ANTHROPOLOGIE • XLVII/1–2 • pp. 81–88 • 2009

OSKAR NOWAK, JANUSZ PIONTEK, ARTUR REWEKANT

OPPORTUNITY FOR NATURAL SELECTION IN THE RURAL POPULATION OF PODBEREZCE (UKRAINE) IN THE 19th AND 20th CENTURIES

ABSTRACT: The goal of this communication is to present a case study describing the opportunity for natural selection researched through the use of the Crow's Index. By measuring differentiated fertility (I_f) and mortality (I_m) of the local population of Podberezce, Ukraine, we argue that the decrease in the opportunity for natural selection was caused by the improvement of the overall economic status of the observed population. The database consists of archival data from 201 questionnaires (106 males and 95 females) collected between 1937–1938. Crow's index has been very useful in the differential analysis of fertility and mortality in various human populations. Crow's Index values of the investigated population are close to the averages observed in other rural Central and Eastern European groups at the turn of the 20th century.

KEY WORDS: Crow's index – Mortality – Fertility – Natural selection – Ukraine – Eastern Europe

INTRODUCTION

In the development of human biology the complete explanation of the research problems can not be guaranteed even by the very extensive and detailed observations of contemporary populations. Therefore it is necessary to obtain data concerning phenomena taking place on the population level in the past. This kind of data enables a proper understanding of the functioning of contemporary populations as well as the prediction of changes that may occur in the future. Studies which are based on archival records of fertility, mortality and mating practices in local populations create the possibility of the inquiry into the historical development of the structure and biological dynamics of human groups and complete the knowledge coming from the investigation of skeletal collections.

Due to advances in medicine the role of natural selection in the dynamics of microevolutional changes, though still significant, is somewhat diminishing. It is possible to assess the intensity of the selection of an individual gene or opportunity for natural selection, since the intensity or opportunity correlates with differences in mortality and fertility between different genotypes. However, measuring of the total opportunity of natural selection to operate is not an easy task. Child mortality and differentiation in female fertility are fairly easy to estimate, but relationships between these variables are difficult to capture. Nevertheless, certain factors determining the scope of opportunity for natural selection can be defined. For instance, the presence of certain genes brings about an individual's death and that some women are infertile due to genetic reasons. These two elements limit the scope of opportunity for natural selection. Another limit may be child mortality resulting from unidentified deletions of certain genes and frequency of women with acquired infertility in the population. Within this scope of changes there is an actual level of opportunity for natural selection.

J. F. Crow (1958) proposed a simple method to measure the opportunity for natural selection based on demographic data. Crow's index has proved to be very useful in populational studies and has been used almost universally in the differential analysis of fertility and mortality in various

human populations (e.g., Johnston, Kensinger 1971, Spuhler 1976, Gonzales, Prado 1986, Jorde, Durbize 1986, Reddy, Chopra 1990, Dharani Priya *et al.* 2003, Korpelainen 2003, V. L. N. Rao *et al.* 2006, Tripp-Reimer 2008, Lakshmi *et al.* 2009). Crow's formula can also be employed to study historical data, including surveys with questions worded in a manner which now makes it possible to extract from them information important for the assessment of the biological condition of the population. It is possible because Crow arbitrarily splits the estimate of the opportunity for natural selection into two components: opportunity for natural selection resulting from differential mortality (I_m) and opportunity for natural selection due to differential fertility (I_f).

The historical period chosen for the present study is particularly important. Gradual decline of the feudal structure and the formation of social relationships typical of capitalistic system began. The final result of the above-mentioned changes was the appearance of demographic processes commonly known as "the demographic revolution". These phenomena were interrelated with the transformation of ecological and cultural situation of human groups, and must have influenced the gene pool (Henneberg 1978, Korpelainen 2003). This is why it is important to use historical sources and data gathered at the turn between the 19th and 20th centuries in anthropological studies, especially when the materials contain biological and demographic characteristics of groups with different levels of technological and organisational development. This kind of sources can show the dynamics of changes regarding the opportunity for natural selection.

The aim of this study is to present basic characteristics describing the opportunity for the operation of natural selection through both differential fertility (I_f) and mortality (I_m) in the local Central European population from the 19th and 20th centuries.

MATERIAL AND METHODS

In the years 1937–1938 F. Wokroj conducted anthropological field studies among the Ukrainian population of Podberezce, a village situated in the Lvov district. The village of Podberezce is situated 14 km from Lvov, on the Lvov to Zloczow route (*Figure 1*). It is an old settlement, founded under the Teutonic (Magdeburg) law. The first written mention of Podberezce is dated back to 1454. Its inhabitants, mainly of the Greek Orthodox confession, belonged to the wealthiest in the area. The results of Wokroj's anthropological research revealed that the village population was generally well-built and well-nourished. The Podberezce inhabitants were mostly farmers and artisans selling their produce in Lvov and its suburbs. Wokroj (1948) also reported that a number of young people from the village studied at the universities in Lvov and abroad indicating a level of affluence of the village population.

In the 1930s the settlement attracted attention of medical circles due to a high incidence of tuberculosis (approx. 30%) in the community, despite its relatively good material, geographic and climatic conditions. The then Institute of Anthropology of the Lvov University was asked to carry out anthropological research on the population in order to investigate its potential predisposition to the disease. The research results, in the form of research records, currently kept in the Institute of Anthropology of the Adam Mickiewicz University in Poznań, served as a basis for this study. After the World War II Prof. Wokroj began his work in the Institute of Anthropology and the research records were at his disposal. They served as a source of important information. First of all family name and birth year of the investigated person was noted. Then the number of brothers and sisters (living or those who died before reaching the age of 14) was taken into account. The same data of the offspring were gathered as regards the person's parents. The records also contained anthropometric information concerning the height and body mass, and head measurements. Only bio-demographic data were taken into account in the present study.

The data from the records formed a database which was subsequently a source of information on individuals with accurately documented life history, born between 1850 and 1918 (106 males, 95 females). The subjects were aged from 18 to 85 years. The study material has been divided into three cohorts of individuals born between: 1850 to 1879, 1880 to 1899, 1900 to 1918. Previous historical and bio-demographic surveys (Borowski 1962, 1967, 1969, Henneberg 1978, 1979, Kędelski 1980, 1985) have revealed that after the transformation into free-market capitalistic economy (which took place in the mid-19th century), significant changes of the demographic structure of the population in Central and Eastern Europe occurred. The first cohort (1850–1879) was created by people who lived for the greater part of their lives before the period of socio-economic transformation. The second one (1890–1899) consisted of human groups living during the initial phase after the transformation, and the third cohort (1900–1918) spent the whole life in the post-feudal socio-economic period. We are aware of the fact that the cohorts are small, however, we think that our population makes an interesting contribution to the study of the opportunity for natural selection in Central and Eastern Europe at that time. We also assume that the survey is a continuation of our earlier analyses concerning secular trend of stature. The obtained results were also published in "Anthropologie".

The index of opportunity for natural selection has been calculated using Crow's formula (Crow 1958). This formula is very popular in the studies of demographic trends and the assessment of the opportunity for the operation of natural selection in different contemporary populations. Its usefulness as regards the opportunity for the operation of natural selection was presented by Spuhler (1976), Piontek and Henneberg (1981), Luna and Moral (1990), and later by other researchers (Ulizzi *et al.* 1998, Astolfi *et al.* 2000, Alfonso-Sánchez *et al.* 2004, Budnik *et al*. 2004). Nowadays Crow's formula is used mainly to describe the opportunity for the operation of natural selection in historical populations (studies of the register data) and contemporary

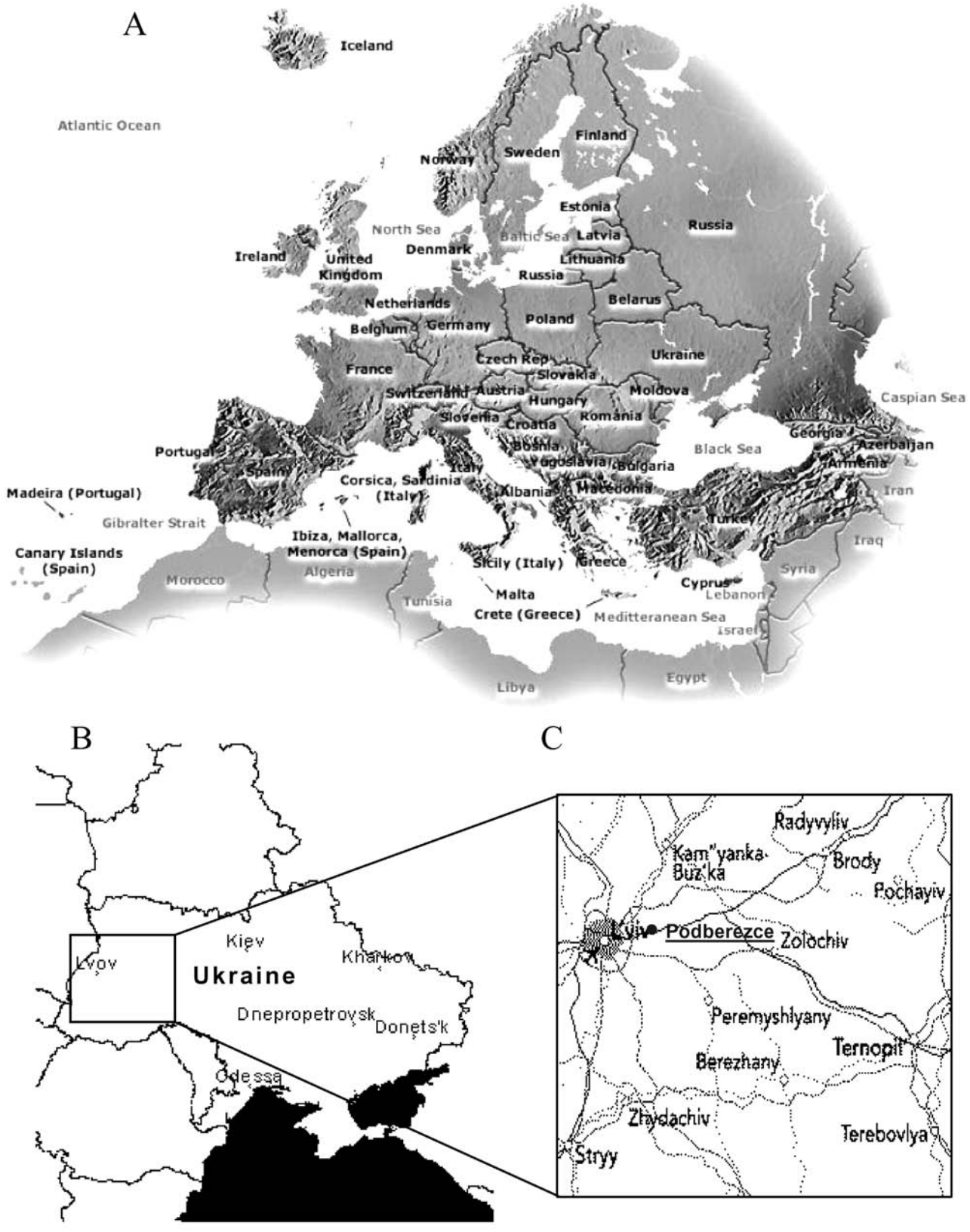

FIGURE 1. Location of the Podberezce village. A. Map of Europe, B. Schematic map of Ukraine, C. Closer view of the Lvov region.

human groups (questionnaire inquiries). In order to estimate the value of Crow's formula one needs the number of children of the parents who outlived the reproductive period, and number of children who died before the age of 14.

The index has two components: the index of opportunity for natural selection through differential mortality I_m and the index of opportunity for natural selection through differential fertility I_f :

$$I = I_m + (1/P_s)\, I_f$$

$$I = P_d/P_s + (1/P_s)\, \frac{V_f}{\bar{x}^2}$$

where:

P_d – fraction of offspring deceased before reachingreproductive age,

P_s – fraction of offspring reaching reproductive age ($P_s = 1 - P_d$),

V_f – variance of the number of offspring in completed family,

$\bar{x}^2$ – square of arithmetic mean of this number.

The data were processed using Excel 7.0 calculation spreadsheet and Statistica 5.1 software package.

RESULTS AND DISCUSSION

Tables 1–3 represent the values of individual demographic parameters used for the calculation of Crow's index and the values of the index in cohorts, for the total population and by sex. A significant difference can be observed between the I_m value in the first cohort and its values in the other cohorts. The 1850–1879 cohort exhibits a considerably higher mortality of individuals under the reproductive age. The difference is evident especially for males. In the two successive cohorts we can see a decline in the value of this component of Crow's index. A high value of the index of opportunity for natural selection through differential mortality determines a high value of Crow's index for both sexes. Differential fertility I_f of the Podberezce population has similar values in the first two cohorts, while for the 1900–1918 cohort we can see a decline in the index value.

The material offers little data describing the family model. From the research sheets we managed to extract the following demographic data: fertility of the generation of a subjects' parents equalling the total number of children in the family of the subject, number of subjects' siblings surviving to reproductive age, number of subjects' siblings deceased before reaching reproductive maturity. Mean values of the above data in cohorts are presented in *Figure 2.* The fertility of subjects' parents remained unchanged over the entire period under study, ranging from 5.19 to 5.51 children in completed family. The greatest number of children being the siblings of the subjects died in the first cohort (1851–1879).

In the studied rural community of Podberezce, a high ratio of child mortality was observed in the first cohort (1850–1879). We can presume that the high mortality of individuals before reproductive age in the years 1850–1879 was due to high incidence of tuberculosis in the community. Tuberculosis had a similar effect on the Danish population between 1890–1940 (Johansen 1999). In the next two cohorts we observe a decrease in I_m value. The lowest value of the I_f index was noted in the 1900–1918 period. This can be interpreted as an indication of growing birth control and family planning. The number of children a woman can have is, however, determined by a number of factors. Childless women are not always infertile. Factors such as immunologic incompatibility of partners, male infertility

TABLE 1. Components of Crow's index and their values in cohorts.

Cohorts	P_d	P_s	I_m	V_f	x^2	I_f	$1/P_s$	I
1850-1879	44.3	55.6	0.797	5.25	26.9	0.195	0.018	*0.800*
1880-1899	30.1	69.9	0.431	6.13	27.2	0.225	0.014	*0.434*
1900-1918	23.9	76.1	0.314	4.47	30.3	0.148	0.013	*0.316*

TABLE 2. Components of Crow's index and their values in cohorts for males.

Cohorts	P_d	P_s	I_m	V_f	x^2	I_f	$1/P_s$	I
1850-1879	47.6	52.4	0.908	5.62	31	0.181	0.019	*0.912*
1880-1899	32.7	67.3	0.486	4.4	23.32	0.189	0.015	*0.489*
1900-1918	23.8	76.2	0.312	4.34	26.7	0.163	0.013	*0.314*

TABLE 3. Components of Crow's index and their values in cohorts for females.

Cohorts	P_d	P_s	I_m	V_f	x^2	I_f	$1/P_s$	I
1850-1879	40	60	0.667	4.72	22.5	0.210	0.017	*0.670*
1880-1899	28.3	71.7	0.395	7.49	30.5	0.246	0.014	*0.398*
1900-1918	24	76	0.316	4.69	24.8	0.189	0.013	*0.318*

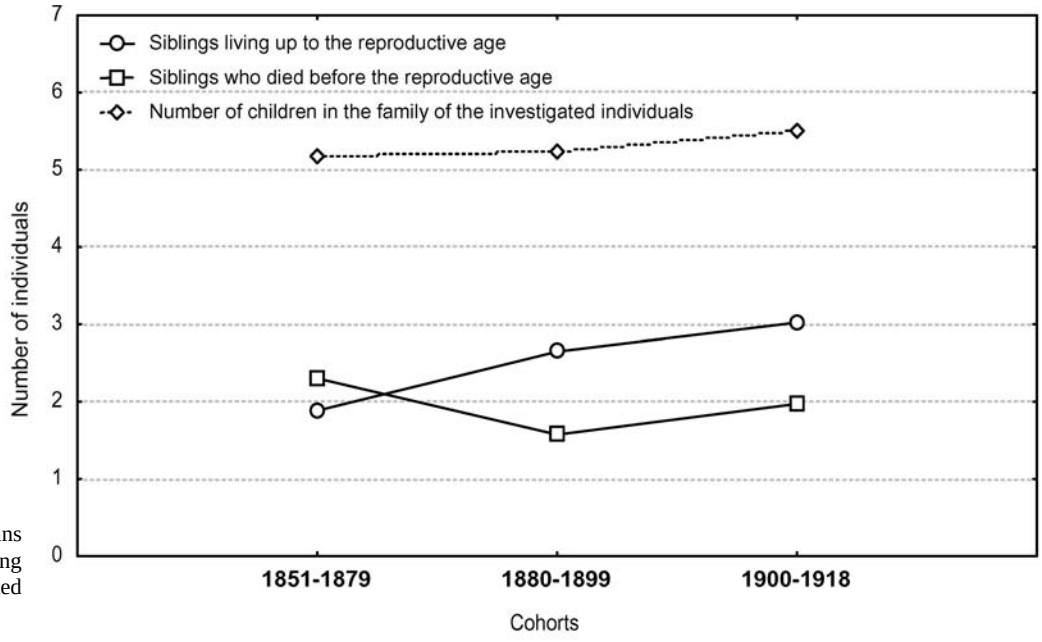

FIGURE 2. Arithmetical means of demographic data concerning the families of the investigated individuals in cohorts.

and a condition of woman's health also have an effect on the number of offspring (Szklarska, Welon 1996, Dziewięcki 1998, Johansen 2000, Pawłowski *et al*. 2000). Perhaps this decreased value of I_f index observed in the third cohort under study is also a hidden effect of the 30% incidence of tuberculosis in the population.

Researchers are often interested in groups who have entered the reproductive age in the stage of a "demographic transition". An example of such studies is the Finnish population, and more specifically the 1870–1949 cohort (Korpelainen 2003). The similar trend is also present in the population under study and concerns the index of opportunity for the operation of natural selection through differential mortality. The index decreases systematically and has particularly low value in the last cohort.

The data for the population under study were compared with the data for other local groups, in order to capture any potential differences or similarities in opportunity for natural selection (*Table 4*). A graphic illustration of this comparison is presented in *Figure 3*. This figure also shows different patterns of changes depending on the level of civilisational development and socio-cultural factors. In the coordinate system formed by the values of indices of opportunity for natural selection through differential fertility (Y-axis) and mortality (X-axis), the distribution of the population is as follows:

As expected, groups with a natural fertility system (which we refer to as „ethnic") are situated at a considerable distance from technologically developed populations. The first cohort of the Podberezce population seems to be fairly close to these „ethnic" populations, undoubtedly due to a high I_m value. The two initial cohorts (Podberezce 1 and 2) remain very close to rural and agricultural populations from this territory. We can say that as regards opportunity for natural selection the group under study falls within the range of mean values characteristic of rural populations. In such populations, traditional standards of demographic equilibrium were expressed in a relatively higher mortality and at the same time in a birth rate maintained at a level fit to balance the mortality. Following a considerable decline in mortality (especially among children), new social mechanisms of birth number determination start to operate, oriented for the maintenance of low I_f index values (Luna, Moral 1990, Kadashnikova *et al*. 1996).

CONCLUSIONS

The introduction of the free-market capitalistic economy in Central and Eastern Europe in the mid-nineteenth century created a considerable economic boom, significant improvement of living conditions and increase in migrations (village→town). These changes also determined the overall decrease in fertility and the decline in mortality of adult individuals. Comprehensive records concerning bio-demographic data of the historical period discussed were presented by Borowski (1962, 1967), Henneberg (1978, 1979), and Kędelski (1980, 1985).

The results of the present study support earlier observations published by the above-mentioned authors. However, it is worth emphasising that the socio-economic transformation which took place in Central and Eastern Europe in the mid-nineteenth century caused very important changes of the bio-demographic structure in a small local community. Our results show that the demographic transition could have changed not only the parameters of the demographic structure of the population under study but, to a large degree, its genetic pool and biological and ecological condition. The number of anthropological surveys which analyse genetic and phenotypic effects of demographic transition seems to be insufficient in comparison with the studies focusing only on demographic aspects. Therefore we

TABLE 4. The values of Crow's index and its components for various populations.

Populations	**Reference**	**I_m**	**I_f**	**I**
Podberezce	Own data			
1850-1879		0.79	0.19	0.80
1880-1899		0.43	0.22	0.43
1900-1918		0.31	0.14	0.31
"Ethnic" populations				
Cashinahua (Peru)	Johnston, Kensinger (1971)	0.79	0.11	0.98
San Pablo (Mexico)	Halberstein, Crowfo rd (1972)	1.63	0.31	2.46
Nomads of Chile	Crow (1966)	1.38	0.17	1.78
Agricultural populations				
Maragateria (Spain)	Bernis (1974)	0.22	0.47	0.80
Camprodon (Spain **)**	Torrejon, Bertranpetit (1987)	0.04	0.28	0.33
Rural Chile	Crow (1966)	0.33	0.22	0.62
Developed populations				
France (1900)	Jacquard (1974)	0.26	0.84	1.32
Australia (1900)	Cavalli-Sforza, Bodmer (1971)	0.25	0.40	0.75
Ute (USA)	Tyzzer (1974)	0.07	0.47	0.57
Rural populations				
from Russia (modern)				
Wologda	Bolshakova, Revasov (1988)	0.19	0.35	0.60
Pinega	Bolshakova, Revasov (1988)	0.53	0.82	1.79
Kursk Oblast (rural)	Ivanov *et al.* (1997)	0.01	0.24	0.26
Urban populations				
from Russia (modern)				
Galich	Bolshakova, Revasov (1988)	0.10	0.37	0.52
Sharia	Bolshakova, Revasov (198 8)	0.11	0.36	0.51
Kursk Oblast (urban)	Ivanov *et al.* (1997)	0.05	0.45	0.54
Rural populations				
from Poland (modern)				
Kashubians from Hel	Budnik (1996)	0.29	0.09	0.38
Pomeranian Kashubians	Budnik (1996)	0.08	0.17	0.26
Great Poland	Henneberg (1978)	0.05	0.26	0.32

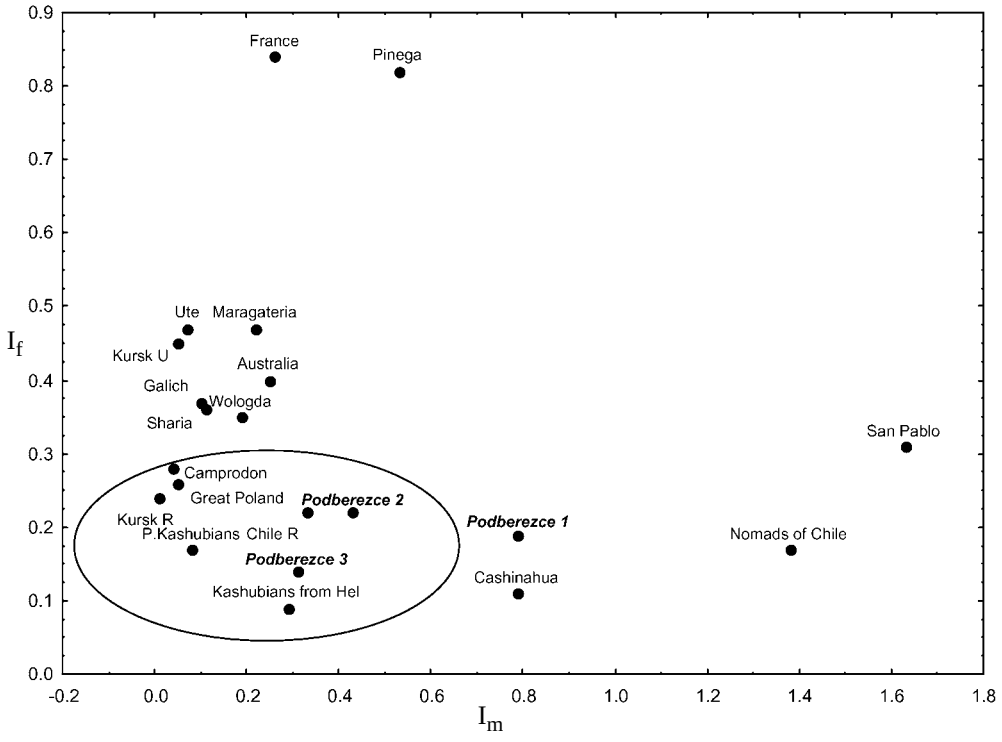

FIGURE 3. Distribution of the populations characterised by different degree of the technology and civilisation development, and the investigated population scattered in the co-ordinate arrangement created by I_f and I_m values. Podberezce 1 – cohort I, Podberezce 2 – cohort II, Podberezce 3 – cohort III.

suggest that our conclusions can make an important contribution to further studies of bio-demography, human ecology and population genetics concerning human groups functioning in "the demographic phase" and socio-economic turning points.

Crow's index values in the population from Podberezce do not differ, over the entire period under study, from mean values encountered in rural/agricultural populations at the turn between the 19th and 20th centuries in this part of Central Europe. When compared with other populations, Podberezce positions itself closer to the Kashubians (Northern Poland), rural communities of the Wielkopolska region (Western Poland), and agricultural populations from Chile and Spain, than to rural populations from Russia.

A relatively high I_m value in the first cohort may be an effect of high incidence of tuberculosis (30% of the population) documented in historical sources. In following years a gradual decline in pre-reproductive mortality of offspring is observed, which is undoubtedly an effect of improving social and living conditions, and of progressing urbanisation of the region.

In agreement with the thesis that a cultural progress is accompanied by a growing share of I_f in the total opportunity for natural selection, we observe an increase in this variable in the first two cohorts of the population studied. A decline of the index in the 1900–1918 cohort may be an effect of a decrease in the reproductive capacity or of the dissemination of broadly understood birth control methods.

At that time various parts of Europe exhibited the transition to the free-market capitalistic economy. This kind of change of the economic structure caused the change of the demographic structure of human populations including the group under study. The observed decrease in the opportunity for natural selection through differentiated fertility (I_f), and the decline in child mortality (I_m) were connected with the improvement of the overall economic status of the group passing over to the free-market capitalistic economy.

REFERENCES

ALFONSO-SÁNCHEZ M. A., CALDERÓN R., PEÑA J. A., 2004: Opportunity for natural selection in a Basque population and its secular trend: Evolutionary implications of epidemic mortality. *Human Biology* 76: 361–381.

ASTOLFI P., ULIZZI L., ZONTA L. A., 2000: Natural selection and reproductive behaviour in Italy, 1930–1993. *Human Biology* 72: 349–357.

BERNIS C., 1974: *Estudio biodemográfico de la población maragata*. Doctoral thesis. University Complutense, Madrid.

BOLSHAKOVA L. P., REVASOV A. A., 1988: Heritability of fertility in human populations and the structure of the Crow index. *Genetika* 24: 340–349.

BOROWSKI S., 1962: *Rozwarstwienie wsi wielkopolskiej w latach 1807–1914.* Rada Naukowo-Ekonomiczna przy Prezydium WRN w Poznaniu, Poznań.

BOROWSKI S., 1967: Zgony i wiek zmarłych w Wielkopolsce w latach 1806–1914. *Przeszłość Demograficzna Polski* 1: 111–130.

BOROWSKI S., 1969: Demographic development and Malthusian problem in the Polish territories under German rule, 1807–1914. *Studies of Historical Economics* 3: 159–179.

BUDNIK A., 1996: Polish Kashubians and chosen European populations – genetic similarities and differences [in Polish]. *Przegląd Antropologiczny* 59: 31–43.

BUDNIK A., LICZBIŃSKA G., GUMNA I., 2004: Demographic trends and biological status of historic populations from Central Poland: The Ostrów Lednicki microregion. *Amer. J. of Phys. Anthropol.* 125: 369–381.

CAVALLI-SFORZA L. L., BODMER W. F., 1971: *The Genetics of Human Populations.* W. H. Freeman and Co., San Francisco.

CROW J. F., 1958: Some possibilities for measuring selection intensities in man. *Human Biology* 30, 1: 1–13.

CROW J. F., 1966: The quality of people: Human evolutionary changes. *Bioscience* 16: 863–867.

DHARANI PRIYA B., VEERRAJU P., VENKATESWARA RAO T., 2003: Selection intensity among Kshatriyas, an endogamous population of Andhra Pradesh. *Indian J. of Human Genetics* 9, 2: 69–73.

DZIEWIĘCKI CZ., 1998: Relationships between fertility and morphological traits of women [in Polish]. *Studies in Human Ecology*, Supplement 2: 271–282.

GONZALES J., PRADO C., 1986: Relative influence of natural selection and genetic drift, along 104 years, on a population in Caceres Province (Spain). *Antropologia Portugalese* 4-5: 191–199.

HALBERSTEIN R. A, CROWFORD M. H., 1972: Human biology in Tlaxcala, Mexico: Demography. *Amer. J. of Phys. Anthropol.* 36: 199–212.

HENNEBERG M., 1978: Ocena dynamiki biologicznej wielkopolskiej dziewiętnastowiecznej populacji wiejskiej. III. Opis stanu puli genów na podstawie danych demograficznych. *Przegląd Antropologiczny* 44: 33–52.

HENNEBERG M., 1979: Breeding isolation between populations: Theoretical model of mating distances distribution. *Studies of Physical Anthropology* 5: 81–94.

HENNEBERG M., PIONTEK J., STRZAŁKO J., 1978: Natural selection and morphological variability. The case of Europe from Neolithic to Modern Times. *Curr. Anthropol.* 19: 67–82.

IVANOV V. P., CHURNOSOV M. I., KIRILENKO A. I., 1997: Selection intensity in the population of the Kursk Oblast. *Genetika* 33: 1438–1440.

JACQUARD A., 1974: *Génétique des populations humaines.* Presses Universitaires de France, Paris.

JOHANSEN H. CH., 1999: *The Decline in Danish Tuberculosis Mortality before World War II.* Research Report 10. Danish Center for Demographic Research. University of Southern Denmark, Odense.

JOHANSEN H. CH., SKYTTHE A., 2000: *Danish Infant Mortality 1835–1935*. Research Report 20. Danish Center for Demographic Research. University of Southern Denmark, Odense.

JOHNSTON F. E., KENSINGER K. M., 1971: Fertility and mortality differentials and their implications for microevolutionary change among Cashinahua. *Human Biology* 43: 356–364.

JORDE L. B., DURBIZE P., 1986: Opportunity for natural selection in the Utah Mormons. *Human Biology* 58: 97–114.

KĘDELSKI M., 1980: Próba rekonstrukcji porządku wymierania w Wielkopolsce w okresie rewolucji demograficznej. *Przeszłość Demograficzna Polski* 12: 47–64.

KĘDELSKI M., 1985: Umieralność i trwanie życia w Wielkopolsce w latach 1816–1875. *Przeszłość Demograficzna Polski* 16: 109–138.

KORPELAINEN H., 2003: Human life histories and the demographic transition: A case study from Finland, 1870–1949. *Amer. J. of Phys. Anthropol.* 120, 4: 384–390.

LAKSHMI N., VENKATESWARA RAO T., VEERRAJU P., 2005: Opportunity for natural selection among three endogamous subpopulations of Andhra Pradesh. *Indian J. of Human Genetics*, 11: 39–43.

LUNA F., MORAL P., 1990: Mechanisms of natural selection in human rural populations, survey of a Mediterranean region (La Alpujarra, Spain). *Ann. Hum. Biol.* 17, 2: 153–158.

PIONTEK J., HENNEBERG M., 1981: Mortality changes in a Polish rural community (1350–1972) and estimation of their evolutionary significance. *Amer. J. of Phys. Anthropol*. 54: 129–138.

PAWŁOWSKI B., DUNBAR R. I. M., LIPOWICZ A., 2000: Evolutionary fitness: Tall men have more reproductive success. *Nature* 403: 156.

RAO V. L. N., DHARMA RAO B., SESHAGIRI RAO CH., BHARATHI K., BUSI B. R., 2006: Selection intensity among Khonds of Andhra Pradesh. *Anthropologist* 8, 2: 143–144.

REDDY B. M., CHOPRA V. P., 1990: Occupation and the opportunity for natural selection: The Indian case. *International J. of Anthropology* 5, 4: 295–308.

SPUHLER J. N., 1976: The maximum opportunity for natural selection in some human populations. In: E. Zubrow (Ed.): *Demographic Anthropology: Quantitative Approaches.* Pp. 185. University of New Mexico Press, Albuquerque.

SZKLARSKA A., WELON Z., 1996: The effects of social factors on two biological potentials: growth of adolescents and reproduction in Polish families [in Polish]. *Przegląd Antropologiczny* 59: 45–50.

TORREJON J., BERTRANPETIT J., 1987: Estructura biodemográfica de la población del Valle de Camprodón. *Trabajos de Antropologia* 20: 393–557.

TRIPP-REIMER T., 2008: Cultural influences on the potential for natural selection. *Central Issues in Anthropology* 4, 2: 49–57.

TYZZER R. N., 1974: *An Investigation of the Demographic and Genetic Structure of a South-Western American Indian Population, the Southern Ute Tribe of Colorado*. Doctoral Dissertation, University of Colorado, Boulder.

ULIZZI L., ASTOLFI P., ZONTA L. A., 1998: Natural selection in industrialized countries: A study of three generations of Italian newborns. *Annals of Human Genetics* 62: 47–53.

WOKROJ F., 1948: Ukrainian populace in Podberezce village in respect of anthropology [in Polish]. *Sprawozdania Polskiej Akademii Umiejętności* 49, 8: 458.

Oskar Nowak
Janusz Piontek
Artur Rewekant
Adam Mickiewicz University, Poznań
Institute of Anthropology
Department of Human Evolutionary Biology
Collegium Biologicum
Umultowska 89
61-614 Poznań, Poland
E-mail: oskarn@amu.edu.pl