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National Game Management Database of Hungary – A 20 years stewardship of Hungarian wildlife resources

Introduction

In the last half century, advances in ecological science and increasing public environmental awareness have resulted in changes in the management of renewable natural resources. Managers are now expected to apply ecological theory and knowledge to management of wildlife species and their habitats. A major goal of wildlife biologists and game managers is to conserve natural resources and manage wild populations on ecologically sound bases. In case of game species, sustainable or "wise" use of their populations is the most important objective of management.

In order to achieve sustainable use of game species, management should be based on intrinsic population attributes, as well as environmental characteristics and processes affecting populations. Wildlife managers need reliable, accessible and well designed data on the managed populations, their habitats, and the complexities of ecological interactions.

The National Game Management Database of Hungary was first mandated by the Game Conservation, Management and Hunting Law in 1996. Since then, the database has contributed significantly to several aspects of game management; from plan development to wildlife ecological research and education. The database have supported the conservation of the famous Hungarian game populations, benefiting both hunters and the public, and has improved understanding and acceptance of ecologically sound wildlife management.

Historical roots

Sustainable use of wild populations is a priority in international conservation treaties and relevant European Union legislation. However, this is not a new concept; in many countries sustainable use of forests and game is a centuries old tradition. In Hungary, the first elements of modern, "sustainable" game management were established in the late 19th century, along with efforts to integrate forestry, agriculture and game management.

To achieve a balanced management of game and reach the conservation objectives, we need comprehensive, organized, and detailed information. For hunted species, this data must include information on population size and structure, data on taken and/or live-caught game, and the quality of the harvested animals, e.g., trophy scoring data, body weight, sex and age composition. Such databases have been developing in several European countries, e.g. Austria, Denmark, Finland, France, Germany, Norway, Switzerland.

Game bag data was first collected in Hungary in the 1890s by Károly Keleti, the renowned president of the Hungarian Office for Statistics, and with some exceptions, bag records have been available for more than 100 years. However, data collection and publication of national and/or regional statistics is not enough for detailed analysis; data should be available in a format for analyses using multiple variables or high level details.

The National Game Management Database

Studies from the 1970s had recurrently indicated that the development of game management and consistency of management decisions required better data collection and the set up of a national game management database, utilizing technological innovations in computer science, data processing, and statistical methods. The database needed to include all relevant information for each game management unit, species populations, game bags, and trophy evaluation. The Act on Game Conservation, Management and Hunting (Act LV, 1996) mandated the formation of the National Game Management Database (NGMD, Országos Vadgazdálkodási Adattár in Hungarian). In accordance with the law, the goals of the NGMD are to:

- Store data on game populations and game management in a way that can be used for multiple analytical procedures.
- Provide input to spatial analyses and mapping.
- Facilitate decision-making and planning efforts at various levels of game management administration.

In order to design such a vast database, the Ministry of Agriculture and Rural Development contracted the Department of Wildlife Biology and Management, University of Agricultural Sciences in Gödöllő (currently the Institute for Wildlife Conservation, Szent István University) to design and develop a database in 1993. From the start, the NGMD was developed on personal computers using commercial software, including the database format and software used for spatial data management and analysis. Using standard computer platforms, the programmers developed the special applications for data input and statistical output (generally descriptive statistics for regions or country level). The NGMD is primarily based on data provided by the 24 game management regions with ca. 1400 game management units (GMUs).

The database contains the following information:

- Spring population data for red deer, fallow deer, roe deer, mouflon, wild boar, brown hare, ring-necked pheasant, and grey partridge.
- Game management reports for red deer, fallow deer, roe deer, mouflon, wild boar, brown hare, ring-necked pheasant, grey partridge, wild ducks (5 species), wild geese (2 species), and other hunted species (mainly predators). These data include the bags, live-catches, non-hunting mortality, game feeding, and costs of game management activities and incomes from hunting during the hunting season.
- Trophy scoring data for red deer, fallow deer, roe deer, mouflon, and wild boar provided by the National/County Trophy Scoring Committees.
- Address and other data for each GMU. Detailed description of borders and game management maps of each GMU (digitalized, scale 50,000).
- Description and maps of the 24 management regions (based on the GMU maps), long-term (10-year) game management plans of the GMUs, and regional game management plans of the 24 game management regions (2003).

The NGMD is compatible with other data bases collected

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Apple branch budding
Photo by János Bakk

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Dezső Surányi[1]

History of apple cultivation in Hungary

European wild apple species (*Malus sylvestis*, *M. dasyphylla*, *M. praecox* és *M. pumila*) – as we see today – had a lesser role in the domestication of apple than certain Central Asian species (particularly *M. sieversii* and *M. kirghisorum*) that show genetic relationship with the best-known world-wide species. However, several historical species from Europe and the Carpathian basin do not 'fit in' this group. It seems that the connection between the areas and cultures of Central (and even Eastern) Asia and Europe dates back much earlier than we previously thought. Several authors published data demonstrating that the Silk Roads might have existed before the settlement of larger civilizations, ethnic groups. Being the migration route of many wild mammal species (e.g. brown bear, roe deer and deer species and even wild horses), it enabled not only the spreading but the genetic interbreeding of these wild apple species, which is also indicated by the genetic diversity of the present wild apple forests in Central Europe. The four apple species in Europe are solitaire species or grow in small groups but they do not form larger stands.

Therefore, it is reasonable to assume that apple varieties that are considered as Hungarian specialities bear the genetic markers of European species. The results of molecular genetic investigations are promising, but proof will only be provided later due to the vast amount of materials to be examined.

Figure 1 *Carbonized wild apple (M. silvestris) fruits, Albertfalva, early Bronze Age pot – from the site of Csepel group (photo: ENDRŐDI A., GYULAI 2002)*

The 'dawn' of cultivated apple in Europe

Here we only mention the facts of early apple production in Europe that applies also to the Carpathian basin. The number and geographical location of seed remains and fruit remains do not allow us to reveal any apple usage 2500-3000 years ago (**Figure 1**). Although the later endemic presence of some local wild species and the remains can be considered as undeniable evidence. Apple was known and consumed as of the late Neolithic period, mainly by the Celts, then by the peoples of Pannonian provinces in Transdanubia, and even by Barbarian ethnic groups in Cisdanubian areas (**Figure 2**).

Figure 2 *Basket with apple (Aquincum, 3rd century) (APICIUS 1996, Figure 3)*

The document *Capitulare de villis*

[1] Fruit Research Institute of Cegléd

was issued by the court of Charles the Great in 795, which contains the text '*…pomari diversii generis*' (there were several kinds of fruit-gardens in the settlements). It mentions the apple varieties Crevedeller, Geroldinger, Gosmaringer (rosemary?) and Sperauke. They recommended sweet and sour, winter and summer apples for planting, and apple was consumed fresh or dried (RAPAICS 1940). *Charles the Great* was portrayed with a golden apple in his hand, then apple was used as royal insignia around 1100 by king *Baldwin I.* As this symbolizes the country's land, it became a royal insignia also in Hungary (SURÁNYI 1985).

Early Western Christian communities attached healing power to apple, hence the saying of Horace: *Ab ovo usque ad mala* ('from egg to apples'). In his receipt-book, Apicius praised apple, promoted proper nutrition and recommended regular consumption of apple. Apple was formerly regarded as a medicinal plant in Great Britain: 'An apple a day keeps the doctor away'. Eating habits in Europe, and thus in Hungary, during the early mediaeval times were influenced by the strange mixture of ancient pagan and Christian view of life (SURÁNYI 1992 és 2002).

Hungarian apple: from deeds to gardens

Archive sources give conclusive evidence that apple cultivation in Hungary dates back to the 11th-14th century, for instance, wild apple was often mentioned in documents on inspection of landmarks. In 1217 '*arborem mali',* in 1225 '*inde currit ad'* apple tree, in 1237 '*agas'* apple tree is mentioned. Trees were planted in a random way and occasionally, and the range of choice of varieties was very poor. However, the 'arborem pomi Red apple tree' phrase in a document dated

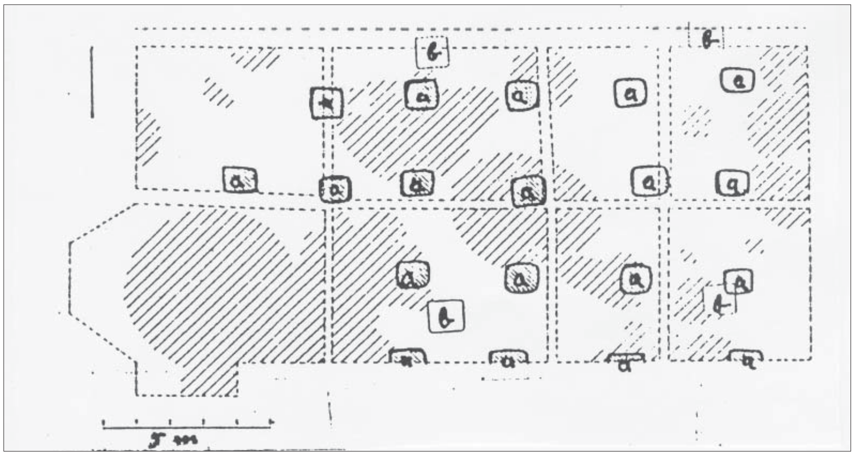

Figure 3 *Location of apple tree-stumps (a=apple, b=peach) (KOVALOVSZKI, 1993)*

in 1422 could be a variety name, but it is known that Fűz (*willow*) apple, Veres (*red*) apple and Telelő (*winterer*) apple were cultivated at that time. In addition, the Code of Döbrentei (1508) praised the Pónyik apple.

In the middle ages, the trees in the fruit-garden (pomerium) were planted in mixture and in a random arrangement, and actually the fruit-garden was the cemetery at the same time and the consumption of such fruit was forbidden. The fruit-garden and the summer cottage explored on the Helemba island in the river Danube was owned by

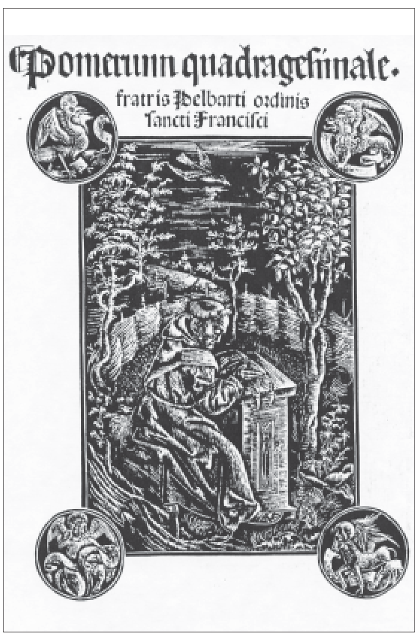

Figure 4 *Temesvári Pelbárt Pomerium (1499, original cover page)*

Robert of Limoges, Archbishop of Esztergom (1226-1239). The 1500 m long and 100-200 m wide Zátony island, which is the load of the river Garam, was planted with apple trees in an arranged way, demonstrated by carbonized tree-stumps revealed by MÉRI (**Figure 3**) (KOVALOVSZKI 1993). Villeins might have understood the symbology of apple-gardens (i.e. the Garden of Eden, passing away), which could be the reason why TEMESVÁRI (1499) chose such an orchard for the cover of his book on meditation (**Figure 4**).

In the middle ages, apple was only grown in the gardens of cloisters, kings and landlords, villeins mainly covered their needs by collecting it. During the Angevin period and under the reign of Mátyás, apple' popularity waned to some extent (new species appeared, the known world expanded), although it cannot be really seen in late Gothic paintings and Renaissance ornamental art. Italian influence could be detected in variety usage as well, therefore, the apple varieties in Hungary were 'summarized' on orders of arches of a portal, fountains and Corvinus manuscripts (such as the Code of Hieronymus, SURÁNYI 2002).

As of the end of the Middle Ages, several tasteful varieties (e.g. the *Boszmán apple*) were brought to the Carpathian basin through the

Balkan region that were more valuable than the varieties of local or Eastern origin, but these were for seasonal (summer, early autumn) fresh consumption (**Figure 5**). In the 16th century winter apple was transported to Austria from Hungary, thus Western European (Eastern Atlantic) apple varieties could have come into usage in the production areas of the Carpathian basin. Medieval varieties were preserved for a long time (partially even today) in the Eastern areas of the country and in Transylvania and in Southern Hungary. Until the middle of the 19th century, peasants produced apple mainly in the floodplains of rivers (The Danube reach at the Great Hungarian Plain, the Upper Tisza Region), and in river valleys, groves and forests in the mountains (the valleys of Maros, Szamos, Nyárád, Garam, Dráva) (LIPPAY 1667, BRÓZIK – REGIUS 1957, SURÁNYI 1985). The apple was transported on carts or boats in autumn to areas with less fruits, for instance from Southern Transylvania or Transcarpathia to the Great Hungarian Plain (*Gyógyi apple*, *Kenézi*) (SURÁNYI 1992 and 2002) (**Figure 6**).

The political-economic situation of both Europe and Hungary changed after the Turks was hounded out of Hungary (1526-/1686/-1718), which was influenced also by the great geographic discoveries. Fruit production was facilitated by the economic boom (and even regional wars). Old trees that remained sporadically, or their branches, or certain varieties were grafted with new ones, and in this way many Western European varieties were introduced. The cultivation of apples with sourish taste was not promoted by the Austrian authority occupying the majority of the country (ZOLNAY 1977 and 1982, SZAKÁLY 1990)

neither by support nor by their eating habits (TAKÁTS 1915-1917, BLAZOVICH – SCHMIDT 2001) (**Figure 7**). The changes are demonstrated by dictionaries, botanical works and economic documents as well. SZIKSZAI FABRICZIUS (1590) mentioned only small red apple, but LIPPAY (1667) differentiated summer and winter red apples. One of the apples might have been the Simonffy red apple (MÁNDY 1972), which is described by LIPPAY as follows: '*The red apple is a bit elongated and sweet', 'An apple is called Tót red apple in some places in Upper-Hungary, the fruit is longish, dark red, with red lines also inside, it is soft and sweet and can be stored for long'.* The apples of the Upper Tisza region, namely *Kenézi piros, Daru, Sóvári,* are produced even today. As of the 16th century, more and more apple varieties were cultivated throughout Europe, CORDUS (1561) listed 33 varieties, while BAUHIN (1650) mentioned 70 varieties from Southern Germany.

Figure 5 *Lucas Cranach: The virgin and the child under an apple tree (SURÁNYI, 1985)*

In his work titled '*Fruit garden'*, LIPPAY (1667) wrote also about the Fűz (*willow*) apple, the Mét apple (excellent for pies) and the Fontos (*important*) apple. BERECZKI clarified the origin of *Orbai* apple, which was called Fűz apple and 'Magotlan' (seedless) apple in the county of Háromszék as it is a triploid variety growing parthenocarp fruits (RAPAICS 1940) (**Figure 8**). BERECZKI also collected other apple varieties such as the Apró piros (*small red*), Borízű (*wine-flavoured*), Eleve érő (*early maturing*) (later called Szentiványi), Igen édes (*very sweet*), János vajda,

Figure 6 *Gyógyi apple (NAGY-TÓTH 1998, Figure 40)*

Kerekded (roundish), Leánycsöcsű (*girlish breast*), Magnélkül való (*seedless*), Mohos (*downy*), Muskotály (Muscat), Paris, Piros (red), Szamosközi, Telelő (*winterer*) and Török György. LIPPAY listed as many as 23 apple varieties in his book 'Fruit garden' (1667) long before.

The apples of Mátyás Bél

Apple production soon revived in the recovering country, the gene stock was improved through introduction (BÉL 1730). In his variety descriptions, Bél wrote that the early-maturing *János apple* (Szentiváni) was small, yellow, sweet and pleasant-tasting, while *Jakab* apple was also small but less tasteful. Among summer varieties, the excellent *Kerek* (*round*) apple has huge tree, middle-sized roundish fruits with whitish pulp. *Tűz* (*fire*) apple was described as very tasty, sweet, large fruits with white skin. The *Nagy csíkos* (*great striped*) apple is large with red stripes and sourish, its smaller variant becomes ripe earlier, is more tasteful and is brought to maturity by a few-day storage. *Muskotály (muscat)* apple – ripening in August - was popular. Téli muskotály (*winter muscat*) apple was also consumed, it had small, sweet fruits with fine taste. *Borízű (wine-flavoured)* apple had sweet and sour variants, both with dense high-yielding crowns. *Tükör* (*mirror*) apple – named after its shiny, glossy skin – is more rare; it has large tree, downy leaf and sourish fruit. *Egér (mouse) apple* does not grow big, it is mostly red, very sweet and fine-tasting. Among winter apples, *Bosnyák (Bosnian) apple* was well-known, its several variants such as sour, sweet, red and partly red were planted. The tree is large and highly branched, the internodes on the twigs are long, the foliage is bright. It favours wet soils. The *Borsdorfi* apple is similarly

Figure 7 *Cider apple tree with harvesters (Tacuinum sanitatis in medicina, 14th century)*

high-yielding and it is recommended for those with bad health due to its special taste. *Messanské apple* – called Misznica by the Czechs – comes from the environs of the town of Misnia. *Berlinger* apple has red- and white-skinned variants, both are juicy and delicious. The appearance of *Citrom (lemon)* apple – named by the people of Pozsony after its colour – resembles to that of the Bosnyák apple, however, it is less tasteful. This variety also has two variants: one of which is larger and the other is smaller, their leaf is similar to that of the Bosnyák apple. *Török (Turkish) apple* can be characterised similarly: the size and

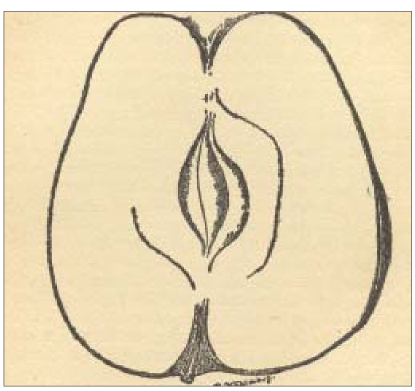

Figure 8 *Orbai apple (RAPAICS 1940, 90.)*

yield are close to those of the Bosnyák apple, it is wine-flavoured and juicy.

With regard to the *Borízű (wine-flavoured)* apple, Mátyás BÉL also mentioned that it is very high-yielding, the fruits almost hide the leaves and they sometimes cause the branches to break; there is a summer apple with the same name. In Pozsony, the *Durva (rought)* apple, and the *Sárga borízű (Yellow wine-flavoured)* apple and the *Brü(n)ni borízű (Brno wine-flavoured)* apple are also known. The real wine-flavoured apple was the *Török borízű* (*Turkish wine-flavoured*), as opposed to the Turkish apple, it has large fruit and is also high-yielding. *Paradicsom (Tomato)* apple with very large red fruit is also productive. *Pogácsa* (*scone*) apple – called Winter Streimapfel by the German community in Pozsony – is very high-yielding, although is less frost-resistant.

The *Fekete fenekű (black-bottomed)* apple is productive, the size and yield resemble to those of the *Paradicsom (Tomato)* apple, but its fruit is cylindrical and rather tartish. It is also high-yielding and tasteful, but smaller in size and is juicy. BÉL found *Széles fenekű (broad-bottomed)* apple, which should be in fact called short-stalked, better. *Füzes (willowy)* apple – named after the tissue-fluid of willow – has hard skin and pulp, but when after-ripening takes place in winter it will have nice taste. PLINIUS described a twin apple that grows fruits in bunches. *Téli muskotályalma (winter muscat)* apple is better in taste and in appearance than the previous one, but has longer stalk, asymmetric fruit and two different variants, tart and sweet.

The size of *Fontos* (*important*) apple is extraordinary, yet, it is not as big as a melon. However, an apple with the size of a melon also exists, it is the *Dinnye (melon*) apple. *Tök (pumpkin)* apple is also known, and *Üveg (glass)* apple has the same size but different taste than this. *Asszony (wife)* and *Szűzlány (virgin)* apples are high-yielding, while *Üveg (glass)* apple can only give medium yield. *Tej (milk)* apple has milky juice and the fruit ends in a thorn, just like *Venucula* – as it is described by BÉL, but this one was a bit larger and greener in his descriptions. The colour of the medium-sized and whitish *Tafota apple* resembles to pure silk. *Salzburgi* and *Bordás (ribbed) apples* are bigger.

Jezsuita csuklyás (Jesuit hood) apple – named after the stipula on the stalk – has hard pulp and can be stored for a long time but it has less good taste and thus it can be used as an ornament rather than a pleasant food. *Császár (emperor) apple* is unique in its size – resembling to Berlini – and its flavour is similar to that of *Paradicsom (tomato) apple.* It is very rare (it has disappeared by now) and produces a fig-like seedless parthenocarp fruit without flowering, therefore, it is called Magtalan (*seedless*) as well. The list can be completed with *Boralma (wine apple)*, *Fekete (black)*, *Rabaudi*, *Zasiaui*, *Kérges (crusty)* and a hundred other apples. However, 'the above are more than enough to demonstrate the large number of apples found in the region of Pozsony' – wrote BÉL in 1730 in his book *The life of the people in Hungary*.

Apple production depending on political and economic circumstances

When the Archbishopry of Esztergom moved back to Esztergom after the recapturing of Buda, the garden in Pozsony was started to be neglected (RAPAICS 1940b, HOLČIK 1986), its location and characteristics are now being exposed. Still, apple production could develop. LÜBECK, BOGSCH, LEIBITZER and many others did a lot for the cultivation of good apple varieties. Accordingly, the view that the period of the 17th-19th centuries was uneventful in terms of apple production is wrong. Well-maintained trees were grown, pruned in several castle gardens by the gardeners.

LÜBECK described the state of Hungarian fruit production in 1804, mentioning among others that there are two valuable apple varieties grown in Sopron, the Mandafit and the Szercsika apples. The booklet written by BOGSCH (1793) refers to even more varieties: Mosánszkai, Kormos (*sooty*), Varga, Zöld ranét, Pogács, Bársony (*velvet*), Sóvári, Boszmány apples. LEIBITZER (1798) described 26 apple varieties, detailing the features of Nyári borízű (*summer wine-flavoured*), Piros császáralma (red emperor), Boszmán, Piros renet, Fontos (*important*) apples.

The new varieties were mainly tried in Transdanubia. The designations delicious, kálvil, parmen, pepin, rambur, renet, etc. became generally known at this time. Meanwhile, the Eastern part of the country, especially Transylvania, continued the production of old Hungarian fruits. RAPAICS (1940) said that Péter ORBÁN listed the fruit varieties in the garden of Baron BÁNFFY, including 149 types of apple, which also indicates that the variety selection in seigniorial gardens was abundant at the beginning of the 19th century, and low-quality varieties were pushed into background.

The first nursery-garden price list was published in 1812 by BODOR in Kolozsvár under the name List of grafted plants offering 34 apple varieties, including the *Nyári jeges (summer icy), Nyári viola (summer matthiola), Szebeni tángyér* (*Szeben plate*)*, Téli piros kormos (winter red sooty)* and *Téli anglus pippin (winter anglus pippin)* apples. RAPAICS (1940) assumed that fruit production for markets started in Hungary with the publishing of this price list.

Let us now examine the question whether varieties were exported to foreign countries from Hungary. When Queen Maria, the widow of Louis II, fled from Buda, a large fruit variety gene source was taken to the West, finally to the Netherlands (where she was a governor between 1530-1558). Atlantic-type apples gained ground in Hungary in spite of that dry vegetation periods continuously gave trouble to the producers.

The owners of seigniorial gardens and big manors, who cultivated less varieties in ever larger areas in apple gardens, suffered numerous losses due to the new varieties. On the other hand, villeins and independent landowners changed the fruit varieties more slowly and probably in a more thoughtful way, resulting in less failure. The development of Transylvania was different in this sense too. We previously studied the data relating to apple in the book of Balázs Orbán titled The description of Székely land (SURÁNYI 2006). The apples grown in the valley of Maros has represented a special cultural botany and diversity value up to the present (BERECZKI 1877-1887, SURÁNYI 2002, SZANI (2011), this is why BERECZKI (**Figure 9**), or nowadays SZANI (2011) could collect so many varieties.

In the same way as the variety collections were created in the 18th-19th centuries as a result of a long-term development, the apple production regions also formed gradually. ELEK (1966) defined 11 regions, not all of which were equally important from historical-traditional or social-economic point of view and more of which lost its role after the socialist large-scale production era.

In the second part of the 19th century, the production of Jonathán apple contributed to making reputation to Hungarian apple, the modernization of apple production, the regional development of rural areas and last but not least to the improvement of entire fruit production. The origin of this variety is uncertain, two different versions exist. However, many took notice of this variety, BERECZKI could obtain Jonathán grafting shoots from Lekehalma (from Károly Fazekas) in 1882, as a result of which Western European apple varieties started to lose their importance (q.v. SURÁNYI 2008). BERECZKI (1877-1887) rendered valuable services through the studying and description of landraces and apple varieties that can be introduced. In his four-volume book, he characterised 423 apple varieties, and could describe at least 100 other apple varieties if he had not died suddenly (q.v. SURÁNYI 2008). Jonathán had such a great importance that only Starking and Golden Delicious could take on. However, the quick change in market requirements and the deficiencies of the variety ended in the decline of Jonathán. It has not completely disappeared as several clones are still in production. A much greater problem is that summer apples were previously relegated to the background because of autumn and winter apples, and a considerable part of the gene source is lost, though good-quality summer apple would be needed again (**Figure 10a and b**).

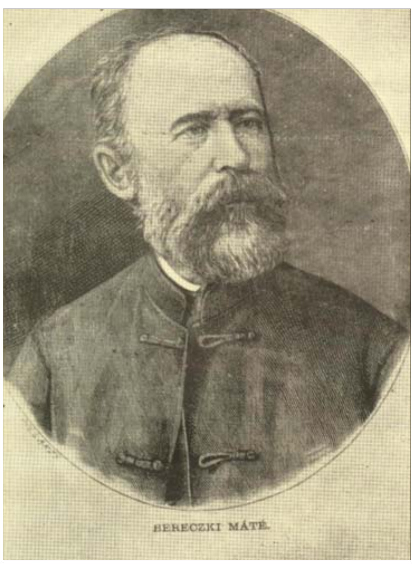

Figure 9 *Bereczki Máté – the founder of Hungarian pomology (Hungarian Agricultural History Biographies, Magy. Agrártört. Életrajzok I. 179.)*

Figure 10 *Two apple trees on stamps: a./ Jonathán M. 41 (work of Zsitva Sz., 1986) b./ Nyári fontos (summer important) apple (work of BENEDEK I., 2011)*

The history of apple production is described in the reviews of PETHŐ (1969) and KAPÁS (1969). The locations of apple production regions and the production structure and development were determined by the ecological features of the natural environment and the various economic-social factors. The development of apple production was analyzed by RAPAICS (1940) and MOHÁCSY (1951) from a historical point of view, while by OKÁLYI (1954) and ELEK (1966) on the basis of statistical surveys. Since the dynamic improvement of apple production started at the beginning of the 20th century, the changes can be assessed as of 1895.

PETHŐ (1969) divided the past period into three stages; 1895-1919: the laying of the foundations of modern apple production, 1920-1945: the golden age of small-scale apple production for markets, 1946-1970: the establishment of large-scale apple production. We completed this division with two other stages: 1971-1989: apple production influenced by economic changes, and 1990-: apple production influenced by social changes (SURÁNYI 2013).

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Development of Methods for Trace of Pálinkas

Introduction

Fruit spirits are widely consumed in European countries (Madrera et al., 2010) such as France, Spain, Italy, Germany, Austria etc. as well as the USA, Canada, China, etc., however "Pálinka" is double-distilled fruit brandies produced in wholly Hungary and four regions of Austria (EEC No 1576/89). Moreover, some types of pálinkas (szabolcsi almapálinka, szatmári szilvapálinka, békési szilvapálinka, kecskeméti barackpálinka, gönci barackpálinka, újfehértói meggypálinka, göcseji körtepálinka és pannonhalmi törkölypálinka) are registered as Protected Geographical Indication (PGI, Regulation No 110/2008 of the European Parliament and of the Council). In harmonisation with EP regulations of, the Hungarian Parlament accepted the so called pálinka law aiming to regulate pálinka, torkolypálinka and establishing a basic law to create the National Pálinka Council in the end of 2008. These activities definitely enhance recognisation of pálinka products in both national and international markets. However, the premium quality - in itself - generally is not enough garantee for sustainable competitiviness of pálinka products. Quality management systems are required to identify and prove the special properties/quality of certain original protected products. Due to intensive research and development, some European countries such as Italy, France, Spain etc. have very good quality management systems for handling the special determination of food products for exapmle: Country of Origin Labeling (COOL), Protected Designation of Origin (PDO), Protected Geographical Indication (PGI), Certificate of Specific Character (CSC). Until now in Hungary, no such systems have been available to qualify individual pálinkas as being from geographical protected regions, thus the development and application of relevant system must have a high impact on both national economic and authentic points of view. In 2009, a consortium with one academic institution and three industrial partners was formed which s made the scientific proposal (Project acronym: PÁLINKAH) for National Technology Program (TECH A3: Competitive Agriculture and Food Industry). The overall goal of the project is to contribute to the enhancement of the competitiveness of pálinka products through three direct main points: a) the development of the production and tracing system of pálinkas registered as PGI; b) the development of a new, effectiveness pálinka production technology; c) the introduction of a pálinka trademark system. This project is made possible with the financial support from National Development Agency (Project No: TECH_09-A3-2009-0194). In this paper, briefs of results and status of projects are described.

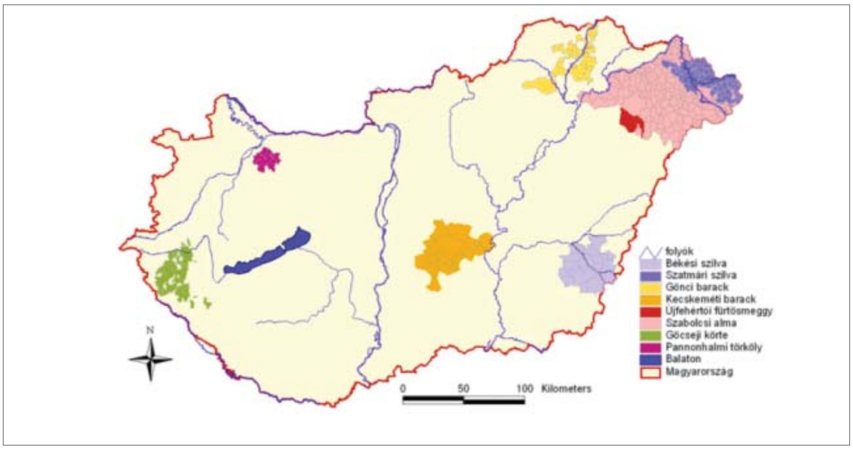

Figure 1. *Geographical regions for production of pálinkas registered as GPI*

Geographical characteristics of different region for production of GPI pálinkas

In Hungary, at the moment GPI pálinkas can only be produced in 8 regions (Fig 1): two in trans-Danubia, one in middle and five in trans-Tisza river.

Geographically, Göcsej region is located in trans-Danubia and in the central hills of Zala. Hours of

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sunshine vary in range from 1850-1900 hours/year with an average 450 mm of percipitation. Soil is clayey and poor in organic content. Numerous pear (*Pyrus*) species cultivated in this region can be used as raw materials to produce GPI "Göcsej körtepálinka" such as Bosc Kobak, Vilmos, Conference, Hardenpont, Clapp, Packham's Triumph, etc, but according to registration document only those pálinkas are known as GPI pálinka which are produced from at least 50 % Bosc Kobak.

Located in the middle of the country, the Kecskemét region is one of the very good areas to cultivate fruits, especially peaches. Sandy soil combined with clay and straw soil with a high numbers of sunshine hours and temperature (about 1770 h sunshine, 3200 ^{o}C of total temperatures in the cultivation period) perfectly suit the production of apricot fruit that is delicious and rich in aromas. For production GPI "Kecskeméti barackpálinka" some species (Magyar kajszi, Gönci magyar kajszi, Pannónia, Ceglédi bíborkajszi and Bergeron) must be used.

"Gönci" apricot (*Prunus armeniaca* L.) is one of very famous fruits in Hungary and Central Europe due to climate, plant (Gönci magyar kajszi, Magyar kajszi, C 235, Mandulakajszi, Bergeron, Ceglédi Piroska, Ceglédi bíborkajszi, Ceglédi arany, Ceglédi óriás, Pannónia species) and soil in the Gönci region.

For production of Békési szilvapálinka (plum spirit), at least 50 % "Vörös szilva" (red plum) fruit must be used. This plum species (*Prunus domestica* L.) is well cultivated in Körösök valley comprised of Békés city and peripheral towns. This cropland belongs to continental climate zone with more than 550 mm rainfalls and 2000 hours of total sunshine time. In Hungary, Békés is one of regions that have very high number of sum temperatures in cultivation period (about 3300 ^{o}C).

The other region registered for production of GPI szilvapálinka is Szatmár located in upper reaches of the River Tisza (Fig. 1) with a special microclimate (parky and dry). Annual average temperature on this region is about 9.2-9.7 °C, total numbers of sunshine are 1950-2050 hours with rainfalls about 550-700 mm. The Szatmári GPI szilvapálinka must be produced mainly (at least 80 %) using Penyigei and Besztercei plum fruits.

The Újfehértó geographical region is located in middle part of Nyírség land (Szabolcs-Szatmár-Bereg Count). Climatically, annually about 550-600 mm rain falls on this region with 1950-2030 hours of sunshine and an average temperature of 9.3–9.9 ^{o}C. Only pálinka produced from cherry (*Prunus avium* or *P. cerasus*) in this region can be traded as Újfehértói GPI meggypálinka.

Collection of data and building of database

In this project, at least three sampling places were selected for each region (7 regions except Pannonhalma) annually, about 100-300 kg fruits were collected and processed in our laboratory. Overall procedure for procession of fruits is schematically demonstrated in Figure 2.

Briefly, each fruits had to pass the selection procedure to be choose good quality ones. After that, fruits were washed with tap water. The cores of fruits (plum, apricot, cherry) were removed mechanically by mashing machine; meanwhile other fruits (apple, pear) were sliced and disintegrated (Hoschke & Panyikné, 2007). The fruit mashes were treated either by adding pectinase enzyme preparation, adjunction of pH to pH 2.8-3.2 using a mixture of phosphoric and lactic acids. Alcoholic fermentation was carried out in a temperature controlled room (Figure 3) using special yeast strains (*Saccharomyces cerevisiae*) from Kokoferm Ltd. After fermentation, mashes were distilled in a pilot plan pálinka making system (Figure 3) constructed by Hagyó Ltd. Samples were taken at various points of processing procedure and analyzed by different ways.

Reducing sugars, pH, extract content, titratable acidity of samples were determined routinely by standard methods. Sugar and organic acid spectrum of fruits and mashes were determined by HPLC using Aminex 87H analytical column from Bio-Rad Corporation (USA). Volatile

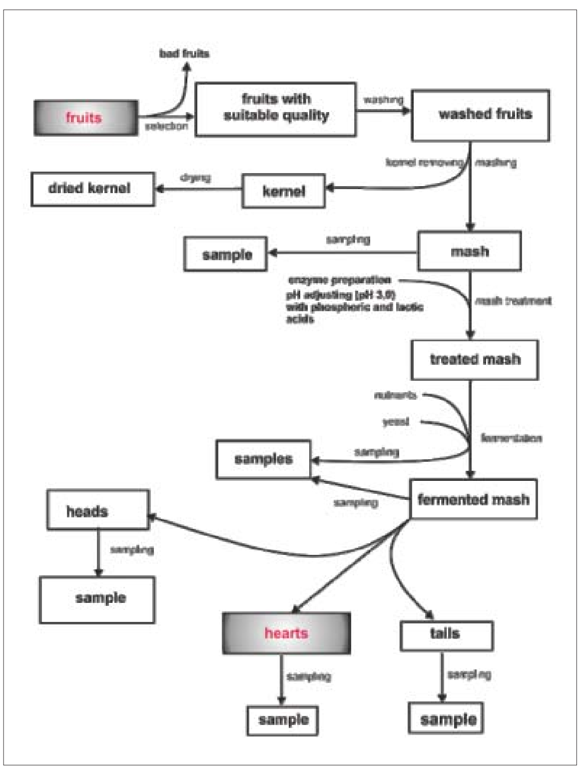

Figure 2. *Scheme for processing of fruits*

Figure 3. *Fermentation and distillation*

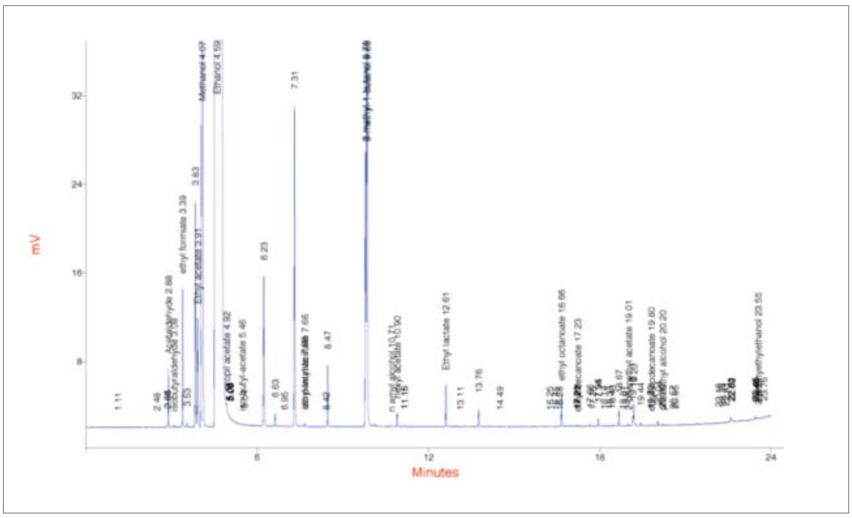

Figure 4. *Typical GC chromatogram of hearts fraction of pear*

for understanding quality of fruits, alcoholic fermentation and distillation processes as well as spirits. In Hungary, apple, pear, plum, cherry, apricot fruits for production of pálinka contain about 100 g/L, 140 g/L, 130 g/L, 150 g/L, 100 g/L soluble carbohydrates, respectively. Generally, these mashes resulted about 3-8 (v/v) % ethanol after fermentation processes. When the fermentation is going with something wrong, the concentrations of 2-buthanol and ethyl-propionate increased significantly. This result may be good indicator for development of pálinka fermentation process with standard quality.

compounds of mashes, heads, hearts and tails were determined by GC-FID and GC-MS, while the ions were measured using nuclear spectroscopy technique. Such works are done by several groups worldwide (Cortés et al., 2011). Typical GC chromatogram of hearts was demonstration in Figure 4. According to GC chromatogram about 55-85 peaks were detected; about 25 components were identified and quantified. Overall, each fruit samples have about 300-500 analytical parameters. Moreover, raw GC chromatograms of spirits (heads, hearts and tails) are also archived in database.

Relation database (SQL) of analytical data was designed and constructed using Oracle Database Engineer. At moment, about 400 data records were uploaded to the database. These data are available to consortium partners for freely analysis and evaluations. Recently, based on these data, the main cluster was constructed and applied for classification of different pálinka samples using principal component analysis and discriminant analysis techniques.

Evaluation of data

Data were evaluated by different ways. Experimental data of individual samples were analyzed

Different statistical methods (cluster analysis, principal component analysis, discriminant analysis, partial least square, support vector machines etc.) were adapted to search for correlations between properties of samples and geographical area, as well as conditions of production (Wei et al., 2010). About 150 parameters of 10 apricot samples were processed by cluster analysis and can be grouped into two classes (Figure 5). The first class contains samples apricots from 2010, meanwhile other classes consists of samples from 2011 year. Climatically, two years are completely different. In 2010, the fall was very high (highest since 1900), while in 2011 the amount of fall was very low. This may have resulted different in characters of two pálinka-s.

Based on experimental data and analytical methods developed, a trademark for pálinka was developed and registered by the Hungarian Patent Office (No. 204395). The symbol is demonstrated on Figure 6. This trademark is one of the important results of the project and managed by Wessling Hungary Ltd. Main goal of this trademark should define standard quality for pálinka production. Only Hungarian pálinka

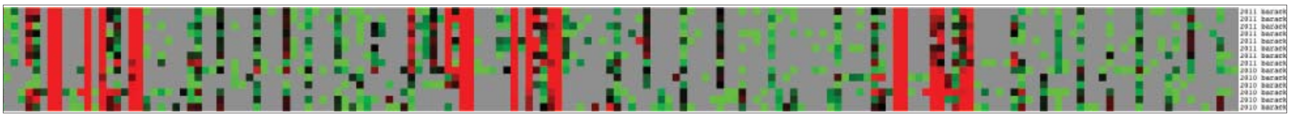

Figure 5. *Cluster analysis of different apricot samples*

producers can apply to use this trademark if quality of their pálinka meets strong criteria formulated in rule.

Figure 6. *Registered trademark of pálinka*

Conclusion and remarks

Some important results were obtained, but due to variable climate, a much higher number of samples is needed for the development of trusty classification system. This Project is under going in the proposed research plan, thus numerous samples are still in analysis and evaluation. Databases stemming from the project may provide a good base for the development of markers and a trace system for pálinkas, even for pálinka-s with Protected Geographical Indicator.

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The Environmental Ethical Aspects of the Cyanide Pollution of the Tisza River

On the night from 30 January to 31 January 2000, there was a break in a dam of a tailings pond filled with wastewater containing cyanide and heavy metals at a facility operated by Aurul mining company in Baia Mare (Nagybánya), Romania, and the worst environmental disaster of the century started. It happened long ago enough not to trigger anger any more and to become history, but recently enough to find evidences and witnesses who can remember the event.

Aurul joint stock company used cyanide to recover gold and silver from the ore mined in the area of Baia Mare. At the time of the disaster, this technology – due to its chemical instability and high toxicity – was only used in the United States and in underdeveloped countries where it is allowed by the law in spite of the considerable social protest. [1]

Worries emerged not only in connection with the technology but also with its practical implementation. The location of the plant significantly contributed to that the breaching of the dam caused severe consequences to the environment. Due to the location of the reservoir, the tailings containing heavy metals flew immediately into the Lapus (Lápos) River, then into the Somes (Szamos) River and then into the Tisza River. Figure 1 shows that the Lapus River practically encircles the facility, therefore, the immediate pollution of the surrounding waters was unavoidable after such an accident.

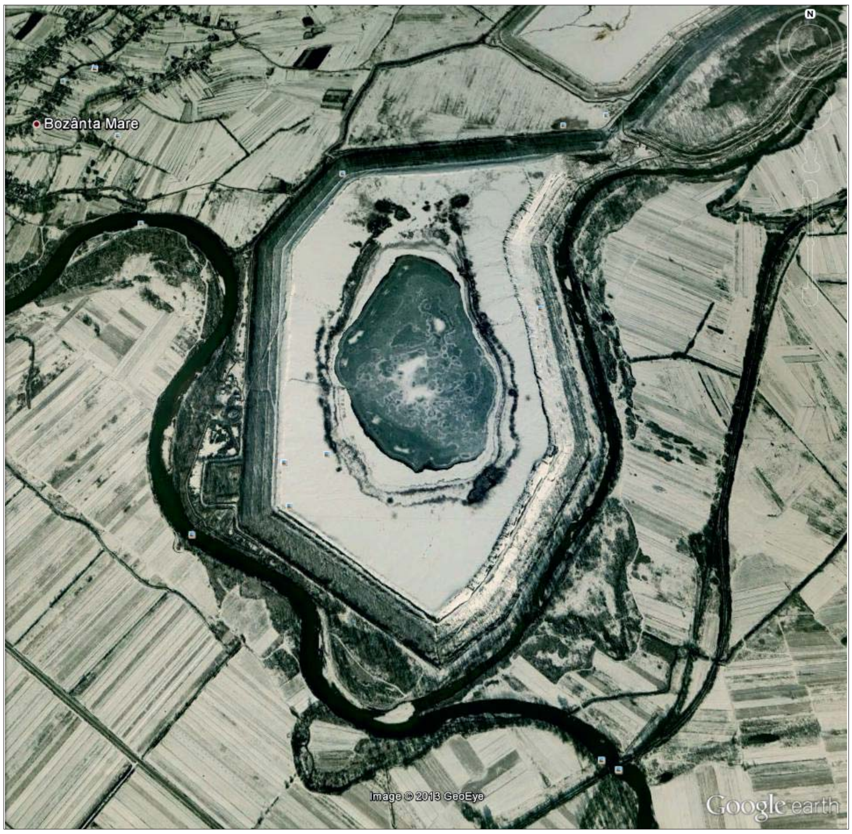

Figure 1: *The location of the tailings pond (Google Earth).*

The tailings used in mining operations is deposited, almost everywhere in the world, in open-air reservoirs which are generally protected by a dike. The liquid mud obtained in washing procedures is spread in a large area, as a consequence of which more types of polluting components get into the environment more easily and in larger quantities than from the original ore. The dike can be completely water-tight or partially permeable. In spite of the fact that water-tight dam (Figure 2) is the most suitable for storing hazardous materials, it is not really used because of its high price. The water-tight dam is used only after it is completely built. The partially permeable dam is not completely built when it is started to be used, instead, the level of the dam is continuously raised during usage. Dam types include dams built inward, outward and upward (Figure 3) depending on the direction of the next layer as compared to the axis of the ridge. The dam built inward is the most common one

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(Figure 3, at the top). The dam is raised by closing the liquid mud, the construction continuously moves inward by placing the water-tight rock on the tailings of the previous layer. It is widely used due to its low market price, but it bears the highest risk. The stability of the dam is significantly endangered when the level of water increases considerably. If this rise exceeds 15 m/year, pore pressure increases and dam stability will decline.

To reduce the costs, Aurul used coarse rocks separated by hydrocyclones from the tailings itself to build the dam of the tailings pond of 93 ha. The final slurry was transported to a reservoir lined with plastic 7 km south of Nagybánya. Theoretically, the system was 'closed': excess liquid was returned to the production process, but 'the Romanian authorities should not have permitted this system unable to prevent overflow' as this technology was – according to EU experts – designed faultily from several aspects and there were severe operational and maintenance faults, too. The hydrocyclones are non-operational below freezing-point, thus in winter the cyanide flew into the pond but the embankment wall was not raised. The Australian designers – who intended the open lake as a simple evaporation pond – underestimated the amount of precipitation to be taken which, in fact, was not exceptionally high that time – according to the Romanian official position that has been maintained up to now. The dikes of the tailings pond had not been constructed with regard to the local conditions and with due care, both the design and the implementation was inappropriate. Although plastic lining was used, the dikes were not properly compacted. 'No mining sites should be operated using this technology as it is out-of-date, endangers the environment and the risks arising from storing wastewater containing cyanide in open lakes are simply unacceptable' – concluded the working group of the European Union [1]

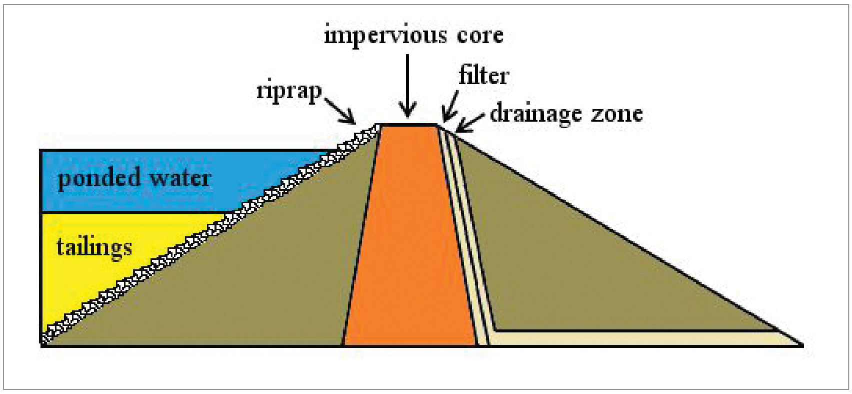


Figure 2: *Water-tight dam (Vick, 1983).*

The disaster was not only caused by the technical condition of the dam. In a comprehensive investigation, the Romanian Prosecution and the Police requested Aurul to present the construction documentation of the tailings pond prepared in 1997. The documents were prepared by the Australian company and was approved by an engineer of the Romanian Ministry of Public Utilities and Country Planning, who stated in the expert's opinion that 'the tailings pond can be safe under normal circumstances, the probability of dam breaching is one to ten thousand. However, this can only be maintained with continuous monitoring, … , and any increase in the ground water level exceeding one meter has to be reported'. The investigation revealed that the water level at the time of the disaster was 1.5 metres higher than the acceptable level [2].

In the event occurred at the Aurul company, the co-existence of two factors lead to the disastrous consequences: the inadequate monitoring of the 'low-cost' dam and the determination of the location of the tailings pond both had considerable role in the tragic outcome. The real catastrophe was practically caused by that no water damage prevention and emergency plan was available at the company, although it is required by the law of Romania.

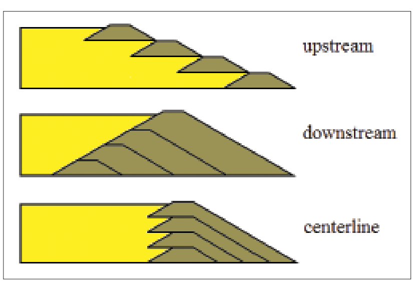


Figure 3: *Partially permeable dam types (Vick, 1983).*

There had been signs before the catastrophe that the operation of the plant is not completely faultless. In September 1999, cyanide water was leaking from the pipelines of Aurul due to material defect, leading to the death of five cows in the village of Zazar (Zazárfalu), for which the owners obtained compensation [3].

The dam was repaired for over two days, during this time at least 100 thousand m^3 of highly toxic wastewater flew away, containing about 120 tonnes of cyanide (the lethal dose for 2 million people). According to Romanian information, the concentration of cyanide bound to metals was approximately 400 mg/l in the discharged water. The technological accident was reported by the Romanian-Australian company with a 24-hour delay. By this time, the pollution had reached the Lapus River. The first official report on the pollution was sent to the Upper-Tisza Regional Inspectorate for Environment by the Cluj-Napoca (Kolozsvár) Waters Authority. The cyanide entered Hungary at Csenger on 1 February 2000 at 3 p.m. (Figure 5). The spill plume travelled at the speed of 3 km/h on the Somes River and then gradually diluted in the Tisza River in the Szabolcs-Szatmár-Bereg County reach, travelling by 2 km/h as a longer plume. The pollution left the country on 12 February 2000 [1].

In Hungary, measures had to be taken to protect the drinking water supply of settlements along the route of the pollution as the pollutant was highly toxic to humans, including the cities of Szolnok and Debrecen where the water is obtained from the Tisza River and the Eastern Main Canal branching off of the Tisza. [4]

The pollution caused further destruction on the Danube (Duna) River which it reached on 13 February with a concentration of 0.5 mg/l, in accordance with the information provided by the Serbian Minister of Environment. Fish were killed by the pollution even under Belgrade. When the spill plume returned to Romania at the Iron Gates gorge (Vaskapu-szoros) it had a concentration of 0.045 mg/l, but the values were still above the acceptable level (0.139 mg/l) at the Bulgarian reach [5].

The cyanide had the most spectacular effect on the living beings most susceptible to poisoning: fish. The total weight of dead fish transported to the protein processing plants exceeded 150 tonnes. However, this was only a part of the real volume as smaller fish were not collected at all, and the investigations demonstrated that a huge quantity of dead fish were left in the mud, and only a portion of them and only much later got on the surface. Accordingly, real damage can only be estimated in an indirect way. Comparing the results of the surveys performed in previous years and the results of fish population estimations, the calculations show that the total amount of dead fish added up to 1241 tonnes. The results of the microscopic examinations reveal that most of the planktonic living beings were also killed by the cyanide pollution on the affected reaches of the Somes and the Tisza [5].

Figure 4: *The breached dam of the Aurul tailings pond with machines compacting the new dam (mokkka.hu, etk.hu)*

After the disaster, numerous fishing ventures had to suspend their activities, endangering the livelihood of people. As a consequence of the incident, tourism also declined significantly.

The amount of damage is hard to be directly quantify not only in individual cases relating to the employment of people or nature. Tisza is more than just a river for the Hungarian people, it is a national symbol, and the nation has become deeply attached to it through folk songs, poems, artistic works and tales. And the monetary value of damage caused in the cultural, ethnographical and aesthetic environment is impossible to define.

After the catastrophe, the responsibility of several parties had to be examined. Beside the Australian company Esmeralda Exploration, the Romanian state also had a share in Aurul, but the Hungarian authorities could not claim for compensation from the Romanian state as no agreement had been concluded between Hungary and Romania that would make it possible. The damage, therefore, should have been compensated by Aurul. The Hungarian State claimed 28.6 thousand million Hungarian forints and its interests from the company for the damages caused by the disaster. The court established the responsibility of Aurul in 2006, and Aurul was obliged to take certain safety measures, too.

The Metropolitan Court of Justice stopped the case relating to the compensation claim against the company in 2009, consequently, Hungary did not receive any financial compensation. As Transgold joint stock company, the legal successor of Aurul went into liquidation, the company was terminated without legal successor, so there is no defendant to be prosecuted. [6]

Conclusions on the consequences

Four major conclusions can be drawn in connection with the consequences of the cyanide disaster of the Tisza.

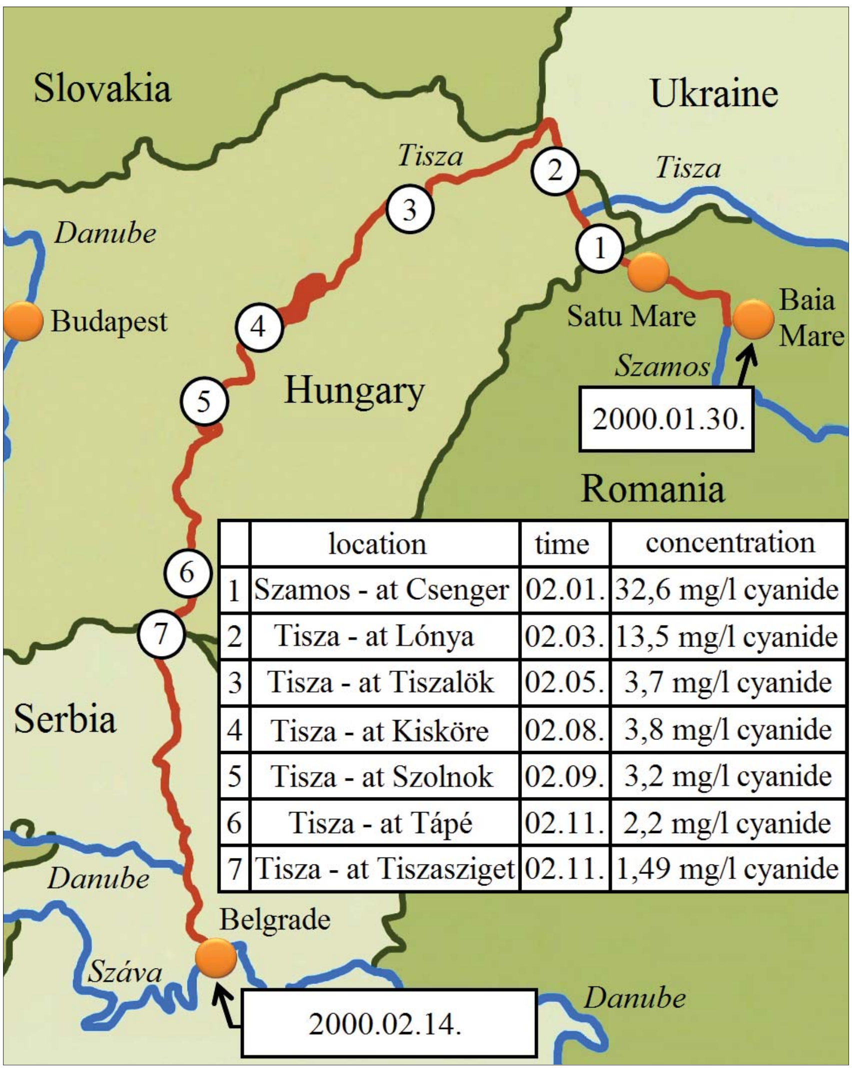
The spill plume that entered live

waters during the two-day repair of the dam affected Romania, Hungary and Serbia. The example of this ecological disaster clearly shows that *the damage is not restricted to the area of the country causing the pollution: environmental pollution does not respect the borders.*

The location of the reservoir, the priority of economic factors over safety, the neglecting of monitoring and safety activities all contributed to the occurrence of the catastrophe. However, accidents leading to such disasters *are easier to be prevented* by adequately performing the engineering and managing tasks introduced in the chapters listed *than to be restored later.*

It is impossible to specify the monetary value of damages in nature, the damages of people losing their work and income, and the damages in the cultural, ethnographical and aesthetic environment. The compensations often defined in indirect ways in such cases can rarely be enforced. The proceedings are usually not taken to international legal level, the defendant companies do not possess the necessary capital, and are often wound up in bankruptcy proceedings. *The amount of compensation (either paid or unpaid) never reaches the amount of damage caused.*

The consequences of such considerable environment pollution may include the most various areas. If more countries are affected by the catastrophe, responsibility is hard to be determined, and the case may generate anger in certain parts of the society. *This is the reason why environmental pollutions crossing country borders usually lead to international conflicts.*



	location	time	concentration
1	Szamos - at Csenger	02.01.	32,6 mg/l cyanide
2	Tisza - at Lónya	02.03.	13,5 mg/l cyanide
3	Tisza - at Tiszalök	02.05.	3,7 mg/l cyanide
4	Tisza - at Kisköre	02.08.	3,8 mg/l cyanide
5	Tisza - at Szolnok	02.09.	3,2 mg/l cyanide
6	Tisza - at Tápé	02.11.	2,2 mg/l cyanide
7	Tisza - at Tiszasziget	02.11.	1,49 mg/l cyanide

Figure 5: *The map of the passing of the pollution with cyanide concentration values (http://www.cian.hu/csucsertekek.htm)*

Conclusions on the ethical responsibilities

Conclusions can also be drawn in connection with the ethical responsibilities of engineers.

The industrial culture was not developed enough for the operation of such a hazardous technology, and more improved infrastructure would have been needed to the procedure requiring such a high level of thoughtfulness. The investors kept economic factors in view during the construction of the dam to the detriment of safety, similarly to those following the theory of utilitarianism in other processes that led to negative consequences.

If the location of the reservoir had been chosen more carefully, the consequences of the accident might have been restricted to a much smaller area.

The plant did not introduce stricter safety measures in spite of that other failures had occurred before the disaster, and the monitoring of the dam was also neglected.

Finally, we can draw the conclusion that such catastrophes can be prevented if engineers make the decisions in a thoughtful way, considering the consequences carefully and on the basis of secure environmental ethics principles.

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Kata Kalóczkai, Zoltán Naár, Attila Kiss, Péter Ákos Biacs

Investigation of pre- and probiotic functional foodstuffs in an in vitro *human gastrointestinal model system*

In vitro digestion models *are widely used in food and pharmaceutical industry to study the bioavalibility of food components, release profile of microencapsulation techniques and toxicology tests of newly developed biologically active materials for bringing products to the market. The results of the in vitro investigation differ from in vivo trials. The reason of this is in the difficulties of standardisation and accurate simulation of the very complex human gastrointestinal tract. The most accurate results usually provide the in vivo feeding methods, using humans or animals. However, they are time consuming and costly, it is not in accordance with the reduced animal experiments for research and needed special equipments, instruments and special trained persons. It needed to find accurate, precise in vitro digestion model. Therefore, we in the EGERFOOD Regional Knowledge Centre had the intention to develop a multi-phase digestion model through the application of a complex biotechnology fermentation processes. The gastrointestinal simulator system is used to study to the prediction of the physiological effects of so-called health promoting (functional) foodstuffs. During our activity it was investigated several „probiotic" products supplemented with living beneficial bacterial strains (e.g. dairy products: yoghurt, kefir) and foodstuffs enriched with „prebiotics" carbohydrates (e.g. bakery products: biscuits), which selectively promote the helpful microbiota in our intestine.*

In vitro human digestion model for food industrial applications

Concept of probiotics and prebiotics

The human large intestine is colonized by microorganisms. These microbe populations live in a symbiosis with the host and have an important role in well-being and health. In a normal health status the microorganisms with potential health benefits are predominant in number over potentially harmful ones. Due to environmental factors, stress or inefficient diet, the critical balance of the beneficial and potentially harmful microorganisms upset and the pathogenic species became dominant, thus creating a disease prone situation. There is much interest in the manipulation of the actions of human colonic bacteria through the dietary intervention of probiotic bacterial strains and prebiotics carbohydrates.

On the European market are functional foodstuffs enriched with probiotics and probiotic strains as food-additives. Probiotics are live microorganisms which when administered in adequate amounts confer a health benefit on the host (FAO/WHO 2002). *Lactobacillus* and *Bifidobacterium species* are the most common used

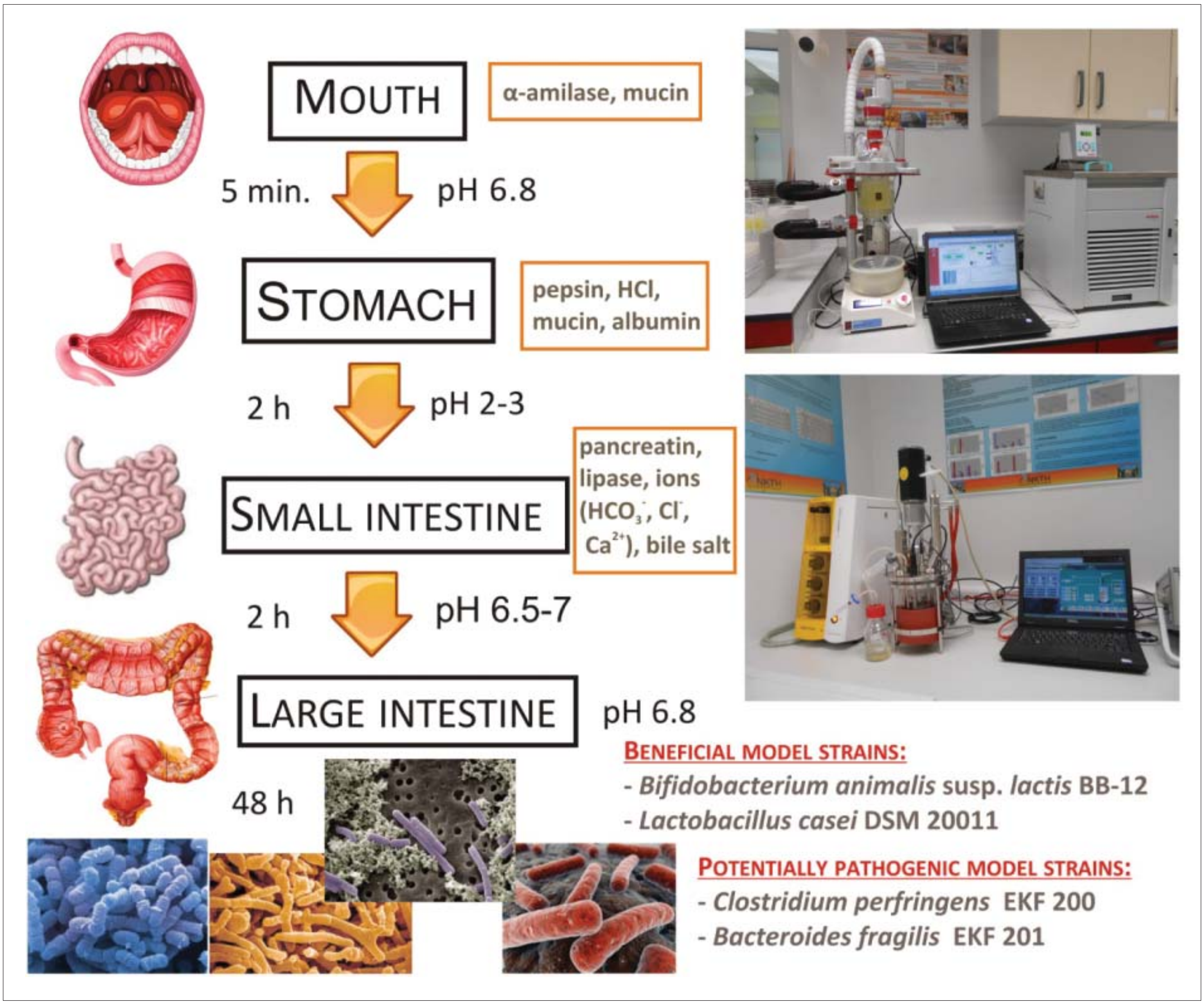

Figure 1 : *Schematic representation of the in vitro digestion model*

probiotics, but recently *Enterococcus faecium*, *Streptococcus thermophilus*, *E. coli* , some *Bacillus* species *Saccharomyces cerevisiae* are also used as probiotics. Different probiotics have been shown to be effective at different levels. It is difficult to standardise one optimal dose for all "probiotics" – scientific literature has documented health benefits for products ranging from 50 million to more than 1 trillion Colony Forming Unit (CFU)/day (ISAAP).

The prebiotic concept defined as the selective stimulation of growth and/or activity(ies) of one or a limited number of microbial genus(era)/ species in the gut microbiota that confer(s) health benefits to the host (Roberfroid et al. 2010.). Prebiotics are non-digestible carbohydrates that reach the colon in intact form. Most prebiotics are naturally occurring produced by many type of plants (chicory root, Jerusalem artichoke, garlic, onion, banana) as a means of storing energy and is typically found in roots or rhizomes. Prebiotic carbohydrates are used in food industry in the development of functional foodstuffs.

Set-up of the in vitro digestion procedure

The schematic representation of the digestion model developed by the EGERFOOD Regional Knowledge Centre is shown on Figure 1.. It describes a four step procedure simulating the gastrointestinal system in humans in a simplified manner. The model consist of four phase, imitating the digestion process in mouth, stomach, small intestine and large intestine. The digestion based on physiologically conditions, i.e. chemical composition of digestive fluids, pH and residence time periods typical for each compartment (Versantvoort et al. 2005). In the large intestinal phase are represented the four most common bacterial species in the human gut, two probiotic species namely *Bifidobacterium animalis* subsp. *lactis* BB-12 and *Lactobacillus casei* DSM 20011, and two potentially pathogenic species *Bacteroides fragilis* EKF 201 and *Clostridium prefringens* EKF 200.

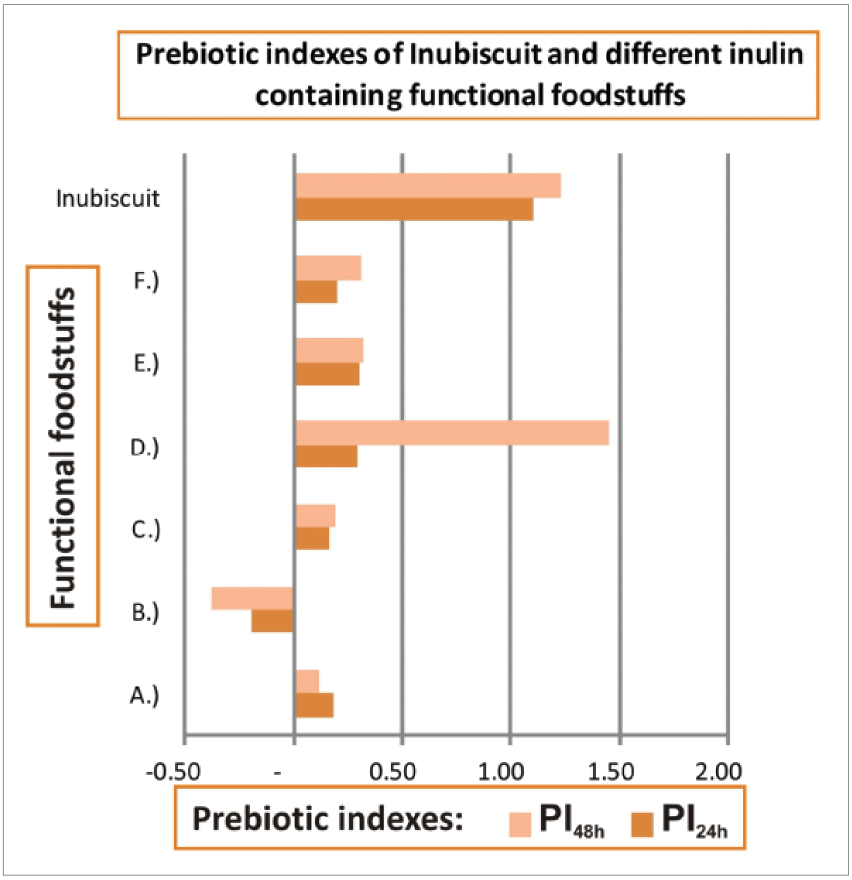

Figure 2: *Prebiotic indexes of Inubiscuit and some other inulin containing functional foodstuffs*

The temperature of the model is set to 37 °C. The incubation time of the different compartments is 5 minutes in mouth, 2 hours both in stomach and small intestine and 48 hours in large intestine.

Investigation the potential physiological effects of nutraceuticals during simulated gastrointestinal transit

In our institute we investigated many type of commercially available prebiotics, and prebiotics supplemented foodstuffs to predict their potential physiological effects in our *in vitro* gastrointestinal model system.

To try to quantify the prebiotic effect of different non-digestible prebiotic carbohydrates or supplemented foodstuffs Prebiotic index equation (Palframan et al. 2003) is used. Prebiotic index is a widely applied quantitative tool to determine the prebiotic effect of different carbohydrates. An increase in the populations of bifidobacteria and/or lactobacilli indicates a positive effect while an increase in bacteroides and clostridia indicates a negative one. On Figure 2. are represented the Prebiotic indexes of the Inubiscuit and some other inulin containing functional foodstuffs. Inubiscuit (Figure 3.) is a newly developed functional product of the EGERFOOD Regional Knowledge Centre, which is an inulin containing functional biscuit pronounced prebiotic impact. This biscuit is commercially available and produced by Detki Keksz Ltd.. We calculated the Prebiotic index values after 24- and 48 hours of incubation. The prebiotic indexes were high on all tested samples, except the B.). Product B.) also contains inulin but it involve different minerals too. The microelements (Ca, K, Mg, Zn, Fe, Mn, Cu, Se) provide buffer capacity to this product, which is beneficial if somebody suffer from hyperacidity in their stomach. However, the probiotic species were not able to grow on this substrate after longer exposure, because the consumption of this product did not allow the pH decrease to the optimal level of *Lactobacillus* and *Bifidobacterium* species, *in vitro*. Consequently, the food matrix has a key

Figure3: *Inubiscuit a newly developed functional product of the EGERFOOD RKC*

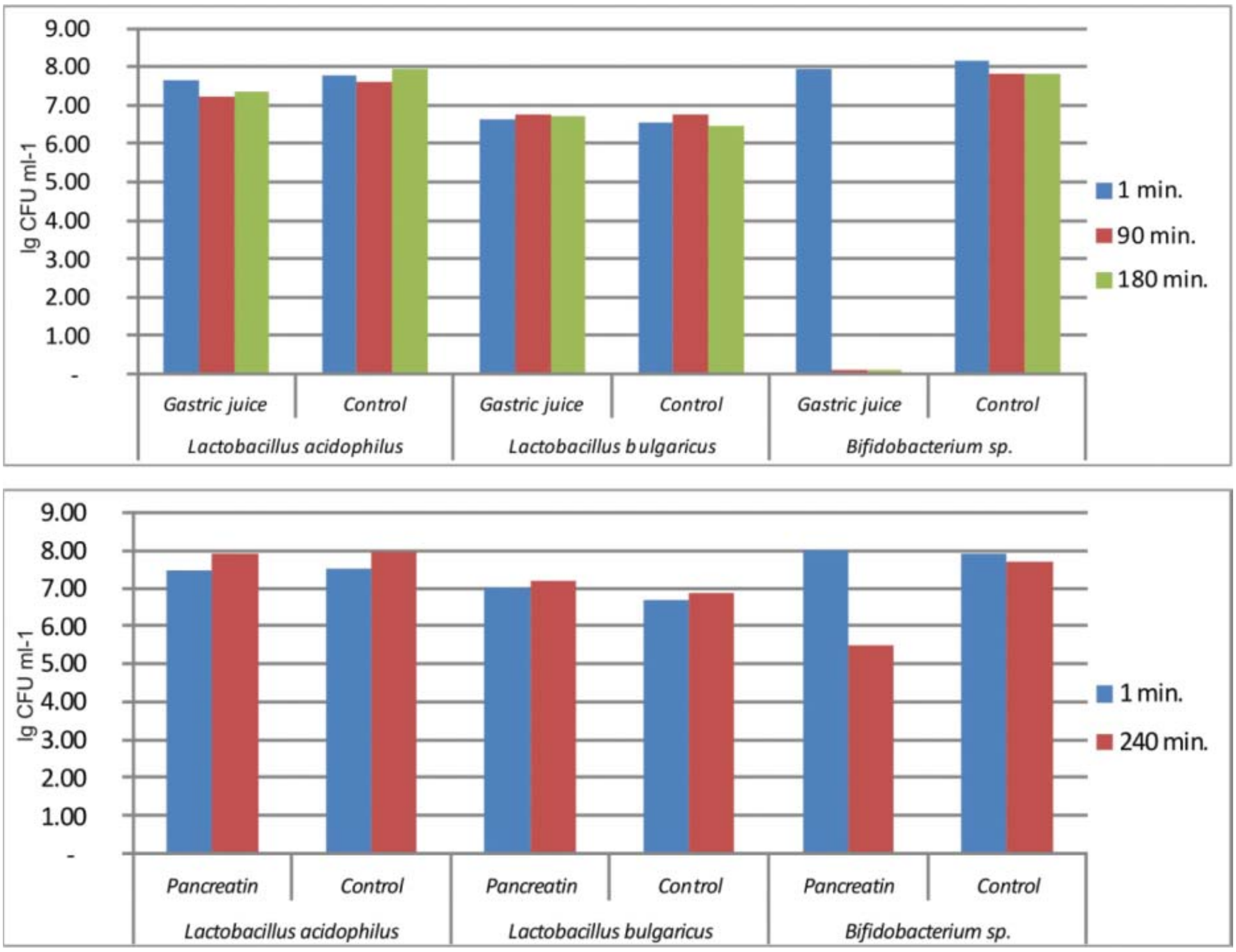

Figure 4: *Gastric- and small intestinal transit tolerance of some probiotic species originated by commercially available products*

role in the expression of the beneficial effect of the prebiotics.

In our gastrointestinal model we investigated the gastric and small intestinal transit tolerance of some probiotic species derived by commercially available capsules and powders (Figure 4. and 5.). On Figure 4. are represented the gastric and small intestinal transit on the viability of three probiotic species. The *Bifidobacterium sp.* exhibited complete loss of viability during the simulated gastric transit. The two tested *Lactobacillus* species showed an appreciate level of survival and considered tolerant to gastric transit. All tested bacterial strains retained viability during simulated small intestinal transit after 240 minutes. The bile resistance of bacterial species were investigated at 1, 2 and 3% bile concentrations. *Lactobacillus acidophilus* tolerated well the bile in all three concentrations during the ten hours of the treatment. *Lactobacillus bulgaricus* showed linear decrease in the viability with the raising concentration of bile. With the increase of bile amount the cell number of *Bifidobacterium* decreased.

Activities of the EGERFOOD Regional Knowledge Centre

Eszterházy Károly College performs high quality educational and research work, binds the two and half century traditions in higher education of the city of Eger.

The **EGERFOOD Regional Knowledge Centre** was established in 2006. Since than, it operates as a dominant professional institute in the fields of food science, food-safety technologies and bioanalytics in Hungary. **35** different and versatile research projects are carried out in collaboration with various industrial and academic partners from both Hungary and Europe. In the last three years the knowledge center elaborated **13** new patents and **22** new know-hows, realized **27** important technology transfer and **37** technological innovation, developed and introduced **4** commercially available food products. The principal activities of the Institute are food analysis, food microbiology and hygiene related studies, electronic traceability system and food safety studies, origin protection, authenti-

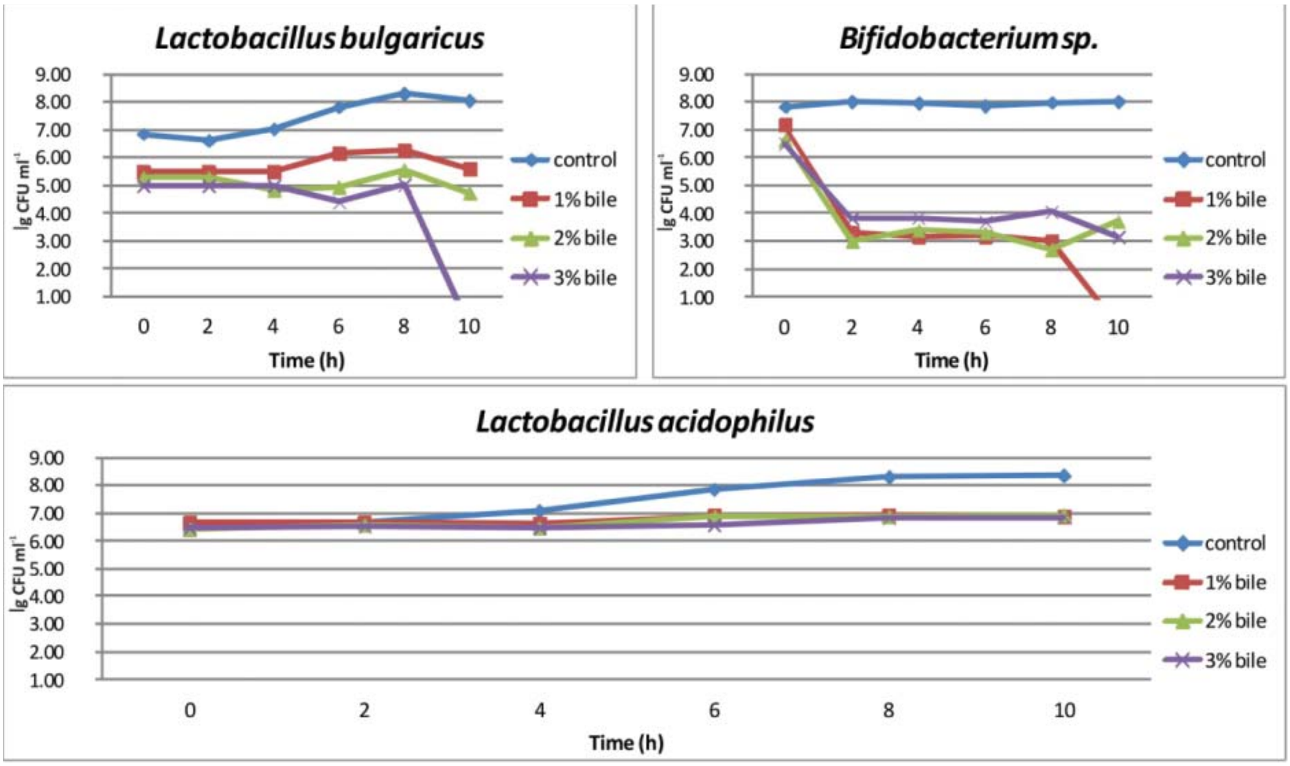

Figure 5: *Bile resistance of probiotic species in commercially available products*

cation and molecular biology studies. The scientific work occurring on four main platforms: analytical chemistry, biosensor development, molecular biology and microbiology. The **laboratory of microbiology** has been accredited in 2009. It provides food industrial services as technology and personal hygiene investigation, identification and characterization of danger sources in food industry and determination of product shelf life.

Consequences

The *in vitro* gastrointestinal simulator is a useful tool for analysis of the potential physiological effects of foods and nutraceuticals *(Hur et al. 2011).* Prebiotic carbohydrates and probiotic bacterial strains are important factors to maintain digestive health because of their positive influence on the intestinal microflora. The investigated bacterial strains showed different tolerance against the digestive enzymes, the most susceptible species was the *Bifidobacterium sp.* The presence of food matrix can alter prebiotic properties and improve the viability of the ingested probiotics during the gastric and small intestinal transit. Our results show that the consumption of prebiotic carbohydrates supports the beneficial probiotic strains in the gut. Thus, these dietary fibers can strengthen the well-being and with an equilibrate diet it can provide us the basic of a healthy way of life. Recently, in our institute we are working on the development of a more sophisticated system that will be supplemented with human intestinal epithelial cell line *(Cencic et al. 2010)* to screen the bioavailability of functional and bioactive components or risk assessment of toxins and study the interactions between the host and the members of the intestinal microbiota.

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in various research and monitoring programs, and thus can be linked with data on forestry, agriculture, and nature conservation. This data includes agricultural land use maps, satellite images, CORINE land-cover maps, soil maps, forest stand maps, and Natura 2000 site maps, among others. In Hungary, the NGMD was the first operating database for wildlife management and nature conservation providing full GIS capabilities and supporting geographical analyses.

The prime objective of this project has been to bring together database technology and wildlife management requirements and problems for comprehensive analyses. The technical aspects and inputs to the database were developed in parallel; however, the resulting models have been tested with separate data from the field. The functioning NGMD system was completed in 1996, and has been available for regular use since then.

The database is and has been used for inter alia:

- The design of the 24 game management regions based on multivariate analyses of game management and environmental data and input to the plan for the 24 game management regions.
- Forming a theoretical framework for the 3-level game management system, introduced in 1996/1997, as well as the development of the annual, long-term and regional management plans, and data input for the long term (10-year) management plans of the GMUs.
- The determination of a maximum sustainable population size for red deer, roe deer, and wild boars in Hungary, and as a follow up, for the design and implementation of the big game harvest quota system.
- Data processing of the annual spring population size reports, game harvest plans, and game management reports, and in connection to these, the design and update of the software package used by the hunting authorities to collect and statistically analyze reports on spring population size, annual game harvest plans and annual game management reports. Designing and updating the software package used by Trophy Scoring Committees for the evaluation process.
- The collection, compilation and maintenance of the state and county level databases for game management, starting in 1960 for spring populations and harvest, and in 1970 for trophy scoring/evaluation. The annual publication of "Game Management Database," a booklet containing the game population, game harvests, and trophy evaluation data for the previous hunting year.
- Designing and updating a public web site, which makes county, regional and state level game management data freely available for public use. This home page also provides all hunting related legislative information, and documents/ guidelines necessary for preparing game management plans.
- Professional advisory services to game management units, state foresters, county game management and hunting authorities and NGOs. Providing information for expert witnesses in legal cases, and advisory input to the Ministry of Rural Development on strategic planning and high level decision-making.

Final remarks

Advances in ecological science and increasing environmental awareness have resulted in changes in the management of renewable natural resources. In Hungary this need was realized in the early 1990s and it opened the way to start the development of the National Game Management Database. Since 1993, when the initial development of the NGMD started, we managed to build up a comprehensive database of game management and hunting data.

This database satisfies the needs of game managers and authorities as it contains the data on game populations and game harvests in a way that can be used for multiple analytical procedures. It provides sound bases to analyze trends of game populations in relation to harvest and/or environmental changes. The database and the analytical tools are especially useful for understanding local/regional changes in environmental conditions, harvest regimes, management attitudes, etc. Using this organized database as a foundation, temporal and spatial analyses can be set up on much wider scales and understanding of long-term processes can be improved.

In order to increase the usability/functionality of NGMD we kept it as open as possible. Consequently, it can be connected with another natural resource management, agricultural, or nature conservation databases. It is compatible with data collected from various wildlife research and monitoring programs. In Hungary, the NGMD was the first operating database in wildlife management and nature conservation providing full GIS capabilities, supporting geographical analyses.

During the last 20 years, the NGMD has facilitated the decision-making and planning efforts at various levels of game management administration. The ability to balance a scientific approach with practical requirements seems to be an essential element for successful conservation of biodiversity and wise use of renewable natural resources like wildlife populations. It is extraordinarily important that the information of the NGMD can be connected to other databases like those pertaining to forestry and nature conservation. This connectivity allows for broadening the applicability of wildlife population and management data.

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