

Examination of pneumatic weapons in the context of individual identification

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Streszczenie

Air weapons are among the most commonly owned civilian weapons in Slovakia, and legislative changes have gradually increased both their power and their significance in forensic practice. This paper addresses the possibilities of individual identification of marks produced by the use of air weapons, particularly those of calibre 4.5 mm. The introductory section briefly outlines the development of legislation governing air weapons in Slovakia and their occurrence in forensic examinations. The practical part of the paper presents two case studies demonstrating the application of comparative microscopy in the examination of barrel bore markings. In the first case, based on individual identifying characteristics, three recovered projectiles were conclusively matched to a specific Slavia 634 air rifle, while at the same time the use of at least three different air weapons was established. The second case documents an unusual use of an air rifle for the initiation of a 7.65 mm Browning cartridge. Examination of marks preserved on the cartridge primer confirmed its individual correspondence with the submitted air weapon. The results highlight the importance of individual identification in relation to air weapons and confirm the applicability of comparative microscopy in their forensic examination.

Słowa kluczowe: air weapon, air rifle, individual identification, comparative microscopy, ballistics, forensic examination, projectile.

Introduction

Air guns are among the most commonly owned types of civilian firearms in Slovakia. Currently, these are primarily air guns with a muzzle energy of up to 17 J, the acquisition of which, in accordance with Act No. 190/2003 Coll. on firearms and ammunition, requires only that the purchaser must be at least 18 years of age and must have full legal capacity.

The 17 J limit represents the highest per-

missible muzzle energy limit ever set for air guns available to the general public that do not require registration. In the past, this limit was lower. The development of the legal regulations in force in the Slovak Republic is presented in Table 1.

Air guns in Slovakia have been subject to gradual legislative changes, which have increased the permissible muzzle energy from an initial 10 J to the current 17 J. Despite this, for a long time the most common air rifles were those with a muzzle energy of up to 7.5 J. These weapons were widely

Table 1. Maximum muzzle energy of airguns available to the general public in Slovakia

Maximum energy	Effective from	Legal basis
17 J	1 February 2022	Act No. 190/2003, Official Journal
15 J	4 June 2003	Act No. 190/2003, Official Journal
10 J	28 September 1993	Act No. 246/1993, Official Journal
10 J	16 December 1983	Act No. 147/1983, Official Journal

available and it can be said that they were found in most households.

The most popular models included, first and foremost, Czech-made products such as the DUO, Slavia 618, Slavia 620, Slavia 630/631 and TEX, as well as Russian models such as the IŽ-22 and IŽ-38. In recent years, Chinese-made air rifles have also become increasingly prevalent on the market, imported mainly through the Polish trading company Kandar. It is precisely these cheaper models that are frequently encountered in forensic practice, including in cases of illegal modifications enabling them to fire .22 calibre cartridges.

By contrast, sporting air rifles from brands such as TAU, Feinwerkbau and Anschütz are only sporadically linked to criminal activity. One reason for this is that they are used primarily within organised sporting circles, which are characterised by a high level of discipline and control.

Forensic examination of air guns

In Slovak forensic and expert practice, air rifles and 4.5 mm calibre projectiles are most frequently submitted for examination. The following section of the article presents two cases documenting the possibilities of identifying individual weapons on the basis of barrel rifling marks imprinted on the surface of the projectile.

Case No. 1 - Damage to the surface of a stainless steel chimney

The subject of the investigation was damage to the surface of a three-layer stainless steel chimney (Fig. A, B).

Six 4.5 mm calibre Diabolo projectiles were secured near the muzzle (photo C). A long-barrelled airgun, a single-shot Česká Zbrojovka Uherský Brod Slavia model 634 air rifle, calibre 4.5 mm, was submitted for forensic examination. The weapon was fitted with a Walther 4×32 optical sight, without a serial number (Fig. D).

This is an air rifle that uses compressed air to fire 4.5 mm calibre lead pellets. The necessary pressure is



Fig. A. Damage of the chimney surface



Fig. B. Damage of the chimney surface



Fig. C. Seized 4,5 mm caliber diabolo projectiles



Fig. D. Seized pneumatic rifle with an optical sight

generated by a spring-driven piston, which is cocked by 'breaking' the barrel. The weapon is fitted with an automatic safety catch. The metal parts have an oxidised finish, whilst the grip is made of plastic.

During the technical inspection, no unauthorised modifications or alterations to the weapon's construction were found.

A test firing was carried out using 4.5 mm calibre Diabolo projectiles, confirming the firing efficiency of the weapon in question. No functional faults were noted during the tests.

Pellet No. 1

One fired sabot pellet manufactured by the Hungarian company Elko, type Golden Rod Long Range Pellet, consisting of a metal tip and a plastic sabot.

Traces of the barrel rifling with the following parameters were found on the plastic part of the pellet:

- 10 right-handed grooves, each 0.9 mm wide.

The parameters of the rifling marks were inconsistent, in terms of their group characteristics, with those of the rifling of the air rifle in question. Consequently, it was concluded that the seized pellet had not been fired from a Slavia 634 air rifle (photo E).

Projectiles Nos. 2 and 3

Two fired lead Diabolo-type projectiles.

Traces of the barrel rifling with the following parameters were revealed on their circumference:

- 10 right-handed grooves, each 0.5 mm wide.

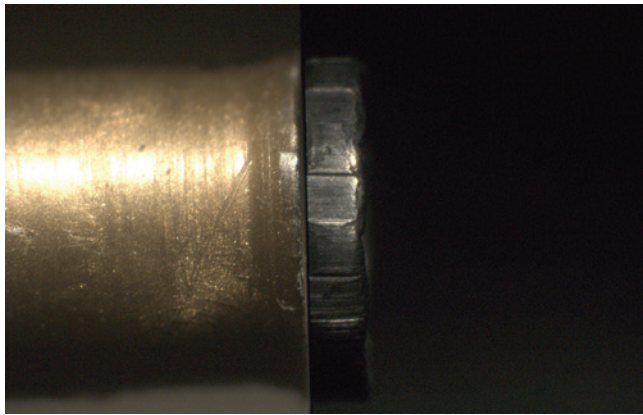


Fig. E. Traces of the barrel rifling on the surface of the evidence projectile

Due to significant corrosion damage to the surface of the projectiles, it was not possible to carry out individual identification. However, the preserved traces allowed for an assessment of their collective characteristics.

The barrel rifling parameters revealed on the projectiles were inconsistent with those of the barrel of the weapon presented. Consequently, the possibility that these two projectiles were fired from the air rifle presented was ruled out (Fig. F).

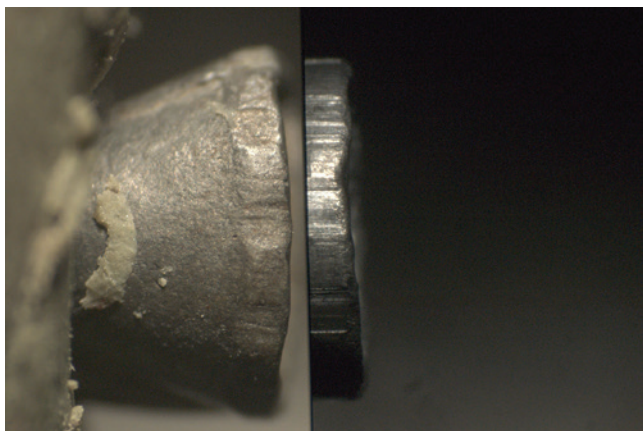


Fig. F. Comparison of barrel rifling marks on the evidence submitted projectile and the comparison projectile

Projectiles nos. 4–6

Three fired Diabolo-type lead projectiles with traces of white paint.

Traces of the rifling with the following parameters were found on their circumference:

- 10 right-handed grooves, each 0.6 mm wide.

A comparison of the preserved marks on the secured projectiles with those found on projectiles obtained during test firing from the air rifle shown revealed, through comparative microscopic examination, a match in individual characteristics. All three projectiles were fired from a Slavia Model 634 air rifle.

Matching features were identified in the pattern of micro-scratches caused by irregularities in the bore. Their nature, location and relative positioning allowed for a positive identification conclusion to be drawn.

The comparative examinations were carried out and documented using a LEICA DM C comparative microscope (Figs. G, H, I).

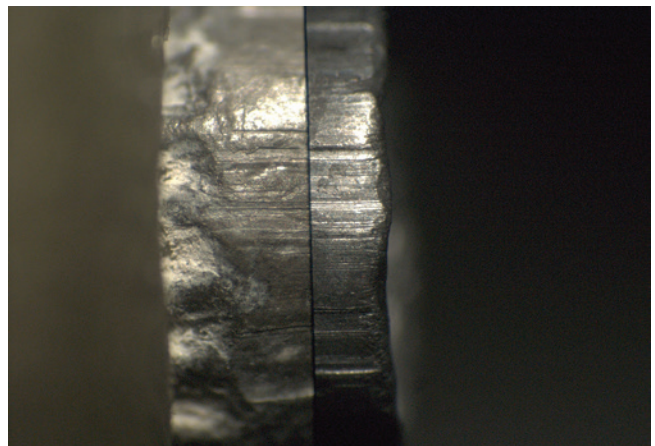
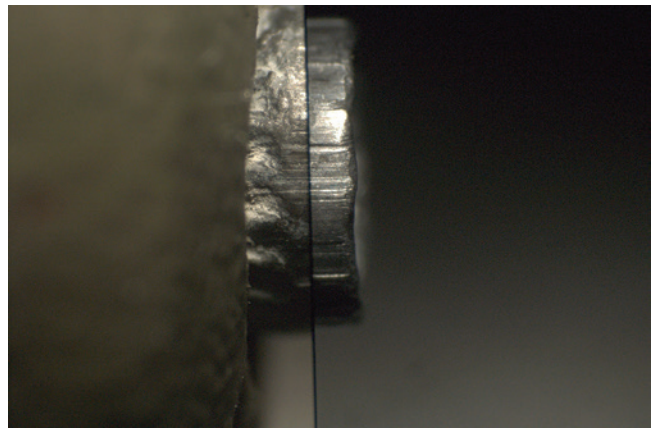


Fig. G, H. Comparison of the characteristic features of the barrel rifling marks on the evidence submitted projectiles and on the comparison projectile

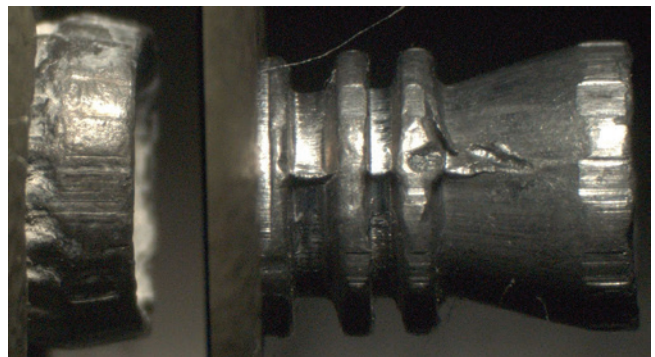


Fig. I. Comparison of barrel rifling marks on the evidence submitted projectile and the comparison projectile.

Conclusions from the investigations

The results of the ballistic tests showed that at least three different air guns were used to fire at the chimney, including one Slavia Model 634 air rifle supplied for testing.

Case No. 2 - A suicide attempt involving an air rifle and a 7.65 mm Browning pistol cartridge

From a forensic point of view, the second case represents an unusual use of an air rifle. It concerned a suicide attempt during which a 7.65 mm Browning calibre pistol cartridge was secured to the muzzle of the air rifle using adhesive tape. The cartridge primer was intended to be ignited by the impact of a projectile fired from this airgun.

A full-metal-jacket bullet from a 7.65 mm Browning calibre pistol cartridge, weighing 4.75 g and consisting of a lead jacket and a steel core, was submitted for examination (Fig. 1).

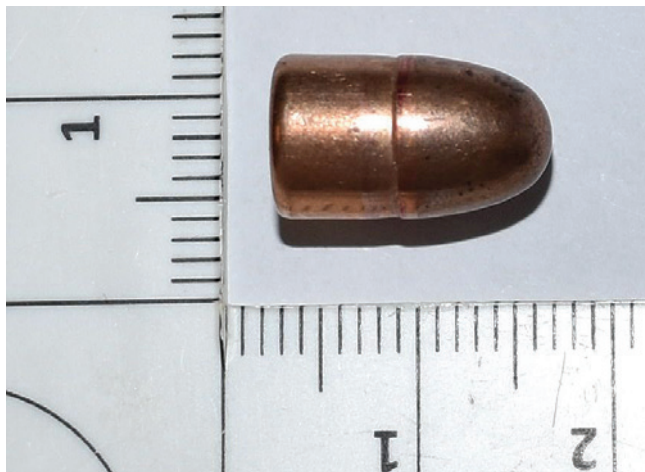


Fig. 1. Evidence submitted projectile

During visual inspection of the projectile, no rifling marks were found on its surface. The absence of rifling marks and grooves indicates that the projectile was not fired from a firearm with a standard rifled barrel. On this basis, it can be concluded that, in all likelihood, the cartridge was fired whilst lying loose or secured outside the firearm's barrel assembly.

Due to the erratic flight path of a projectile fired without being engaged through the barrel rifling, it was not possible to experimentally determine its initial velocity or to reliably assess its lethal potential.

A single-shot air rifle manufactured by the Chinese company Shanghai Gong Zi Machinery Manufacturing Co. Ltd., model B2-4, calibre 4.5 mm, was also submitted for examination. Fragments of a torn cartridge case from a 7.65 mm Browning-calibre pistol cartridge were attached to the muzzle of the carbine using adhesive tape (Figs. 2, 3).

This is an air rifle that utilises the energy of compressed air generated by a piston driven by a coil spring. The mechanism is cocked by 'breaking' the barrel. The metal parts have an oxidised surface, whilst the stock is made of wood.

It was not possible to determine the year of manufacture of the weapon with certainty. During the inspection, a slight bend in the barrel was noted just behind the barrel clamp. The piston cylinder bore the mark of the Polish trading company Kandar. The weapon submitted did not bear the technical approval mark required by Act No. 64/2019 (Journal of Laws) concerning the making available of firearms and ammunition on the civilian market.

The length of the firearm, measured from the muzzle to the trigger guard, was 76 cm. During the technical inspection, no unauthorised modifications or alterations to the firearm's construction were found.

Test firing confirmed the firing efficiency of the weapon presented. No functional faults were noted during the tests.



Fig. 2, 3. View of the evidence - submitted pneumatic rifle and the muzzle of it's barrel

At the muzzle, there were fragments and part of a torn brass cartridge case of 7.65 mm Browning-calibre pistol cartridge, manufactured by Sellier & Bellot, marked with the base mark 'SBP 7.65' (Fig. 4).

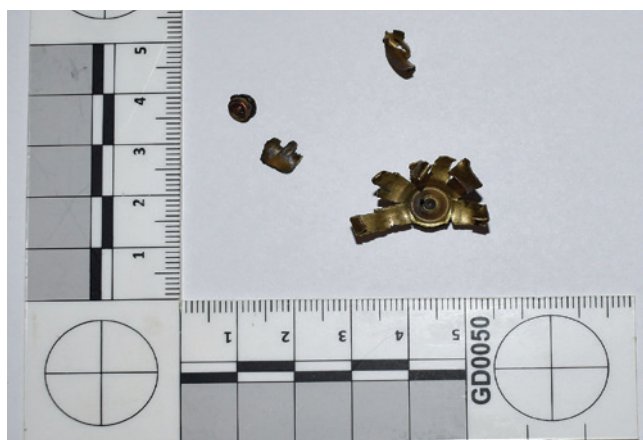


Fig. 4. Evidence submitted cartridge case

No traces of firearm mechanisms were found on the surface of the cartridge case, in particular no traces of the firing pin, extractor or ejector. The nature of the damage was consistent with the cartridge being fired outside the chamber of a firearm.

A comparison of the marks found on the secured lead fragment with those on projectiles obtained during test firing from the air rifle in question, carried out using a comparative microscopic method on a LEICA DM C microscope, revealed only a match in group characteristics. This means that the projectile fragment was fired from a weapon with a barrel bore possessing the same group characteristics as the air rifle in question (Figs. 5, 6).

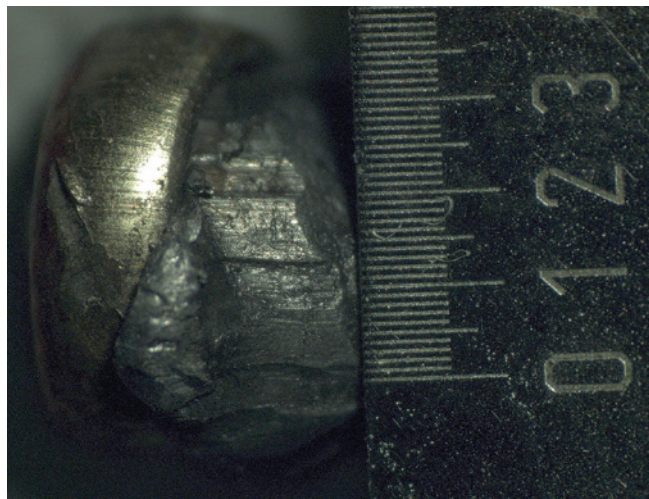


Fig. 5. Traces of the barrel rifling marks on the piece of the projectile submitted as evidence

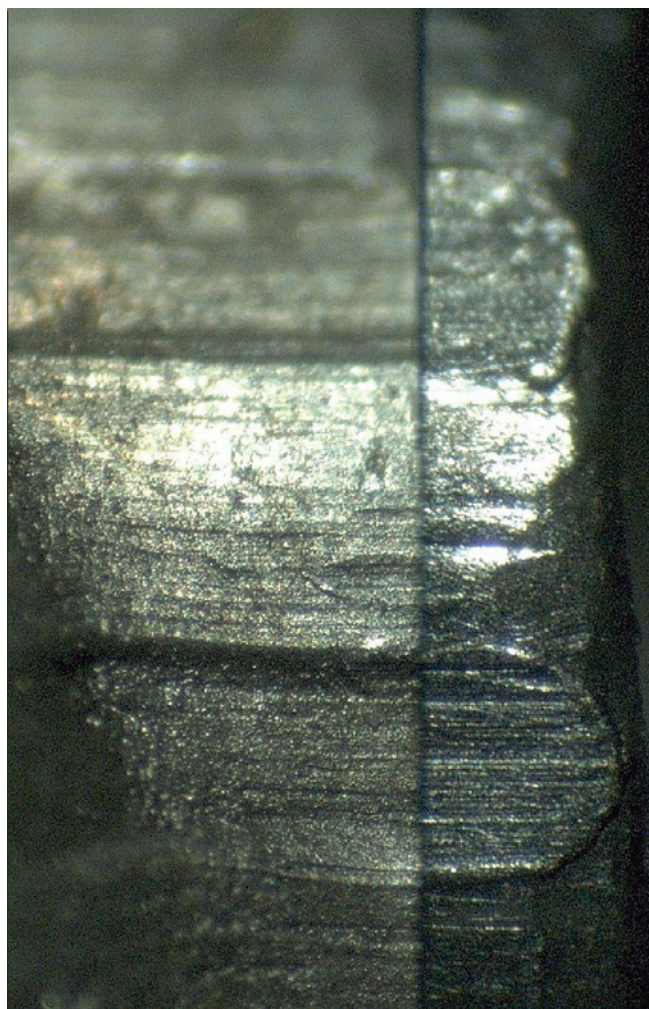


Fig. 6. Traces of the barrel rifling marks on the piece of the projectile submitted as evidence and on the comparison projectile

Among the recovered fragments was also a brass Berdan-type primer, into which a lead fragment of a projectile had been embedded, probably originating from a projectile for a Diabolo-type airgun. Traces of the barrel rifling were also found on the surface of the primer, with the same group characteristics as those found on the projectile that had embedded itself in the primer, i.e. 12 right-handed fields, each 0.5 mm wide (Fig. 7).



Fig. 7. Traces of the barrel rifling marks on the evidence submitted primer and on the piece of the projectile

A comparison of the preserved barrel rifling marks revealed on the primer with those found on projectiles obtained during test firing from the weapon in question showed a match in the individual characteristics.

The individual characteristics identified showed consistency in terms of their course, shape and relative positioning, which enabled a positive identification conclusion to be reached.

On the basis of the examinations carried out, it was confirmed that, as a result of the cartridge being fired, the primer was partially forced into the muzzle of the Shanghai Gong Zi Machinery Manufacturing Co. Ltd. air rifle, model B2-4, 4.5 mm calibre, where individual identification marks corresponding to the barrel rifling of that weapon were formed on its surface.

Comparative examinations were carried out and documented using a LEICA DM C comparative microscope (Figs. 8, 9, 10).

Conclusions from the investigations

The investigations carried out showed that the 7.65 mm Browning calibre pistol cartridge was fired outside the firearm, using a 4.5 mm calibre B2-4 model air rifle.

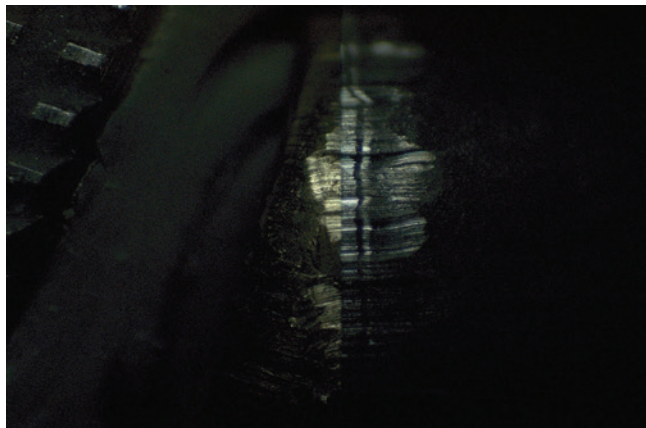


Fig. 8. Comparison of the barrel rifling marks of the evidence submitted primer and on the comparison projectile

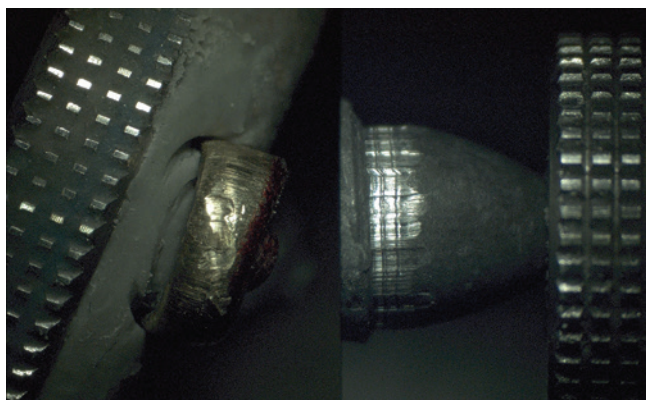


Fig. 9. Comparison of the barrel rifling marks of the evidence submitted primer and on the comparison projectile

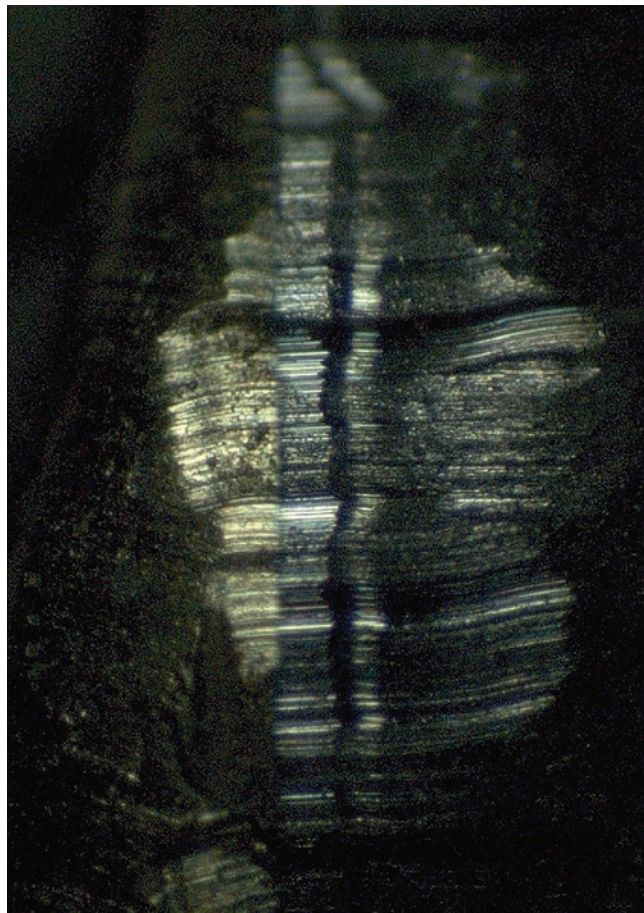


Fig. 10. Comparison of the barrel rifling marks of the evidence submitted primer and on the comparison projectile

Whilst it was only possible to establish that the group characteristics of the lead fragment matched those of the barrel rifling of the firearm in question, individual characteristics consistent with the muzzle of the air rifle were revealed on the primer of the cartridge case, confirming its contact with the muzzle of the air rifle.

The case presented here constitutes a unique example of the formation of traces outside the typical process of firing a firearm and, at the same time, highlights the importance of research into individual identification, including in relation to non-standard uses of air guns.

References:

1. Federálne zhromaždenie Československej socialistickej republiky. (1983). Zákon č. 147/1983 Zb. o zbraniach a strelive. Zbierka zákonov ČSSR.
2. Národná rada Slovenskej republiky. (1993). Zákon č. 246/1993 Z. z. o zbraniach a strelive. Zbierka zákonov Slovenskej republiky.
3. Národná rada Slovenskej republiky. (2003). Zákon č. 190/2003 Z. z. o strelných zbraniach a strelive a o zmene a doplnení niektorých zákonov. Zbierka zákonov Slovenskej republiky.
4. Planka, B. (2009), Kriminalistická balistika (2. doplnené vyd.). Vydavateľství a nakladatelství Aleš Čeněk.