogo-mehaniz-74057> (date accessed: 29.04.2022).

22 Про Заяву Верховної Ради України «Про вчинення Російською Федерацією геноциду в Україні»: Постанова ВР України від 14.04.2022 р. № 2188-IX. URL: <https://zakon.rada.gov.ua/laws/show/2188-20#Text> (date accessed: 29.04.2022).

but also of legal systems is important. Unfortunately, the Rome Statute of the ICC cannot yet be considered a component of current Ukrainian legislation, although it remains an auxiliary and important legal basis for prosecuting those guilty of aggression against Ukraine. Therefore, it is logical to continue the work of the International Criminal Court to record war crimes and war crimes in Ukraine. It is worth noting that national criminal legislation is the basis for representatives of law enforcement agencies of Ukraine in bringing guilty persons to criminal responsibility. The predominance of violations of the laws and customs of war (Article 438 of the Criminal Code of Ukraine), which are blanket and disclosed with the help of international treaties (in particular, the Rome Statute of the ICC that Ukraine has not yet ratified).

In our opinion, consequence of such rapid development of the national criminal legislation will be its further reformation, which will contribute to the adoption of the new Criminal Code of Ukraine in the post-war period. In this context, it is appropriate to pay attention to the activities of the Working Group on the Development of Criminal Law of the Commission on Legal Reform under the President of Ukraine, which has already proposed an incomplete draft of the Criminal Code of Ukraine, in where the book 11 *Crimes against the international legal order* is planned with five chapters (genocide, crimes against humanity, crime of aggression, war crimes, crimes against the peace and security of mankind)²³. It is clear that the adoption of the new Criminal Code of Ukraine, for its part, will require amendments to at least the Criminal Procedure Code of Ukraine and

the reclassification of acts committed by Russian aggressors against our state and its citizens. Therefore, the proposals included in the text of the draft Code of Criminal Procedure of Ukraine need to be monitored and adjusted.

Conclusions

Issues of investigating the Russian aggression against Ukraine are complex and large-scale, caused by the commission of war, war crimes and other crimes, so they require appropriate qualification — as the alleged commission of genocide. In this context, the interaction of state law enforcement and judicial bodies with relevant foreign and international institutions is important. Therefore, today it is essential to ratify and implement the Rome Statute of the ICC, the jurisdiction of which Ukraine has repeatedly recognized, and to establish an International Criminal Tribunal for cases where the jurisdiction of the ICC cannot be applied.

Law enforcement agencies of Ukraine, which carry out pre-trial investigations into crimes committed during the Russian aggression against Ukraine, work in extremely difficult conditions, under which the number of atrocities of the aggressor's army increases, hostilities continue, there are no safe conditions for recording and collecting probative information (that can be lost, if the necessary investigative actions are not taken). The problem is also the need to involve technical, expert and special assistance at crime scenes and to create qualified investigative teams. Another challenge for law enforcement agencies is the recording of large-scale crimes by the aggressor, which requires the use of non-standard equipment (for example,

23 Діяльність Робочої групи з питань розвитку кримінального права. URL: <https://newcriminalcode.org.ua/article/diyalnist-robchoyi-grupy-z-pytan-rozvytku-kryminalnogo-prava-i86> (date accessed: 29.04.2022).

drones) and the correct procedural design. The situation is also affected by a certain instability of the justice system and the need to change criminal procedural norms, which will make it possible to conduct investigative and judicial actions remotely (with the help of video communication, registers and other means of transmission and accumulation of information), thus securing information and introducing real electronic justice.

Excessive concentration of attention only in the practice of registration of criminal proceedings is of concern (on the website of the Prosecutor General's Office, a significant number of criminal proceedings have been initiated). At the same time, the procedural terms and scope of investigative actions indicate that the main difficulties of law enforcement agencies are still ahead. Therefore, in our opinion, the main efforts of forensic scientists should focus on the creation of forensic methods, algorithms for investigating crimes and conducting investigative actions (in particular, related to large-scale events: shootings, mass torture, burials, places of hostilities, etc.).

Проблеми розслідування російської агресії проти України Михайло Шепітько

Досліджено сучасний стан розслідування військових, воєнних та інших злочинів, спричинених російською агресією проти України, окреслено правові та процесуальні проблеми їх розслідування. Звернено увагу на національний, іноземний та міжнародний характер розслідування таких злочинів, що свідчить про їх масштабність і складність. Також розглянуто проблеми, що виникли через ведення бойових дій на території України, та їх наслідки (небезпечність проведення слідчих дій, нестача кваліфікованих кадрів, наявність значної кількості біженців і тимчасово

переміщених осіб тощо). Мета дослідження пов'язана з початком неспровокованої широкомасштабної війни РФ проти України й необхідністю притягнути до кримінальної відповідальності винних у її розв'язанні осіб, що передбачає розслідування воєнних, військових та інших злочинів на території України й потребує розв'язання окремих нагальних проблем. Особливу увагу приділено невдалим спробам України ратифікувати й імплементувати Римський статут Міжнародного кримінального суду, що може ускладнити оцінювання суспільно небезпечних дій згідно з Кримінальним кодексом України й вимогами Міжнародного кримінального суду та стати на заваді створенню правового підґрунтя для притягнення агресора до кримінальної відповідальності. У цьому контексті кримінально-процесуальне законодавство потребує змін, які сприятимуть спрощенню проведення слідчих і судових дій в умовах воєнного стану, а також запровадженню електронного правосуддя в Україні (зокрема, використанню відеозв'язку й забезпеченню інформації під час передавання та збирання доказових даних).

Ключові слова: російська агресія; воєнні злочини; військові злочини; розслідування; Римський статут Міжнародного кримінального суду; криміналістика.

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The author declare that he has no conflict of interest.

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Identifying Taxonomic Belonging of Animal Hair Using Instrumental and Microscopic Methods

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Urgent need to develop a methodology for identifying taxonomic belonging of animal hair using modern research methods (identification of additional objective criteria in the case of a comparative research on material evidence, namely: animal hair) is considered that contributes to solving a larger range of issues raised while appointment forensic biological examination. Authors aimed to substantiate possibility of identifying the taxonomic affiliation of animal hair using instrumental and microscopic methods, in particular, scanning electron microscope, allowing forensic biologists to study the surfaces of objects of animal origin, both of significant linear dimensions, and of microparticles in a wide range of magnifications (from 10× to more than 200,000×), providing a resolution of up to 10⁻⁹ m. Obtaining a general image of the surface and selecting appropriate areas for detailing (at the maximum possible magnifications) does not require significant reconfiguration of the device. A significant depth of focus provides detailed images of various surfaces with developed relief (cracks; traces of mechanical damage; morphological specifics of periodically reproduced surface

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structures). Contrast is the detection result of reflected electrons (depending on the distribution of phase components differing in chemical composition the studied sample surface). The proposed method of researching animal hair will significantly expand possibilities of examination of these objects: it will reduce the time and increase the accuracy of conducting such research, as well as make it possible to supplement illustrative material (for example, microphotographs of hair cuticles of frequently encountered animal species).

Keywords: animal hair; elemental composition of hair; objects of animal origin; scanning electron microscopy; forensic biological examination.

Research Problem Formulation

Specific expertise application from various fields of science for the forensic science needs is of great importance in solving issues of strengthening law and order in Ukraine. One of the prominent places among the types of forensic examination is occupied by research in the field of forensic biology, in particular, research on animal hair as objects of animal origin.

Hair research is an independent evidence base for law enforcement agencies contributing to identification of crime tool, the persons committed the crime, as well as to the investigation of other circumstances. Hair is the most common biological material and is often the only physical evidence recovered at crime scene.

Currently, domestic experts: medical examiners and biologists have a number of techniques and methods for researching animal hair.

Development of science and technology contributes to the steady enrichment of methods and means of researching physical evidence. Purposeful, scientifically based study of the signs and

properties of these objects, based on the achievements of various scientific fields, increases reliability of conclusions and quality of forensic research.

Laboratory research on physical evidence using modern methods and tools provides detectives and investigators with important information about crime and criminals that is essential for the search and detection of the latter, prevention and detection of crimes.

Analysis of Essential Researches and Publications

Formation of forensic examination on animal hair is connected with research papers of medical examiners and biologists of different countries. Professionals who study its morphology play a leading role in development of animal hair research.

The important forensic significance of hair was also highlighted by forensic scientists and forensic physicians of the 19th century. Thus, at the I. Pirogov Congress of Physicians ¹, held in St. Petersburg in 1885, the participants heard and discussed the report of the assistant prosecutor at the Department of Forensic

1 Верхратський С. А., Заблудовський П. Ю. Історія медицини : навч. посіб. 4-те вид., випр. і допов. Київ, 1991. 431 с.

Medicine of the Kharkiv University M. O. Obolonsky "On hair in forensic medical terms" according to which a year later he defended his doctoral dissertation ², and in 1894 another prominent physician, P. A. Minakov, defended his doctoral dissertation on the same topic that has not lost its importance ³.

Forensic significance of hair was highlighted by such well-known scientists as: L. P. Bulyha, L. K. Bulysheva, Yu. I. Buraho, O. Yu. Kaniuka, M. V. Kisin, O. V. Lukomska, M. L. Mamotiuk, V. S. Mytrychev, O. I. Razorenova and others. ⁴

However, the issues of identifying taxonomic affiliation of animal hair using instrumental and microscopic methods

has not been sufficiently investigated by domestic forensic science.

While forensic biological research on animal hair, research objects can be: specific animal; specific set of animals; specific item containing treatment product of fur of one or more animals (product made of animal skins and fur: a collar, coat, fur coat, floor covering, etc.); specific volume of animal wool; specific collection of animal skins, etc.

Prevalence of domestic and wild animals, the use of their skins, fur, and wool for the manufacture of clothing and other items of daily use, etc., necessitates the use of this type of objects as carriers of probative information.

Obtaining such information is based on the need to find out correlation between

- 2 Chisnikov V. Ukrainian professor N. A. Obolonsky – prime propagandist of anthropometric systems A. Bertillon in the Russian empire. *Criminalistics and Forensics*. 2016. Vol. 61. Pp. 576–582. URL: http://nbuv.gov.ua/UJRN/krise_2016_61_63 (date accessed: 03.06.2022).
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- 4 Е.г.: Булыга Л. П. Исследование волос животных близких родов в практике судебной экспертизы : пособ. для эксперт. Москва, 1979. 108 с. ; Еадем. Методика дифференциальной диагностики волос животных близких родов. Криминалистика и судебная экспертиза. 1972. Вып. 9. С. 361–365 ; Бурого Ю. И. К особенностям некоторых физико-химических свойств морфологически сходных волос животных при судебно-медицинской экспертизе их видовой принадлежности (комплексное микрофотометрическое, спектрофотометрическое, абсорбционно-спектрографическое экспериментальное исследование) : дис. ... канд. мед. наук. Барнаул, 1977. 168 с. ; Каниюка О. Ю. Методичні особливості дослідження перехідного волосся пса свійського. *Теорія та практика судової експертизи і криміналістики*. 2020. № 22. С. 340–347. DOI: [10.32353/khrife.2.2020.27](https://doi.org/10.32353/khrife.2.2020.27) (date accessed: 03.06.2022) ; Кисин М. В., Булышева Л. К., Мамотюк М. Л., Разоренова О. И. Волосы животных как объект судебно-биологической экспертизы : учеб. пособ. Москва, 1984. 115 с. ; Лукомська О. В. Морфологічні особливості волосся собак порід Yorkshire Terrier, West Highland White Terrier, Airedale Terrier та Australian Terrier / *Біологічні дослідження* — 2021 : зб. наук. пр. Житомир, 2021. С. 93–96 ; Wandhare P. P., Bhosale M. S. Trichology: a Science of Hair Examination in Identification of Dog Breeds. *International Journal of Applied and Pure Science and Agriculture (IJAPSA)*. 2017. Vol. 03. Is. 6. Pp. 61–66. DOI: [10.22623/IJAPSA.2017.3055.FZ1ES](https://doi.org/10.22623/IJAPSA.2017.3055.FZ1ES) (date accessed: 03.06.2022) ; Tridico S. R. Examination, Analysis, and Application of Hair in Forensic Science — Animal Hair. *Forensic science review*. 01 Jan, 2005. Vol. 17. Is. 1. P. 17–28.

the facts of the presence or condition of animal hair and the circumstances of availability to be established. Determining the information essence and value of information generated from the results of hair research is the result of comparing research data with other circumstances established in the case ⁵.

Article Purpose

Justify possibilities of identifying taxonomic affiliation of animal hair using instrumental and microscopic methods, in particular, scanning electron microscope.

Main Content Presentation

The main tasks of the research on objects of biological origin are diagnostic and identification.

Diagnostic tasks (in the case when the carrier of information is the animal hair) are, in particular, determination of whether the hair belongs to a certain animal within a specific classification system (family, genus, species). The basis of most diagnostic studies are natural or artificial classification systems.

Identification tasks are to establish identity of compared objects (a hair belongs to a certain animal, a fragment of fur is separated from a certain collar, etc.); determination of the belonging of the compared objects to an animal of the same taxon, so-called common generic belonging; clarification of the general group belonging of the compared objects.

Thus, while examination of objects of biological origin, it is often necessary to compare animal hair found at the crime scene with samples taken from persons suspected of murder, rape, theft of animals, wool or fur products, etc.

In the practice of morphological research on animal hair, it is often necessary to establish its belonging to a certain species or a larger taxonomic unit (kind, family). Despite a significant number of works covering this field of knowledge, forensic scientists and biologists still experience some difficulties while relevant examinations.

Currently, morphological methods of animal hair research are the main ones while forensic examination of such objects. Analysis of specifics of hair structure remains crucial for identifying their taxonomic and group affiliation.

For identifying taxon of animal hair, available methods are used, that involve (along with the rest of the research) treating the hair with a hot lye solution in order to obtain core discs, by which taxon of the animal can be identified.

Unfortunately, it is sometimes quite difficult to determine taxonomic affiliation of hair using this method, since similarity of morphological structure of the hair of some animals makes it difficult to differentiate them. In addition, for the study of downy hair, which is often found in expert practice, the morphological method is not enough, because it is common knowledge that core itself most often has a specific composition for a specific taxon. It is necessary to note clear inadequacy of using in expert practice only morphological tests of modified animal hair that was subject to certain technological processing (fur).

Therefore, it is not always possible to use generally accepted methods of analysis to solve the problems of forensic biological research of animal hair that is why development of new methods of research of biological materials is urgent. One of these methods is determining content of elements in biological objects.

5 Кисин М. В., Митричев В. С. Судебно-биологическая экспертиза волос животных: методическое пособие для экспертов, следователей и судей. Москва, 1996. 136 с.

Recently, we have observed an increase in interest in the study of the content of macro- and microelements in the human body in normal conditions and in the presence of pathological conditions. They are necessary for almost all the most important life processes, as well as for the normal course of many metabolic reactions and the implementation of physiological functions⁶. However, in forensic biology (in contrast to medicine), the study and use of this knowledge remains limited and not in sufficient demand. According to modern concepts, the elemental composition of hair reflects the condition of humans and animals better than other bioindicator systems. In addition, the use of special hair research methods makes it possible to detect elements and substances a long time later (after days, weeks, years). A valuable characteristic of hair as an object of research is its resistance to influence of natural factors. In connection with the above, there is a need to apply new methods of animal hair research in order to reveal additional identification and diagnostic signs.

Following issues may be asked for forensic biological examination:

- “Does presented object-carrier contain objects of animal origin, in particular hair?”;
- «Are the detected objects animal hair?»;
- “If detected objects are animal hair, what is its taxonomic affiliation?”;
- “Does detected animal hair come from the animal hair or from a fur product?”;
- “Is the object exposed to specific factors of the external environment?”;
- “Do hair found on the carrier object and hair of a certain animal (animal hair product) have a common generic (taxonomic) or group affiliation?”;
- “To what breed of animal does the detected hair belong? Is it the same as the hair taken as a sample?”;
- “From what part of the animal body does the detected hair come from?”;
- “Does detected hair belong to this particular person?” etc.⁷

One of the traditional methods of hair research is the macroscopic method. In addition, the color, shape and length of the hair are determined. To determine

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- 7 Основи судової експертизи: навчальний посібник для фахівців, які мають намір отримати або підтвердити кваліфікацію судового експерта / авт.-уклад.: Л. М. Головченко, А. І. Лозовий, Е. Б. Сімакова-Єфремян та ін. Харків, 2016. 928 с.

the hair color, it is washed in warm water with soap and degrease with ether. For measuring the length, a ruler is placed on the hair and carefully straightened. By shape, hair is divided into straight, arc-shaped, wavy, curly. The shape of the hair is determined by studying each individual hair.

One of the main methods for solving issues of forensic biological examination is microscopic examination. Hair is an epidermal keratinized formation containing a root part, fixed in the skin at an angle to the surface and a stem part (shaft). The root of the hair ends with a thickening (hair follicle) and the peripheral end (shaft) ends with a tip of various shapes (needle-shaped, in the form of a broom, etc.).

There are three layers in hair:

- 1) core, or brain substance that is located in the central part of the hair and contains one or more rows of cells. The core of the hair is made up of cells, which size and shape of differ in different animals. In thin hair, the core can be missing;

- 2) cortical substance containing cells stretched along the hair. They contain a pigment that determines hair color;
- 3) cuticle that is surface layer of thin cells located in the form of scales (tiles) along the entire hair shaft. Cuticle scales can vary in size, shape, and location in the hair in different animal species. Furthermore, the shape, size and location of the cuticle scales can vary according to the length of the hair.

For example, the hair of mammals is divided into several types: guides of the 1st-3rd order, spiny hair of the 1st-4th order, downy hair of the 1st-4th order, vibrissae.

Currently, methods of microscopic analysis of hair based on the features of the cuticle and core have been developed, which make it possible to determine whether an animal belongs to a specific group, for which specialists use catalogs of photos of the hair of these animals (standards). However, these methods are not applicable when the required standard is missing from the catalog.

Recently, researchers often turn to highly informative methods ⁸ (for example,

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nuclear-physical methods of elemental analysis), which provide information about the content of the most important bioactive macro- and microelements in biological objects of various levels of organization. These methods are characterized by high accuracy.

The main advantages of nuclear physics methods (compared with traditional chemical and biophysical methods):

- high absolute sensitivity (mcg/g), which allows to analyze even a very small amount of substance;
- ability to determine a significant number of elements at the same time;
- high sensitivity to concentration (up to 1 mcg);
- ability to analyze both thin layers of the substance and bulk samples;
- ability to conduct non-destructive analysis;
- speed of obtaining information (up to 10 minutes per target);
- automation of measurements and processing of results.

For carrying out research using the above-mentioned methods, researchers chose animal hair that is most often found in practice of forensic biologists, as well as human hair.

Preparation of hair samples for research using the gamma activation method does not require the use of many chemical reagents, long time, etc. compared to the preparation of these objects for other types of analysis. Thus, for gamma-activation analysis, hair samples were processed according to the P. J. Barlow method: they were washed

twice with distilled water, followed by treatment with a mixture of ethanol and diethyl ether (1:1), dried at a temperature of 250 °C, weighed on an analytical balance and packed in aluminum foil. For the gamma activation analysis, the weight of the hair sample was approximately 0.5 g (the weight of the sample may be less). The sample was placed in foil and reweighed. All packages were numbered and placed in a common foil pencil case that was placed under the beam of a linear electron accelerator.

Irradiation was carried out on a linear electron accelerator with a beam of bremsstrahlung gamma rays with an energy of 24 MeV and a current of 700 μ A. The sample activation time was 3 days. Upon completion of the activation, the samples were removed from the pencil case and successively transferred to the detector, which registers the given activity. We used a Ge(Li) detector with a volume of 50 cm³, manufactured at the Kharkiv Physical and National Science Center Kharkiv Institute of Physics and Technology (KIPT), the resolution of which was 2.8 keV (on the 1333 keV line).

The detector was connected to the AI-1024 pulse amplitude analyzer. Calibration of the energy scale of the spectrometer was performed using a set of sample spectrometric sources (OSGI, kit № 69). To measure the activity of the samples, they were sequentially installed on the end of the cover of the cryostat, behind which was the Ge(Li) detector. In the process of measuring the above activity, the stability of the position of the channel (energy) of the gamma spectrometer was monitored. The spectrum acquisition

Шклярський В. І., Педан А. Д. Скануючий оптичний мікроскоп для клінічної лабораторної діагностики. *Прикладна радіоелектроніка. Стан і перспективи розвитку МРФ'2008* : тези доп. 3-го міжнар. радіоелектр. форуму (Харків, 23—25.10.2008). Харків, 2008. Т. 4. С. 127—131.

time ranged from 10 min to 5 h (depending on the activity of the sample). The resulting spectrum was processed on an amplitude analyzer. The absolute values of concentrations of macro- and microelements were determined using standard samples. The detection limit of the elements was 10^{-4} – 10^{-7} % by mass.

As a research result, approximately 30 spectra of hair samples were obtained, in which the following main elements were detected: Ca, Na, Mn, Cr, Zn, Pb, Sr, Ni, Zr, I (Figs. 1-3). It seems possible to detect more elements, provided that the period of start of registration on the detector is reduced.

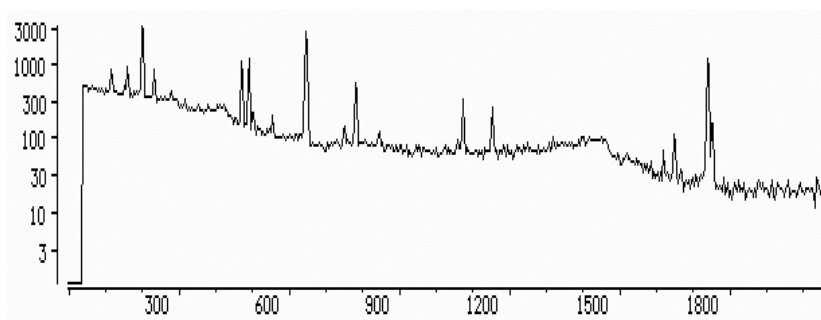


Fig. 1. Spectrum of domestic dog hair

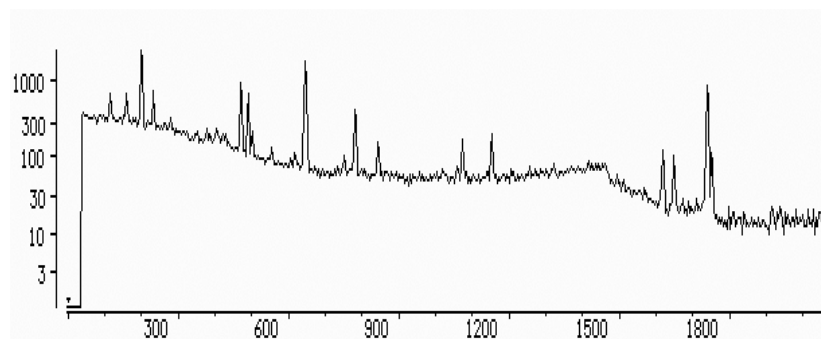


Fig. 2. Spectrum of domestic cat hair

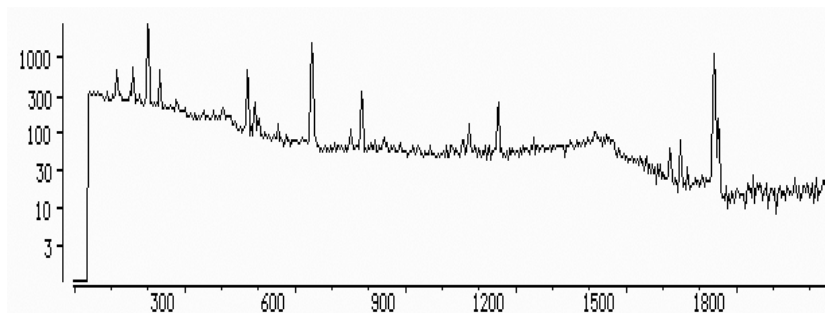


Fig. 3. Spectrum of domestic goat hair

The analysis of obtained results by absolute value, taking into account root mean square deviations, shows that there are certain differences in the content of macro- and microelements between families and genera of animals. Quantitative characteristics of the detected elements in the samples make it possible to detect interfamilial and intergeneric differences using correlation analysis.

In addition to the research on animal hair by the gamma-activation method, a priority and powerful direction is research using scanning electron microscopy that is based on the registration of analytical signals arising from the interaction of a focused beam of accelerated electrons (electron probe) with the object surface under research.

Scanning electron microscopes (hereinafter referred to as SEM) are actively used in various fields of materials science, as they have (due to the physical principles of image formation) a number of significant advantages over any optical microscopes. These advantages include:

- magnification up to 1 000 000×, that is fundamentally unattainable for Bright-field microscopy (BF);
- significant depth of focus making it possible to research relief specifics of volumetric samples (surfaces of fractures, mechanical traces of contact interaction, individual hair samples, microparticles of various morphological structures, etc.);
- ability to receive images with phase contrast of multiphase objects.

While interaction of accelerated electrons with the substance atoms of the sample under research, we observe the following main physical effects:

- secondary electron emission, i.e., release of electrons beyond the electron shells of the atoms of a substance due to the acquisition of additional energy, exceeding the binding energy, from the electrons of the primary beam. Secondary electrons (hereinafter referred to as *SE*) are low-energy, and the intensity of their formation depends mostly on the angle of contact of the electron probe with the surface of the sample. Therefore, images in secondary electrons have a maximum depth of field;
- elastic reflection of primary electrons by atoms of the substance under study at angles of $\approx 90^\circ$ to the surface of the sample. Such electrons are called *backscattered electrons* (hereinafter referred to as *BSE*). Probability of occurrence of elastic reflection is proportional to the atomic density in the area of interaction of the substance of the object with the primary electron beam. Accordingly, their registration makes it possible to obtain phase-contrast images;
- X-ray fluorescence is producing electromagnetic radiation with defined energies (wavelengths) that correspond to energy differences between the internal electron shells of the atoms of the sample substance (due to the transition of electrons to positions on lower shells, released in the process of interaction with the primary beam). Determining the numerical values of these energies (wavelengths) and the intensity of corresponding fluorescence maxima is a tool for

establishing the qualitative and relative quantitative elemental composition of the research object;

- formation of Auger electrons. While ionization of the inner atomic shells, there is a possibility of the atom returning to its ground state without emitting a quantum of energy. In this case, excess energy is transferred to one of the electrons of the atom that as a result, leaves its boundaries. The numerical value of the energy of such an electron does not depend on the energy of the primary electron, but is determined by the structure of the electron shells. This phenomenon is the basis of Auger electron spectroscopy (AES);
- cathodoluminescence is emergence of electromagnetic radiation in the visible, ultraviolet, and infrared ranges due to multiple ionization of target atoms under the action of an electron beam. The study of cathodoluminescence is used in scientific research in the field of solid state physics.

Furthermore, informative analytical signals use the current of absorbed electrons and the current of electrons that have passed through the sample.

Secondary electrons (*SE*) are registered mainly by the Evergarth-Thornley detector, a scintillation type detector. Secondary electrons emitted by the sample surface have negligible energy (< 50 eV), so they are attracted (if they enter the detection zone) by the electric field of the detector, where they are accelerated and collide with the surface of the phosphor, causing a flash of light. The optical signal is registered by a photoelectric multiplier (hereinafter

referred to as a photomultiplier). The electrical signal from the photomultiplier is amplified and, after digital processing, converted into a gray level on the electronic image. The process occurs in correlation with the coordinate position of the primary beam at a certain point on the surface of the object, thanks to which a relief image of the scanned surface is formed. Backscattered electrons have a much higher energy, so they are not captured by the detector field and they practically do not affect the formation of the image.

Both scintillation and semiconductor detectors are used to register backscattered electrons: reflected electrons (*BSE*). Semiconductor detectors are usually built according to the scheme of a semiconductor diode, which additionally has, in addition to p- and n-conductivity zones, a zone of its own conductivity (depleted of charge carriers). If an ionizing particle (in particular, electron with sufficient energy) enters this zone, carriers of electric charge are formed in so-called electron-hole pairs that are registered in the form of an electric current pulse.

X-ray fluorescence is registered by two types of detectors — a cooled semiconductor detector, which, in combination with an electronic analytical signal processing circuit, simultaneously registers the characteristic maxima of X-ray fluorescence energies of the atoms of the substance of the object in the full energy range available for registration (Energy Dispersive X-ray Fluorescence (EDXRF)).

Detectors by wavelengths use the phenomenon of X-ray diffraction on single crystals.

The use of SEM makes it possible to study the surfaces of both objects of significant linear dimensions and microparticles in

a wide range of magnifications (from 10× to more than 200,000×). In addition, it is possible to provide a resolution of up to 10^{-9} m. Therefore, without significant reconfiguration of the device, it is possible to quickly obtain a general overview image of the surface and select the appropriate areas for detailing at the maximum possible magnifications.

Significant depth of focus makes it possible to obtain detailed images of various surfaces with developed relief (namely: cracks, traces of mechanical damage, morphological features of periodically reproduced surface structures).

BSE detection provides the ability to form a contrast depending on the distribution of phase components that vary in chemical composition, on the surface of the test sample.

The corresponding images obtained using the *Tescan Vega3* microscope are indicated in Figures 4 and 5.

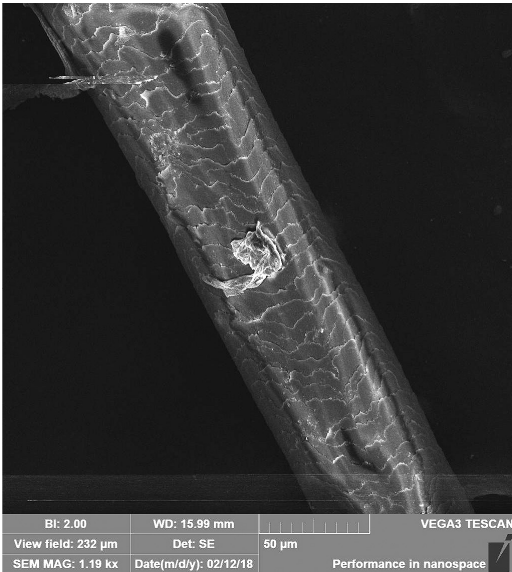


Fig. 4. Animal down hair (magnification 1190×1190)

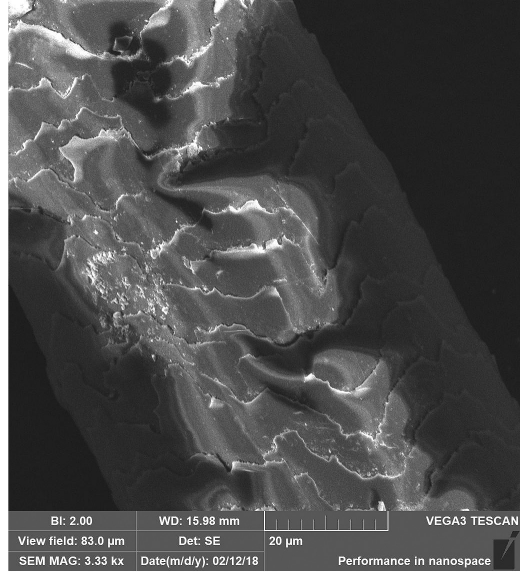


Fig. 5. Detailed image of the figure of the animal's down hair cuticle (magnification 3330×)

Conclusions

Thus, using a scanning electron microscope, biologists can study the surfaces of both objects of animal origin of significant linear dimensions and microparticles in a wide range of magnifications (from 10× to more than 200,000×). In addition, it is possible to provide a resolution of up to 10^{-9} m.

Without major adjustments to the instrument, you can get a general overview of the surface and select the appropriate areas for detailing at the maximum possible magnifications. Significant depth of field makes it possible to obtain detailed images of various surfaces with developed relief (such as: cracks, traces of mechanical damage, morphological specifics of periodically reproduced surface structures).

BSE detection provides the ability to form a contrast depending on the

distribution of phase components that vary in chemical composition, on the surface of the test sample.

The proposed methods for researching animal hair will significantly enrich the possibilities of examination of the specified objects: it will make it possible to reduce the time and increase the accuracy of conducting such studies, as well as to supplement illustrative material (for example, microphotographs of hair cuticles of various types of animals, which are often encountered while forensic researches).

Use of modern research methods makes it possible to identify additional objective criteria in the case of a comparative research on animal hair that will contribute to solving a larger range of issues while forensic biological examination.

Встановлення таксономічної належності волосся тварин за допомогою інструментальних і мікроскопічних методів

Лариса Дереча, Олександр Борзов, Флорін Русіторіу

Розглянуто загальну потребу в розробленні методики для встановлення таксономічної належності волосся тварин за допомогою сучасних методів дослідження (виявлення додаткових об'єктивних критеріїв у разі порівняльного дослідження речових доказів — волосся тварин), що сприяє розв'язанню більшого кола питань, поставлених під час призначення судово-біологічної експертизи. Автори мали на меті обґрунтувати можливість встановлення таксономічної належності волосся тварин за допомогою інструментальних і мікроскопічних методів — зокрема, сканувального електронного мікроскопа, який дає змогу експертам-біологам вивчати поверхні об'єктів тваринного походження як значних лінійних розмірів,

так і мікрочастинок у широкому діапазоні прирощень (від $10\times$ до понад $200\,000\times$), забезпечуючи роздільну здатність до $10\text{--}9\text{ м}$. Отримання загального зображення поверхні й вибір відповідних ділянок для деталізації (за максимально можливих збільшень) не потребує істотного переналаштування приладу. Значна глибина різкості дає деталізовані зображення різних поверхонь із розвиненим рельєфом (злами; сліди механічних пошкоджень; морфологічні особливості поверхневих структур, що періодично відтворюються). Контрастність є результатом детектування відбитих електронів (залежно від розподілу поверхнею досліджуваного зразка фазових компонентів, що різняться за хімічним складом). Запропонована методика дослідження волосся тварин суттєво розширить можливості експертизи зазначених об'єктів: зменшить час і збільшить точність проведення таких досліджень, а також дасть змогу поповнити ілюстративний матеріал (наприклад, мікрофотографіями кутикули волосся видів тварин, що часто зустрічаються).

Ключові слова: волосся тварин; елементний склад волосся; об'єкти тваринного походження; сканувальна електронна мікроскопія; судово-біологічна експертиза.

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Declaration of Competing Interest

The authors state that there is no conflict of interest on this topic, although Larysa Derecha is a member of the journal Advisory Board; she did not take part in decision regarding publication and this article is subject to a full peer review process.

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Peculiarities of Determining Affecting Properties of Small-bore Bullets After Ricochet

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^c Resources.

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Authors aimed to summarize experimental researches of affecting properties of monolithic .22 Long Rifle bullets after their ricochet from various types of obstacles. Alternative criterion for evaluating the affecting properties of bullets is proposed using this criterion it is possible to forecast the degree and severity of bodily injuries after ricochet. Specifics and conditions under which fragmentation of monolithic small-bore bullets occurs are revealed, as well as flight speed of bullets and their fragments after impact-contact interaction with obstacles of various types is determined. Special attention is paid to research on interaction nature of bullets and their fragments with a viscoelastic environment imitating biological human body tissues after ricocheting. It has been determined that energy concept of affection to biological target and criteria for its evaluation research on affecting properties of bullets after ricochet have limited application, since it is not always possible to accurately determine initial conditions of hitting as the bullets themselves as their individual fragments. Obtained results of experimental research and

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field tests made possible to form an alternative criterion for assessing the severity of bodily injuries that a person suffered as a result of being hit by small-bore lead bullets after ricocheting. It is the length of the wound channel caused by a bullet or its fragments as a result of their impact on a person's body after ricocheting. A calculation method for determining the length of the caused wound channel is proposed that can be used in forensic expert practice to determine potential injury to human life and health.

Keywords: *energy concept of target hitting; calculation method; affecting properties; alternative evaluation criterion; length of the wound canal; imitator of biological tissues; small-bore bullet; ricochet.*

Research Problem Formulation

Forensic research on specifics of impact-contact interaction of bullets, fragments of bullets or individual structural elements after their ricochet from surfaces of relatively dense obstacles with biological objects is quite a difficult task. The main difficulties arise while research on affecting properties of these objects and the assessment of their ability to inflict bodily harm on human body of varying severity, since there are no scientifically based methods for such studies, and the modern energy concept of target damage, which is used in forensic ballistics, in such cases has a rather limited application. First of all, this is due to inability to determine initial conditions for hitting a bullet destabilized after the ricochet and the chaotic fragmentation of the bullet due to its impact-contact. In this connection, there is a need to apply an alternative criterion for evaluating the affecting

properties of bullets after ricochet and to introduce a limit value of this parameter. In addition, in the practice of forensic ballistics, it is necessary to introduce a calculation method for assessing the affecting properties of bullets after ricochet, which will make it possible to predict the severity of damage caused to human life and health.

Analysis of Essential Researches and Publications

Modern experts in the field of forensic ballistics, including M. and L. Haag ¹, G. A. Rathman ², Z. Kotas, C. E. Reno ³, A. V. Kofanov ⁴ and others, paid considerable attention to research on ricochet. However, they mainly have a practical orientation related to the experimental reproduction of conditions of ricocheting of balls, or consider only the consequences of real cases of ricocheting of balls from the surfaces of various types of obstacles

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(in particular, E. Thompson, R. Wyant ⁵, O. V. Kolomiitsev ⁶, A. O. Husentsov, A. A. Artiushyn, V. A. Danylova ⁷). A small amount of research papers is devoted to determining the aeroballistic characteristics of bullets after ricochet ⁸, as well as to computer modeling of physical processes that occur while ricocheting of various types of affecting elements ⁹.

A separate direction is research on consequences of ricochet of bullets, which is outlined in the works of forensic medicine professionals ¹⁰. The leading topic of these

research papers is determination of a set of signs of gunshot wounds, characteristic of cases of bullet ricochets from various types of obstacles. Another branch of research on the ricochet of bullets of different calibers is wound ballistics ¹¹ determining combat effectiveness of action against a live target. A significant part of research papers is devoted to research on physical processes that occur while the impact-contact interaction of balls with the surfaces of obstacles (mostly metal ones ¹²). At the same time, extremely

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insufficient attention has been paid to research on the affecting characteristics as the bullets themselves as their fragments after ricocheting: only separate research papers are related to research on energy characteristics of affecting elements after ricochet¹³.

Most of mentioned research papers are devoted to research on FMJ bullets with steel or lead cores. However, the affecting properties of bullets of small-bore rimfire cartridge (in particular, .22 *Short* and .22 *Long Rifle*, hereinafter referred to as .22 *LR*) are not paid enough attention, despite the fact that they are the most common and most often become objects of forensic ballistics and legal medicine.

Article Purpose

Experimental research on affecting properties of monolithic bullets of the

.22 *LR* caliber after their ricochet from surfaces of various types of interference. Based on obtained results of full-scale tests, to propose an alternative criterion for assessing their affecting properties that will make possible to forecast the degree and severity of bodily harm caused to a person by a bullet or its fragments as a result of ricochet.

Main Content Presentation

For experimental researches, 5.6 mm sport rimfire cartridges (.22 *LR*), equipped with a monolithic lead bullet, and 5.6 mm pistols of the *Grand Power K22 S* and *K22 X-TRIM* models were used (see Fig. 1–3).



Fig. 1. 5.6 mm sport rimfire cartridges

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Fig. 2. Right and left sides of the 5.6 mm *Grand Power K22 S* pistol



Fig. 3. Right and left sides of the 5.6 mm *Grand Power K22 X-TRIM* pistol

Experimental firing in a series of 25 shots was carried out in a concrete block of curb, white silicate bricks and a metal slab, the angle of meeting of bullets with the surface of obstacles was 0-30°. Due to the relatively

low speed of the bullets at the time of impact, it was possible to obtain data on the energy characteristics of the bullets and their fragments after the ricochet. The results of the research are given in Table 1-3 and in fig. 4—6.

Table 1

Ballistic characteristics of the affecting elements before and after the ricochet while firing at the concrete block with 5.6 mm rimfire cartridge from the Grand Power K22 S pistol (only scoring shots)

Shot №	Bullet speed to ricochet, m/s	Bullet speed (bullet fragments) after ricochet, m/s
1	285,9	189,6
2	296,0	40,5

Shot №	Bullet speed to ricochet, m/s	Bullet speed (bullet fragments) after ricochet, m/s
3	296,9	212,3
4	279,0	201,5
5	282,0	270,8
6	285,0	76,7
7	284,6	201,3
8	303,1	251,9
9	283,2	244,2
10	267,1	233,4
11	303,4	268,4
12	296,8	263,8

Table 2

Ballistic characteristics of affecting elements before and after the ricochet while firing at silicate bricks with 5.6 mm rimfire cartridges from the Grand Power K22 S pistol (scoring shots only)

Shot №	Bullet speed to ricochet, m/s	Bullet speed (bullet fragments) after ricochet, m/s
1	296,6	232,5
2	294,4	234,2
3	297,6	48,5
4	297,3	246,7
5	301,2	246,5
6	286,1	225,5
7	297,2	232,2
8	280,0	232,1
9	292,8	101,4
10	301,4	226,2

Table 3

Ballistic characteristics of the striking elements before and after the ricochet when firing at the metal plate with 5.6 mm round-ignition cartridges from the Grand Power K22 X-TRIM pistol (scoring shots only)

Shot №	Bullet speed to ricochet, m/s	Bullet speed (bullet fragments) after ricochet, m/s
1	287.7	244.4
2	285.8	246.2
3	298.8	265.5
4	295.8	262.5
5	290.3	208.8

Shot №	Bullet speed to ricochet, m/s	Bullet speed (bullet fragments) after ricochet, m/s
6	292.3	259.5
7	285.4	195.4
8	286.8	237.8
9	295.8	244.0
10	291.3	195.8
11	293.4	252.3

The speed of flight of bullets before and after the ricochet was measured by the optoelectronic measuring complex IBH-731.4. Ballistic plasticine served as a target that is imitator of biological tissues of the human body.



Fig. 4. Damage to the concrete block caused by ricochet of 5.6 mm lead bullets



Fig. 5. Traces of ricochet on the metal plate surface caused by the hit of 5.6 mm lead bullets



Fig. 6. Damage to white silicate bricks caused by the ricochet of 5.6 mm lead bullets

While research it was determined that fragmentation of 5.6 mm lead bullets of sports and hunting cartridges of ring ignition almost always occurs at angles of encounter with the surface of the obstacle from 5 to 30°. This is primarily due to the significant primary area of contact with the obstacle, which physical and mechanical characteristics of the material of are equal to or exceed corresponding parameters of the material of the bullets. The magnitude of reaction resistance forces of the interference material (taking into account the contact pressure) significantly exceeds tensile strength of the bullet material that causes devastating consequences (see Fig. 7–10).



Fig. 7. Fragments of bullets formed as a result of ricochet (one side of fragments; angle of meeting is 5–30°)

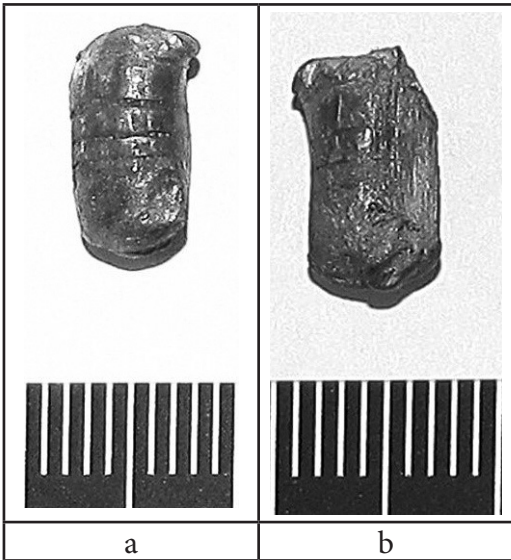


Fig. 8. 5.6 mm lead bullet at an angle of encounter with the surface of a concrete block close to 0° (a is one side of the ball; b is reverse side of the bullet with traces of ricochet)

While meeting angles are close to the range of 0–5°, lead bullets of 5.6 mm caliber at a contact speed of up to 300 m/s cause less damage (see Fig. 8). Weighing determined that the mass of 5.6 mm lead bullets before

the ricochet was 2.55–2.60 g, and after the ricochet: 2.37–2.44 g with a fragment mass of 0.25–1.75 g.

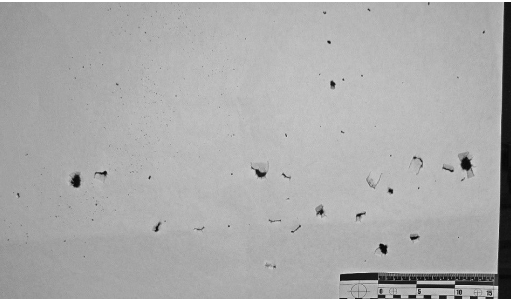


Fig. 9. Dispersion of 5.6 mm lead balls and their fragments after ricochet

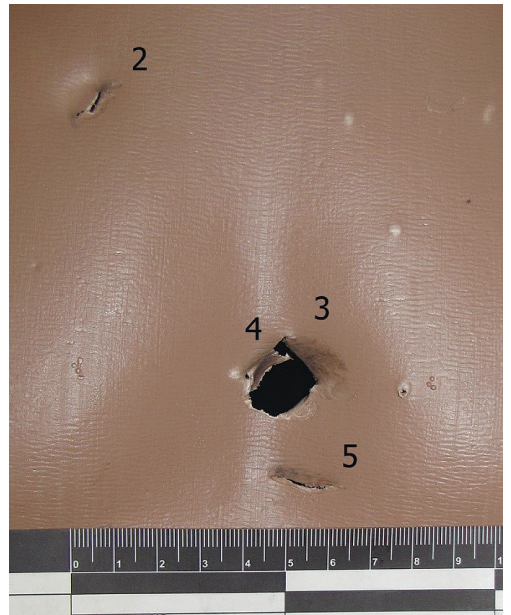


Fig. 10. Damage to the dummy by 5.6 mm lead bullets and their fragments after the ricochet

Ability to determine the speed and mass of bullets and their fragments made possible to calculate energy characteristics of secondary damaging elements formed as a result of the ricochet. For this purpose, outside optoelectronic device for measuring the speed of the affected

elements, a block of ballistic plasticine measuring $150 \times 210 \times 140$ mm was installed, distance from the block to the obstacle (from ricocheting surface) is 1000 mm. The research results are indicated in the table 4 and Fig. 11–17.

It is worth noting that most of the bullet mass is preserved (E.g., Table 4), but the bullet shape varies quite strongly, that significantly complicates the calculations related to determining coefficient of

resistance forces of the medium during the movement of a kinetic projectile in it (E.g., Fig. 8). In addition, after deformation, the main bullet fragment after the ricochet acquires a rather complex spatial shape with variable motion parameters, it, as a affecting element, has an unpredictable (quasi-ballistic) trajectory of movement, which makes it impossible to determine the shape and area of its primary contact with the ballistic plasticine block.

Table 4

Ballistic characteristics of the striking elements before and after the ricochet while firing at a block of ballistic plasticine 5.6 mm rimfire cartridges from the Grand Power K22 S pistol (only scoring shots)

Shot №	Mass of fragments after ricochet, g	Bullet speed to ricochet, m/s	Bullet speed (bullet fragments) after ricochet, m/s	Damage channel length, mm
1	-	287.4	245.6	-
2	-	300.6	206.8	-
3	-	289.4	254.9	72*
4	2.43	292.2	254.2	58**
5	2.36	259.6	226.7	89***
6	2.05	302.3	256.9	98****
7	2.38	290.8	242.4	50*****
8	-	298.2	266.3	-

Note:

* — damage marked as «1»;

** — damage marked as «2»;

*** — damage marked as «3»;

**** — damage marked as «4»;

***** — damage marked as «5».



Fig. 11. Fragments of 5.6 mm bullets after ricochet (one side)

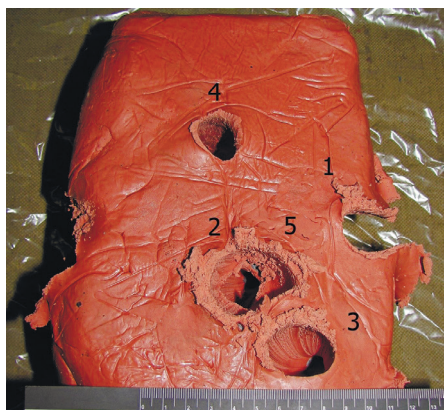


Fig. 12. Damage to ballistic plasticine block by fragments of 5.6 mm bullets after ricochet



Fig. 13. Longitudinal section of damage to ballistic plasticine block, designated as «1»

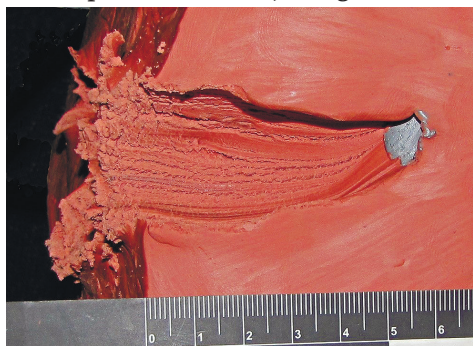


Fig. 14. Longitudinal section of damage to ballistic plasticine block, designated as «2»

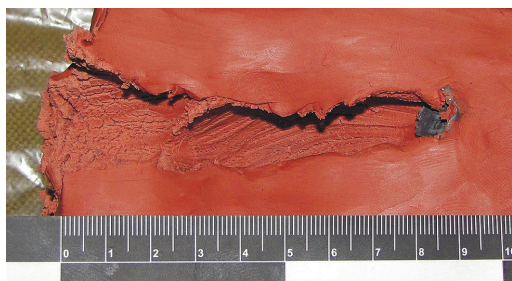


Fig. 15. Longitudinal section of damage to ballistic plasticine block, designated as «3»

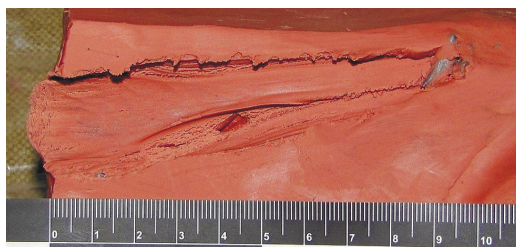


Fig. 16. Longitudinal section of damage to ballistic plasticine block, designated as «4»

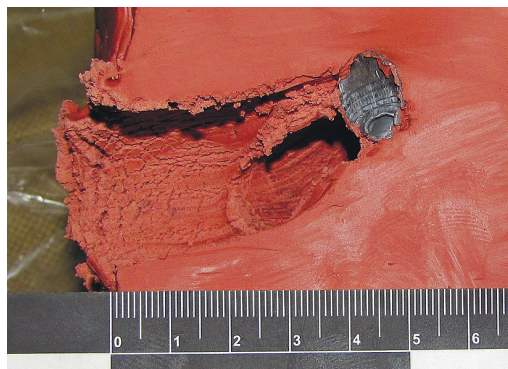


Fig. 17. Longitudinal section of damage to ballistic plasticine block, designated as «5»

Taking into account research results, the most typical shape of the bullets, designated as «2», «3» and «5» (see Figs. 14, 15, 17), after their deformation due to ricochet can be considered a shape close to oval one. If, moving in obstacle

thickness, they did not change their position, then contact area of deformed bullets with viscoelastic medium of ballistic plasticine block was 141.14-176.15 mm².

For such bullets, Tables 5 and 6 are compiled with the parameters necessary for further calculations (in particular, to determine coefficient of environmental resistance forces).

Table 5

Parameters of ball fragments for determining coefficient of environment resistance forces

Fragment №	Bullet fragment mass, g	Estimated contact area, mm ²	Bullet fragment velocity at the time of impact after ricochet, m/s	Depth of the damage channel, mm
2	2.43	160.42	254.2	58
3	2.36	141.14	226.7	89
5	2.38	176.15	242.4	50

Table 6

Energy parameters of bullet fragments after ricochet

Fragment №	Kinetic energy, J	Specific kinetic energy, J/mm ²
2	78.51	0.489
3	60.64	0.430
5	69.92	0.396

Data analysis of the tables Fig. 5 and 6 indicates that although the bullet fragments have a rather high contact velocity at the time of hitting the ballistic plasticine block, the damage caused by them is characterized by rather shallow channels, due to the significant contact area of the deformed fragment of the bullet. Despite this, based on the limit value of the length of the wound canal of 50 mm, it can be stated that in the event of a hit on the human body, studied fragments of bullets will necessarily cause a permeable wound with a significant amount of damaged biological tissues.

Since all the kinetic energy fragments of the balls transferred to the block of ballistic plasticine, at a first approximation it is possible to neglect the energy losses for heating and overcoming friction forces.

Thus, we believe that all the kinetic energy of a single fragment of a bullet is spent on overcoming resistance forces of the viscoelastic environment. Then:

$$A = E_{kin} = \frac{m V_c^2}{2} = F_c \cdot l, \quad (1),$$

where: A is the work performed by a fragment of a bullet in obstacle thickness, J;

E_{kin} is kinetic energy of bullet fragment at the moment of impact, J;

m is weight of bullet fragment, kg;

V_c is bullet fragment velocity at the time of impact, m/s;

F_c is environment resistance force, H;

l is damage channel length, m.

By converting empirical dependence (1) on the resistance force F_c and taking into account the empirical dependence

for calculating the resistance force, we can determine the coefficient of resistance force of viscoelastic environment:

$$C_1 = - \frac{2 \cdot E_{kin}}{\rho V_c^2 \cdot S_0 \cdot l}, \quad (2),$$

where: ρ is the density of the medium, kg/m^3 ;
 S_0 — contact area of bullet fragment at the time of impact, m^2 .

Calculation results are provided in Table. 7. Analysis of the results indicates that the larger the contact area and velocity of the bullet fragment at the time of impact, the greater the environment resistance force and the smaller the wound channel in length.

Reducing the contact speed with a smaller contact area increases the damage depth.

In the calculations, the density of the medium was 1040 kg/m^3 . Obtained data make possible to calculate the ultimate velocity of bullet fragment after ricocheting in a viscoelastic environment (V_{gr}), that is determined by the formula ¹⁴:

$$V_{gr} = a \ln V_c - b, \quad (3),$$

where: V_c is bullet fragment velocity at the time of impact, m/s ;
 a , b are correlation coefficients.

Table 7

Environment resistance coefficient of bullet fragments after ricochet

Frag- ment №	Damage channel depth, mm	Estimated contact area, mm^2	Kinetic energy, J	Environment resistance force, N	Coefficient of resistance forces of environment
2	58	160.42	78.51	1353.62	0.251
3	89	141.14	60.64	681.35	0.181
5	50	176.15	69.92	1398.40	0.260

The limit value of V_{gr} velocity is determined on the basis of the quadratic law of resistance according to the velocity of the affecting element in the case of the so-called blind gunshot wounds (damages) cannot be equal to 0: it is determined from the obtained functional dependencies for a specific damaging

element under assumption that $l = 0$, besides $\ln V_c = \ln V_{gr}$.

Based on data provided in the table. 7 data, it is determined that for studied fragments of bullets after ricochet, values of correlation coefficients are: $a = 0.349$; $b = 1.977$. The value of the drag coefficient for the tested bullet fragments after

14 Озерецковский Л. Б., Гуманенко Е. К., Бояринцев В. В. *Op. cit.* ; Коломійцев О. В., Остропілець В. Р., Нікітюк В. Г., Герман О. М., Добри́вченко Б. Д. Розробка методичних рекомендацій з визначення уражаючих властивостей куль після рикошету. Рукопис. № держреєстр. 0118U004606. Харків, 2019. 110 с.

ricocheting for a viscoelastic environment is 0.181-0.260.

Therefore, if we consider the limit value of wound channel length to be 50 mm, then the calculated limit value of the velocity of such an affecting element as a deformed fragment of a 5.6 mm lead bullet after the ricochet will be 250 m/s.

Therefore, using the empirical expression (3), it is possible to calculate the length of wound channels for experimentally determined values of the contact velocity of bullet fragments after the ricochet.

Calculation results are indicated in the Table. 8.

Table 8

Estimated values of length of damage channels

<i>Frag- ment №</i>	<i>Bullet fragment velocity at the time of impact after ricochet, m/s</i>	<i>Experimentally determined depth of the damage channel, mm</i>	<i>Calculated value of damage channel depth, mm</i>	<i>Error, %</i>
2	254.2	58	52	10.3
3	226.7	89	33	62.9
5	242.4	50	47	6.0

Analysis of the following in Table 8 data indicates availability of rather high differences in the depth values of damage channels, obtained experimentally and by calculations, in the case of contact velocity values less than the limit. This can only be explained by the insufficient amount of experimental data necessary for their statistical processing. At the same time, a significant number of experimental researches are quite difficult to process statistically. Therefore, empirical dependencies identified for calculating the depth of wound channel of fragments of 5.6 mm lead balls after ricochet have limited application, since they can be used for cases where contact velocities are close to the limit value (250 m/s). At lower contact velocities, the calculated value of the length of the wound channel significantly decreases, and at higher ones, it increases, although

the conducted experiments proved an inverse relationship, which has a physical explanation: as the speed increases, the drag force increases in a quadratic relationship, which, other things being equal, leads to a decrease in the length of the wound channel. For example, for bullet fragment «3», other things being equal (with contact velocities of 200, 250, and 300 m/s), the calculated values of length of the damage channel will be 10.4; 50.0 and 82.4 mm respectively, although in practice the reverse trend occurs.

According to the energy concept of hitting a target, the main criterion is the limit value of the specific kinetic energy (0.5 J/mm^2), therefore, for the studied fragments of balls, the corresponding values of the contact velocity can be calculated. The results of the calculations are set out in the table 9.

Table 9

**Fragment velocity is 5.6 mm lead balls after ricochet
 (limit value of specific kinetic energy 0.5 J/mm²)**

Fragment №	Limit value of specific kinetic energy, J/mm ²	Corresponding velocity value, m/s
2	0.5	256.9
3	0.5	244.6
5	0.5	272.1

The average value of the top velocity is 257.8 m/s that is close to the previously defined limit value (250 m/s). However, these values are relevant only for fragments that are close in mass (not less than 90-95 % of the primary mass of bullets) and have a corresponding contact area, similar in shape and degree of deformation of the bullet after ricochet. For other parameters of the shape, size and mass of bullet fragments, their damaging properties after ricochet must be determined individually.

Conclusions

The results of performed researches give grounds to assert that (despite the complexity of experiments and availability of incomplete correlation of results of these researches with the results of calculations), introduction into practice of forensic ballistics and legal medicine of alternative criterion for assessing the affecting properties of bullets and their fragments after the ricochet is based on the length of the wound canal with its corresponding limit value, is appropriate. Certain disadvantages of this approach (without the use of computer modeling of physical processes occurring during the ricochet and without a more accurate calculation of the contact surface values of affected

elements during their advancement in the thickness of the biological tissue imitator) provided that the length of wound channel is calculated on the basis of existing empirical dependencies, degree of reliability of the results may be reduced. However, as a first approximation, such a calculation method can be used to determine the affecting properties of bullets and their fragments after ricochet and to determine the probable damage caused to the human body. In addition, the conducted studies show that this method is appropriate for determining the striking properties of small-bore bullets as well as other calibers after ricochet.

Separately, it should be noted that during experiments, for the first time, data were obtained on velocity of lead small-bore bullets and their fragments after ricochet that made possible to calculate and determine the empirical dependence of the length of the wound channel on contact velocity of the damaging element.

**Особливості визначення уражаючих
 властивостей малокаліберних куль
 після рикошету**

**Олександр Коломійцев, Віктор Сапелкін,
 Павел Гіверц, Олександр Герман**

Автори мали на меті узагальнити експериментальні дослідження уражаючих властивостей безоболонкових куль

калібру .22 Long Rifle після їх рикошету від різних видів перешкод. Запропоновано альтернативний критерій оцінювання уражаючих властивостей куль, за допомогою якого можливо прогнозувати ступінь і тяжкість тілесних ушкоджень після рикошету. Виявлено особливості й умови, за яких відбувається фрагментація безоболонкових малокаліберних куль, а також визначено швидкість польоту куль і їх фрагментів після ударно-контактної взаємодії з перешкодами різних видів. Особливу увагу приділено дослідженню характеру взаємодії куль і їх фрагментів після рикошету із в'язко-пружним середовищем, що імітує біологічні тканини тіла людини. Установлено, що енергетична концепція ураження біологічної цілі та критерії її оцінювання під час дослідження уражаючих властивостей куль після рикошету мають обмежене застосування, оскільки не завжди можна достеменно визначити початкові умови влучання як самих куль, так і їх окремих фрагментів. Здобуті результати експериментальних досліджень і натурних випробувань дали змогу сформувати альтернативний критерій оцінювання ступеня тяжкості тілесних ушкоджень, яких людина зазнала внаслідок влучання свинцевих малокаліберних куль після рикошету. Ним є довжина ранового каналу, спричиненого кулею чи її фрагментами внаслідок їх влучання у тіло людини після рикошету. Запропоновано розрахунковий метод визначення довжини спричиненого ранового каналу, який можна застосовувати в експертній практиці для визначення потенційної шкоди життю та здоров'ю людини.

Ключові слова: енергетична концепція ураження цілі; розрахунковий метод; уражаючі властивості; альтернативний критерій оцінювання; довжина ранового каналу; імітатор біологічних тканин; малокаліберна куля; рикошет.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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Problematic Issues on the Use of Forensic Analysis During Investigation of Crimes

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The purpose of the work is to consider the possibilities of applying the method of forensic analysis in the detection and investigation of crimes, to identify problematic issues and ways of optimizing the specified activity of law enforcement agencies. Particular attention is paid to the directions and possibilities of using forensic analysis for the detection and investigation of crimes. Positive examples of the use of forensic analysis in investigative practice for the purpose of uncovering and investigating crimes are presented, as well as the shortcomings of this method are outlined. The effectiveness of the considered method and its availability are noted. The necessity of using forensic analysis in combination with other analytical methods is substantiated. Problematic issues of the application of the method of forensic analysis are identified, ways of solving them are proposed. The need for proper methodical support for the use of forensic analysis in the investigation of crimes was noted. Attention is focused on the fact that the use of forensic analysis requires awareness of its possibilities, in particular, a certain level of knowledge and skills in applying this method during an investigation, gaining experience in using its results in practice, as well as relevant literature and methodological recommendations and access to them by all employees of law enforcement agencies engaged in the detection and investigation of crimes. The need for a comprehensive solution to the problem of methodological support for the use of forensic analysis

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by all interested state bodies with the involvement of the necessary scientific potential for conducting relevant research and preparing practical recommendations in order to ensure the proper conditions for effective detection and investigation of crimes is emphasized.

Keywords: criminalistics; forensic analysis; investigation of crimes; methodological support; serial murders; sexual maniacs; investigative leads.

*Analysis — splitting a system into parts — gives us knowledge,
and synthesis — combining elements into a whole — gives us
understanding.*

Joseph O'Connor

Research Problem Formulation

The issue of the application of forensic analysis during the detection and investigation of crimes is relevant to this day, and the science of forensics is under a certain lack of interest of domestic and foreign scientists and practitioners in its solution. There are practically no dissertations, monographs, other scientific studies, as well as relevant sections on this issue in guides for investigators and inquirers, textbooks, training manuals, methodological recommendations.

In recent years, there has also been no approach to the solution of the mentioned problem, no notable works on this topic have been published, and individual publications that appear from time to time in periodicals and materials of scientific conferences both in Ukraine and abroad, mostly have a theoretical, general nature and relate only to certain aspects of the use

of the mentioned method, without solving the problem in general.

Analysis of Recent Researches and Publications

Among scientific researches on the above-mentioned issues, the authors of which at one time investigated in considerable detail the main issues of the application of forensic analysis in criminal justice (in particular, during the investigation of crimes), scientific articles, educational and practical manuals by V. Zhuravel, V. O. Konovalova, V. Kurapka, E. Lokar, H. Malievski, P. Saukko, E. B. Simakova-Yefremian, B. Kholyst, D. Tsekhan, V. Shevchuk, V. Yu. Shepitko, M. V. Shepitko, V. Yusupov, and others¹, which could form a solid basis for further scientific investigations. In addition to those mentioned, some aspects of forensic analysis (although not to such an extent,

1 Коновалова В. Е. Убийство: искусство расследования : монография. 2-е изд., доп. и перераб. Харьков, 2016. 320 с. ; Шепітько В. Теоретико-методологічна модель криміналістики та її нові напрями. *Теорія та практика судової експертизи і криміналістики*. 2021. Вип. 3 (25). С. 9—20. DOI: 10.32353/khrife.3.2021.02 (date accessed: 17.03.2022) ; Шепітько М. В. Концептуальні засади розвитку криміналістики та судових наук. *Архів кримінології та судових наук*. 2020. № 1. С. 89 ; Шепітько В. Ю., Коновалова В. О., Журавель В. А. та ін. *Криміналістика : підручник ; за ред. проф. В. Ю. Шепітька*. У 2 т. Т. 1. Харків, 2019. С. 252—254.

but regarding to individual situations and specific areas of application) were analyzed by S. K. Shali ², P. Rani and A. R. Randzhan ³, R. Drishti ⁴, E. Viler ⁵, E.-A. Yanku ⁶, J. Peterson with co-authors ⁷, R. Gehl and D. Plecas ⁸ and many other scientists ⁹ (in particular, domestic ones ¹⁰). Also known in this direction are the fundamental

methodological works of both specialized institutions of foreign countries ¹¹, and the UN, published in the E4J series (“*Education for Justice*”) ¹².

Among the works of domestic scientists on the mentioned issues, it is worth paying attention to the monographs by V. V. Tyshchenko ¹³, P. Ya. Minka and

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K. O. Chaplynskyi ¹⁴, as well as separate articles by K. V. Kaliuha ¹⁵, K. V. Latysh ¹⁶ and some other researchers who indicates a much lower interest of Ukrainian criminologists in researching forensic analysis issues.

Article Purpose

Consists in considering possibilities of applying the method of forensic analysis to uncover and investigate crimes, identifying problematic issues and ways to optimize the activities of law enforcement agencies in this direction.

Main Content Presentation

Recently, scientific and technical progress is developing very rapidly: every year, if not every month, new technical means and technologies appear, thanks to which the possibilities to collect, accumulate, transfer, process and use information are enriched and expanded. However, not only honest people, but criminals actively use the latest achievements of scientific and technological progress in their activities: neglecting this fact can greatly complicate the work of law enforcement officers.

The analysis of investigative practice convincingly demonstrates that against the background of the growing importance of the information

component in the investigation process, the need to develop new approaches to the investigator's work with the data that comes to them, primarily in digital form, has also increased. In this regard, scientists and law enforcement officials rightly draw attention to the fact that *"it is possible to accumulate gigantic masses of information, literally bathe in a sea of facts, information and data and not be able to use them, to make timely, accurate and effective decisions based on them"* ¹⁷.

It should be noted that along with modern opportunities in the fight against crime, significantly enriched by the above-mentioned factors (rapid development of information technologies, digitization of the global space), the emergence of new means and methods for detecting, recording, and removing traces of crime, information about the criminal, physical evidence, stolen property, as well as their use for evidence in criminal proceedings, time-tested methods of investigators' work remain no less important and irreplaceable.

Among such methods is forensic analysis, which can be recognized with complete confidence as one of the tactical forensic tools and an important component of the tactical forensic support for the investigation of crimes ¹⁸.

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Forensic analysis is always present in the activity of an investigator. From it, in fact, any investigation begins, since “*criminal case study /proceedings*” is impossible without an analysis of all available information, determination of the purpose, directions and tactics of further investigative (search) actions.

Regarding the importance and possibilities of the mentioned method of cognition, the following should be noted. When we speak about the analysis of materials of a criminal case or proceedings, it should be borne in mind that such an analysis can be carried out for different purposes:

- to resolve the issue of the sufficiency of the grounds for the initiation of a pre-trial investigation;
- to find out the investigative situation in criminal proceedings after an investigator accepts a case for their investigation from another investigator;
- to resolve the issue of choosing the further direction of the investigation (for example, whether the crimes were committed in one way, whether there are signs of a “*series*” of crimes; if so, what exactly do these signs indicate — what is the direction of the series of crimes, etc.: the so-called “*method forensic analysis of the operational situation*”);
- to resolve the issue of the sufficiency of the collected evidence and its reliability during the resolution of the issue of completing the investigation and drawing up the indictment.

Such an analysis can be carried out by a prosecutor during the implementation of the procedural management of the investigation, during the research of materials of the criminal proceedings

before the approval of the indictment, during the preparation for the trial. Also, forensic analysis is carried out by the defender/lawyer, getting familiar with the materials of the criminal proceedings/ case during the investigation (investigative actions with the client, completion of the investigation), during preparation for defense in court, etc., as well as other participants in criminal proceedings.

However, let’s speak about the importance and possibilities of forensic analysis in the activity of the investigator, since it is a qualitatively conducted investigation that determines the possibility of a further judicial perspective of criminal proceedings.

Forensic analysis is one of the important work methods and tools of the investigator, effective and at the same time quite easy to use, accessible because it is always “*with the investigator*”, who must be ready to use it. Analytical abilities should be recognized as professionally necessary qualities of the investigator, without which their investigation will not be complete.

It is with the help of the forensic analysis of the criminal case materials / proceedings that shortcomings of the investigation are revealed: both individual or several investigative (search) actions, tactical operations, operative and investigative measures, and the organization of the investigation in general.

The investigation of a crime does not take place without a forensic analysis of all case files/criminal proceedings, the completeness and quality of investigative actions, their results, obtained evidence, available forensically significant information. During the investigation of unsolved crimes of the past years, forensic analysis is one of the main methods of work to identify and detain criminals.

There is no doubt that the concept of “*trifle*” does not and cannot have a place

in the activity of the investigator. Any insignificant, at first glance, detail (not a trifle!), regardless of whether it has a material (object, thing, their parts, etc.) or other origin (information or any data about a person, its psychological and characterological peculiarities, habits, etc.), in the investigation can become important, gain importance and become a starting point for putting forward, verifying or refuting the version, choosing the right direction of the investigation or decisive evidence in the criminal proceedings / case. That is why the investigator (as well as the operative) must learn to recognize possible clues (details), no matter how insignificant or improbable they may seem at first, carefully research them, be creative with possibilities of their use in order to establish all circumstances of the crime.

On the other hand, as practice shows, neglecting or incorrectly evaluating a certain fact / circumstance, which, at first glance, seems insignificant, unimportant, can lead to significant complications or other serious consequences. Retrospective analysis of high-profile crimes committed in past years can help today's researchers develop the right guidelines for forensic analysis when investigating crimes committed in the present. That is why we will consider cases from the investigative practice of past years.

For example, as a result of the analysis of materials of the criminal case of the so-called Odintsov maniac, the investigators correctly determined the likely place of residence of the criminal who committed a series of brutal murders of boys in the suburbs. According to the results of the analysis, everything indicated that the killer was a local resident. However, Golovkin (Soviet and Russian serial killer, pedophile, sadist, whose victims, according to court documents, were 11

boys between 1986 and 1992) was not included in the list of persons subject to verification, as he had registration in the capital, and the list of suspicious persons was made according to the passport office of the suburb. However, in fact, Golovkin lived without registration in the Odintsovo district, had a job, an apartment and a garage there, in the basement of which he tortured, raped, killed his victims and dismembered their corpses. Therefore, the neglect by the law enforcement officers of the fact that the circle of persons who should be checked should include not only persons registered by their place of residence in the Odintsovo district, but those who actually lived there, slowed down the investigation to a certain extent, and improper forensic analysis materials of the right contributed to the death of several more children at the hands of a serial killer until the killer was apprehended.

Let us give another negative example of the lack of a correct analytical approach to the investigation. In the early 1990s, two serial killers operated simultaneously in the same region: the aforementioned Golovkin and another criminal, Ryakhovsky. The first chose boys as victims, the second — adult men and women, especially the elderly. The methods of committing the murders and marks on the corpses of victims were strikingly different. However, the investigation at a certain stage of the investigation came to the erroneous conclusion that all these crimes were committed by one person.

Even the long history of the mistakes made by investigators in the investigation of the crimes of serial sex killers in the above and other examples, and today proves the need to take into account all the features of serial crimes, and also confirms the importance to the investigation of a properly conducted forensic analysis.

The mental activity of the investigator (investigative thinking) has its own specificity, determined by the scope and tasks of such activity. The art of investigation is largely about seeing and understanding small things. The complexity, inconsistency and considerable volume of the investigation's material make it impossible to research it without careful analysis. At the same time, the understanding of all the material obtained as a result of the analysis is achieved through synthesis. Development of investigative versions, investigation plans, evaluation of evidence – all these are synthetic formations. Here we are in complete solidarity with O. R. Ratnov, who notes that investigative thinking requires a harmonious combination of analysis and synthesis¹⁹.

Determining the directions and ways of solving the crime involves knowledge of the evidence collected in the criminal proceedings / case, available forensically significant information, as well as shortcomings in the investigation that prevented the quick solving of the crime and the identification of the criminal. In order to effectively identify and solve problems that arise during the detection and investigation of crimes, along with others, the method of forensic analysis is used, which must precede the synthesis of its results.

The field of application of the specified method in law enforcement activities is quite wide. With the help of the forensic analysis of the materials of the criminal case / proceedings (or the materials on the basis of which a decision is made to start a pre-trial investigation), the direction and planning of the investigation are chosen, shortcomings that were admitted during the investigation are identified: as

a separate or several investigative (search) actions, tactical operations, operative and search measures, and the organization of the investigation in general.

If investigative actions are properly conducted, the results of forensic analysis can become a starting point in solving crimes and identifying criminals. This method is effective and should be used at every stage of the investigation. The investigation of the crime is based on a detailed analysis of the materials of the criminal case / proceedings, which is based on many years of investigative practice. The application of forensic analysis becomes especially important during the investigation of unsolved crimes of the past years, where it is one of the main methods – it is actually the starting point of this activity.

Forensic analysis is also necessary during the investigation of serial and serial sexual (or sexual-sadistic) murders, which mostly belong to the category of crimes of past years, committed over a long period of time (months, years, decades), and which are quite often discovered by chance. According to investigative practice, during the investigation of mentioned crimes, the investigation chose the right direction thanks to the results of a detailed forensic analysis. Thus, the progress in the investigation of the case of the serial killer Mikhasevich (during the years 1971–1985 he committed 36 murders of women and one attempted murder in Vitebsk, Polotsk and the surrounding countryside, as a result of which he received the nickname “*Vitebsk Strangler*”) became possible primarily thanks to the analytical abilities of Mykola Ignatovich, the investigator of the prosecutor's office, who studied in detail the criminal cases about the

19 Op. cit.: Шепітько В. Ю. Кримінальна психологія: історія становлення та сучасний стан. *Юридична психологія*. 2021. Т. 28. № 1. С. 14–20. DOI: [10.33270/03212801.14](https://doi.org/10.33270/03212801.14) (date accessed: 17.03.2022).

murders of women in the region, properly analyzed the available information and came to the correct conclusion about the commission of crimes by one person. According to the results of the forensic analysis, M. Ignatovych succeeded in combining all criminal cases into one proceeding, after which the search for the criminal acquired an organized character and contributed to the identification and detention of the serial killer²⁰. Even before the practical use of the *“psychological portrait”* for the search for serial killers (it was first used by the psychiatrist O. Bukhanovskyi during the investigation of the crimes of the serial killer Chikatilo), by analyzing materials of the criminal case, the received operational data and reports from citizens, the investigator M. Ignatovych drew up an approximate portrait with his own hands a serial maniac (his appearance, occupation, presence of a car, involvement in law enforcement agencies), which later completely coincided with Mikhasevich's characteristics. Later, by analyzing the case materials, operative and other data, M. Ignatovych warned of an investigative error, coming to the conclusion that the killer was trying to divert the attention of the law enforcement officers from Polotsk, where he lived and worked, by sending a letter from the *“patriots of Vitebsk”*, and focused the attention of operative-investigative groups on the city of Polotsk.

The practice of investigating serial sexual murders contains many other examples of the effective use of the method of forensic analysis. Work on the criminal case of the serial maniac Chikatilo (one of the most famous Soviet serial killers, from 1978 to 1990 committed 53 proven murders: 21 boys aged 7 to 16, 14 girls aged 9 to 17 and 17 older girls and women)

began with an analysis of the lifestyle of the criminal's victims. The investigation found out important details: among all those killed (young women and children), only two girls were considered socially prosperous. According to the results of surveys of hundreds of witnesses, it was established that the victims most often caught the maniac's eyes at suburban bus and train stations. This is how the tactics of the search were determined, and it was in this direction that investigators and operatives concentrated their efforts. Later, when the case came to a dead end, it was the analytical abilities and practical experience of the head of the investigative team, I. Kostoyev, that made it possible to suspect again and eventually arrest Chikatilo.

Forensic analysis of a series of intentional murders also contributed to the establishment of an important feature of another killer — Kuznetsov (a Soviet and Russian serial killer who killed 10 girls and women aged 15 to 30 in 1991-1992), who followed a certain stereotype in choosing his victims. It was this circumstance that was taken into account during the organization and implementation of operational search activities.

Unfortunately, there are quite shortcomings associated with improper use of the method under consideration. In the indictment in the case of Golovkin, the aforementioned Odintsov maniac, it is stated that at the initial stage, criminal cases were investigated separately, without taking into account the specific situation, evaluation of evidence and *analysis* of available data [*Highlighted by me. — Auth.*]. Investigative operatives substantiated their conclusions with assumptions or analogies of the existing practice of solving serious crimes, which made it difficult to find the criminal.

20 Кримінальна справа № 18/58404-86 з обвинувачення Г. М. Міхасевича.

The speed of solving the crime directly depends on the analysis of materials of the criminal case / proceedings and its results. This thesis is supported by the following example. During the investigation of the case of the “honored teacher” Slivko (a Soviet serial killer and pedophile who killed 7 boys and teenagers who were his students between 1964 and 1985), the investigation became interested in his identity only after the disappearance of the seventh teenager, the last victim of the killer (July 1985), although under conditions of proper assessment of the fact that all the victims visited the tourist club “CherGiD” (“Through the mountains and valleys”), which is popular with children, it would be logical to immediately start the investigation from there. During the investigation, a number of mistakes were made: if they started immediately with the club; if the investigator worked with children, but the not police officers who did not have experience and did not know the specifics of interviewing children; if Slivko was interrogated immediately after receiving information that the head of the club was filming strange tapes about strangulation; if they had immediately searched the premises of the club, they would have found hundreds of meters of film and many photographs that completely exposed the criminal, etc. Therefore, under the conditions of proper organization of the work based on the results of the forensic analysis, it would not have taken 22 years to solve the crime, but much less, and the lives of numerous victims of the maniac could have been saved: after all, after the arrest, Slivko confessed to committing

crimes, showed the places of murders and burials of the victims’ remains ²¹.

We see that the importance of forensic analysis in the process of investigating not only the types of crimes mentioned here, but also any other, is that, in addition to organizational and cognitive aspects (to establish the necessity and sequence of conducting investigative actions, operative and investigative measures, etc.), this method makes it possible to identify all the shortcomings / errors of the investigation, determine measures to eliminate them and prevent them in the future. To do this, the investigator must know about this method, understand its essence, meaning, place in establishing the circumstances of the event, and properly apply it in his daily activity of investigating crimes.

For the effective use of forensic analysis, in addition to practical experience, depending on the category of crime, direction and purpose of application, expected results, the investigator, operatives, experts, prosecutors-procedural managers need to have certain knowledge.

In particular, serial sexual murders are characterized by certain features that distinguish them from other murders, in particular those committed due to sexual motives. Therefore, their investigation should be carried out taking into account such features. This also applies to forensic analysis. It is rightly stated that “*the methodological basis of forensic analysis consists of knowledge of criminology, criminal law, theoretical foundations of criminology*”²².

We positively assess that the introduction of modern analytical

21 Александренко О. В., Женунтій В. І. Криміналістичне забезпечення розслідування серійних сексуальних вбивств. *Social function of science, teaching and learning* : Abstracts of XIII International Scientific and Practical conference. December 14–17, 2020. Bordeaux, France. Pp. 179–183. URL: <https://isg-konf.com/wp-content/uploads/XIII-Conference-14-17-BordeauxFrance-book.pdf> (date accessed: 17.03.2022).

22 Шепітько В. Ю., Коновалова В. О., Журавель В. А. та ін. Op. cit.

technologies (in particular, forensic analysis) into law enforcement activities is recognized as necessary. At the same time, it should be taken into account that, despite the interest of scientists and practitioners in the method of forensic analysis, such activity requires the presence of analytical specialists who should be trained, taught all the subtleties of this work, provided with appropriate technical and software tools, etc. Our opinion is aptly summed up by the conclusion made by the prominent criminologist V. P. Kolmakov: *“The shortcomings of the investigation are primarily due to the weak theoretical training of our investigative personnel and, in particular, weak and sometimes complete ignorance of criminology. This is also the reason for the fact that methodological manuals, which summarize investigative practice, remain without the necessary attention... Criminology requires that a practicing criminologist, an investigator, master all the variety of knowledge necessary for collecting and researching evidence... Equipped with a variety of knowledge, criminology, studying the ways of committing crimes and summarizing the experience of investigative work, should show the investigator the right way to solve crimes and expose criminals”*²³.

It is also necessary to take into account that the further development of the method of forensic analysis is aimed at the future: this work requires the efforts of more than one person and a certain amount of time — just as specialists must properly and correctly interpret the obtained results in order to successfully apply them in practice. Then the results of the practical application of the specified method should be evaluated, its possible weaknesses should be identified. It is also necessary to take into account possible problems with the training of analytical specialists, the

development of appropriate software and methodological support, the time required to create an effective system of forensic analysis, its effective implementation, testing in practice, evaluation of the obtained results and, if necessary, taking measures to improve this method.

That is why, despite the importance of using modern and effective analytical methods and techniques from the experience and practice of foreign law enforcement agencies in the fight against crime, methods tested by domestic investigative practice should also be used, which (if used correctly) can also contribute to the success of the investigation. One of these methods is forensic analysis. In addition, it is quite easy to use, does not require special abilities from the investigator, except for analytical skills.

Conclusions

The use of forensic analysis requires awareness of its possibilities, in particular, a certain level of knowledge and skills in the application of this method during an investigation, gaining experience in using its results in practice, as well as relevant literature and methodological recommendations and access to them by all law enforcement officers engaged in the detection and investigation of crimes.

Since there is a lack of such literature, interested state bodies and institutions (the MIA, the National Police, the State Bureau of Investigation, the Prosecutor General's Office of Ukraine, etc.) should take appropriate measures as soon as possible, involving the necessary scientific potential to conduct relevant research and prepare practical recommendations for the use of forensic analysis in order to ensure

23 Колмаков В. П. Больше внимания криминалистике : сб. науч. тр. : к 100-лет. со дня рожд. учен.-криминалист. ; сост.: В. В. Тищенко, О. П. Ващук. Одесса, 2013. С. 11, 15.

proper conditions for effective detection and investigation of crimes.

Проблемні питання використання криміналістичного аналізу під час розслідування злочинів

Олена Александренко

Мета роботи — розглянути можливості застосування методу криміналістичного аналізу в розкритті й розслідуванні злочинів, визначити проблемні питання та шляхи оптимізації зазначеної діяльності правоохоронних органів. Особливу увагу приділено напрямам і можливостям використання криміналістичного аналізу для розкриття та розслідування злочинів. Наведено позитивні приклади застосування у слідчій практиці криміналістичного аналізу з метою розкриття й розслідування злочинів, а також окреслено недоліки цього методу. Відзначено ефективність розглядуваного методу та його доступність. Обґрунтовано необхідність використання криміналістичного аналізу в поєднанні з іншими аналітичними методами. Визначено проблемні питання застосування методу криміналістичного аналізу, запропоновано шляхи їх вирішення. Зауважено необхідність належного методичного забезпечення використання криміналістичного аналізу в розслідуванні злочинів. Акцентовано увагу на тому, що використання криміналістичного аналізу потребує поінформованості про його можливості — зокрема, певного рівня знань і навичок застосування цього методу під час розслідуванні, набуття досвіду послуговування його результатами на практиці, а також відповідних літератури й методичних рекомендацій і доступу до них усіх працівників правоохоронних органів, які займаються розкриттям та розслідуванням злочинів. Наголошено на необхідності комплексного розв'язання проблеми методичного забезпечення використання криміналістичного аналізу всіма зацікавленими державними органами із залучен-

ням необхідного наукового потенціалу для проведення відповідних досліджень і підготовки практичних рекомендацій з метою забезпечити належні умови для ефективного розкриття та розслідування злочинів.

Ключові слова: криміналістика; криміналістичний аналіз; розслідування злочинів; методичне забезпечення; серійні вбивства; сексуальні маніяки; слідчі версії.

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Declaration of Competing Interest

The author declares that she has no conflict of interest.

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Research on Grape and Fruit and Berry Wines and Detection of their Falsification

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Grape and fruit and berry wines were studied in order to detect signs of their falsification by adding synthetic dyes. It is noted that in the process of analysis (examination) of unknown liquids provided for research, specialists must first of all establish the nature of such objects. It is possible to find out only after identifying the spectrum of features characteristic of the object in its actual state. The list of organic acids, which are components of grape and fruit and berry wines, was established experimentally; the possibility of determining organic acids in the analyzed samples was proven; signs of falsification of wines with the addition of dyes were given and methods of their detection were proposed. One of the cornerstone requirements for forensic examination is the mandatory confirmation of the results of analysis by at least two reliable methods, therefore, in the proposed scientific research, options for the study of some synthetic dyes

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using methods of thin-layer chromatography, IR spectroscopy and the addition of alkaline solutions are considered. It was established that the set of specific organic acids in grape and fruit and berry wines, which can be detected using the chromatography method, makes it possible to use them as differential signs in the process of establishing the nature of the wine. Samples of real grape wines are marked by a high concentration of tartaric acid, which is present only in grape products. It has been proven that the set of methods for studying grape and fruit and berry wines, aimed at determining the presence and identification of synthetic dyes, makes it possible to answer the questions posed by the examination on the falsification of winemaking products by coloring.

Keywords: organic acids; thin-layer chromatography; grape must; solvent systems; wine color; chromatographic mobility; synthetic dyes; sorting; falsification.

Research Problem Formulation

During the study of unknown liquids received for research, experts must first of all establish the nature of the research object. It is possible to determine this only under the condition of identifying features characteristic of a specific object in its actual state. For fruit and berry juices (as well as drinks made from them), such features can be organic acids, which (to a greater extent than any other compounds) determine the taste characteristic of mentioned juices.

Analysis of Recent Researches and Publications

Some researchers believe that the identification indicators of wine should be based on the search for natural compounds, characteristic or uncharacteristic for this type of product, as well as on the search for chemicals of natural or synthetic origin, deliberately added to the drink to give it the desired properties for the purpose of falsification ¹. Thus, M. H. Markovskiy ² proposes to carry out an examination of

- 1 Агеева Н. М., Гугучкина Т. И., Марковский М. Г. Критерии оценки фальсифицированности виноградных вин. *Известия ВУЗов. Пищевая технология*. 2002. № 2—3. С. 84—86 ; Герасимов М. А. *Технология вина*. Москва, 1959. 642 с. ; Бабаева М. В., Панасюк А. Л., Кузьмина Е. И. Соотношение основных компонентов экстракта красных вин. *Виноделие и виноградарство*. 2014. № 1. С. 18—20 ; Нилов В. И., Скурихин И. М. *Химия виноделия*. 2-е изд., доп. и перераб. Москва, 1967. 442 с. ; Charters St., Pettigrew S. Conceptualizing product quality: the case of wine. *Marketing Theory*. 2006. V. 6. Is. 4. P. 467—483. DOI: [10.1177/1470593106069932](https://doi.org/10.1177/1470593106069932) (date accessed: 04.06.2022).
- 2 Марковский М. Г. Оптимизация определения органических кислот вина методом капиллярного электрофореза. *Новации и эффективность производственных процессов в виноградарстве и виноделии*. 2005. Т. 2. С. 242—246 ; Методика оценки подлинности вина. Белые сухие вина и виноматериалы: РД 50.27.15.18/0003-99. Краснодар, 1999. 13 с. (Государственная система обеспечения единства измерений).

wines to confirm their naturalness by the proportion of bound organic acids, which in natural wines (according to the scientist) is more than 90 %, and in falsified products does not exceed 10 %. Some researchers are convinced that it is necessary to use a set of indicators to detect falsification: quality composition and content of amino acids; presence and concentration of glycerol; ratio of concentrations of free and bound forms of organic acids; given extract ³. So, it is believed that real wines are characterized by the ratios “mass concentration of tartaric acid / mass concentration of citric acid” in the range of 6.2:1...21:1 and “mass concentration of tartaric acid / mass concentration of malic acid” within 1.1:1...5,3:1 ⁴. However, to this day, the forensic literature lacks information on conducting examination in this direction.

Drinks made from fruits and berries contain a variety of acids, but only one of them can predominate in each type. For instance, apples contain: malic, citric, succinic, adipic, α -ketoglutaric, oxaloacetic, pyruvic, acetic, chlorogenic and other acids. In general, this is due to the presence of only a few acids, namely: approximately 70 % is malic acid; up to 20 % — citric; almost 7 % — succinic and only up to 3 % — the rest of acids. Malic acid also prevails in other grain and stone fruits, and in most berries. Citrus fruits have more citric acid.

In grape must and wines, organic acids are represented by tartaric, malic, citric, succinic, oxalic, lactic, glycolic,

glucuronic, salicylic and some other acids, which may be present in trace amounts and which cannot always be detected. However, the content of tartaric and malic acids in grape must and wine is the highest; in addition, it is known that tartaric acid is found in significant quantities only in grapes, that is a specific component of grape juice and wine, and is not contained in fruit and berry wines.

Lactic (0.5—6.3 g/dm³) and (in slightly smaller amounts) succinic (0.24—1.5 g/dm³) acids are detected in grape wines in fairly significant quantities. Citric acid contained in must (from traces to 0.7 g/dm³) is not a permanent and stable component of wine due to its easy destruction by bacteria, so it cannot always be detected in grape wines. In addition to the above, other acids can be detected in various wines, mainly in the form of traces: benzoic acid, dimethylglycerin acid, galacturonic acid, gluconic acid, glutamic acid, malonic acid, oxalic acid, hydrogen cyanide, phosphoric acid, hydrogen chloride, etc.

Diluting grape wine with cheap fruit and berry or other drinks to increase its volume is the most common and at the same time crude method of falsification. As a result, the intensity of color changes, the saturation of the bouquet, and the strength of wine decreases. For the most part, such wines are “corrected” by adding various chemical components (alcohol, more often technical, containing fusel oils; sugar substitutes; artificial dyes, etc.).

3 Бабаева М. В., Панасюк А. Л., Кузьмина Е. И. *Ор. cit.* ; Зотов А. Н., Аникина Н. С., Зинькевич Э. Л. Система контроля качества вина в странах старого и нового света. *Формирование национальной системы качества винопродукции* : междунар. форум. Одесса, 2013. С. 14—15 ; Марковский М. Г. Совершенствование технологии и методов оценки качества виноградных вин на основе анализа и регулирования их кислотного состава : автореф. дис. ... канд. техн. наук. Краснодар, 2006. 24 с.

4 Кишковский З. Н., Мержаниан А. А. *Технология вина* : учебн. пособ. для студ-в вузов пищев. пром. Москва, 1984. 439 с.

Galization of wine as a method of falsification consists in the fact that sour wines are “improved” by adding water to a known volume, followed by bringing the strength and acidity to certain limits, regulated by the current standard.

Chaptalization of wine is a method of processing sour must with alkaline agents and adding sugar before or during fermentation.

Petiotization of wine is a method of obtaining wine by infusing and fermenting sugar syrup on the pomace remaining after the separation of grape juice.

Shellification, or the addition of glycerin, is used to reduce acidity and bitterness, increase sweetness, and to stop the fermentation process.

The use of preservatives (salicylic acid, other antiseptics) in order to speed up the technological process.

Forgery of a bouquet of wine. For this, mixtures of various complex esters (enanthic, valerian, valerian-amyl, butyric, etc.) are used, as well as dried grape flowers.

Falsification of the production method. Wines produced in violation of the technological scheme developed and approved for the current designation of wines are considered high-quality. This type of falsification is quite difficult to recognize, moreover, it is quite diverse in methods and means, for example:

- varietal wines are replaced by blended wines;

- different fractions of must are mixed;
- the aging period of the wine is falsified;
- “artificial wines” are made. Grape juice is not required for making such wines, as they are a well-chosen mixture of components (water, yeast, sugar, tartaric potassium, crystalline tartaric and citric acids, tannin, glycerin, ethyl alcohol, enanthate ether, etc.), which the consumer organoleptically perceived as grape wine.

Wine coloring is used to hide other forgeries (for example, dilution) or to recolor certain varieties of low-value white wines into red. For this, natural (elder berries, blueberries, aqueous beetroot infusion, etc.) and synthetic dyes (aniline, naphthalene, anthracene dyes, indigo carmine, fuchsin) are used, many of which are not only harmful, but even poisonous compounds (for example, fuchsin).

A wide range of methods for studying and identifying the main organic acids in wines is given in the literature. The authors offer both fairly simple types of examinations, including the addition of alkaline solutions, thin-layer chromatography ⁵, and complex instrumental methods: ultrasonic monitoring ⁶, the use of electrochemical biosensors ⁷, IR spectroscopy ⁸, capillary

- 5 Samarasekara D., Hill C., Misna D. Analysis and Identification of Major Organic Acids in Wine and Fruit Juices by Paper Chromatography. *Journal of Chemical Education*. 2018. Vol. 95. Is. 9. Pp. 1621–1625. DOI: [10.1021/acs.jchemed.8b00129](https://doi.org/10.1021/acs.jchemed.8b00129) (date accessed: 04.06.2022).
- 6 Novoa-Diaz D., Rodriquez-Nogales J. M., Fernandez-Fernandez E., Vila-Crespo J., Garcia-Alvarez J., Amer M. A. & all. Ultrasonic monitoring of malolactic fermentation in red wines. *Ultrasonics*. 2014, Aug. Vol. 54. Is. 6. Pp. 1575–1580. DOI: [10.1016/j.ultras.2014.04.004](https://doi.org/10.1016/j.ultras.2014.04.004) (date accessed: 04.06.2022).
- 7 Gimenez-Gomez P., Gutierrez-Capitan M., Capdevila F., Puig-Pujol A., Fernandez-Sanchez C., Jimenez-Jorquera C. Monitoring of malolactic fermentation in wine using an electrochemical bienzymatic biosensor for L-lactate with long term stability. *Analytica Chimica Acta*. 2016, Jan 28. Vol. 905. Pp. 126–133. DOI: [10.016/j.aca.2015.11.032](https://doi.org/10.016/j.aca.2015.11.032) (date accessed: 04.06.2022).
- 8 Regmi U., Palma M., Barroso C. G. Direct determination of organic acids in wine and wine-

electrophoresis ⁹, high-performance liquid chromatography (HPLC) ¹⁰, ¹H-NMR spectroscopy ¹¹.

The application in expert practice of methods for identifying the complex of basic organic acids contained in wines (oxalic, citric, malic, amber, adipic, lactic, in particular, tartaric acid – characteristics specific to grape wines), and identifying, establishing the types of dyes will allow not only to establish the nature (origin) of the unknown liquid submitted for examination, but also to differentiate grape and fruit and berry wines in the event of their sorting or mixing.

Article Purpose

Research grape and fruit and berry wines, as well as to identify signs of their falsification by adding synthetic dyes.

Main Content Presentation

Preparation for conducting the examination

Solutions of organic acids -“witnesses”. A mixture of organic acids: oxalic, citric, tartaric, malic, succinic, adipic, lactic,

prepared at a concentration of 5 mg/cm³ of each acid (aqueous solution), is taken as a standard sample. Solutions of individual acids can be prepared in the same concentration (if necessary).

Solvents. A solvent system is recommended: ethanol – ammonia – water in a volume ratio of 50:15:2.5. The solvent system is used for chromatography immediately after preparation. Before immersing plates, the hermetically sealed container with the introduced system is vigorously shaken to saturate it with solvent vapors.

Developer. 2 cm³ of freshly distilled (colorless) aniline is dissolved in 20 cm³ of ethanol, and 2 g of l-arabinose (other carbohydrates can also be used) in 20 cm³ of distilled water. The two obtained solutions are poured together and the volume is brought to 100 cm³ with butanol. A chromatogram is developed with the prepared mixture using a sprayer.

Examination of liquids for the presence of organic acids by the method of chromatography in a thin layer of sorbent

Apply 5 mm³ of wine (an unknown liquid sample) to a plate with a thin layer of

derived products by Fourier transform infrared (FT-IR) spectroscopy and chemometric techniques. *Analytica Chimica Acta*. 2012, June 30. Vol. 732. Pp. 137–144. DOI: 10.1016/j.aca.2011.11.009 (date accessed: 04.06.2022).

- 9 Coelho C., Bagala F., Gougeon R. D., Schmitt-Kopplin Ph. Capillary Electrophoresis in Wine Science // Methods in Molecular Biology. Series Editor Walker J. M. 2016. MIMB, Vol. 1483. Pp. 509–523. DOI: 10.1007/978-1-4939-6403-1_23 (date accessed: 04.06.2022).
- 10 Eyéghé-Bickong H. A., Alexandersson E. O., Gouws L. M., Young Ph. R., Vivier M. A. Optimisation of an HPLC method for the simultaneous quantification of the major sugars and organic acids in grapevine berries. *Journal of Chromatography B*. 2012, Feb 15. Vol. 885–886. Pp. 43–49. DOI: 10.1016/j.jchromb.2011.12.011 (date accessed: 04.06.2022) ; Perez-Ruiz T., Martinez-Lozano C., Tomas V., Martin J. High-performance liquid chromatographic separation of citric, lactic, malic, oxalic and tartaric acids using a post-column photochemical reaction and chemiluminescence detection. *Journal of Chromatography A*. 2004. Feb 13. Vol. 1026. Is. 1–2. Pp. 57–64. DOI: 10.1016/j.chroma.2003.10.130 (date accessed: 04.06.2022).
- 11 Avenoz A., Busto J. H., Canal N., Peregrina J. M. Time course of the evolution of malic and lactic acids in the alcoholic and malolactic fermentation of grape must by quantitative ¹H NMR (qHNMR) spectroscopy. *Journal of Agricultural and Food Chemistry*. 2006, Jun 7. Vol. 54. Is. 13. Pp. 4715–4720. DOI: 10.1021/jf060778p (date accessed: 04.06.2022).

sorbent — *Sorbfil* — measuring 15×10 cm. After each touch of the capillary to the plate, the resulting stain is dried with a stream of warm air. In the same way, 2—3 mm³ of a standard solution of a mixture of organic acids (8—10 touches of the capillary) are applied next to the spots of the sample under examination¹².

A plate ready for chromatography is immersed in the solvent system: ethanol — ammonia — water (50:15:2.5). The chromatography process lasts 75-90 minutes. Then the plate is removed from the container, dried for 3-4 hours. After complete removal of the solvent, the plate is re-immersed in a freshly prepared solvent system and the process is repeated. The plate dried after the repeated chromatography process is moistened with a developer reagent from the sprayer under draft.

To develop the color of spots, the chromatogram is placed in a thermostat at a temperature of 100—110 °C. In 10—15 minutes, dark brown spots appear on a light yellow background, which retain their color for a long time at room temperature. The chromatogram is evaluated by the method of visual comparison.

The examination of wines using the specified system of solvents makes it possible to detect on chromatograms up to 10-11 acids, the presence of which in complex biological systems (such as wines) is not excluded.

Table 1 shows approximate R_f values for organic acids that can be detected in grape and fruit and berry wines.

Table 1

***R_f values of organic acids
that can be detected in wines***

Acids	System: ethanol — ammonia — water, R_f
Oxalic	0,00
Citric	0,14
Tartaric	0,31
Malic	0,44
Amber	0,56
Adipic	0,68
Glycolic	Not detected
Lactic	0,82

Note. The nature of the distribution of spots on chromatograms and their sequence remain unchanged.

It should be noted that the solvent system benzene — ethanol — ammonia (10:20:5) can be used for chromatography, but the spots of organic acids in such a solvent system are located close to each other, which makes it difficult to identify the acids on the chromatogram. Considering the above, it is worth recommending the eluent system ethanol — ammonia — water (50:15:2.5).

The chromatogram of pure organic acids is shown in fig. 1.

12 Гейсс Ф. Основы тонкослойной хроматографии : в 2-х т. : пер. с англ. / под ред. В. Г. Березкина. Т. 1. Москва, 1988. 404 с.



Fig. 1. Chromatogram of pure organic acids in the system: ethanol – ammonia – water (50:15:2.5). Acids: 1 – oxalic; 2 – citric; 3 – tartaric; 4 – malic; 5 – amber; 6 – adipic; 7 – lactic

Evaluating the results of testing liquids for the presence of organic acids

When testing unknown grape and berry wines, it is difficult to predict in advance the composition and quantitative content or ratio of individual acids in the sample, so the amount of wine that the expert puts on the plate is not always equal to 5 mm³. In some cases, wines contain significantly more of one acid than other acids, for example, malic. One under such conditions, the application of 5 mm³ will cause overloading of the sorbent with this acid, which will distort the chromatographic pattern. If the concentration of detected components of the examined samples does not correspond to the concentrations of the acids of the compared reference mixture, then inaccuracies are possible during the evaluation of chromatograms. In this case,

the amount of wine to be applied to the plate must be reduced to 2.5–3 mm³, but to such an amount as to be able to detect other acids, the amount of which is very small.

Separately, we should note that a standard mixture of acids – “witnesses” – must be applied to the plate next to the stain of the sample under examination: for a more correct and clear identification of individual acids. The objects of our research are expert samples of “Margrani” red wine, “Somersby” cider, and “Somersby Watermelon”. The chromatogram of grape red wine “Margrani”, apple cider “Somersby” and a mixture of organic acids is shown in fig. 2.

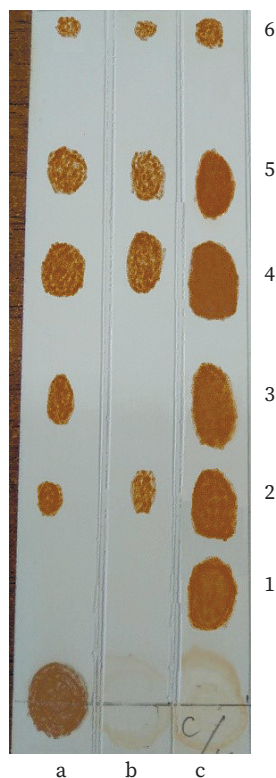


Fig. 2. Chromatogram for the examined samples: a) “Margrani”; b) apple cider “Somersby”; c) acids for comparison (1 – oxalic; 2 – citric; 3 – tartaric; 4 – malic; 5 – amber; 6 – lactic)

Chromatographic picture in fig. 2 is an example of a typical picture for grape and fruit and berry wines. Grape wines are characterized by the presence of tartaric and malic acids in much greater quantities than the rest of acids. Sometimes the malic acid predominates the tartaric one.

In most grape wines, citric acid is either absent or present in very small amounts; amber acid is detected in small amounts; between the spots of citric and tartaric acids, a spot of an unidentified acid is observed. In addition, oxalic acid, if it is present in wines, is at the start, possibly in a mixture with other acids. Near the start, many fortified wines have a stain of unidentified acid. Lactic acid is always detected near the solvent front.

It should be noted that the typical chromatographic pattern of fruit and berry wines is characterized by the absence of tartaric acid. For the most part, in fruit and berry wines, an unidentified acid ($R_f = 0.2$) is absent or appears as traces, which is clearly observed in grape wines (placed on the chromatogram between citric and tartaric acids).

Most fruit and berry wines (from cranberries, red and black currants, strawberries, black rowan, plums, gooseberries, raspberries, etc.) contain quite a lot of citric acid. Malic acid is well detected (it is present in significant quantities in apple wines). Unlike grape wines, fruit and berry wines contain a significant percentage of amber acid; adipic and one or two unidentified acids placed between amber and lactic acids may be detected.

The set of specific organic acids in grape and fruit and berry wines, which are detected by experts using the chromatography method, makes it possible to use them as differential signs

in the process of establishing the nature of the wine. Samples of real grape wines are characterized by a high concentration of tartaric acid, which is present only in grape products. In samples of fruit and berry wines made from apricot, raspberry and plum fruits, the main component is malic acid.

During the examination of home-made grape wines, the absence of tartaric acid can serve as evidence of wine falsification, that is, its production from grape pomace, sugar, water. Such wines also lack malic acid.

Using the considered method of chromatography in a thin layer of sorbent, it is quite difficult to examine wines containing sugar, especially when its content is significant. Therefore, the examination of fortified wines should be preceded by work on the separation of organic acids on ion-exchange resins, after which the obtained eluates are chromatographed in a thin layer of sorbent.

The color characteristics of wine products are quite variable — depending on the type of raw materials, technological production, composition of the blend. This feature is used by some unscrupulous producers, often using cheaper fruit and berry raw materials to tint grape wines.

Natural food dyes are obtained from plant raw materials (flowers, leaves, berries, root crops) and waste from wineries and canneries. Natural dyes most often belong to carotenoids and flavonoids.

Synthetic food dyes are complex organic substances obtained by a chemical method. Unlike natural ones, they do not contain flavors and vitamins. Compared to natural dyes, synthetic ones give bright saturated tones that are less sensitive to storage conditions. Inorganic food dyes

are obtained from mineral raw materials of natural or chemical origin. These include some finely dispersed metals and metal oxides (hydroxides), amorphous carbon (E152, E153), calcium carbonate, as well as blue pigment (ultramarine).

One of the requirements for forensic examination is mandatory confirmation of analysis results by at least two reliable methods, so in our research we consider the option of examination some synthetic dyes using the method of thin-layer chromatography and IR spectroscopy. Research objects are expert samples of synthetic dyes: azorubine (carmoisin; E122), a mixture of azorubine (E122) and Ponceau 4R (E124), yellow “sunset” (E110), tartrazine (E102), samples of red wine “Margrani”, “Somersby” and “Somersby Watermelon” cider, “Ripe Cherry” and “Peach” alcoholic beverages. Experts also prepared a model mixture of “Somersby Watermelon” cider with synthetic dyes E122, E124.

Detection of synthetic dyes by adding an alkaline solution

Synthetic dyes can be detected by adding an alkaline solution (ammonia, soda) in an amount that exceeds the amount of the drink. A change in the pH leads to a change in the color of natural dyes: red to dirty blue, violet to red-brown. If the liquid has a yellow, yellow-hot or green color, then after adding alkali, the mixtures must be boiled. Such pigments as carotenoids and chlorophyll are destroyed. At the same time, yellow and yellow-hot colors disappear, and green turns into brown or dark green. The color of synthetic dyes does not change under these conditions. Thus, the color of the wine “Margrani” bordeaux in the case of adding soda solution changed to

blue-green, and the deep red color of the model mixture (“Somersby Watermelon” cider with synthetic dyes E122, E124) did not change after adding soda solution (see Fig. 3). A sample of “Somersby Watermelon” cider, in the composition of which the manufacturer noted sugar color III, changed its color from pink to pale yellow (almost colorless) with the addition of soda solution (see Fig. 4).

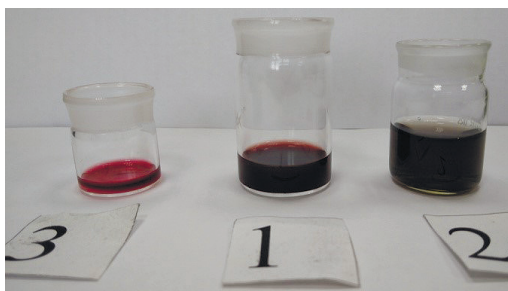


Fig. 3. 1 – red wine “Margrani”; 2 – red wine “Margrani” with addition of soda solution; 3 – a sample of the mixture of “Somersby” cider, E122, E124 with the addition of soda solution

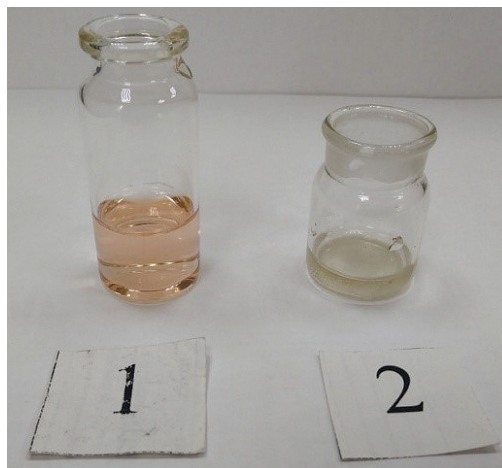


Fig. 4. 1 – a sample of “Somersby Watermelon” cider; 2 – a sample of “Somersby Watermelon” mixture with the addition of soda solution

This method makes it possible to answer the question about the presence of synthetic dyes in their composition in principle and quickly at the preliminary stages of winemaking product examination.

Examination of liquids for the presence of synthetic dyes by thin-layer chromatography

Thin-layer chromatography (due to its accessibility, simplicity and expressivity) is widely used for the analysis of dyes. Synthetic dyes form colored spots on chromatographic plates clearly visible to the naked eye, which helps the expert to visually evaluate the obtained results.

As of today, it is impossible to choose universal separation conditions for most dyes. This is due to the fact that food

synthetic dyes have close R_f values that tightly fill almost the entire possible interval ($R_f = 0.10...0.95$), which is a significant obstacle for thin-layer chromatography with high resolution.

To determine the qualitative composition of individual and mixed synthetic dyes, the researchers used the following systems:

- 1) n-propanol — ethyl acetate — ammonia — water (10:3:3:0.1);
- 2) isobutanol — ethanol — ammonia — water (1:2:0.1:1).

Two solvent systems were used to separate dyes with similar values of chromatographic mobility, and also as reference to each other. Chromatographic properties of dyes in different systems are shown in tbl 2.

Table 2

Chromatographic properties of dyes in different systems

Name of the dye	System No. 1		System No. 2	
	R_f	Color of chromatographic zones	R_f	Color of chromatographic zones
Azorubine (E122)	0,35	Crimson	0,80	Orange
			0,92	Crimson
Ponceau 4R (E124)	0,76	Red-crimson	0,84	Violet
Tartrazine (E102)	0,11	Yellow	0,75	Bright yellow
Yellow “sunset” (E110)	0,46	Yellow-hot	0,82	Orange

To check the reliability of the method, the examination was conducted: red wine “Margrani”, alcoholic beverages “Ripe cherry” and “Peach”. Chromatography

was performed in the solvent system n-propanol — ethyl acetate — ammonia — water (10:3:3:0.1): see Fig. 5a.

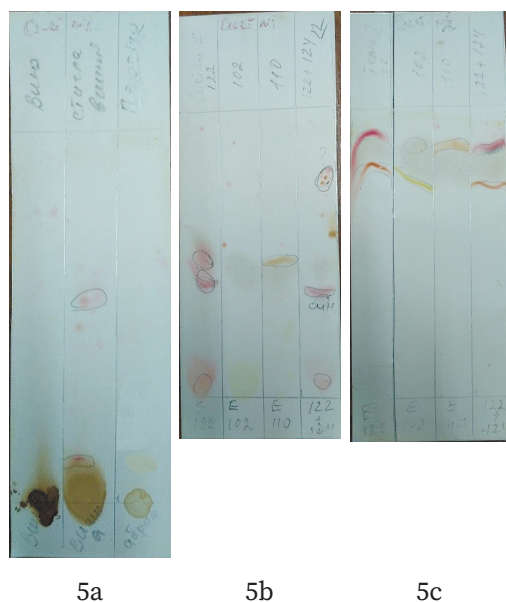


Fig. 5. 5a) — chromatogram of red wine “Margrani”, alcoholic beverages “Ripe cherry” and “Peach” (from left to right) in eluent system No. 1; 5b) — chromatogram of synthetic dyes E122, E102, E110, E122 + E124 (from left to right) in eluent system No. 1; 5c) — chromatogram of synthetic dyes E122, E102, E110, E122 + E124 (from left to right) in eluent system No. 2

As a result of the examination, it was established that:

- the chromatogram with the examined sample of “Margrani” red wine does not contain colored zones, that is, there are no dyes;
- the chromatograms of “Ripe cherry” drink showed orange and crimson spots, which in terms of color and chromatographic mobility correspond to the synthetic dye azorubine (E122);
- a yellow spot appeared on the chromatogram of “Peach” drink, which in terms of color and chromatographic mobility

corresponds to the synthetic dye tartrazine (E102).

The above thin-layer chromatography method requires samples for comparison. In the absence of reference samples, it is difficult to obtain reliable information about the nature and component composition of the examined dyes, so there is a need to apply additional research methods. To perform a number of practical tasks, you can use the IR spectroscopy method, which allows you to identify the object under examination with the help of computer information and search systems, spectral libraries and reference information. For this, preliminary preparation of samples aimed at separating the dye from the examined mixture is necessary.

Examination of liquids for the presence of synthetic dyes by IR spectroscopy

Sample preparation. The method of solid-phase extraction followed by evaporation of the extract to a dry residue is used to isolate synthetic dyes. Spectra were recorded on a spectrophotometer *NICOLET — 380 SMARTPERFORMER* attachment manufactured by *Thermo Electron Corporation* (USA) under standard conditions.

Analysis parameters:

- measurement range — 650—4000 cm^{-1} ;
- resolution — 4;
- recording speed — 0,6329;
- amplification — 4;
- number of scans — 32.

The obtained spectra were analyzed by examining the shape, position, and relative intensities of the characteristic absorption bands with the help of databases (electronic spectral libraries), as well as reference materials and special literature. At the same time, it was proved that dyes of different types differ from each other in IR spectra and can be differentiated.

Conclusions

It has been proven that the application in expert practice of methods for detecting the complex of basic organic acids contained in wines (oxalic, citric, malic, amber, adipic, lactic, as well as tartaric as specific for grape wines) made it possible not only to establish the nature (origin) of an unknown liquid submitted for examination, but to differentiate grape and fruit and berry wines in case of their re-sorting or mixing.

It was established that the set of specific organic acids in grape and fruit and berry wines, which can be detected using the chromatography method, makes it possible to use them as differential signs in the process of determining the nature of wine. Samples of real grape wines are characterized by a high concentration of tartaric acid, which is present only in grape products.

It has been proven that a set of methods for researching grape and fruit and berry wines, aimed at determining the presence and identification of synthetic dyes, makes it possible to answer the questions of experts on the falsification of winemaking products by coloring.

Дослідження винограджних і плодово-ягідних вин та виявлення їх фальсифікації

Алла Клімчук, Ольга Буй,

Хосе Мануель Колодрас, Ольга Пашкова

Досліджено виноградні та плодово-ягідні вина з метою виявити ознаки їх фальсифікації шляхом додавання синтетичних барвників. Зазначено, що у процесі аналізування (експертизи) невідомих рідин, наданих для дослідження, фахівцям насамперед необхідно встановити природу таких об'єктів. З'ясувати це можливо тільки після виявлення спектра ознак, характерних для об'єкта в реально існуючому стані. Дослідним шляхом установлено

перелік органічних кислот, що є складовими виноградних і плодово-ягідних вин; доведено можливість визначення органічних кислот в аналізованих зразках; наведено ознаки фальсифікації вин за допомогою додавання барвників і запропоновано методи їх виявлення. Одна з наріжних вимог до судової експертизи — обов'язкове підтвердження результатів аналізу не менш ніж двома достовірними методами, тому в запропонованій науковій праці розглянуто варіанти дослідження деяких синтетичних барвників із застосуванням методів тонкошарової хроматографії, ІЧ-спектроскопії та додаванням лужних розчинів. Констатовано, що сукупність конкретних органічних кислот у виноградних і плодово-ягідних винах, які можна виявити за допомогою методу хроматографії, дає змогу використовувати їх як диференційні ознаки у процесі встановлення природи вина. Зразки справжніх виноградних вин відзначено високою концентрацією винної кислоти, наявної лише у виноградній продукції. Доведено, що комплекс методів дослідження виноградних і плодово-ягідних вин, спрямованих на визначення наявності й ідентифікацію синтетичних барвників, дає змогу відповісти на питання, поставлені на вирішення експертизи про фальсифікацію продуктів виноробства шляхом забарвлення.

Ключові слова: органічні кислоти; тонкошарова хроматографія; виноградне сусло; системи розчинників; колір вина; хроматографічна рухливість; синтетичні барвники; пересортиця; фальсифікація.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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Forensic Economics Regarding Fuel Accounting in Armed Forces of Ukraine

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Theoretical best practices of forensic experts on peculiarities of fuel accounting in transport and defense fields has been studied and a list of legislative and regulatory acts regulating the procedure for accounting, movement and write-off of fuel and lubricants in military units is given. The authors aimed to highlight the issue of fuel accounting in conditions of martial law and Russian military aggression, document effective use of fuel by military units of the Armed Forces of Ukraine and territorial defense while carrying out combat missions. Research objects of forensic economic examinations are summarized, range of powers granted to experts while conducting such examinations is outlined. Peculiarities of the accounting and movement of military property that are characteristic of the rules for receiving, accounting, issuing and writing off material assets in Armed Forces of Ukraine are indicated. The issues and tasks solved by forensic experts while forensic economic examinations related to accounting and use of fuel by military units of Armed Forces of Ukraine are defined. The list of legislative and normative legal acts that should be guided by forensic economists in their professional

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activities while accounting for military property, is presented. Attention has been drawn to the unsettledness of some issues of such accounting (for example when some legislative acts have lost their validity, and new ones have not been adopted instead) causing certain difficulties. The main types of accounting of military property (quantitative and qualitative accounting; accounting of military property in numerical and value indicators) are highlighted and disclosed.

Keywords: *military property; property accounting specifics; fuel and lubricants; quantitative, qualitative, account number accounting; military property accounting in value indicators.*

Research Problem Formulation

In conditions of Russian military aggression, issues of accounting and effective use of fuel by the military units of the Armed Forces of Ukraine (hereinafter referred to as AFU) and territorial defense are becoming quite important and relevant.

From the first day of invasion in Ukraine, Russian invaders have been purposefully destroying Ukrainian industrial (in particular, oil refining) and social infrastructure. Shortage of fuel in Ukraine that was felt not only by ordinary citizens, arose as a result of the destruction of the main producer of such fuel: the Kremenchuk Oil Refinery, a number of large oil depots, blocking of sea routes and the stoppage of supplies from Belarus. In fact, country has to build a new infrastructure for the supply of oil products through the western borders from scratch. Therefore, effective resolution of the issues of the fuel use by military units of the Armed Forces

of Ukraine in the circumstances of Russian aggression can directly affect combat capability of our State.

At the same time, conducting forensic economic examinations on accounting and use of fuel by military units has some peculiarities compared to civilian objects.

Analysis of Essential Researches and Publications

Like any other defense field, functioning of state institutions is subject to control and evaluation both by society and by economists. Rational operation of defense expenditures can not only ensure the country independence but stimulate the development of its economy. S. Atesoglu and M. Mueller ¹, as well as C. Xuang and A. Mintz were among the first to highlight the relationship between defense spending and economic growth ².

J. S. Smith and M. H. Tuttle ³ proved as early as 2008 that defense spending can

- 1 Atesoglu H. S., Mueller J. M. Defense Spending and Economic Growth. *Defence Economics*. 1990. Vol. 2. Is. 1. Pp. 19–27. DOI: [10.1080/10430719008404675](https://doi.org/10.1080/10430719008404675) (date accessed: 31.05.2022).
- 2 Xuang C., Mintz A. Defence Expenditures and Economic Growth: The Externality Effect. *Ibid*. 1991. Vol. 3. Is. 1. Pp. 35–40. DOI: [10.1080/10430719108404713](https://doi.org/10.1080/10430719108404713) (date accessed: 31.05.2022).
- 3 Smith J. S., Tuttle M. H. Does Defense Spending Really Promote Aggregate Output in the United States? *Defence and Peace Economics*. 2008. Vol. 19. Is. 6. Pp. 435–447. DOI: [10.1080/10242690701701950](https://doi.org/10.1080/10242690701701950) (date accessed: 31.05.2022).

contribute to economic growth if it is used to improve social field and infrastructure allowing business to develop steadily, calmly and stably. They note that wartime military spending rises rapidly with a direct effect on real gross domestic product during the first two quarters but loses its predictability during this period.

A. Abu-Qarn's research⁴ analyzed (using Todd-Yamamoto version of the Granger causality test) relationship between defense spending and the economic growth of the rivals in the Arab-Israeli conflict over past four decades and indicated that, contrary to popular opinion and many previous research, he failed to find any sustained negative impact of military spending on economic growth.

In research paper work by JiTian You, LinXi OuYang, XueYing Zhang, ShaoYi Du⁵, it is noted that against the background of the integration of world economy and new international situation that emerged in the mid-2010s, defense legislation has become an important national strategy and its analysis by means of economics plays an important role in building and even increasing competitiveness of the country and nation in international community.

On the other hand, a number of research paper are devoted to economic research in the field of fuel and lubricant accounting and control. The latter include, in particular, research by M. Kotov and V. Drobakha⁶ and others.

M. A. Al Qubaisi⁷ proposed the following classification of expenses for logistical support for the troops:

- a) weapons and military equipment procurement;
- b) operation and maintenance of weapons and military equipment procurement;
- c) maintenance of military bases and training grounds both inside the country and outside its borders;
- d) fuel and lubricants.

For obvious reasons, data on accounting and effective use of fuel in defense field are not available to the general public. If we turn to organization of accounting for consumption of fuel and lubricants in the USA, we found out the following. According to the American non-governmental portal GlobalSecurity.org⁸, unit responsible for the army fuel reserves is usually at battalion level or higher: it is there that the actual accounting procedures of fuel and lubricants released and consumed by

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- 4 Abu-Qarn A. The Defense-growth nexus: An application for the Israeli-Arab conflict. *MPRA Paper*. Ben Gurion University of the Negev, 2010. URL: https://mpra.ub.uni-muenchen.de/22275/1/MPRA_paper_22275.pdf (date accessed: 31.05.2022).
 - 5 JiTian You, LinXi OuYang, XueYing Zhang, ShaoYi Du. The Application of Economic Analysis in the Field of Military and National Defense Legislation. *ICEBT 2018 : Proceedings of the 2nd International Conference on E-Education, E-Business and E-Technology*. July 2018. Pp. 175—180. DOI: [10.1145/3241748.3241766](https://doi.org/10.1145/3241748.3241766) (date accessed: 31.05.2022).
 - 6 Kotov V., Drobakha V. Increase accuracy accounting and control of diesel fuel consumption. *Collected scientific works of Ukrainian State University of Railway Transport*. March 2019. DOI: [10.18664/1994-7852.183.2019.169648](https://doi.org/10.18664/1994-7852.183.2019.169648) (date accessed: 31.05.2022).
 - 7 Al Qubaisi M. A. Modern military expenditures and problems of sustainable development. *Economic and Social Development : 55th International Scientific Conference on Economic and Social Development* (Baku, 18—19 June, 2020). 2020. Vol. 2/4. Pp. 483—488. URL: https://www.esd-conference.com/upload/book_of_proceedings/Book_of_Proceedings_esdBaku2020_Vol2_Online.pdf (date accessed: 31.05.2022).
 - 8 Chapter 8. Accounting / Petroleum Pipeline and Terminal Operating Units // GlobalSecurity.org. 12 May 1998. URL: <https://www.globalsecurity.org/military/library/policy/army/fm/10-416/ch8.htm> (date accessed: 31.05.2022).

various units take place. Incoming and outgoing data are collected and transferred to responsible person, who uses them to prepare and submit requests for the next period. If a unit (for example, a company) operates as a separate unit, then its commander is responsible for submitting fuel requirements for operation of vehicles. For planned events, need for fuel and lubricants is calculated for four months (current plus the next three). These services conduct daily and weekly inventories of petroleum products belonging to the army, separately for each type of product.

In the US army, fuel was always accounted for, although they were not used to saving on defense costs. However it was not until 1999 that the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics asked the Defense Science Board to investigate the Army's fuel-related problems because of the increasing number of such problems. A report on that inquiry released in 2001, *Making War More Effective by Reducing the Fuel Burden* found that until the Department of Defense begins to measure the true cost of fuel and develops clear plans to reduce fuel consumption of military vehicles, military will continue to will experience significant logistical and financial difficulties, as well as issues with transporting fuel to battlefield. Department of Defense is the largest consumer of fuel in the United States using approximately 1.8 % of the nation total transportation fuel ⁹. This is not surprising, given the types of vehicles used by the US military. It is interesting that among the 10 largest army consumers

of fuel, only the *M1 Abrams* tank and the *McDonnell Douglas AH-64*, Apache helicopter are combat vehicles, the rest are auxiliary equipment (for transporting fuel and other ammunition).

Scientific Council recommended that Ministry of Defense standardize pricing methods for estimating the cost of fuel (until then, it set fuel prices based on the wholesale price of refinery without taking into account the cost of delivery, caused the actual cost of fuel to be much higher than that indicated in the military accounting systems). Interestingly, software that the military used to calculate fuel efficiency was written in Fortran (a computer language that is no longer used) back in 1972 and has not been updated since.

Another recommendation of Scientific Council (to which our legislators can make sense) is to stimulate fuel economy throughout the Ministry of Defense: while purchasing new weapons, be sure to take into account its fuel efficiency (note that the allocation of resources and accounting in the Ministry of Defense on at that time efficiency was not encouraged and inefficiency was not punished). Excessive fuel costs are not only a mindless waste of budget funds: after all, it becomes an obstacle to effective war conducting. There are combat advantages of fuel economy in the growth of deployability, maneuverability, range, speed, reliability, etc.

However, such a transition to more energy-efficient weapons, unfortunately, cannot happen quickly. According to A. Andrews (2009) ¹⁰, the US Department of Defense consumed 145 million barrels

9 Book E. Pentagon Needs Accurate Accounting of Fuel / National Defense Magazine. 03/01/2002. URL: <https://www.nationaldefensemagazine.org/articles/2002/2/28/2002march-pentagon-needs-accurate-accounting-of-fuel> (date accessed: 31.05.2022).

10 Andrews A. Department of Defense Fuel Spending, Supply, Acquisition, and Policy. CRS Report for Congress. September 22, 2009. 27 p. URL: <https://sgp.fas.org/crs/natsec/R40459.pdf> (date accessed: 31.05.2022).

of petroleum products every year. In fiscal year 2000, fuel costs accounted for 1.2 % of the total expenditures of the Ministry of Defense and in 2008 they increased to 3.0 %. Over the same period, total defense spending has more than doubled, fuel spending has increased by nearly 500 %. According to the same report, there were 141 oil refineries in United States.

At the same time, V. Dachkovskiy and I. Kondratiuk¹¹ note that new or modernized weapons and military equipment should be effective in performing military tasks. However, not only adequate cost of their acquisition, but the cost of their operation is an integral part of the adoption of new and modernization of old models. The mentioned researchers proposed a method of technical and economic evaluation of weapons and military equipment procurement samples adopted or allowed for operation in the Armed Forces where structure of total costs for operation of weapons and military equipment procurement has the following components: costs of storage, maintenance, fuel and lubricants, repair of weapons and military equipment procurement samples and costs for ammunition.

However, most materials reveal these issues as of peacetime. It should be noted that a certain experience of the functioning of the forensic expert system during the war, that ensured necessary researches in Yugoslavia (1991–2001) is highlighted in the book by H. Ball¹², published much after the end of Yugoslav wars.

On the other hand, application specifics of forensic examinations during martial law were not considered in these research papers.

Professionals of the Sumy branch of the NSC «Hon. Prof. M. S. Bokarius FSI» during 2020 developed *Guidelines for conducting forensic economic examinations in cases of resolving issues related to research on military property accounting*. As is well known, military property includes, in particular, fuel and lubricating materials. In conditions of hostilities and shortage of fuel in Ukraine, the issue of accounting and effective use of fuel by military units of Armed Forces of Ukraine requires closer attention.

Article Purpose

Elucidation of fuel accounting issues in conditions of martial law and Russian military aggression, determination of documentary justification for effective use of fuel by military units of the Armed Forces of Ukraine and territorial defense during combat missions.

Main Content Presentation

Preservation issue and effective use of military property has gained considerable relevance in recent years. This is primarily due to the armed aggression in Crimea and East of Ukraine, started by Russia in 2014, and hostilities throughout the territory of Ukraine that have been ongoing since February 2022, as well as the current difficult economic situation. In addition, in the military field there are issues of imperfect regulatory and legislative provision of accounting and handling of military property (in particular, regarding its write-off), which elimination will make possible to protect military property from

11 Dachkovskiy V., Kondratiuk I. Technical and economic assessment of the weapons and military equipment exploitation. *Political Science and Security Studies Journal*. 2021. Vol. 2. № 4. Pp. 39–47. DOI: [10.5281/zenodo.5810146](https://doi.org/10.5281/zenodo.5810146) (date accessed: 31.05.2022).

12 Ball H. *Working in the Killing Fields: Forensic Science in Bosnia*. University of Nebraska Press, 2015. 232 p. DOI: [10.2307/j.ctt1d9nj5c](https://doi.org/10.2307/j.ctt1d9nj5c) (date accessed: 31.05.2022).

theft, damage, destruction, etc., as soon as possible.

Legislation of Ukraine defines military property as state property assigned to military units, institutions and organizations of the Armed Forces. It includes *"houses, buildings, transmission devices, all types of weapons, combat and other equipment, ammunition, fuel and lubricants, food, technical, airfield, skipper, material, cultural and educational, medical, veterinary, household, chemical, engineering property, communication property, etc."*¹³.

Military property is managed by the Ministry of Defense of Ukraine by attaching it to military units (in case of their formation or reformation) and redistributing this property between military units (in case of their disbandment). Military property is assigned to military units of Armed Forces of Ukraine under the right of operational management.

It is necessary to account for all military property, regardless of its purpose and sources of income, at the same time, it should be done in a timely, reliable and accurate manner. This is necessary in order to obtain factual data on availability, loss, shortage, movement, value and quality (technical) condition of military property that will contribute to correct organization of logistical support of military units, arrangement of proper control over storage conditions, expediency and

effectiveness of military property use (expenditure) and will help prepare data for compilation of accounting documents and state statistical reporting.

Taking into account the state of war currently operating on the territory of Ukraine with the aim of preventing abuse and effective use of fuel and lubricant materials, forensic economists are asked questions about documentary and regulatory validity of the use of fuel by military units of Armed Forces.

Forensic experts have right to act only within the limits of granted powers. The same forensic economic examination is carried out based on the established facts of fuel shortages and overtime write-offs in compliance with relevant decision of investigating judge or the investigator's resolution.

Research on these issues is carried out taking into account peculiarities of accounting and movement of military property, in accordance with accepted rules for receiving, issuing and writing off material assets in Armed Forces, regulated by relevant regulatory acts, in particular:

- Law of Ukraine: *On the Legal Regime for Property in the Armed Forces of Ukraine*¹⁴;
- Instruction on accounting for military property in Armed Forces of Ukraine¹⁵;
- Regulation on procedure for accounting, storage, write-off and

13 Про правовий режим майна у Збройних Силах України : Закон України від 21.09.1999 р. № 1075-XIV (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/1075-14> (date accessed: 31.05.2022).

14 Про правовий режим майна Збройних сил України URL: <https://zakon.rada.gov.ua/laws/show/1075-14> (date accessed: 31.05.2022).

15 Про затвердження Інструкції з обліку військового майна у Збройних Силах України : наказ Міністерства оборони України від 17.08.2017 р. № 440 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/z1192-17> (date accessed: 31.05.2022).

use of military property in Armed Forces ¹⁶;

- National regulation (standard) of accounting in public sector 121 *Fixed assets* ¹⁷;
- Regulation on inventory of military property in Armed Forces ¹⁸;
- Procedure for applying the Project on accounting accounts in the public sector; A standard correspondence of accounting sub-accounts to reflect transactions with assets, capital and liabilities by managers of budget funds and State trust funds; Standard correspondence of accounting sub-accounts for displaying operations for the State budget implementation; Standard correspondence of accounting sub-accounts for displaying local

budget operations; Changes to some regulatory legal acts of the Ministry of Finance of Ukraine on accounting ¹⁹;

- Procedure for drawing up standard forms of memo slips and other accounting registers of public sector entities; memo slips № 1—17; log of analytical accounting of deposited wages and scholarships; register of deposited sums; negotiable instrument; accounting certificate; log: *Journal-main* ²⁰;
- Guidelines on organization and maintenance of accounting in Armed Forces of Ukraine ²¹;
- Calculating project of accounting in the public sector ²²;
- Regulations on accounting in the Armed Forces of Ukraine ²³;

- 16 Про затвердження Положення про порядок обліку, зберігання, списання та використання військового майна у Збройних Силах : Постанова КМУ від 04.08.2000 р. № 1225 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/1225-2000-%D0%BF#Text> (date accessed: 31.05.2022).
- 17 Про затвердження національних положень (стандартів) бухгалтерського обліку в державному секторі : наказ Міністерства України від 12.10.2010 р. № 1202 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/z1017-10> (date accessed: 31.05.2022).
- 18 Про затвердження Положення про інвентаризацію військового майна у Збройних Силах : Постанова КМУ від 03.05.2000 р. № 748 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/748-2000-%D0%BF#Text> (date accessed: 31.05.2022).
- 19 Про затвердження деяких нормативно-правових актів з бухгалтерського обліку в державному секторі : наказ Міністерства України від 29.12.2015 р. № 1219 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/z0085-16> (date accessed: 31.05.2022).
- 20 Про затвердження типових форм меморіальних ордерів, інших облікових реєстрів суб'єктів державного сектору та порядку їх складання : наказ Міністерства України від 08.09.2017 р. № 755 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/z1416-17> (date accessed: 31.05.2022).
- 21 Методичні рекомендації з організації та ведення бухгалтерського обліку у Збройних Силах України : наказ Міністерства України від 19.12.2014 р. № 905 (зі змін. та допов.).
- 22 Про затвердження Плану рахунків бухгалтерського обліку в державному секторі : наказ Міністерства України від 31.12.2013 р. № 1203 (із змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/z0161-14> (дата звернення 31.05.2022).
- 23 Положення з бухгалтерського обліку в Збройних Силах України : затв. наказом Міністерства України від 21.06.2007 р. № 363 (зі змін. та допов.). URL: <http://parusconsultant.com/?doc=06VHE9B9B8&abz=ARUA4> (дата звернення 31.05.2022).

- Instruction on the use of automotive equipment in the Ministry of Defense and Armed Forces of Ukraine ²⁴.

It should be remembered that accounting of military property in cases provided for by law is carried out in compliance with requirements for preservation of state secrets.

Military property of permanent reserves intended for use in a special period (which in peacetime is in long-term storage in military units) is accounted for separately from the other.

Military property at military (ship) facilities, in support services of military administration bodies, in services of military units and formation, in warehouses, arsenals, and bases are accounted for both in peacetime and in a special period in accordance with requirements of regulatory and legal acts of the Ministry of Defense of Ukraine and legislative acts of Ukraine.

In accounting of military units, full and reliable information on military property and funds, income and expenses, as well as on all economic transactions carried out for:

- balance sheet and off-balance sheet accounts provided for by the Project of accounting calculations of Budget Institutions ²⁵;
- general and special funds of the State Budget of Ukraine;
- software classification codes of expenses;
- codes of economic classification of expenses or codes of classification

of budget revenues by special fund;

- items of expenditure according to the estimate of Ministry of Defense or types of income of special fund;
- security services;
- structural subdivisions;
- materially responsible persons;
- military units enrolled in support.

Next, we will consider the types of accounting of military property conducted by relevant services (food, property, housing and maintenance, fuel and lubricant materials, etc.), some features of such accounting, as well as the amount of knowledge of forensic experts necessary for conducting forensic economic examinations related to accounting and use of fuel by military units of the Armed Forces of Ukraine.

Firstly, there are four main types of military property accounting maintained by relevant services (in particular, service of fuel and lubricants):

- quantitative accounting of military property;
- qualitative accounting of military property;
- accounting of military property in numerical indicators;
- accounting of military property in value indicators.

Quantitative accounting of military property is carried out in natural indicators in standard units of measurement and accounting, determined by the *State Classifier of Ukraine, Classifier of the system of designations of measurement and*

²⁴ Про затвердження Інструкції про використання автомобільної техніки у Міністерстві оборони та Збройних Силах України : наказ Міноборони України від 12.12.2016 р. № 678. Київ, 2016.

²⁵ Про затвердження деяких нормативно-правових актів URL: <https://zakon.rada.gov.ua/laws/show/z0085-16#n13> (date accessed: 31.05.2022).

accounting units ДК 011-96²⁶. According to quality (technical) condition, military property is recorded by categories (no more than five) by degrees of suitability (suitable or unsuitable) or by grade in accordance with State standards.

Military property is recorded in accounting and numerical indicators in accordance with factory numbers of samples of military property. Valuation of military property is carried out in national currency of Ukraine.

Military property value (as of the moment it comes under the control of the Ministry of Defense) is determined by its purchase price or the value (price) specified in contracts concluded for its manufacture and delivery.

Military property value of located in military units and secured by them under the right of operational management is determined according to the Methodology for determining the residual value of the property of the Armed Forces of Ukraine and other military formations²⁷ (except for cases when the value of military property is determined on the basis of a report on the valuation of property prepared by

in accordance with the Law of Ukraine *On Appraisal of Property, Property Rights and Professional Appraisal Activity in Ukraine*²⁸).

Secondly, accounting of military property is carried out by materially responsible persons and relevant services.

Previously, military property according to its characteristics can be qualified as stocks (in particular, fuel and lubricants), according to the requirements of the order of the State Treasury of Ukraine; *On approval of standard forms of accounting and write-off of stocks of budgetary institutions and Instructions on their compilation*²⁹ (expired on the basis of the order No. 838³⁰ of Ministry of Finance of Ukraine dated on 31.12.2020) were recorded in the following accounting registers:

- logs on quantitative and total accounting (standard form No. 3-6);
- logs on quantitative and total accounting (standard form No. 3-6a);
- quantity and total accounting cards (standard form No. 3-7);

26 Державний класифікатор України «Класифікатор системи позначень одиниць вимірювання та обліку ДК 011-96»: затв. наказом Держкомстандартизації, метрології та сертифікації України від 09.01.1997 р. № 8. [Чинний від 01.07.1997 р.]. URL: <https://zakon.rada.gov.ua/rada/show/v0008217-97> (date accessed: 31.05.2022).

27 Про затвердження Методики визначення залишкової вартості майна Збройних Сил України та інших військових формувань: Постанова КМУ від 29.05.1998 р. № 759 (зі змін. та допов.). URL: [https://zakon.rada.gov.ua/laws/show/759-98- %D0 %BF](https://zakon.rada.gov.ua/laws/show/759-98-%D0%BF) (date accessed: 31.05.2022).

28 Про оцінку майна, майнових прав та професійну оціночну діяльність в Україні: Закон України від 12.07.2001 р. № 2658-III (зі змін. та допов.). URL <https://zakon.rada.gov.ua/laws/show/2658-14> (date accessed: 31.05.2022).

29 Про затвердження типових форм обліку та списання запасів бюджетних установ та Інструкції про їх складання: наказ Держказначейства України від 18.12.2000 р. № 130 (утрат. чин.). URL: <https://zakon.rada.gov.ua/laws/show/z0962-00> (date accessed: 31.05.2022).

30 Про затвердження змін до деяких нормативно-правових актів з бухгалтерського обліку бюджетних установ: наказ Держказначейства України від 28.01.2002 р. № 12 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/z0140-02#Text> (date accessed: 31.05.2022).

- negotiable note (standard form № 3-11).

In other words, military property accounting was carried out by recording in cards, accounting logs, other material media in a special (paper or electronic) format in the form of information, order, manuals, journals, typescripts, containing information about amount of property accounted for, its quality (technical) condition, registration and factory numbers, value (price), as well as about its movement, loss or shortage.

Instead, Ministry of Finance of Ukraine (order No. 816 dated on 28.12.2020³¹) changed the norms of guidelines on accounting for public sector entities, as a result of which budgetary institutions received an updated form of inventory write-off act.

Missing of approved standard forms for registration of individual economic transactions with stocks, State sector entity is allowed to independently develop and approve in administrative document on organization of accounting appropriate forms of necessary primary documents, which must contain mandatory details.

There are two types of military property accounting in military administration bodies: operational and according to primary accounting documents. Operational accounting of military property is the main accounting type, it is conducted on the basis of reports periodicity determined by time sheets of urgent reports.

Military property (in particular, fuel and lubricants) received from the supplier is subject to accounting according to primary accounting documents.

Primary accounting documents include: invoices, orders, purchase orders, check demands, distribution and delivery information, deeds, receipts, travel, work, production and distribution letters, certificates. They are intended for registration of operations related to movement and change of value and qualitative (technical) condition of military property and are the basis for records of accounting data in accounting registers.

Accounting registers reflect availability, movement and quality (technical) condition of military property (its value).

Military property is recorded at the place of its responsible storage (location) and in financial service.

Accounting in military units is conducted according to memo slip form.

All memo slips are registered in registers of synthetic accounting: *Journal-Main* log.

Procedure for keeping records of fuel and lubricants of service of fuel and lubricants in the division of the military unit is defined in ch. XVIII *Peculiarities of the accounting of fuel and lubricants, special liquids, alcohol and technical means of service of fuel and lubricants* Instructions on the accounting of military property in the Armed Forces of Ukraine ³² (hereinafter referred to as *Instruction № 440*) defining:

31 Про визнання таким, що втратив чинність, наказу Державного казначейства України від 18 грудня 2000 року № 130 : наказ Міністерства України від 28.12.2020 р. № 816. URL: <https://zakon.rada.gov.ua/rada/show/v0816201-20> (date accessed: 31.05.2022).

32 Про затвердження Інструкції з обліку військового майна URL: <https://zakon.rada.gov.ua/laws/show/z1192-17> (date accessed: 31.05.2022).

"1. Accounting for fuel and lubricants, specific liquids and alcohol is carried out according to the following standard units of measurement:

- in support services of military administration bodies and military units, in operational and accounting unit, storage units and Military property registration card (categorical one) of support center, in fuel warehouse and refueling point for equipment of military unit, in unit of the aviation unit, as well as in the unit located or operating separately from its of military unit, in kilograms by name, brand and quantity, and in warehouses (storages) of the supply center, in fuel warehouse, in price terms per accounting unit;*
- in a unit stationed or operating with its military unit, in liters, by names, brands and quantity;*
- in financial and economic body of military unit, supply center, as well as on the ship (vessel) in kilograms by names, brands, quantity and value.*

Structural division of Ministry of Defense designated for organization and conducting public procurement, conclusion and support of contracts for the supply of military property in the direction of rear support, keeps records of fuel and lubricant materials that come from manufacturers (suppliers) according to centralized calculations, by names, brands, quantities and cost, as well as control over the fulfillment of the terms of contracts for the supply of fuel and lubricants.

2. For the refueling of equipment with fuel and lubricants in the service of a military unit, a distribution (handover) notice is drawn up separately for each unit

handed over to the Head of fueling point of military unit for execution. After expiry of its validity period (at the end of each working day), the Head of equipment refueling point of the military unit sums up results of fuel delivery (in liters and kilograms) in the report and submits it to relevant service of providing military unit.

Recalculation of issued fuel from liters to kilograms is carried out by the head of the military unit or the head of the filling station. Calculation accuracy is one kilogram (at the same time, the mass of 0.5 kg and more is rounded up to 1 kg and less than 0.5 kg, to zero).

3. Release of fuel from warehouse of a military unit to driver of a fuel filling station or tanker truck for refueling equipment is carried out under a signature in manual of military property issued for temporary use. At the same time, the Head of supply service of military unit issues to the driver of the refueling station (tanker) a distribution (dispensing) notice, according to which the driver of the refueling station (tanker) refuels vehicle with fuel and accepts the fuel that is drained from, under his signature in the log of accounting documents. Refueling and receiving fuel are made out with separate distribution (dispensing) information.

After refueling (acceptance) of fuel, the driver of fuel tank (tanker truck) hands over the distribution (delivery) list and the remaining (accepted) fuel to the warehouse of the military unit. The head of the warehouse puts his signature in the record book of military property issued for temporary use, about the acceptance of fuel and handing out information from the driver of the fuel tank (tanker). At the end of each working day, Head of military unit warehouse sums up results of the fuel delivery (in liters and

kilograms) in handout (handover) report and submits it to relevant service of the military unit.

4. Fuel received at a warehouse (refueling point) of a military unit by a unit that independently refuels equipment with regular fuel is recorded in this unit in the book of military property (warehouse, unit).

Dispensing of fuel in a unit that carries out independent refueling of equipment with regular means is carried out according to distribution (issuance) information with appropriate records of amount of fuel dispensed in the waybills (appendix 82) and work sheets of aggregates (appendix 83)".

The form of the waybill and its design is determined by Clause 1 of Appendix 82 of Instruction № 440, according to which "waybill is an administrative document issued to the unit commander and the driver for the performance of the task and is the basis for accounting for the operation of the machine, as well as for writing off expenses and determining saving (over expenditure) of fuel".

The Instruction on the use of automotive equipment in the Ministry of Defense and the Armed Forces of Ukraine (hereinafter referred to as Instruction No. 678)³³ defines the main measures for the effective use of machines, saving motor resources, diesel fuel, gasoline, lubricants, etc., as well as the procedure and features of vehicle using in Ministry of Defense and Armed Forces. It states the following:

"2.5. The main measures to save motor resources and fuel are:

compliance with the norms and rules for operation of automobile equipment, defined

in instructions for operation of equipment samples;

<...>

vehicle use at the most economical modes of engine operation; <...>

3.2. Planning the use of vehicles should ensure combat readiness, combat duty, project implementation for combat training and economic activity of military units, efficient and accident-free use of vehicles and economical use of fuel.

<...>

3.35. Accounting of vehicle use and the work performed is carried out: in the road and route sheets, work unit sheet, in the accounting log for the vehicle work, consumption of fuel and lubricants, in the accounting log k of automotive equipment (Appendix 11), in Monthly Operation Project, in the vehicle license (special installation, engine).

3.36. Vehicles of military units are used according to waybill <...>.

The waybill is an order to the unit commander and the driver to perform the task. It is the basis for writing off and determining fuel savings (overspending), as well as accounting for work performed.

The waybill is drawn up in the automobile service (technical unit) of the military unit, signed by the automobile service Head certified with a seal, and handed over to the division for signature (in some cases, to the officer on duty in the unit).

Waybill is issued for one day, for on-duty vehicles — an on-duty tractor, a fire engine, fire engines of fire departments — for up to five days and when the vehicle is sent on combat duty, training and on a long business trip — for the duration of the task, but not more than 10 days In the event of

33 Про затвердження Інструкції про використання автомобільної техніки ...

a longer business trip, the head of the vehicle (head of the convoy) is issued for reporting forms of waybills, which are registered and signed by the deputy commander of the military unit for armaments (automobile service Head) and certified with a seal.

Waybills are handed over for signature to the unit commander who assigned cars taking into account provision of sufficient time for the preparation of drivers and cars for the flight, but no later than 4:00 p.m. the day before departure.

In the event that a military unit leaves due to an alarm, waybills are prepared in advance and stored in the unit (unit) on duty issued to the senior who is going to the park with drivers.

In some cases (if there are specifics of deployment or performance of tasks by a military unit), procedure for storing and issuing travel documents is established by the military unit commander.

3.40. The operation of the machine during use is confirmed by entries in the waybill. After each trip or on the day the car is returned, the driver fills out section II: "Car operation". The head of the car (the person at whose disposal the car was allocated) in column 14 of the waybill makes a record of the speedometer reading, the time and place of release of the cars and puts his personal signature. If the use of the machine was entrusted to the driver, the entry in the waybill about its operation is made by the driver. After the end of using the car, the waybill is checked, signed by the commander (senior technician) of the unit or a person appointed by the military unit commander and handed over to the military unit automobile service (technical unit).

It is forbidden to issue a new waybill to drivers, if the waybill for previous car leaving the park has not been drawn up and handed

in, and in case of loss, until the reasons are clarified and measures are taken.

3.41. Data from the waybill about vehicle operation, fuel consumption are recorded daily in accounting log for the vehicle operation, fuel and oil consumption."

Therefore, requirements of the above legislative acts provide that:

- accounting in the Armed Forces is conducted in accordance with normative legal acts of the Ministry of Defense and State Treasury of Ukraine defining the rules and specifics of accounting in budgetary institutions (military units, warehouses, etc.);
- accounting is a mandatory type of accounting that is kept at the enterprise;
- basis for displaying an entry in accounting registers are properly executed primary documents;
- primary documents must have mandatory details;
- military property is recorded at the place of its responsible storage (location) and in the financial service;
- accounting in military units is conducted according to memo slip form.
- all memo slips are registered in the registers of synthetic accounting (*Journal-main log*).
- waybill is an administrative document issued to the unit commander and the driver to perform the task, it is the basis for accounting for vehicle operation, as well as for writing off expenses and determining fuel economy (overspending).

In other words, research objects while forensic economic examination

on accounting and use of fuel by military units of Armed Forces are:

- primary accounting documents;
- property purchase or delivery contracts;
- content of conducted inventories,
- accounting registers of analytical accounting of military property (fuel) regarding quantity, movement, shortage or surplus;
- registers of synthetic accounting (memorial orders, *Journal-main logs*).

Forensic expert investigates asked questions for issue resolution and based on results of a thorough analysis of these objects, provides a well-founded conclusion.

However, as forensic expert practice demonstrates, most often documents provided for research make impossible to provide categorical answers, because they do not have a complete and sufficient amount of information, or are selective and contain a significant number of unconditioned corrections. Responsible persons of military units of the Armed Forces of the Armed Forces in conditions of martial law prepare fuel accounting documents in an untimely manner causing their untimely submission for examination.

Thus, on the one hand, the issue of effective use of fuel by military units of the Armed Forces is very important and relevant. On the other hand, the following issues accompany the conduct of forensic economic examinations on accounting and use of fuel by military units of the Armed Forces:

- provision of an incomplete package of documents necessary for solving the issues raised before forensic economics;

- provision of documents containing a significant number of unconditional corrections;
- difficulty in calculating the total amount used fuel related accounting documents is recorded either in kilograms or in liters requiring correct conversion from one value to another, taking into account fluctuations in air temperature and fuel density (such data that cannot always be provided to forensic expert for research).

While forensic economic examinations related to accounting and use of fuel by military units of the Armed Forces of Ukraine, forensic experts resolve the following issues:

- 1) "Is the write-off of fuel and lubricant materials (specify which exactly) justified according to primary documents and accounting records of the military unit ... for the period ... for military equipment operation (specify which ones exactly)?";
- 2) "In what quantity and for what amount, according to military unit waybills ... is use of fuel and lubricants (specify what exactly) during the period ... for military equipment operation (specify what exactly)?";
- 3) "Is the lack of fuel and lubricating materials (specify which ones) of military unit ... for materially responsible person ... indicated in inventory description from ... for the total amount of ... UAH as of (specify date) documented?";
- 4) "Is it documented that the remains of fuel and lubricant materials (specify which ones) of the military unit ... for materially responsible person ..., specified in the inventory description

from ... for the total amount of ... UAH as of (specify the date)?";

- 5) "Whether the conclusions of audit report (inspection or other control measure) regarding the causing of material damage to the military unit ... (therefore – the state) in the form of a lack of fuel and lubricant materials (specify which ones) for the total amount of ... UAH specified in the inventory have been documented description from ...?";
- 6) "Whether the conclusions of the professionals regarding the causing of material damage to the military unit ... (therefore, to the state) in the form of a lack of fuel and lubricants (specify what exactly) for the total amount of ... UAH indicated in the inventory from ..., provided that the primary accounting documents to which (as determined by investigation) knowingly false information regarding the issue of fuel at the combat supply point of military unit ... (or specify other reasons) was entered?";

Conclusions

The authors analyzed current legislation of Ukraine regulating expert economic activity regarding the accounting of fuel costs in the Armed Forces, noting that it does not provide an opportunity to unequivocally answer the questions asked to forensic experts. On the other hand, it does not take into account peculiarities of conducting such examinations in wartime conditions that requires a separate regulation.

Theoretical and practical aspects of conducting forensic economic examinations on accounting and use

of fuel by military units of the Armed Forces of the Armed Forces of Ukraine can be applied in forensic expert practice in order to optimize working time of forensic experts.

Судові економічні експертизи з питань обліку пального у Збройних силах України Наталія Панченко, Ірина Гордієнко, Ольга Грек

Досліджено теоретичні напрацювання судових експертів щодо особливостей обліку пального в транспортній та оборонній сферах, наведено перелік законодавчих і нормативних актів, якими врегульовано порядок обліку, руху та списання пально-мастильних матеріалів у військових частинах. Авторки мали на меті висвітлити питання обліку пального в умовах військового стану й російської військової агресії, документально обґрунтувати ефективне використання пального військовими частинами Збройних сил України та територіальної оборони у процесі виконання бойових завдань. Узагальнено об'єкти дослідження судових економічних експертиз, окреслено коло наданих експертам повноважень під час проведення таких експертиз. Зазначено особливості обліку й руху військового майна, характерні для правил прийому, обліку, видавання та списання матеріальних цінностей у Збройних силах України. Визначено питання й завдання, вирішувані експертами під час проведення судових економічних експертиз, пов'язаних з обліком і використанням пального військовими частинами Збройних сил України. Наведено перелік законодавчих та нормативно-правових актів, якими мають керуватися у своїй професійній діяльності економісти-експерти, обліковуючи

військове майно. Звернено увагу на не-врегульованість деяких питань такого обліку (наприклад, коли одні законодавчі акти втратили чинність, а нових натомість не ухвалено), що спричиняє певні складнощі. Висвітлено й розкрито основні види обліку військового майна (кількісний і якісний облік; обліки військового майна в обліково-номерних і вартісних показниках).

Ключові слова: військове майно; особливості обліку майна; пально-матильні матеріали; кількісний, якісний, обліково-номерний облік; облік військового майна у вартісних показниках.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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Technical Malfunctions Determination of Vehicle Brake System while Road Accident Analysis

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Issues related to the driver's characterization of condition and technical malfunction of the vehicle braking system before a traffic accident are considered. This Article Purpose is to determine specifics of a technical malfunction of a vehicle braking system before a traffic collision, as well as to consider the interaction of investigative bodies with experts (in particular, in criminal proceedings related to traffic accidents) while establishing reliability of driver statements. Features of appointment of a forensic auto-technical road accident analysis aimed at establishing technical condition of braking system of vehicles, preparation of initial data and research objects are structured. The goals and objectives of the investigation of the technical malfunction of the brake system of the vehicle before the traffic accident are outlined. The procedure for establishing the reliability of drivers' statements about mechanism of development of a traffic accident is specified. Issues related to the study of the vehicle brake system, troubleshooting and their causes are considered. Theoretical provisions and practical recommendations for the application of special knowledge in process of researching the technical condition of the braking system of the vehicle and identifying its malfunctions are formulated. The causal relationship between driver actions and detected malfunctions of the

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vehicle's braking system was clarified. Attention is drawn to possible consequences and features of the further investigation of the traffic accident after determining technical reliability of driver statements.

Keywords: *driver's testimony; technical vehicle condition; vehicle operation; traffic accident; brake system malfunctions.*

Research Problem Formulation

While investigation of traffic collision at the stage of receiving testimony of its participants by the investigator (court), there are cases when drivers state that the cause of traffic collision was a malfunction of brake system of the *vehicle*. Complete or partial failure of the braking system is recorded, as which result the vehicle lane changes in an uncontrolled state. Therefore, during inspection of vehicle at the scene of traffic collision, it is necessary to carefully inspect the elements of the brake system. While inspection of the scene of traffic collision, technical condition of the motor vehicle should be identified and recorded, noting the signs of malfunction of the motor vehicle (unless it is obvious that such malfunction is a consequence in the form of a collision, collision or overturning of the motor vehicle and not the cause of the accident), especially if the driver refers to a refusal brake system before the accident. At the same time, it is not enough just to record

the detected malfunctions in the vehicle inspection report without appointing a further road accident analysis, because then questions about the time of occurrence of the malfunction (long before or immediately before traffic collision) and possibility of its timely detection by the driver (mechanic) remain unanswered, without the answers to which it is impossible determine the fault of the persons involved in the accident.

Analysis of Essential Researches and Publications

The theoretical foundations of the research of issues related to the investigation of road accidents caused by vehicle malfunctions were laid by such domestic scientists as: V. A. Bekasov, H. Ia. Bohrad, B. L. Zotov and H. H. Indychenko¹, A. B. Razumov², Yu. B. Suvorov and H. V. Zhylynskyi³, M. G. Shcherbakovskiyi⁴, as well as foreign professionals D. Collins and D. Morris⁵, R. Bayett and R. Watts⁶, and others.

- 1 Бекасов В. А., Боград Г. Я., Зотов Б. Л., Индиченко Г. Г. Автотехническая экспертиза. Москва, 1967. 254 с.
- 2 Судебно-автотехническая экспертиза (часть III). Основы судебно-экспертного исследования технического состояния транспортных средств / под ред. А. Б. Разумова, сост. Г. В. Жилинский. Киев, 1987. 112 с.
- 3 Суворов Ю. В., Жилинский Г. В. Применение специальных технических познаний при расследовании дорожно-транспортных происшествий. Минск, 1989. 73 с.
- 4 Щербаковский М. Г. Призначення та провадження судових експертиз: процесуальні основи, методичні рекомендації, запитання експерту. Харків, 2011. 400 с.
- 5 Коллинз Д., Моррис Д. Анализ дорожно-транспортных происшествий. Москва, 1971. 128 с.
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Article Purpose

While establishing reliability of the driver's testimony, determine specifics of technical malfunction of vehicle brake system before the traffic accident, as well as consider the interaction of investigative bodies with experts (in particular, in criminal proceedings related to traffic accidents).

Main Content Presentation

When a driver fails to stop the car in time, he usually cites brake failure. Unfortunately, it is not always possible to study in detail the chain of events and circumstances that caused the collision, which is caused by the impossibility of stopping in time. The driver is not always able (and sometimes unwilling) to recall important details or logically reproduce the sequence of events. Therefore, in order to identify the circumstances of an accident, it is appropriate to determine the causes of these events, the most common of which include: uneven braking, partial or temporary brake failure, loss of frictional properties, problems with heat distribution, the presence of air in the brake system, expansion of the brake drum, problems with the brake amplifier, partial failure of brake systems with a separate hydraulic drive, etc ⁷.

The brake system is a set of devices designed to create and change artificial movement resistance. When diagnosing the brake system, it is necessary to evaluate its compliance with the design, the requirements of the manufacturing plant,

as well as working capacity and efficiency of the action ⁸.

Having recognized the need to conduct a forensic automotive technical examination, investigator (in accordance with Criminal Procedural Code of Ukraine ⁹) adopts a resolution on this, in which he notes the grounds for the appointment of the examination; the name of the institution where the examination is to be conducted and/or the surname of the expert; materials provided to the expert for research; the raw data on which the research is to be based, as well as the questions to be addressed.

Solving issues in criminal proceedings requires specific expertise in the field of forensic examination (in particular, auto technical one) according to Art. 110 *Procedural decisions*", Art. 242 "Grounds for examination", Art. 243 *Procedure for engaging an expert* of Criminal Procedural Code of Ukraine of Ukraine ¹⁰.

Data on the technical condition of vehicles, namely systems designed to ensure road traffic (condition of relevant parts, units and assemblies) are required for performance of auto technical examinations. The main safety systems of motor vehicles: braking system, steering, external lighting devices and chassis. It is possible to check technical condition of aggregates, assemblies and parts of the vehicle in different ways, the most common of that in expert practice are running and bench tests (diagnostics) and element-by-element research. In some cases, it is necessary to carry out a comprehensive examination to determine the causes of malfunctions of individual parts.

7 Байэтт Р., Уоттс Р. *Op. cit.*

8 Жилинский Г. В., Остапюк О. Я., Лошманов В. П. и др. *Экспресс-диагностика систем автомобилей и автобусов на местах дорожно-транспортных происшествий* / под ред. А. Б. Разумова. Киев, 1980. 56 с.

9 Кримінальний процесуальний кодекс України від 13.04.2012 р. № 4651-VI (зі змін. та допов.). URL: <http://zakon2.rada.gov.ua/laws/show/4651-17> (date accessed: 02.06.2020).

10 Ibid ... URL: <http://zakon2.rada.gov.ua/laws/show/4651-17> (date accessed: 02.06.2020).

Vehicle (as well as a separate unit, unit or part) should be considered technically serviceable if, during its actual inspection, all its functional parameters meet the design and operational characteristics, as well as the requirements of regulatory and technical documentation. However, not every malfunction of a separate unit or part leads to a violation of vehicle performance, therefore, causes traffic collision.

Therefore, taking into account the issues that professionals have to solve while road accident analysis (identification of vehicle malfunctions), the following objects of expert research can be singled out.

Objects of road accident analysis forensic research

1. Vehicles

a) mechanical motor vehicles (i.e. motor vehicles, the which movement occurs thanks to the engine) including tractors, self-propelled machines and mechanisms, as well as trolleybuses and motor vehicles with an electric motor with a power of more than 3 kWh ¹¹:

- motor vehicles (in accordance with Art. 1 of the Law of Ukraine On Motor Vehicle Transport ¹², they are defined as wheeled vehicles (bus, truck and car, trailer, semi-trailer), which are used to transport passengers, goods or perform special work functions);
- motorcycles and mopeds recognized as two-wheeled

mechanical vehicles (apparently, these objects should belong to the objects of road accident analysis, taking into account the number of accidents with their participation);

- rail vehicles (trams and platforms with special equipment moving on tram tracks);

b) bicycles (except wheelchairs) are vehicles, which movement is due to the muscular force of the person who is on ¹³.

2. Parts of vehicles, their structural parts and their elements.
3. Vehicle technical documentation.
4. Circumstances at the scene of traffic collision.
5. Traffic collision procedure.
6. Materials of criminal proceedings (procedural documents (protocols of examinations, interrogations, investigative experiments, conclusions of forensic experts, etc.), schemes of traffic collision, video recordings, photo tables).

Forensic expert, examining the objects placed at his disposal, examines only those characteristics that allow to answer the questions posed. It is the characteristics and signs of a specific object that make it possible to distinguish it from others and identify it. Identification and research of such signs helps to solve diagnostic, classification, situational and identification types of tasks ¹⁴.

After the expert vehicle technician receives resolution on appointment of an examination, forensic expert first

11 Правила дорожнього руху : затв. Постановою КМУ від 10.10.2001 р. № 1306 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/1306-2001-%D0%BF> (date accessed: 02.06.2020).

12 Про автомобільний транспорт : Закон України від 05.04.2001 р. № 2344-III (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/2344-14#Text> (date accessed: 02.06.2022).

13 Правила дорожнього руху URL: <https://zakon.rada.gov.ua/laws/show/1306-2001-%D0%BF> (date accessed: 02.06.2020).

14 Лубенцов А. В. Теоретичні та методичні основи судової автотехнічної експертизи : дис. ... канд. юрид. наук. Харків, 2018.

get acquainted with all the provided case materials and objects of research, the scene of the accident, as well as the questions posed by the investigator (court). After studying all the materials of the criminal case, forensic expert should plan the sequence of the research. At the initial stage of research, forensic expert should create a model for the occurrence of an accident, that will then be subjected and reasonable research.

During the preliminary study at the preparatory stage of the road accident analysis, actions of forensic expert can lead to the return of materials to the initiator of the examination for their proper registration. Having studied the case materials, forensic expert determines: integrity of packaging and the availability of research objects, their compliance with the list in the accompanying documents; the state of the objects of research (their integrity, the absence of changes caused by transportation, etc.); sufficiency and quality of the objects of research provided for examination; the need to violate the petition for the provision of additional materials (samples) and access to the objects of research related to forensic examination; necessary research methods and sequence of their application.

Forensic research can be carried out only by a qualified forensic expert, on the other hand, the effectiveness and quality of such a research depends on qualifications of the person who appointed the research, as well as on the use by the expert of advances in science and technology and modern technologies that make it possible to store the objects of examination for additional research.

First, the investigator determines the task of the research by formulating questions to the expert and the need for the latter to leave for the inspection of the objects under research and agrees on the research timing. At this stage, the expert identifies the shortcomings that arose during the appointment of expertise and the removal of the materials and objects submitted for research and should demand their elimination for further research.

Road accident analysis begins with the expert's study of actual data about the accident and its individual moments. According to Clause 11.2 of the Instruction on appointment and conducting forensic examinations and researches, forensic expert is prohibited from independently collecting materials to be examined, as well as selecting raw data, if they are ambiguously reflected in provided materials¹⁵. However, forensic expert has the right to independently use the necessary literature from normative and reference sources regarding the objects provided for research (vehicle), namely: the structure of the structures of certain units and aggregates, their operational parameters and characteristics recommended by the manufacturer. If, during the investigation, the expert comes to the conclusion that the objects provided for investigation, specified in the resolution on the appointment of the expertise (resolution), and the circumstances of the accident from a technical point of view are unreliable, then the expert must notify the investigator (court) who ordered the expertise in writing, and request new materials necessary for conducting the study, or clarify the identified shortcomings.

15 Про затвердження Інструкції про призначення та проведення судових експертиз та експертних досліджень та Науково-методичних рекомендацій з питань підготовки та призначення судових експертиз та експертних досліджень : затв. наказом Мініюсту України від 08.10.1998 р. № 53/5 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/z0705-98> (date accessed: 02.06.2020).

While research, forensic expert can find out new data and circumstances about which the investigator (court) did not raise issues in the decision on the appointment of the examination, but which identification is essential for subsequent conclusion of the case. Therefore, in order to uncover the crime, the investigation may accept these additional circumstances and use them as evidence in the case¹⁶. Timely detection of such circumstances makes it possible to promptly investigate and solve the crime, based on the actual versions.

Studying materials submitted for forensic examination, expert develops a dynamic model of the accident, integral which part is the calculations necessary both to verify technical reliability of the initial data and to directly solve the questions posed to the expert. Usually, engineering calculations provide an opportunity to determine not so much absolutely accurate values of values (for example, the length of the braking distance of the vehicle), but the limit of possible range of values available while accident¹⁷.

Peculiarity of calculation application methods in auto technical examinations to some extent brings them closer to the methods of mathematical modeling: their main purpose is not to determine the exact quantitative values of certain parameters, but to determine the structure of the investigated process, its main characteristics and the limits in which it occurred.¹⁸ *It should be noted that solving questions regarding the mechanism of interaction of vehicles with each other or with elements of the road environment is most often possible only by means of real-time modeling, that is, direct research and comparison of*

tracks on vehicles. Therefore, forensic expert can obtain actual results when the vehicle is in the same condition at the time of its submission for examination as it was immediately after the accident (for this purpose, it should be stored in conditions that exclude the change of existing and the appearance of new traces on).

Having appointed an examination aimed at determining the technical condition of the brake system, it is necessary to provide a vehicle for the research (to solve the tasks of forensic examination, the vehicle inspection protocol and its photos are often not enough). Before the vehicle is presented to forensic expert institution or until the expert arrives at the vehicle storage place, it is necessary to ensure complete preservation of the vehicle. It is forbidden to adjust the brake mechanism, replace components, add brake fluid and carry out any other repair and restoration work. Transportation of vehicles for examination, checking of the technical condition of the brake system is allowed only by fully loading. If it is necessary to determine the cause of depressurization of the brake system, destruction of brake discs or drums, air entering the brake system, etc., then this part or assembly can be sent for research, having previously dismantled it from the vehicle describing it in detail and attaching it to the case with an appropriate decision. At the same time, the appearance and position of the removed part (node) on the vehicle (tractor, motorcycle, etc.) must be described in detail in the vehicle inspection report and photographed. Dismantling conditions must be noted in the physical evidence review protocol, which, together with the detail (node), vehicle review protocol and

16 Про затвердження Інструкції ... URL: <https://zakon.rada.gov.ua/laws/show/z0705-98> (date accessed: 02.06.2020).

17 Кристи Н. М. Методические рекомендации по производству автотехнической экспертизы. Москва, 1971. 112 с.

18 Лубенцов А. В. Оп. cit.

decision on appointment of road accident analysis is sent to forensic expert institution or expert. When sending a destroyed part for examination, it is necessary to provide all its fragments; the fracture surfaces must be isolated from mechanical impact (friction or impacts), moisture, etc.¹⁹

The impact of brake system malfunctions on the occurrence of traffic collision is usually detected in extreme conditions, when the driver of the vehicle is forced to use the maximum functionality of the system to prevent harmful consequences (collision, collision, etc.). In such conditions, the driver applies emergency braking in order to stop the vehicle at a minimum distance. In emergency braking mode (depending on the technical condition of the brake system and the road surface), wheel locking (all, rear or front only, left or right bead or individual wheel) may occur. Driving a vehicle while braking in wheel lock mode in certain road situations can cause traffic collision²⁰.

Even a slight violation of the tightness of the hydraulic system leads to leakage of brake fluid and depressurization of the system. Air in the brake system first gradually increases working stroke and reduces the hard stop of the brake pedal at the end of the stroke, then, as the amount of air in the system increases (this process increases), pedal can completely sink to the floor of the cabin, and braking in this case is possible, only several times pressing the brake pedal. Air entering the brake system increases the brake application time and the length of the braking distance compared to the standard values. As air accumulates, braking performance will decrease because much of the pedal effort will be spent compressing the air and

displacing the brake fluid through the leak, causing the brake system to depressurize. The same situation is observed when air enters the system through the supply tank of the main brake cylinder in conditions of a significant decrease in the brake fluid level. Braking efficiency is significantly reduced if (in addition to such processes) fluid leaks into the working brake cylinders with brake fluid spilling onto the friction linings and barrel.

Braking may not be sufficiently effective if additional supports (jamming of levers, pedals, swelling of cuffs during the use of poor-quality brake fluids or ingress of gasoline, gas, acetone, etc.) have emerged in the drive elements.

Malfunctions of the vacuum brake booster, related to the disruption of its connection system or the destruction of diaphragm, do not directly affect the performance of the brake system, but the driver has to put much more effort to the pedal. However, if the vacuum booster fails suddenly, the driver who is accustomed to operating the booster system is not always able to respond to the maximum deceleration of the braking situation, so the booster failure may indirectly affect the event.

The gradual increase in the gap between the linings and the barrel increases the working stroke of the pedal and reduces the force of pressing the brake linings against the drum, thus reducing the braking torque and the overall braking efficiency. Wear of the linings to the brake pads leads to a significant reduction in the braking torque developed by the brake mechanism due to a reduction in the coefficient of friction. The coefficient of friction also decreases in the pair of the lining – the barrel and in the case of lubrication of the linings.

19 Байэтт Р., Уоттс Р. Оp. cit.

20 Судебно-автотехническая экспертиза

Malfunctions of the hydraulic brake system, such as breakage of flexible hoses or destruction of brake pipes, the escape of pistons with brake cylinder collars outside the working area, significant dusting cause a complete failure of the brake system.

During emergency braking in the road environment, when it is necessary to stop the vehicle at the minimum possible distance, specialists most often record failures of the brake system associated with its lack of efficiency and/or failure.

Uneven braking can lead to loss of transverse stability, that can cause a slip, exit from the roadway, roll over of the vehicle, exit to the lane of oncoming traffic, collision with oncoming vehicle, as well as provocation of other emergency situations²¹.

The vehicle should be considered technically faulty if its technical condition does not meet the requirements of Section 31 "Technical condition of vehicles and their equipment", Clause 31.4.1 "Brake systems" of Traffic codes, as well as if there are other defects in the brake system that make it impossible to protect traffic²².

Driver actions, if he operates a motor vehicle with brake system malfunctions, which he knows about or should have discovered during the operation of the motor vehicle, should be considered as a violation of the Traffic codes. For example, air was detected in the brake system on the vehicle (reducing efficiency of the brake mechanisms). While driving, the driver, having applied the brakes, lost control and drove into the oncoming traffic lane, where the accident occurred. Inspection of the vehicle did not reveal

any damage or depressurization of the brake system, the brake pedal was soft, fell under the influence of the driver on the controls, but braking occurred only from the second or third time it was pressed. In such a traffic situation, the driver was able to detect the improper condition of the brake system, because he must monitor the technical condition of the vehicle: equipment should meet the requirements of standards related to road traffic safety, environmental protection, as well as the requirements of technical operation rules, instructions of manufacturing companies and other regulatory and technical documentation. In addition, while driving, the driver had to pay attention to the road conditions, the condition of the roadway, and the technical condition of the vehicle he was driving if there was air in the working brake system²³. Since in the given traffic situation the driver did not take into account these factors, which led to his loss of control and the departure of the vehicle into the lane of oncoming traffic, as which result of the accident occurred, actions of the driver do not meet the requirements of the mentioned section. 31 "Technical condition of vehicles and their equipment" and clause 31.4.1 "Brake systems" of the Traffic codes, which were (from a technical point of view) causally related to the occurrence of this accident.

However, conclusion that there is no causal relationship between such actions (or inaction) of the driver and event is possible, if forensic expert determines that even in the lack of a technical malfunction of the brake system, driver did not have

21 Судебно-автотехническая экспертиза ...

22 Правила дорожного руху ... URL: <https://zakon.rada.gov.ua/laws/show/1306-2001-%D0%BF> (date accessed: 02.06.2020).

23 Ibid.

the technical ability to prevent an accident in a certain road environment.

There may also be no causal relationship between the actions of the driver operating the vehicle with a technically faulty brake system and the event when the driver had the opportunity to prevent the event and in the presence of a malfunction. In this case, the driver may take other measures to prevent the event from occurring in a timely manner due to the cause of the event ²⁴.

After performed research, forensic expert formulates a conclusion in which he evaluates the results obtained, referring to certain signs (materiality of the complex of signs; stability and individuality of the identified signs that coincide and differ; the significance of the signs for the conclusion about the availability or lack of identity).

The results of road accident analysis should be evaluated by analyzing the expert compliance with the procedural order of obtaining initial data on the vehicle and its investigated details, as well as the scientific validity and reliability of the expert's conclusions. First of all, it is necessary to analyze the reliability and quality of the source data, because in the case of their unreliability (even after applying scientifically based research methods), it is possible to reach wrong conclusions. For this, it is important to determine whether the expert applied the correct values of the design and operational parameters of the vehicle, the quantitative indicators of the actions of the participants of the movement and its conditions (that is, whether they correspond to the current methodological provisions). In order to evaluate the

research of individual parts, assemblies and aggregates, as well as damaged vehicle and other material objects, it is necessary to analyze the circumstances of their detection, fixing, removal and packaging; find out whether proper measures were taken to preserve them, whether they could be replaced or damaged already after the accident. Evaluating the results obtained on the basis of calculations, forensic expert sometimes has to change the primary road accident model or completely abandon it and develop a new one that would be consistent with the results of the conducted research ²⁵.

Conclusions

Possibility of detecting malfunctions of the brake system during the inspection of the technical condition or control of the vehicle is established on the basis of the determined time of the occurrence of the malfunction, the nature of such detection, the location of the damage (hidden or open defect of parts), the data of trace evidence and metallographic research, as well as taking into account the list of inspection operations technical condition of braking system of vehicles, provided for by job instructions for drivers and other persons. It is possible to establish a cause-and-effect relationship with detected malfunctions of the brake system of the vehicle only in the case of applying special knowledge in the field of auto engineering, i.e. only by appointing an road accident analysis that is able to reliably find out whether the driver was able to detect malfunctions of the brake system and whether the detected malfunctions are in causal connection with traffic collision.

24 Иларионов В. А. Судебная автотехническая экспертиза : метод. пособ. Ч. 2. Москва, 1980. 163 с.

25 Лубенцов А. В. *Op. cit.*

Визначення технічної несправності гальмової системи транспортного засобу під час проведення автотехнічної експертизи

Артем Кошкарів

Розглянуто питання, які стосуються характеристики водієм стану та технічної несправності гальмової системи транспортного засобу перед дорожньо-транспортною пригодою. Мета статті — визначити особливості технічної несправності гальмової системи транспортного засобу перед дорожньо-транспортною пригодою, а також розглянути взаємодію слідчих органів з експертними (зокрема, у кримінальних провадженнях, пов'язаних із дорожньо-транспортними пригодами). Структуровано особливості призначення судової автотехнічної експертизи, спрямованої на встановлення технічного стану гальмової системи транспортних засобів, підготовки вихідних даних та об'єктів дослідження. Окреслено цілі й завдання дослідження технічної несправності гальмової системи транспортного засобу перед дорожньо-транспортною пригодою. Зазначено порядок встановлення достовірності показань водіїв про механізм розвитку дорожньо-транспортної пригоди. Розглянуто питання, пов'язані з дослідженням гальмової системи транспортного засобу, усуненням її несправностей і їх причинами. Сформульовано теоретичні положення та практичні рекомендації із застосування спеціальних знань у процесі дослідження технічного стану гальмової системи транспортного засобу й виявлення її несправностей. З'ясовано причинний зв'язок між діями водія та виявленими несправностями гальмової системи транспортного засобу. Звернено увагу на можливі наслідки й особливості подальшого розслідування дорожньо-транспортної пригоди після визначення технічної достовірності показань водіїв.

Ключові слова: технічний стан транспортного засобу; експлуатація транспортного засобу; дорожньо-транспортна пригода; несправності гальмової системи.

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Declaration of Competing Interest

The author declare that he has no conflict of interest.

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Koshkarov, A. (2022). Technical Malfunctions Determination of Vehicle Brake System while Road Accident Analysis. *Theory and Practice of Forensic Science and Criminalistics*. Issue 2 (27). Pp. 120–130. DOI: [10.32353/khrife.2.2022.09](https://doi.org/10.32353/khrife.2.2022.09).

Possibilities of Forensic Video and Audio Analysis while Investigation of Crimes, Related to Human Trafficking

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This article purpose is to investigate current issues arising while preparation of materials and appointment of forensic video and audio analysis in case of investigations of crimes related to human trafficking, as well as possibilities of analysis for forming the investigation evidence base. Attention is focused on the global and international significance of human trafficking issues, aggravation of people exploitation in war conditions. Exploitation types of victims of human trafficking and responsibility for committing such crimes were analyzed; types of procedural actions are given, for which technical means are used to obtain video and audio information in order to record traces of crimes; main legal characteristics of such procedural actions are specified. Mistakes that subjects of

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crime investigation make while obtaining evidence that causes loss of a large part of evidence at the stage of the trial, are considered. Specifics and modern possibilities of forensic video and audio analysis for investigation of such crimes are highlighted; it was found out exactly what information from investigated records is used by investigative bodies and for what purpose. An analysis of the tasks solved thanks to video and sound recording expertise and their role in law enforcement activities for further use in court proceedings was carried out. On the basis of researched materials, attention is focused on the results of forensic examinations contributing to resolution of topical issues regarding qualification of acts and circumstances of committed crimes in the field of human trafficking and exploitation of such people, as well as strengthens the evidence base in the case. There are a number of requirements for the proper preparation of materials for forensic video and audio analysis.

Keywords: *forensic video and audio analysis; human trafficking; identification research; diagnostic research.*

Research Problem Formulation

Human trafficking is a global problem that affects the lives of millions of people in almost every country in the world every year. The most well-known form of human trafficking is usually sexual exploitation. In addition, hundreds of thousands of victims become objects of trade for the purpose of forcing them to physical labor, labor exploitation (domestic service, child begging), removal of organs, etc. People exploitation increases in conditions of a state of war or armed conflict (especially such types as recruitment, coercion to participate in armed conflict, abduction and forced transfer for the purpose of obtaining a certain benefit, etc.).

According to the UN Commission on Combating International Crime, the trade in "slaves" is third largest category of organized crime: more profits are made

only from the illegal trade in drugs and weapons ¹. Illegal income from human trafficking feeds of corruption procedures, prepares a favorable basis for further development of illegal business and greatly complicates the work of legal structures and law enforcement agencies.

Law enforcement agencies, NGOs and the State in general are supposed to provide an effective fight against this negative social phenomenon. Ensuring the right to freedom and personal integrity, creating safe conditions for an individual life is an important and primary task of law enforcement agencies. Among remaining types of forensic examinations, it is forensic video and audio analysis that is able to fully and objectively establish circumstances of events in order to clarify the crime procedure and the guilt of the participants while investigation of this crime category.

1 Всесвітній день протидії торгівлі людьми / Річанський ЗЗСО І–ІІІ ст. URL: <https://richanskazos.com.ua/plan-provedennya-informatsijno-prosvitnytskyh-zahodiv-z-metoyu-vidz-nachennya-vsесvitnoho-dnya-protydiji-torhivli-lyudmy> (date accessed: 23.05.2022).

Analysis of Essential Researches and Publications

The issues of evidence formation while investigation of crimes related to human trafficking were considered at different times by the following scientists: M. O. Buriak ², V. K. Veselskyi and V. V. Piaskovskyi ³, N. O. Hutorova ⁴, O. M. Dzhuzha ⁵, V. S. Ivashchenko ⁶, V. M. Pidhorodynskyi ⁷, O. M. Radchenko ⁸, D. V. Shvets and K. L. Buhaichuk (with co-authors) ⁹, K. O. Shcherbakovska ¹⁰ etc.

The main current international legal documents designed to combat trafficking in persons (Protocol

to Prevent and Suppress Human Trafficking, Especially Women and Children and to Punish it supplementing United Nations Convention against Transnational Organized Crime and Council of Europe Convention ¹¹ on Measures to countermeasures against human trafficking ¹²), contain, in particular: basic terms and concepts related to human trafficking; list of socially dangerous acts; methods and techniques for preventing and countering this crime (in particular, for the purpose of labor exploitation); measures aimed at the protection and rehabilitation of its victims.

- 2 Buryak M. Yu. Торговля людьми и борьба с ней (криминологические и уголовно-правовые аспекты) : автореф. дис. ... канд. юрид. наук. Владивосток, 2005. 15 с.
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- 4 Гуторова Н. О. Проблеми кримінальної відповідальності за торгівлю жінками, вчинену організованими групами. Боротьба з торгівлею жінками: проблеми вдосконалення законодавства та завдання органів внутрішніх справ. Вісник Університету внутрішніх справ : спец. вип. Харків, 1999. С. 26—28.
- 5 Джуца О. М. Боротьба з торгівлею людьми. Міжнародне співробітництво ОВС у боротьбі з транснаціональною злочинністю : тези доп. Міжнар. наук.-теорет. конф. (Київ, 24.03.2010). Київ, 2010. 272 с.
- 6 Іващенко В. С. Кримінальна відповідальність за торгівлю людьми у законодавстві України. Юридичний журнал. 2005. № 8. С. 59—63.
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Article Purpose

This Article purpose is raising main problematic issues directly related to the global problem of crimes in the field of people trafficking and exploitation and issues arising while preparation of materials and appointment of forensic video and audio analysis in case of investigations of such crimes, as well as explore possibilities of this analysis to form investigation evidence base.

Main Content Presentation

For many months, if not years, not a day goes by without reports of the unbearable suffering of people in war-torn regions, of desperate journeys in safety search that end in exploitation or death.

Some researches demonstrate people exploitation, trafficking of women, children and men and their enslavement that like a shadow accompany conflicts and wars, are taking on new scales, intensities and forms, especially in countries where conflicts are raging: it is sexual exploitation, forced labor, involvement in armed and terrorist groups, exploitation for drug and organ trafficking, and much more. Trends in development of violence and human trafficking are alarming.

In addition to the hate-driven brutality that usually characterizes the early stages of war (killing men in front of their family members, enslaving women, exploiting children), human beings are increasingly being used as a disposable resource to satisfy the war-generated demand for organs and blood. Such victims are mostly men. In addition, during hostilities, people are often held against their will, they

become victims of kidnapping for ransom, or they are forced into unpaid labor.

As you know, the following types of exploitation are conventionally distinguished in human trafficking¹³:

- sexual one (the most common) is provision of sexual services related to meeting the needs of other people;
- labor one is the use of other people's labor in production, provision of services not related to the satisfaction of sexual needs, production of material or other goods;
- begging;
- forced participation in a military (armed) conflict;
- removal of organs and tissues for transplantation, illegal trade in human anatomical materials, or other purposes.

In our country, the criminal-legal characteristics of human trafficking are given in Art. 149 of the Criminal Code of Ukraine¹⁴ According to it, *"trafficking in human beings, as well as recruiting, moving, concealing, transferring or receiving a person, committed for the purpose of exploitation, with the use of coercion, kidnapping, deception, blackmail, material or other dependence of the victim, his vulnerable state or bribery of a third person, who controls the victim, in order to obtain consent for his exploitation"* shall be punished by deprivation of liberty for various terms (depending on the severity of the consequences caused by such a crime and the specifics of its commission — in relation to a minor or in relation to several persons, or repeatedly, or with a prior conspiracy by a group of persons, or an official using

13 Швець Д. В., Бугайчук К. Л., Федосова О. В., Михайлова Ю. О., Пазинич Т. А. та ін. *Op. cit.*

14 Кримінальний кодекс України від 05.04.2001 р. № 2341-III (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/2341-14#Text> (date accessed: 30.05.2022).

an official position, or an organized group from three to fifteen years) with or without confiscation of property ¹⁵.

Fig. 1 demonstrates the main forms of human trafficking and their characteristics ¹⁶.

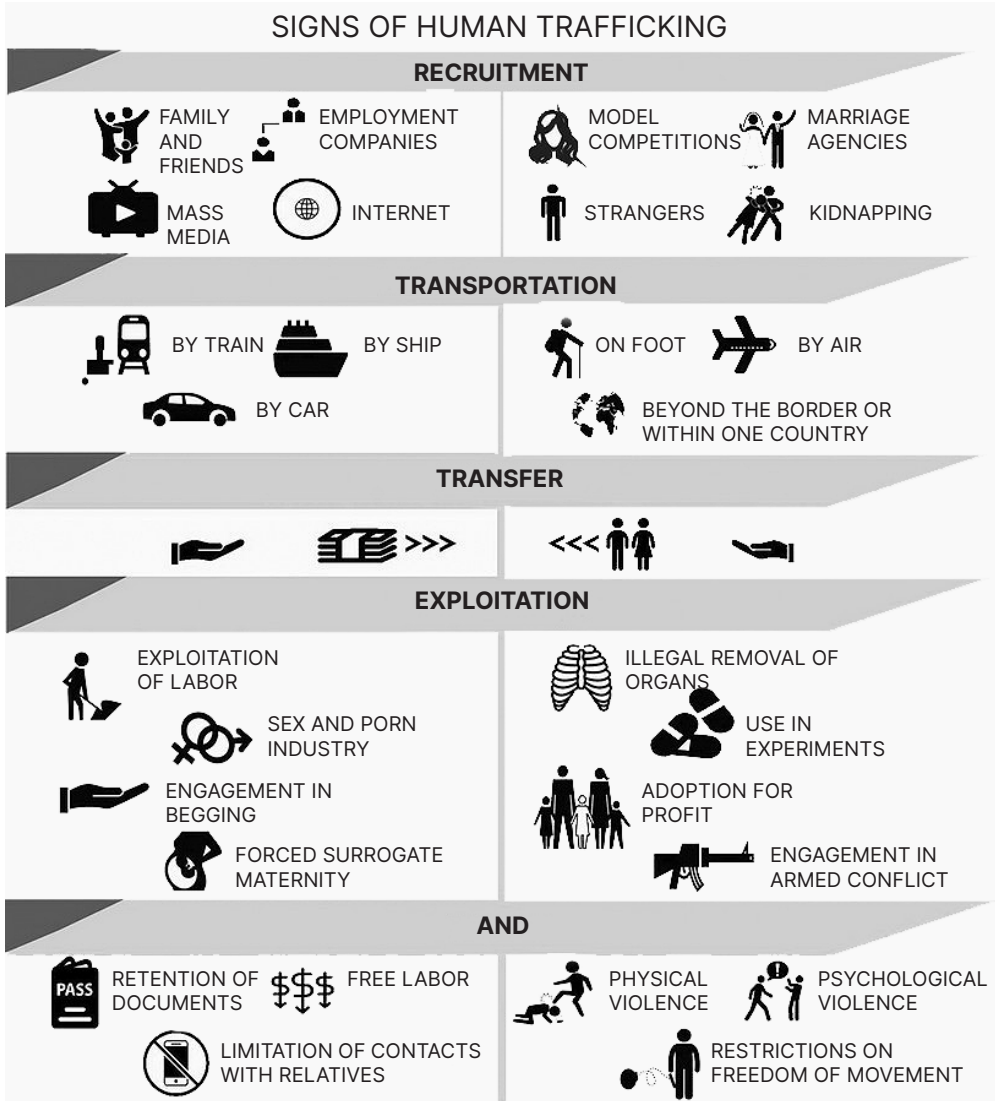


Fig. 1. Signs of human trafficking

¹⁵ Ibid.

¹⁶ Доброта В., Требунських І. Торгівля людьми: злочин, що не має кордонів. *Народне слово*. 07.09.2019. URL: <https://n-slovo.com.ua/2019/09/07/%d1%82%d0%be%d1%80%d0%b3%d1%96%d0%b2%d0%bb%d1%8f-%d0%bb%d1%8e%d0%b4%d1%8c%d0%bc%d0%b8-%d0%b7%d0%bb%d0%be%d1%87%d0%b8%d0%bd-%d1%89%d0%be-%d0%bd%d0%b5-%d0%bc%d0%b0%d1%94-%d0%ba%d0%be%d1%80%d0%b4%d0%be/> (date accessed: 29.04.2022).

According to the requirements of the Criminal Code of Ukraine, in addition to those indicated in fig. 1 of human trafficking crimes, torture: *"intentional infliction of severe physical pain or physical or moral suffering by means of beatings, torture or other violent actions"* is subject to criminal liability (Article 127)¹⁷. In Ukraine, this is a crime and is prohibited under any circumstances as a form of punishment.

Usually, the first steps in human trafficking are search for potential victims and their recruitment, most often by deception. In the search for and attraction of new victims, as well as consumers of their services (customers), criminals either openly address relevant offers to the general public (advertise their services using various types of deception and fraud), or covertly (secretly) look for potential victims in certain environments, that correspond to the purpose of customers of "live goods", or even use modern sources of information about potential victims (for example, using file cabinets or databases of enterprises, organizations, institutions, etc.). Open (loud) informing takes on a public character, criminals place advertisements about the attraction of potential victims or persons who need such services in the mass media.

Important factor in investigation of human trafficking crimes committed in an open (public) form is the real and tactically justified use of video surveillance to achieve an illustrative effect in order to record specific events, development in dynamics of events or phenomena, etc., that is quite difficult to do in the protocol by description. The use of technical means creates the maximum flow of evidence information, reflected in visual and sound images, which significantly facilitates the assessment of the results of investigative

actions in the form of obtained evidence data, the verification of compliance with the procedural requirements that regulate the conduct of investigative actions. Video and audio analysis at this stage can help the investigation to confirm a number of important circumstances regarding the offense under investigation, for example:

- confirm/deny the fact of availability/lack of specific persons at a specific time in a specific place;
- confirm/deny the fact and degree of acquaintance of these persons;
- determine the degree of involvement of each of participants in the offense;
- establish attitude of persons to investigated offense and their emotional state;
- find out chronology of events: data that can be used to reconstruct the course of events, behavior of participants, situation and conditions under that this event took place, etc.

Application of technical means of video monitoring of events in the case of investigation of a hidden (unspoken) form of searching for potential victims of human trafficking is very difficult. However, information obtained in this way creates the maximum flow of evidence that makes possible: prove the event fact that took place; expose a specific person involved in crime commission, or vice versa, confirm innocent person alibi; collect information useful for the investigation (about persons who committed the crime or those involved in its commission; about crime circumstances (conspiracy or concealment of traces of the crime); about facts of meetings or acquaintances; about involvement of specific persons in the crime commission or degree of their

17 Кримінальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/2341-14#Text> (date accessed: 30.05.2022).

involvement; about participant attitude to event, etc.).

Hidden (unspoken) form of committing such a crime certainly providing investigation with a much smaller volume of trace evidence (traceable) information than open (overt) form. Usually, only traffickers themselves, their counterparties and victims have information relevant to criminal proceedings in hidden (unspoken) form of committing such a crime¹⁸.

It is common knowledge that every committed criminal act leaves traces. Certainly, people who commit criminal acts in the field of human trafficking leave traces of their illegal activities. Law enforcement officers should identify and document the facts of such crimes according to a certain scheme of actions, in accordance with requirements of current legislation, taking into account the practical experience of detecting and preventing crimes in the field of human trafficking. Identification of such traces, their fixation and procedural registration, forensic research and interpretation of its results in forensic expert conclusions form the basis of the evidence base in criminal proceedings¹⁹.

The authors of the "Investigator's handbook" in the structure of forensic characterization of crimes consider such elements as *typical traces of a crime* covering any changes in the environment that occurred as a result of crime commission, namely:

- a) changes in material situation;
- b) traces-reflection (traces of hands, feet, transport, tools, etc.);
- c) material material evidence;
- d) ideal traces (traces of human memory);
- e) odorous traces and traces of microparticles²⁰.

Due to the wide range of issues which solution requires the use of specific expertise in form of forensic examination while investigation of crimes related to child trafficking, investigators sometimes do not appoint necessary forensic examinations, especially in presence of eyewitnesses to the crime, in particular victims, who directly indicate on the suspect or the accused. Investigators motivate this position by a number of objective and subjective factors, among which they single out specifics of purpose and duration of forensic researches, conducting them in another department, difficulty of

18 Черечукіна Л. В., Яковенко М. О. Виявлення та розслідування злочинів, пов'язаних з торгівлею людьми : метод. рек. для практ. працівн. Луганськ, 2013. 135 с. URL: <https://dspace.lduvs.edu.ua/bitstream/123456789/184/1/%D0%A7%D0%B5%D1%80%D0%B5%D1%87%D1%83%D0%BA%D1%96%D0%BD%D0%B0%20%D0%9B.%D0%92.%20%D0%AF%D0%BA%D0%BE%D0%B2%D0%B5%D0%BD%D0%BA%D0%BE%20%D0%9C.%D0%9E.%20%D0%92%D0%B8%D1%8F%D0%B2%D0%BB%D0%B5%D0%BD%D0%BD%D1%8F%D0%D1%82%D0%B0%20%D1%80%D0%BE%D0%B7%D1%81%D0%BB%D1%96%D0%B4%D1%83%D0%B2%D0%B0%D0%BD%D0%BD%D1%8F%20%D1%82%D0%BE%D1%80%D0%B3%D1%96%D0%B2%D0%BB%D1%96%20%D0%BB%D1%8E%D0%B4%D1%8C%D0%BC%D0%B8.pdf> (date accessed: 29.04.2022).

19 Пілюков Ю. О. Процесуальні вимоги до висновку експерта у кримінальному провадженні. Актуальні проблеми правознавства. 2018. Вип. 3 (15). С. 99—102. URL: http://nbuv.gov.ua/UJRN/aprpr_2018_3_19 (date accessed: 30.05.2022).

20 Панов М. І., Шепітько В. Ю., Коновалова В. О. та ін. Настільна книга слідчого : наук.-практ. вид. для слідч. і дізнавач. 2-ге вид., перероб. і доп. Київ, 2007. 728 с.

obtaining samples for comparative research and their storage, etc.²¹

Sources of sound information form in their totality sound environment of the crime commission of a , make it possible to establish both the identity of the criminal and the rest of the circumstances to be proven. Forensic analysis of sounds recorded in a audio recording helps to recognize and identify sound signals, establish the type of sound sources and their number, and identify such sound sources. As Yu. V. Yashchurynskyi notes, *"sound environment of a crime event is a single system of sound traces of natural and artificial sources, subject-communicative activity of the criminal, and the tools, instruments and technical means used by him, united by a single goal. Achieving the specified goal is determined by nature and time of the action on the object of criminal encroachment, as well as the unity of the place (space) and the method of its achievement"*²².

While crime investigation by law enforcement agencies related to human trafficking, in parallel with the rest of measures, law enforcement officers can carry out the following types of procedural actions requiring the use of technical means of obtaining video and audio information to record crime traces:

- secret investigative (search) actions²³ (Chapter 21 of the Criminal Procedure Code of Ukraine carried out exclusively in criminal proceedings regarding serious or especially serious

crimes. Run and results of secret investigative (search) actions are recorded according to rules of criminal proceedings;

- surveillance of a person, thing or place²⁴ (Article 269 of Criminal Procedural Code of Ukraine). Conducting this covert investigative (search) action consists in direct or indirect visual observation using technical means of video recording, photography, special technical means by a person who observes traders, recruiters and others involved in the commission of a crime in order to find them and record illegal activities;
- audio and video control of the scene (Article 270 of Criminal Procedural Code of Ukraine)²⁵.

Measures to record criminal offenses are carried out with help of audio and video recording technical means. While investigating the criminal activity of human traffickers, video recording of negotiations (interference in private communication) with buyers or audio recording of their conversations with the victim of assault and other persons is quite often used.

Traces of such crimes, in addition to results of wiretapping and video surveillance, obtained in the process of wiretapping actions and measures, can be video and audio recordings obtained at enterprises providing telephone communication services. Potential sources of forensically significant information are

21 Щербаківська К. О. Використання можливостей судових експертиз при розслідуванні торгівлі дітьми. *Теорія та практика судової експертизи і криміналістики*. 2011. Вип. 11. С. 183—189. URL: http://nbuv.gov.ua/UJRN/Tpsek_2011_11_27 (date accessed: 30.05.2022).

22 Ящуринский Ю. В. Криминалистическая диагностика звуковой среды : дис. ... канд. юрид. наук. Киев, 1990. 327 с.

23 Кримінальний процесуальний кодекс України від 13.04.2012 р. № 4651-VI (зі змін. та допов.). URL: <http://zakon2.rada.gov.ua/laws/show/4651-17> (date accessed: 02.06.2020).

24 Ibid.

25 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

mobile communication devices: a evidence variety and indicative information is contained in the mobile phones of participants in human trafficking. Mobile phone, on the one hand, is a carrier of traces of a crime, on the other hand, source of information.

General for removing information from electronic communication (Article 263 of Criminal Procedural Code of Ukraine)²⁶ and electronic information systems (Criminal Procedural Code of Ukraine)²⁷ in Crime detection and investigation activities is the use of technical control over information directly transmitted through technical communication channels. Information from communication channels is automatically recorded continuously while period of time determined by investigator. In contrast, specialists extract information already available and stored in their memory from mobile communication devices. Not only the content of the information, but its emotional color, background and other information that can accompany the speech and be recorded, for example, by sound recording devices, can be of cognitive importance for the removal of information from communication channels.

Practice of conducting video and audio analysis indicates that they can be conventionally divided into two main groups. The first group includes records made directly in activity field of law enforcement agencies, including: records of information that comes to the next part; records made while investigative

activity; records of court sessions, etc. This group should include records in the field of criminal proceedings as a result of the use of video and audio recording in the process of official and production activities (for example: records of messages from the *Ambulance* service, the State Emergency Service; conversations between aircraft crews and airfield controllers; conversations between power plant controllers, gas supply enterprises, railways, taxi services, etc.). The second group includes records obtained by private individuals to record information for purpose of its using to interpret various situations that are subject of a preliminary investigation. With such records, interested parties try to prove the fact of the event that took place; expose a certain person involved in the commission of a crime, or vice versa; substantiate one's own alibi. This group of records can contain information or details useful to the investigation²⁸.

Video and audio analysis is of fundamental importance for the objective consideration of crimes in the field of human trafficking by an investigator (detective, prosecutor), since wide use of technical means makes it possible to document the actions of criminals during the commission of such crimes. Thus, for example, in modern conditions, a valuable source of evidence and indicative information is:

- video and sound recordings obtained using household recording devices (recorder, telephone, etc.);

26 Кримінальний процесуальний кодекс України URL: <https://zakon.rada.gov.ua/laws/show/4651-17/ed20220520#Text> (date accessed: 02.06.2022).

27 Ibid.

28 Брендель О. І. Організаційні проблеми під час призначення судової експертизи відео-, звукозапису. *Науковий вісник Дніпропетровського державного університету внутрішніх справ*. 2020. Вип. 4 (108). С. 284—290. DOI: 10.31733/2078-3566-2020-4-284-290 (date accessed: 30.05.2022).

- video and sound recordings made on special devices for receiving information secretly;
- video and sound recordings from various video recorders (from external surveillance cameras, car video recorders, etc.);
- mobile phones and other data carriers that are components of mobile phones (SIM cards and memory cards, etc.), which under certain conditions also become objects of research. (Unfortunately, some investigators are not sufficiently familiar with forensic science possibilities and do not even guess that from the mobile phones seized while investigation, a highly qualified specialist can obtain data from the memory of mobile terminal and SIM card (sometimes several), from removable media, as well as connection information, audio and video recordings, messages, etc.).

Mistakes made in while obtaining evidence by the investigation subjects of crimes related to human trafficking can cause the loss of a significant part of evidence at the trial stage, if the court finds such evidence inadmissible due to violations of procedural norms during its collection. It is a carefully conducted examination of video and audio recordings that can ensure a complete and objective establishment of circumstances of the events to clarify the crime procedure and the guilt of the participants based on the available video and audio recordings while investigation of this crime category.

While investigating crimes related to human trafficking, there is often a need not so much to obtain and investigate in real time the content of conversations transmitted by mobile communication networks but to determine and further

extract the necessary information (if there are sufficient grounds to believe that such information is essential for establishing crime circumstances).

In forensic research of video and sound recordings, two main directions are distinguished: the first, where the research object is oral human speech and the second, which object is the technical component of recording. In view of the above, the main tasks of video and audio analysis are research on oral speech with the aim of identifying a person by voice and/or speech, as well as determining technical conditions and technologies for obtaining video and sound recordings. Video and audio analysis at this stage will help investigation to establish a number of important circumstances regarding the investigated offense (some of them we have already mentioned above), for example:

- confirm facts of presence/absence of specific persons in a certain place at a certain time;
- confirm the fact and acquaintance degree of these persons and each involvement degree of participants in offense;
- establish attitude nature of potential victim, as well as criminals directly, to a certain event that is taking place;
- find out data that will make it possible to reconstruct the situation and conditions under which the event took place, behavior of its participants;
- determine connections of accomplices and establish the facts of receiving remuneration for recruitment, people transportation, transfer, hiding and exploitation;
- establish the fact of person transfer to the customer and exploitation type for which such transfer took

place (for example, illegal removal of organs, forced surrogate motherhood, involvement in begging, adoption for profit, etc.);

- find out the facts of forcing people to perform certain types of work or exploitation (for example, using threats, deception or other coercion, blackmail, etc.);
- establish the facts of remuneration non-compliance the (its size, nature, conditions and duration) with the pre-arranged and agreed conditions or facts of of such remuneration missing in general;
- find out the facts of specific individuals sending children to photo studios for filming pornographic materials, etc., for a fee.

Specificity of research objects, diversity of tasks to be solved that can be put to forensic expert solving, as well as other factors determine some specifics that investigator should pay attention to when passing a resolution on appointment of video and audio analysis. These specifics can apply both to the questions posed to forensic expert and to the scope, nature and order of obtaining materials provided for research ²⁹.

It should be noted that quite often video and audio analysis is prescribed in a complex with examinations of other types (or types). For example, in a complex with video and audio analysis, semantic-textual examination is most often prescribed (in particular, when oral speech or its fragments are to be interpreted). The direct analysis of text reproduction of the content of conversation helps to strengthen the

evidence base in the case, since forensic expert conclusion is one of the pieces of evidence, on the basis of which the circumstances that are important for the correct further consideration of the case in court are established. Even the conclusion that records submitted for research are not suitable for conducting research will always be motivated and illustrated (for example, by numerical values of the relevant criteria of parameters under research).

We will briefly consider diagnostic technical research on recording media and equipment that can contain information about the technologies of obtaining/fixing/saving video and audio recordings, characteristics and features of the data media itself. Essence of this area of forensic Video and audio analysis is to perform research on technical means of reception/transmission/fixation/storage of visual and additive information and its carriers. Such researches are carried out with the aim of determining technical conditions and technologies for obtaining video and sound recordings (in particular, find out the recording system (mechanical, optical, magnetic one), method and means (analog or digital); detect the fact of copying, overwriting or duplicating, as well as signs, methods and means of installation; establish the technological characteristics of recording production detected defects, damages, etc.), as well as with the aim of diagnosing devices for recording recordings, means of their production, determining the technical condition of video and sound recording devices and their components, nature of malfunctions, probable causes their occurrence, etc ³⁰.

29 Можаяев М. О., Брендель О. І. Деякі організаційні та проблемні питання при призначенні комп'ютерно-технічних експертиз та експертиз відео-, звукозапису. *Судово-експертна діяльність в Службі безпеки України: актуальні питання теорії та практики* : зб. мат-лів Міжнар. наук.-практ. конф. (Київ, 31.03.2021). Київ, 2021. С. 191—195.

30 Брендель О. І. Сучасні можливості діагностичних досліджень у криміналістичній експертизі відео-, звукозапису. *Теорія та практика судової експертизи і криміналістики*. 2021. Вип. 23. С. 203—211. DOI: 10.32353/khrife.1.2021.15 (date accessed: 30.05.2022).

Conclusions

Despite introduction of strict criminal liability for human trafficking, adoption by most civilized states of numerous by-laws with the aim of solving this urgent problem worldwide as soon as possible, the number of real criminal proceedings and corresponding sentences for its occupation remains insignificant. A successful strategy for combating human trafficking consists in application of criminal punishment, in international coordination of police actions and in a set of some other measures that make it possible to prosecute criminals more effectively. In this sense, the fight against human trafficking is focused on fight against crime.

Attention should be paid to fundamental points that relate to certain aspects of the tactics of appointing and conducting forensic examinations while investigation of human trafficking cases and effectiveness of the use of forensic expert conclusions in such proceedings. Appointment of forensic examination should be preceded by actual measures to find additional and confirm available evidence, relating not only to the actual circumstances of the crime, but to the degree of awareness of involved persons proving their intention to commit a crime, as well as verifying complicity version in criminal activity of certain persons. In addition, investigators should more actively use non-procedural forms of specific expertise application for example, consultations of specialists, experts. While consultation, you can get background information related to a specific examination type, namely:

- modern capabilities of forensic research;
- correct question formulation;

- list of objects that should be provided to forensic expert, etc.

At preparatory stage, investigator should carefully consider question wording to forensic expert: they should be aimed at finding connections with the main fact, namely, the act of human trafficking that is of direct importance for establishing the truth in the proceedings. Forensic expert conclusion is information obtained through forensic research, which result directly depends on materials provided to forensic expert for research. In this regard, propriety and admissibility of the expert's opinion depends on the legality of obtaining (in the course of investigative (search) actions) information and material evidence provided to expert for research. In this case, preparation of objects for identification research becomes especially important. In order to solve the questions, expert should provide high-quality samples for comparison (experimental, free, conditional-free), trace-forming objects, information about other circumstances related to formation of traces.

Video and audio recording materials attached to the proceedings are the most objective source of evidence that is essential for crime investigation. Proper preparation of materials provided for Video and audio analysis not only facilitates forensic expert's work and shortens the research period, but guarantees the lack of comments while court hearing.

**Можливості експертизи відео-,
звукозапису під час розслідування
злочинів, пов'язаних із торгівлею
людьми**

**Ольга Брендель, Костянтин Нікулін,
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Мета статті — дослідити актуальні проблеми, які виникають під час

підготовки матеріалів і призначення експертизи відео-, звукозапису в разі розслідування злочинів, пов'язаних із торгівлею людьми, а також можливості цієї експертизи для формування доказової бази розслідування. Акцентовано увагу на глобальності й міжнародному значенні проблеми торгівлі людьми, загостренні експлуатації людей в умовах війни. Проаналізовано види експлуатації жертв торгівлі людьми та відповідальність за скоєння таких злочинів; наведено різновиди процесуальних дій, за яких застосовують технічні засоби для отримання відео- й аудіоінформації з метою зафіксувати сліди злочинів; зазначено основні правові характеристики таких процесуальних дій. Розглянуто помилки, яких у процесі отримання доказів припускаються суб'єкти розслідування злочинів, що спричиняє втрату значної частини доказів на етапі судового розгляду. Висвітлено особливості й сучасні можливості застосування судової експертизи відео- та звукозапису для розслідування таких злочинів; з'ясовано, яку саме інформацію із досліджуваних записів використовують слідчі органи та з якою метою. Проведено аналіз завдань, вирішуваних завдяки експертизі відео-, звукозапису, і їхньої ролі у правоохоронній діяльності для подальшого використання у судочинстві. На підставі досліджених матеріалів акцентовано увагу на результатах експертиз, що сприяє розв'язанню актуальних питань із кваліфікації діянь і обставин скоєних злочинів у сфері торгівлі людьми й експлуатації таких людей, а також зміцнює доказову базу у справі. Наведено низку вимог до належної підготовки матеріалів для проведення експертизи відео- та звукозапису.

Ключові слова: судово експертиза відео-, звукозапису; торгівля людьми; ідентифікаційне дослідження; діагностичне дослідження.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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Brendel, O., Nikulin, K., Aslanovi, E. (2022). Possibilities of Forensic Video and Audio Analysis while Investigation of Crimes, Related to Human Trafficking. *Theory and Practice of Forensic Science and Criminalistics*. Issue 2 (27). Pp. 131–145. DOI: 10.32353/khrife.2.2022.10.

Research Peculiarities of Sebaceous Traces of Palms and Fingers Using the Projectina Docustat DS-210 device

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Characteristic features of technological research on palm and finger prints are defined and described in detail. Considerable attention has been paid to methodical approach development that enables forensic research to be carried out without harming integrity of the paper medium on which invisible prints are left. The opinion that use of Projectina Docustat DS-210 and Regula 4305 devices (in the case of applying the principle of gradual combination) provides an opportunity to prepare at least preliminary conclusions regarding identification of belonging (non-belonging) of invisible fat traces to the same person. Attention is focused on the possible solution of forensic tasks (during the next stages of the investigation) regarding identification of the chemical composition of substances in fat traces, that makes possible to determine whether the suspect was in contact with material evidence in the case (for example, with weapons, drugs etc.). The research purpose is to formulate certain preliminary conclusions before further conducting objective fingerprinting examination itself, as well as to ensure the integrity of the source document by applying a methodical approach developed in “National Bureau of Expertises” State Non-Profit Organization of the National Academy of Sciences of the Republic of Armenia that

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will help forensic expert to more accurately identify belonging (non-belonging) of invisible fat traces to the same person.

Keywords: *fingerprinting; invisible imprints; fat traces; instrumental method; person identification ; document integrity; principle of post-reliable combination; analytical devices Projectina Docustat DS-210 and Regula 4305.*

Research Problem Formulation

Modern forensic science is characterized by a high level of theoretical knowledge and progress use for investigation of crimes and justice administration. Among the various branches of forensic technology, fingerprinting occupies the most important place. It makes it possible to reliably establish a person behind the marks of the palms or fingers, that ensures the proper quality of the pre-trial investigation.

Fingerprint identification is the most common type of specific research. Unfortunately (due to the lack of a law on forensic expert activity), it is still premature to discuss creation of state registers of forensic experts and methods in the Republic of Armenia, however, while its formation, we consider it possible to use some of the provisions set forth in Art. 23 "State Register of Forensic Experts" of the Model Law "On Forensic Expert Activity" ¹. According to the Artur Davtyan's statement, Prosecutor General of the Republic of

Armenia dated September 25, 2019 in Yerevan at international conference: *Actual issues of forensic science, modern problems of forensic expertise and criminology, trends and prospects of development*, the improvement of the legislation regulating this field, in particular, through the adoption and application of the law on the activity of forensic examination in the state and relevant by-laws ². For example, in Ukraine, Instruction on appointment and conducting forensic examinations and researches resolves a number of identification (in particular, the issue of identification of a person by fingerprints left at the scene) and non-identification tasks related to the determination of mechanism of trace formation and some other characteristics of trace-forming object ³.

In foreign countries, in addition to the improvement of certain techniques for detecting and extracting fingerprints, specialists are constantly replenishing fingerprint collections and improving automatic fingerprint identification

- 1 Модельный Закон «О судебно-экспертной деятельности» : прил. к постановлен. Межпарламент. Ассамбл. гос-в — участн. СНГ от 19.04.2019 г. № 49-8. URL: <http://www.parliament.am/library/modelayin%20orenqner/377.pdf> (date accessed: 22.02.2022).
- 2 Speech by the RA Prosecutor General Artur Davtyan in Yerevan on 25.09.2019 in the International Conference on «Current Issues of Forensic Expertise and Criminology, Trends and Prospects for Development» / The Prosecutor General's Office the RA : website. URL : <https://www.prosecutor.am/en/mo/7562/> (date accessed: 19.06.2022).
- 3 Про затвердження Інструкції про призначення та проведення судових експертиз та експертних досліджень та Науково-методичних рекомендацій з питань підготовки та призначення судових експертиз та експертних досліджень : наказ Мін'юсту України від 08.01.1998 р. № 53/5 (зі змін. та допов.). URL: <https://zakon.rada.gov.ua/laws/show/z0705-98> (date accessed: 21.02.2022).

systems. For example, in Germany there is an innovative high-tech EVISCAN workstation, with the help of which experts detect and store invisible and barely visible fingerprints in digital format. The device works without contact and without any chemicals. In this case, the fingerprints remain in their original state and, if necessary, they can be re-examined some time later⁴. In the US, there is a new contactless system that allows you to take fingerprints under special SLI (Structured Light Illumination) lighting conditions. Unlike EVISCAN, skin oiliness or air humidity do not affect SLI technology in any way. This system is actively used by the FBI in its activities: when inspecting the scene, agents use a special wireless scanner that immediately sends detected samples to the central laboratory for verification⁵.

Implementation of the latest automated fingerprint record keeping technologies into the activities of law enforcement agencies is one of the most urgent and promising tasks. Recently, there has been active development in the field of automated fingerprint recognition. The use of computer search systems based on accumulated fingerprint databases will significantly increase efficiency of the work of forensic experts. Taking into account foreign experience, automated fingerprint information and search system

should meet the following requirements: first of all, it is the ability to work with significant volumes of information, ability to process traces and fingerprint maps of average quality, the opportunity to freely exchange information in digital form using modem communication, and the simplicity of processing of fingerprint information, ability to obtain statistical information both on the identifying data of persons and traces and on quantity and quality of entered fingerprint information, ability to form search requests according to the proposed parameters (date, place, method of committing the crime)⁶.

Therefore, the problem of collecting, researching and using fingerprint information while investigation of crimes necessitates development of scientific and legal bases for the activities of pre-trial investigation bodies, forensic science institutions, improvement of means and methods of working with such information. In order to achieve the appropriate level of implementation of the latest fingerprint and other identification technologies, law enforcement agencies need to immediately take appropriate measures for material and technical support, monitoring of new scientific developments training and exchange of practical experience with specialists of law enforcement agencies of European Union and the United States⁷.

- 4 Лапта С. П. Перспективні напрями розвитку дактилоскопії в зарубіжних країнах. *Вісник Харківського національного університету внутрішніх справ*. 2017. № 3 (78). С. 59–66. URL: <http://dspace.univd.edu.ua/xmlui/handle/123456789/2532> (date accessed: 27.02.2022).
- 5 Рогатюк І. В. Напрями удосконалення використання дактилоскопічної інформації в діяльності органів досудового розслідування та прокуратури. *Часопис Київського університету права*. 2014. № 1. С. 292–296. URL: http://nbuv.gov.ua/UJRN/Chkup_2014_1_69 (date accessed: 27.02.2022).
- 6 Хахановський В. Г. Автоматизація експертних дактилоскопічних досліджень. *Форум права*. 2011. № 1. С. 1078–1084. URL: http://nbuv.gov.ua/UJRN/FP_index.htm_2011_1_174 (date accessed: 27.02.2022).
- 7 Членов М. В., Журба О. М. Міжнародний досвід та перспективи розвитку дактилоскопічних технік під час розслідування злочинів. *Актуальні питання судової експертизи і криміналістики* : зб. мат-лів міжнарод. наук.-практ. конф., присвяч. 150-річ. з дня народж. Засл. проф. М. С. Бокаріуса (Харків, 18–19.04.2019). Харків, 2019. С. 254–255.

Currently, in the case of development and addition of forensic researches with new methodological tools, there is inevitably a need to solve a whole series of diagnostic tasks and to find new identification signs that is impossible without development of original instrumental solutions, which, preferably, do not have to cause damage or significant changes to physical evidence⁸. In contrast to typical methods designed to solve the same type of forensic expert tasks (for example, fingerprint identification of a person who left traces at the scene), new informative and reliable methods, which were developed using modern instrumental methods of research and which make it possible to expand limits of detection of qualitative and quantitative characteristics of the objects under research, now is an actual and demanded request by forensic expert community, designed to ensure effective practical activity of forensic expert⁹.

Article purpose

For formulating certain preliminary conclusions before next conducting of the subject fingerprint examination itself, to ensure the integrity of the source document by applying the methodological approach developed in the “National Bureau of Expertises” State Non-Profit Organization of the National Academy of Sciences of the Republic of Armenia (NBE — SNPO) (hereinafter referred to as National Bureau of Expertises SNPO NAS RA) that will allow forensic expert to identify with high accuracy belonging / non-conformity of invisible fat traces to the same person.

As part of researches previously started at “National Bureau of Expertises” SNPO NAS RA concerning combined approach to research of invisible traces of a biological nature (sebaceous secretions), as well as pollution combined with palm and finger prints, this article presents the obtained experimental results based on research

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- 8 Фоминых И. С. Судебная дактилоскопия : учеб. пособ. Томск, 2010. 128 с. ; Корноухов В. Е., Ярослав Ю. Ю., Яровенко Т. В. Дактилоскопическая экспертиза: современное состояние и перспективы развития : моногр. Москва, 2011. 320 с. ; Шведова О. В. Дактилоскопічні дослідження : навч. посіб. Київ, 2010. 208 с. ; Щербаковський М. Г. Проведення та використання судових експертиз у кримінальному провадженні : монографія. Харків, 2015. 560 с. та ін.
- 9 The Science of Fingerprints: Classification and Uses / by Federal Bureau of Investigation (Author). Empire Books, 2011. 298 p. ; Barnes J. G., Maceo A. V., Wertheim K., Sr. Cutro B. T., Hutchins L. A., Moses K. R., Yamashita B., French M., Vanderkolk J. R. at all. The Fingerprint Sourcebook ; ed. A. McRoberts / U. S. Department of Justice Office of Justice Programs. CreateSpace Independent Publishing Platform, 2014. 428 p. URL: <https://www.ojp.gov/pdffiles1/nij/225320.pdf> (date accessed: 26.05.2022) ; Advances in Fingerprint Technology / ed. by Lee H. C. and Gaensslen R. E. 2nd ed. CRC Press LLC, 2001. 426 p. (CRC series in forensic and police science). URL: http://www.esalq.usp.br/lepse/imgs/conteudo_thumb/Advances-in-Fingerprint-Technology-2nd-ed.pdf (date accessed: 26.05.2022) ; Мухачев А. А., Шошин С. В. Инновационные технологии в дактилоскопии. Совершенствование следственной и экспертной практики : мат-лы Междунар. науч.-практ. конф. (Омск, 02.06.2010). Омск, 2010. С. 41—43 ; Про затвердження Інструкції про порядок формування, ведення та використання оперативно-довідкового і дактилоскопічного обліку в органах внутрішніх справ та органах (установах) кримінально-виконавчої системи України : наказ МВС України від 23.08.2002 р. № 823/188. URL: <https://zakon.rada.gov.ua/laws/show/z0738-02#Text> (date accessed: 26.05.2022).

that continues to this day, regarding development of the methodology of forensic examination of human fat traces, in particular traces in the form of solid spots, smears, etc., that do not contain a sufficient amount of fingerprint information ¹⁰.

Analysis of Essential Researches and Publications

A sufficient number of publications both in the Republic of Armenia and abroad are devoted to the issues of fingerprint identification, tools, technical support, methods and techniques, procedural design, etc. ¹¹. However, publications about the peculiarities of working with the device

of the previous model *Projectina Docustat DS-210* are not known enough.

Main Content Presentation

It is important to note the proposed technical solution for improving fingerprinting using the *Projectina Docustat DS-210* analytical device helps to obtain additional information while ongoing research that makes possible to determine the locations of invisible traces of palms and fingers without damaging the papillary pattern.

Mentioned approach makes possible to detect not only the location of palm prints and fingerprints, but also to obtain fingerprint information that can be used repeatedly in forensic procedures for

- 10 Method for Fingerprint Identification / Interpol European Expert Group on Fingerprint Identification II. IEEGFI-II. Lyon, France, 2004. 35 p. URL: <http://www.latent-prints.com/images/IEEGF2.pdf> (date accessed: 26.05.2022) ; Ярослав Ю. Ю. О системе методов обнаружения и фиксации потожировых следов папиллярных узоров. *Криминалистика и судебная экспертиза*. 1979. № 18. С. 94—99.
- 11 Barnes J. G., Maceo A. V., Wertheim K., Sr. Cutro B. T., Hutchins L. A., Moses K. R., Yamashita B., French M., Vanderkolk J. R. at all. Op. cit. URL: <https://www.ojp.gov/pdffiles1/nij/225320.pdf> (date accessed: 26.05.2022) ; McMurtrie J., Swirls and Whorls: Litigating Post-Conviction Claims of Fingerprint Misidentification after the NAS Report (March 5, 2010). *Utah Law Review*. 2010. No. 2. Pp. 267—297. URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2405096 (date accessed: 26.05.2022) ; Cole. S. A., Scheck B. Fingerprints and Miscarriages of Justice: 'Other' Types of Error and a Post-Conviction Right to Database Searching (July 5, 2018). *Albany Law Review*. 2017/18. Vol. 81. No. 3. *UC Irvine School of Law. University of California. Research Paper*. Ser. No. 2018-52. *Cardozo Legal Studies Research Paper*. No. 546. Pp. 807—850. URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3208975 (date accessed: 26.05.2022) ; A Review of the FBI's Progress in Responding to the Recommendations in the Office of the Inspector General Report on the Fingerprint Misidentification in the Brandon Mayfield Case / Office of the Inspector General Oversight and Review Division. June 2011. 53 p. URL: https://forensicresources.org/wp-content/uploads/2019/05/2019-05-28_OIG-Mayfield-Case-Review.pdf (date accessed: 26.05.2022) ; Strengthening Forensics Science in the United States. A Path Forward. Washington, D. C. : National Academies Press, 2009. DOI: [10.17226/12589](https://doi.org/10.17226/12589) (date accessed: 26.05.2022) ; Wanxiang L. U. O., Xiaoling C. I. A. A study of the principle of the electrostatic imaging technique. *Journal of the Forensic Science Society*. July, 1988. Vol. 28. Is. 4. Pp. 237—242. DOI: [10.1016/S0015-7368\(88\)72841-8](https://doi.org/10.1016/S0015-7368(88)72841-8) (date accessed: 26.05.2022) ; Yaraskavitch L., Graydon M., Tanaka T., Ng L.-K. Controlled electrostatic methodology for imaging indentations in documents. *Forensic Science International*. 20 May, 2008. Vol. 177. Is. 2—3. Pp. 97—104. DOI: [10.1016/j.forsciint.2007.11.004](https://doi.org/10.1016/j.forsciint.2007.11.004) (date accessed: 26.05.2022) ; Стандарт ASTM E 2291-03. Electrostatic detection device / ASTM International. West Conshohocken, PA, 2003. URL: <https://www.astm.org> (date accessed: 26.05.2022) ; Foster D. J., Morantz D. J. An electrostatic imaging technique for the detection of indented impressions in documents. *Forensic Science International*. 1979. Vol. 13. Pp. 51—54. DOI: [10.1016/0379-0738\(79\)90262-7](https://doi.org/10.1016/0379-0738(79)90262-7) (date accessed: 26.05.2022) etc.

identification of a person, without use of traditional solutions in similar situations.

Taking into account the need to detect general and separate signs of identification, first of all, in order to significantly narrow down the likely circle of persons suspected of a specific crime, optimization of fingerprint identification with visualization help of palm and finger prints is an important place in the developed technical approach, thus it is guaranteed to obtain reliable results and the possibility of human error is reduced¹².

Within the scope of the performed work, professionals of the department of documentation examinations “National Bureau of Expertises” SNPO NAS RA examined more than 500 experimental samples. The samples were made both with invisible man-made grease marks (fingerprints, palm prints or traces of individual parts of the palm) and with invisible marks left on the paper by various topics.

Methodological research feature was that invisible traces on the surfaces of the analyzed paper media were treated by experts with an electrostatic charge, without damaging or contaminating the researched document, that is, during the study of the sample, the latter did not lose its intended purpose and, as mentioned above, could be used repeatedly to obtain the same test image. In laboratory conditions, experts placed samples of documents with fingerprints on the vacuum surface of the *Projectina Docustat DS-210* device.

Then these samples with fingerprints and palm prints were covered with a hydrogel polymer film of the IW type. By connecting an electrostatic system, which contains a device for transferring an electrostatic charge, the film was

charged that made possible to take prints of invisible traces — both fingerprints and sweaty palms; further, with the help of covering developing powder (toner), such prints were visualized.

We fixed the detected prints on special paper using a self-adhesive film designed for this research that ensured integrity (preservation) of the document with palm or finger prints (see Figs. 1 and 2).



Fig. 1. Paper medium with an invisible palm print



Fig. 2. Paper medium with visualized palm print

12 Бондаренко Р. В. Автоматизация в дактилоскопии. Москва, 2013 ; Zahid H., Khan U. Comparative Study of Authentication Techniques. *International Journal of Video & Image Processing and Network Security (IJVIPNS-IJENS)*. 2010. Vol. 10. No 04. Pp. 9—13. URL: <https://cite-seerx.ist.psu.edu/viewdoc/download;jsessionid=DF1F2BFF7C60DEF304224039CAE42ACC?doi=10.1.1.657.1219&rep=rep1&type=pdf> (date accessed: 26.05.2022).

It should be noted that while conducting research traces of sebaceous secretions on the surface of the human skin, left on various paper media, experts noted that in some cases — thanks to visualization of high-quality traces (see Fig. 3); it is possible to exclude while investigation under case circumstances, unidentified person from among the potential suspects/accused who left this fingerprint, moreover, with a significant probability degree. For the case under consideration, if there are two different images of the same fingerprints or palms (combining two different images with the help of various modern graphic programs or using the publicly available *Regula 4305* device), there is a high probability of obtaining all the necessary grounds that will allow us to prepare in a categorical form expert opinion on their identification.

In availability of low quality fingerprint images of palms or fingers of, in particular with weakly pronounced or partially blurred structures of papillary patterns (see Fig. 4), combination results of images of fingerprints of palms or fingers left by different persons, in certain cases make possible to exclude a person from among potential suspects/accused persons who left these prints, but a similar case of forensic examination will require a more complex registration procedure, namely: aggregate analysis, while which it is necessary to pay attention to characteristic features of the palm, general structure of fingerprints, their geometric dimensional features: width, length, location of papillary patterns, peculiarities of their construction, etc.



Fig. 3. Visualized fingerprint with the clearest possible image



Fig. 4. Visually blurred (weak expressed) fingerprint image

For example, after matching the fingerprints shown in the left and middle pictures (see Fig. 5) of two different people using the *Regula 4305* device, forensic experts found that the prints did not match in structure, size, width, curvature of edges, size of the individual images and their location. The differences in the visualized samples of fingerprints separately and after combining are shown in fig. 5 (circled with ovals).

We will consider the features of forensic research of high-quality palm prints with the most clear image, left on different paper documents at different times by the same person (see Fig. 6).

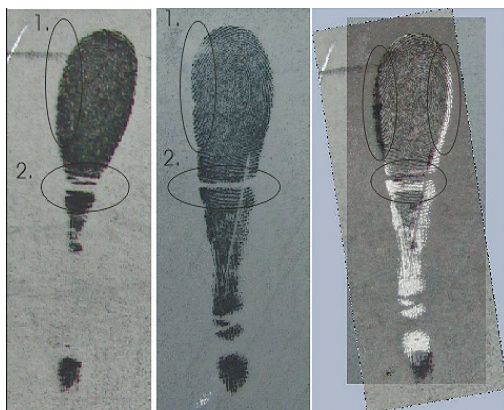


Fig. 5. Difference in results combination of fingerprints, demonstrated in fig. 3 and 4

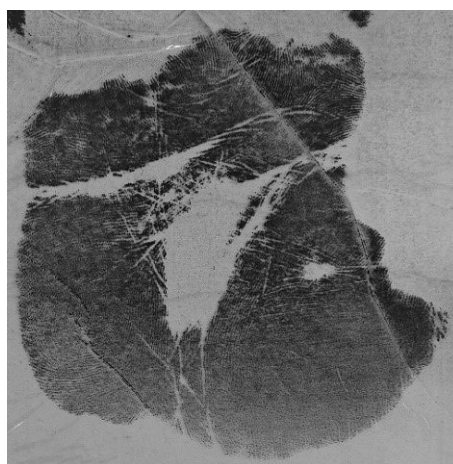
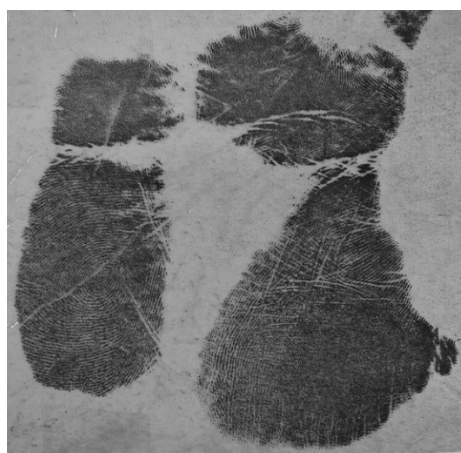


Fig. 6. Visualized palm prints, left by the same person at different times

While research with implementation of step-by-step combination of general images of palm prints, as well as structure of patterns of palm surface, it was established that (in the case of applying the previously described methodical approach) it is possible to identify the person who left this palm print, since the diagnostic nature

of solving the question is differentiated due to superimposition of the structure of overlapping papillary patterns and palmar flexion creases, their location in relation to each other, dimensional features, etc., and also, last but not least, the coincidence of traces of scars in impressions of papillary patterns of palms or fingers (see Fig. 7).

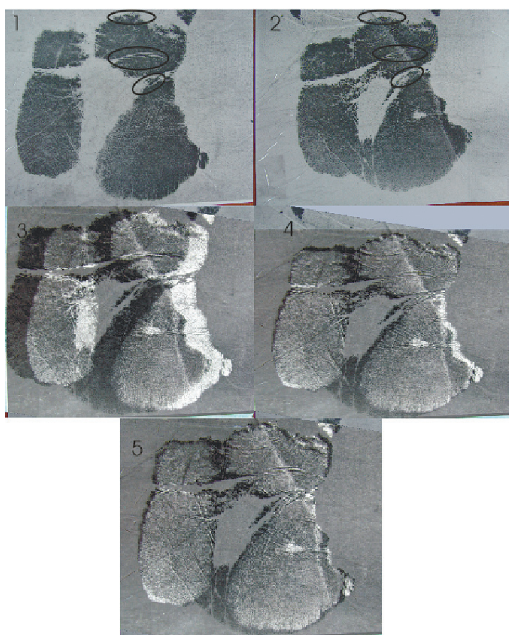


Fig. 7. Schematic algorithm gradual combination of images of palm prints

In particular, considering evaluation results of combining the first and second photographs in Fig. 7, in photos 3—5, you can notice coincidences; both general and individual signs, which, ultimately, allows you to formulate certain preliminary conclusions before the next conduct of the actual fingerprint identification itself.

Based on the results of performed researches, the following can be summarized: thanks to application of proposed methodical approach to the research on invisible prints of greasy traces of palms and fingers (in particular, on paper media), it is quite easy and simple to conduct a research on prints and obtain at least preliminary conclusions regarding their identification.

Conclusions

Thus, it can be concluded that while fingerprint identifications for cases, which

research requires preservation of integrity of the original document, methodical technological approach developed at the “National Bureau of Expertises” SNPO NAS RA allows forensic expert to identify with high accuracy belonging/non-belonging of invisible fat traces to the same person.

The specified method helps to determine the ownership of fingerprints by combining and identifying the features of the structure of papillary patterns (already at the preliminary stage of expert research), having several palm prints or fingers in the case under consideration. A positive factor of the considered method is also the fact that the expert can conduct fingerprint document examinations of (in particular, a paper medium) multiple times without damaging its integrity and without leaving traces of various solutions on the document in contrast to well-known and actively used in expert practice fingerprint research methods fingers.

Особливості дослідження потожирових слідів долонь і пальців рук за допомогою пристрою *Projectina Docustat DS-210* Арсен Багдасарян

Детально визначено й докладно описано характерні особливості технологічного дослідження відбитків долонь і пальців рук. Значну увагу приділено розробленню методичного підходу, що дає змогу виконувати експертні дослідження без шкоди цілісності паперового носія, на якому залишено невидимі відбитки. Обґрунтовано думку про те, що використання пристроїв *Projectina Docustat DS-210* і *Regula 4305* (у разі застосування принципу поетапного суміщення) сприяє підготовці щонайменше попередніх висновків щодо ідентифікації належності (неналежності) невидимих потожирових слідів тій самій особі. Акцентовано увагу на можливому

розв'язанні криміналістичних завдань (під час проведення наступних етапів дослідження) щодо ідентифікації хімічного складу речовин потожирових слідів, що, зі свого боку, дає змогу визначити, чи контактував підозрюваний із речовими доказами за справою (наприклад, зі зброєю, наркотиками тощо). Мета дослідження — сформулювати певні попередні висновки перед подальшим проведенням уже самої предметної дактилоскопічної експертизи, а також забезпечити цілісність вихідного документа шляхом застосування методичного підходу, розробленого в Національному бюро експертиз Національної академії наук Республіки Вірменія, що допоможе експертові з більш високою точністю ідентифікувати належність (неналежність) невидимих потожирових слідів тій самій особі.

Ключові слова: дактилоскопія; невидимі відбитки; потожирові сліди; інструментальний метод; ідентифікація особи; цілісність документа; принцип поетапного поєднання; аналітичні пристрої Projectina Docustat DS-210 і Regula 4305.

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Contributors

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Declaration of Competing Interest

The author declares that he has no conflict of interest.

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International Round Table: *Forensic Expert Activity: Challenges of War*

On April 26, 2022, on the initiative of the Ministry of Justice of Ukraine, Kyiv Scientific Research Institute of Forensic Expertise and National Scientific Center «Hon. Prof. M. S. Bokarius Forensic Science Institute» held a meeting on the International Round Table: *Forensic Expert Activity: Challenges of War* in online format.

The topic relevance of the of this Round Table gathered an unprecedented number of international participants. The discussion was joined by representatives from more than 25 countries: the United States, Canada, Great Britain, Italy, Israel, Germany, the Netherlands, India, Spain, Lithuania, Latvia, Estonia, Montenegro, Sweden, Slovakia, Poland, Belgium, Cyprus, Georgia, Bulgaria, Moldova, Armenia and other countries.

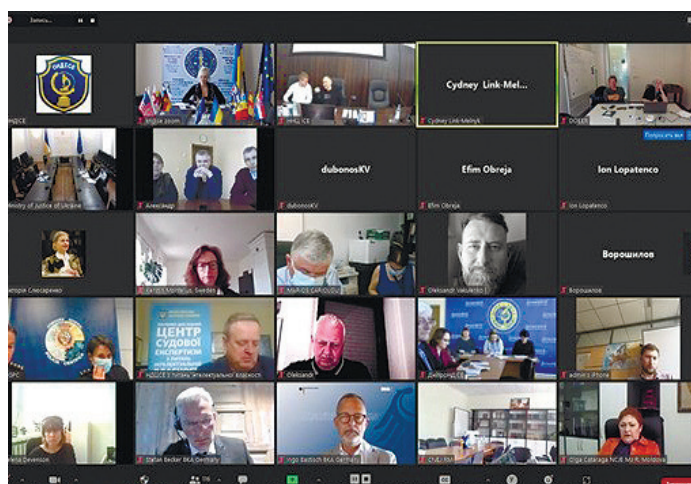
On behalf of the Ministry of Justice of Ukraine, the participants of the event were welcomed by **Andrii Haichenko**, Deputy Minister and **Natalia Tkachenko**, Director of the Department of Expert Support of Justice of the Ministry of Justice.

Foreign professionals within the exchange of experience with Ukrainian colleagues presented reports on the peculiarities of conducting forensic examinations in various fields during the investigation of war crimes.

The topical presentation Cross-border collection and ad-

missibility of evidence by **Dariusz Zuba**, Director of Institute of Forensic Research (IFR) (Kraków, Poland) talked about well-established practice of collecting and admissibility of evidence that is important for solving a specific case: experience will definitely be useful for Ukrainian forensic experts.

Cydney Link-Melnyk, Project Coordinator: Crimes against Humanity and War Crimes Section, Department



of Justice/ Government of Canada gave a speech on effective mechanisms for investigating crimes against humanity and underlined Canada willingness to involve relevant representatives in such work.

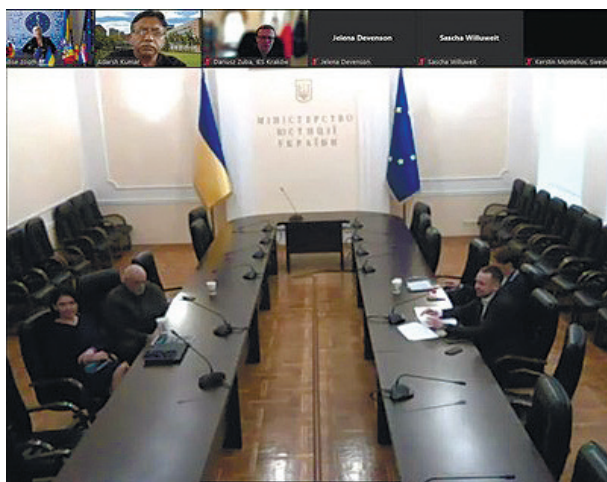
A representative of the Dr. **Stefan Becker**, Member of the ENFSI Council, Head of Central analytics, material and micro traces Federal Criminal Police Office Wiesbaden, Germany, on behalf of ENFSI participating institutions, stressed the readiness to provide assistance in solving complex tasks while forensic examinations.

Doris Earhart, Senior Advisor on International Forensic Sciences / Coordinator of Scientific Support (Netherlands Forensic Institute presented the capabilities of Netherlands Forensic Institute (NFI) to provide practical forensic (technical) support at the crime scene: in particular, regarding interdisciplinary coordination for the recovery of traces (human, microtraces, etc.), analysis of bloodstains and nodes, X-ray screening of small objects, chemical analysis (microtraces, explosives, DNA) and digital research, etc.

In his presentation: BKA experience in complex identification scenarios including the cooperation with ICMP, Dr. **Bastish Ingo**, Head of the DNA Department of the Institute of Forensic Science of the Federal Criminal Police Office (Germany), drew attention to the key points and experience of cooperation with the International Commission on Missing Persons and conducting complex expert work on identification.

Silvia Pérez Pavia, Head of Operational Coordination Central Unit, the Superintendent, Spanish General Headquarter for Forensic Police and Maria Bueno Fernández, Chief Inspector (Head of International Cooperation Area), Spanish General Headquarter for Forensic Police, provided the presentation: The Forensic International Cooperation in complex scenarios.

Dr. **Aleksandar Ivanović**, Director of Forensic Center of the Police Administration of Montenegro (FC PD MN), in his report: Securing a crime scene; handling of forensic evidence, application of standardization and accreditation in mass crimes and forensic



analytical interpretation of obtained expertise in mass crimes emphasized the experience of Montenegro in obtaining forensic evidence for mass crimes and the readiness of Montenegrin forensic scientists to share algorithms for processing such evidence in compliance with standardized procedures.

Nino Kochiashvili, MD, PhD, LEPL Levan Samkharauli National Forensics Bureau, Head of Forensic Biology Department in the presentation: Georgia's DNA Laboratory experience in human remains identification outlined the main aspects of the work on the identification of victims.

Marios A. Cariolou, Ph.D., Professor, Cyprus School of Molecular Medicine, Head of the Department of Cardiovascular Genetics and Director of the Laboratory of Forensic Genetics, The Cyprus Institute of Neurology and Genetics in his speech: Identification of missing persons and mass disaster victims using DNA methods spoke about experience of specialists of the Cyprus Institute of Neurology and Genetics in conducting research on victims of mass disasters.

Tim Clatyon, B.Sc, Ph.D, MBE Senior Forensic Scientist Eurofins Forensic Services, Wakefield, UK, presented at the discretion of the trainees the presentation: New Forensic Techniques and Victim Identification – Making the Right Choice highlighting in detail all the currently known progressive forensic techniques for victim identification and noting the importance of the right choice in each individual case.

Argam Ovsepyan, PhD in Medicine, Docent, Director of the National Bureau of Expertise, National Academy of Sciences, Yerevan, Republic of Armenia, in his report: The role of forensic science as an important part of establishing the facts of war crimes and violations of international human rights norms in the context of the war against the civilian population of the Republic of Armenia and Artsakh in 2020" gave examples of violations of international human rights norms as a result of military conflicts against the civilian population.

Prof. Adarsh Kumar, Double Commonwealth Fellow, Scotland, UK, FIAMLE, FISCA, FIST, FIAFM Governing Council/ Board Member- IALM, INPALMS, APMLA Honorary Medicolegal Expert-National Human Rights Commission & Central Bureau of Investigation Professor, Forensic Medicine & Toxicology & In-charge, Forensic Anthropology & Forensic Radiology in the presentation: War Crimes vis-a-vis Humanitarian forensics: From Forensic Medicine perspective focused on medical and biological issues arising during the investigation and trial.

Dr. **Jelena Devenson**, Head of voice recognition Division Forensic Science Centre of Lithuania, made a speech: Forensic Speech and Audio Analysis: FSCL experience and drew the attention of the trainees to the experience of Lithuanian colleagues during forensic examinations in speech and audio analysis.

The organizers of this round table fully achieved their goal; a significant number of eminent foreign experts who took part in the event presented practices proven by practice, which will be useful to Ukrainian criminologists during the investigation of war crimes, conducting DNA examinations for the identification of the bodies of the dead, mine clearing territories, organizing inspection of the scene of the incident, as well as calculation of damages caused to the state and legal entities and individuals as a result of large-scale damage and destruction of movable and immovable property, etc.

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ENFSI Annual Meeting 2022 European Academy of Forensic Science Conference (EAFS 2022)

On May 30–31, 2022, Stockholm hosted the annual meeting of representatives of the European Network of Forensic Science Institutes (hereinafter referred to as ENFSI). The event was attended by representatives from 40 countries. ENFSI was founded in 1995 to improve the exchange of information in the field of forensic examination, as well as to improve the quality of forensic expert activity in the world. Today, under the auspices of this network, there are 17 expert working groups in various areas and types of expert research, 2 standing committees, the Secretariat and the Council. The European Commission has recognized ENFSI as one of the leading organizations in the field of forensic science.

Ukrainian forensic institutions are part of this respected organization. In particular, the Kyiv Scientific Research Institute of Forensic Expertise was admitted to ENFSI in 2017, and National Scientific Center «Hon. Prof. M. S. Bokarius Forensic Science Institute» is a member of ENFSI from 2018. The State Scientific Research Forensic Center (SSRFC) of the Ministry of Internal Affairs of Ukraine is a member of ENFSI, and recently Ukrainian Research Institute of Special Equipment and Forensic Science of the Security Service of Ukraine of the Security Service of Ukraine was also a member. Therefore, the membership of Ukrainian organizations in the most powerful European organization of forensic experts is a promising direction for the integration of forensic expert institutions of Ukraine into the European Community.



Traditionally, representatives of ENFSI institutions meet once a year, in accordance with the Constitution of membership. Participants consider the activities of expert working groups, the involvement of ENFSI members in European projects on forensic science and criminalistics, the election of new members of the Council, admission of new institutions and

their permanent representatives, etc. It should be noted that cooperation within ENFSI opens many opportunities for expert institutions: first of all, it is a powerful support in solving topical expert tasks, exchange of experience in the field of forensic expert activity and scientific developments at international level.

European Academy of Forensic Science Conference (EAFS) is held in Stockholm, Sweden, on May 30th – June 3rd June 2022. The conference motto was Together for a Safer World. The EAFS conference is held every three years for all the world leading professionals in the field of forensic science and forensic science.

This year, this large-scale event brought together more than 1,100 participants from all the leading forensic institutions of the world in the largest hall in Stockholm – the city conference center. EAFS 2022, under the patronage of ENFSI, organized the National Forensic Centre (NFC) of the Swedish Police Authority.

The purpose of this conference is to determine the directions of development of the forensic community, taking into account the needs of law enforcement agencies in the fight against organized crime and terrorism, as well as to outline new areas of criminal activity. In the program of the conference, the organizers laid down the following topics: digital transformation of the process of forensic science, forensic databases, the human factor during forensic examinations, judicial social responsibility and innovative forensic technologies, etc.

During the conference, poster presentations of participants traditionally take place and exhibitions of advanced technology manufacturers in the field of forensics continue. For example, a significant part of the research program was devoted to digital signatures (DCS), as the European Network of Forensic Handwriting Experts (ENFHEX) is one of the 17 expert working groups within ENFSI.

At the conference, numerous aspects of the forensic examination of handwriting were considered. Digital signatures, also known as biometric signatures, have been introduced by participants in a variety of formats over the past decade. Forensic handwriting experts use physical and technical processes to verify the



quality of writing through comparative analysis (authenticity, authorship, any alterations, and temporal distribution). In late 2020, scientific research on the forensic validity of digital signatures (compared to paper signatures) and forensic procedures was published. The EAFS 2022 conference presented the use of digital signatures in typical cases where forensic experts investigated questionable signatures.

The current motto of this year conference was Together for a Safer World (especially against the background of pandemic and notorious events that are currently taking place in Ukraine) emphasizes the importance for institutions of different countries to cooperate in the field of forensic science and forensic examination and promptly respond to the expectations of the judicial community in such a difficult period for the entire civilized world. As practice shows, conferences of this scale are a great opportunity for all stakeholders to exchange knowledge, experience and skills acquired in the field of criminalistics and forensic examination.

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All-Ukrainian Scientific and Practical Conference (with international participation): *Actual Issues of forensic psychology analysis in Cases on Claims for Compensation for Moral Damage*

On June 3, 2022, All-Ukrainian Scientific and Practical Conference (with international participation): Actual Issues of forensic psychology analysis in Cases on Claims for Compensation for Moral Damage organized by National Scientific Center «Hon. Prof. M. S. Bokarius Forensic Science Institute» with the support and using the technical base of National University “Yuri Kondratyuk Poltava Polytechnic”.

At the beginning of the conference, **Oleksandr Kliuiev**, Director of NSC «Hon. Prof. M. S. Bokarius FSI», Doctor of Law, Professor, Honored Lawyer of Ukraine noted that in the extremely difficult time of Ukraine's confrontation against Russian aggression, such an event is a symbol of unity and inflexibility of scientists working in difficult conditions of war. The conference relevance is growing because of the numerous moral sufferings that people throughout Ukraine are experiencing from the crimes committed by Russian aggressors. The main goal of the conference is to discuss the most pressing problems regarding the methodical provision of forensic psychological examination in cases of individual and collective claims for compensation for moral damage caused by the Russian aggressor. The high publication activity of conference participants: domestic lawyers, scientists, forensic experts and practical psychologists, as well as specialists of the Republic of Moldova is a significant contribution to the development of the methodology and practice of forensic psychological examination.

Welcome speeches were also made by **Nataliia Tkachenko** Director of the Department of Expert



Support of Justice of the Ministry of Justice of Ukraine, PhD in Law, Honored Lawyer of Ukraine, **Volodymyr Onyshchenko**, Rector of National University "Yuri Kondratyuk Poltava Polytechnic", **Olga Cataraga**, Director of Centrului Național de Expertize Judiciare (Republic of Moldova) PhD in Law; , spoke about the current problems and the current state of forensic psychological analysis in Moldova.

Reports were devoted to the theoretical and methodological issues of forensic psychological analysis: **Marharyta Zhuravlyova** Laboratory Head of psychological, art history and other types of research of the Odessa Forensic Science Institute, Senior Researcher of the Institute of Correspondence and Distance Learning of the National Academy of Internal Affairs, **Sergey Kushnarev**, Laboratory Head of the of the NGO Union of Sociological and Psychological Research Specialists, **Volodymyr Sopov**, Senior Researcher, consultant psychologist of Alternative Forensic Expertise Center, LLC, **Natalia Alikina**, Professor of the Department of Fundamental and Legal Disciplines of Faculty No. 6 of the Kharkiv National University of Internal Affairs, **Anatolii Shulha**, senior researcher of Poltava Branch of NSC «Hon. Prof. M. S. Bokarius FSI» by **Olena Slipets** and others. Among the most important problems, conference participants singled out: the need to define the concept of "moral damage" within the scope of the subject of psychological examination and in the context of understanding human nature; the need to develop a universal methodology for psychological research in claims for moral damages; application of valid and reliable psychodiagnostic research methods; thoroughness of research and formation of conclusions; modernization of methods for calculating the

estimated amount of compensation for moral suffering, etc.

The participants devoted a significant number of reports to urgent issues of forensic psychological examination regarding compensation for moral damage to victims of Russian military aggression. In particular, the director of the Kyiv International Forensic Institute



of Psychological Examination and Polygraph Research, **Oleg Nazarov**, emphasized the joint work of Ukrainian specialists and international organizations to determine fair and scientifically based ways of calculating monetary compensation to the residents of Ukraine for moral suffering as a result of the armed military attack of the Russian Federation and caused non-property damage. **Oleh Shchelkunov** Lawyer, partner of JSC GRECO noted that Ukrainian legislation does not have the concept of "value of life" and, accordingly, there is no officially recognized methodology for determining the value of human life, and neglecting this indicator leads to an underestimation of the life of the population of Ukraine when determining the amount of compensation for moral damage. **Olena Yatsyna**, professor of the Uzhhorod National University of Higher Education and Research, qualified sexual crimes and/or torture with direct weapons by the Russian enemy against the civilian population of Ukraine.

In continuation of the topic of moral suffering of the victims of the military aggression of the Russian enemy, there was a lively discussion of the issue of compensation for moral damages through group lawsuits. In the reports of **Pavlo Kuftyryev**, Attorney, managing partner of JSC GRECO and **Oleksandr Vakulenko** Associate professor of Department of general psychology of Taras Shevchenko National University of Kyiv emphasized the need to apply positive international practice and to develop the appropriate methodology of forensic psychological research for group lawsuits as soon as possible. **Yurii Irkhin**, department head of psychological research of the Kyiv Scientific Research Institute of Forensic Expertise noted that a forensic psychological study to determine the moral suffering of victims of collective lawsuits requires the development of a special methodology, which has differences in the object, subject, tasks, methods and algorithms of the research. **Tetyana Yehorova**, Department Head of Poltava Branch



of NSC «Hon. Prof. M. S. Bokarius FSI» noted that (in view of the excessive number of victims of the Russian military aggression) forensic psychological research on group claims for compensation for moral damages is relevant, however, as of today, there is no categorical psychological apparatus and methodological basis for such researches.

While open discussions, the participants made appropriate remarks and proposals, which formed the basis of the Conference Resolution: problems of the theory and methods of forensic psychological examination in cases for compensation for moral damage are the most urgent issues that concern each citizen of Ukraine, especially in the conditions of war, and therefore require further improvement; theoretical and methodological support of forensic psychological examination in cases for group claims should be clearly formed within the subject, object, tasks of forensic psychological examination, based on the subject of science of psychology.

*Content prepared by **Tetyana Yehorova**
Department Head of Poltava Branch of NSC
«Hon. Prof. M. S. Bokarius FSI»*

In Memory of Leonid Vitaliyovych Bokarius

On May 5 of this year, at the 78th year of life, Leonid Vitaliyovych Bokarius, PhD in Medicine, grandson of the Center founder, outstanding forensic scientist, Mykola Serhiyovych Bokarius, died.

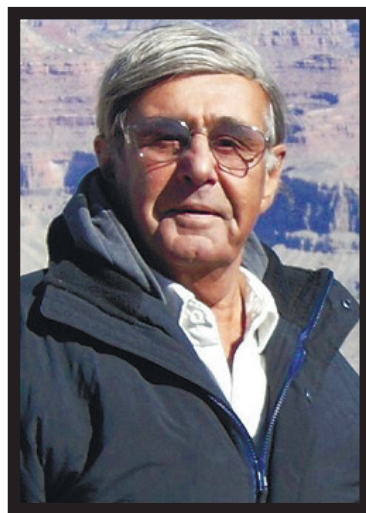
Paying tribute to this outstanding person and brilliant scientist, let us once again recall the stages of his life and activities.

Leonid Vitaliyovych Bokarius was born in Kharkiv in 1944. After graduating from school in 1961, he entered medical faculty of the Kharkiv Medical Institute. In 1965, he married and transferred to the 1st Leningrad Medical Institute named after I. P. Pavlova, who graduated in 1967, becoming the ninth doctor in the famous Bokarius medical dynasty. Subsequently, he studied in the clinical residency of the Institute of Obstetrics and Gynecology of the Academy of Medical Sciences of the USSR named after D.O. Ott.

In 1972, after graduating from postgraduate studies, Leonid Vitaliyovych Bokarius defended his dissertation for the degree of PhD in Medicine in two area of specialization: Obstetrics and Gynecology and Medical Genetics. He worked as a clinical resident, then as a junior researcher, and since 1974 as a scientific secretary of the Institute of Obstetrics and Gynecology where he repeatedly served as director.

In 1989, he left for permanent residence in the United States (California). The desire to help the sick did not leave L. V. Bokarius on a foreigner, so he began to work in homes for the elderly. Achieved credibility and undeniable achievements in medicine enabled him to work even without a medical license, and in 1992, with the special permission of the California Health Administration (as a registered physician and PhD), Leonid Vitaliyovych Bokarius led clinical work with patients of a specialized psychiatric hospital for elderly patients, where he worked for almost 20 years (until 2011). In the last years of his glorious life, L. V. Bokarius lived with his son's family on the coast of Lake Tahoe (on the border of the states of California and Nevada).

The residents of the city of South Lake Tahoe remembered Leonid Vitaliyovych not only as a master doctor and a wonderful person who always rushed to



their rescue. Above all, he was an ardent public figure who took an active part in preserving the unique nature of the lake.

From the first day of the armed aggression of the Russian Federation against Ukraine, Leonid Vitaliyovych fervently supported our state, gathering hundreds of like-minded people for pickets and rallies. Loving Ukraine with all his heart, he carried the truth about this war, kept in touch with NSC «Hon. Prof. M. S. Bokarius FSI».

Unfortunately, Leonid Vitaliyovych health deteriorated rapidly after the illness. He passed away quietly, in the family circle.

In the hearts of grateful students, colleagues, and good friends, he will forever remain full of life, warmth, and kindness. With pain in our hearts, we realize that we will never get his support, hear his good jokes, or take his wise advice.

RIP, Dear Leonid Vitaliyovych! Eternal memory to you!

*Content prepared by grandson of Hon. Prof. M. S. Bokarius
Sergei Bokarius (USA);
Doctor of Law, Professor, Associate Professor of Department of Law
of the Faculty of Law and Humanitarian Law National Aerospace
University – "Kharkiv Aviation Institute",
NAU "KhAI" Kharkiv Aviation Institute
named after M. Ye. Zhukovskiy **Nataliia Filipenko***

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