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Morphological evolution of Bardigiano horse

A. Sabbioni¹, V. Beretti¹, A. Zanon¹, G.P. Pagani², S. Filippini¹,
P. Superchi¹, A.L. Catalano¹

¹ Dipartimento Produzioni Animali, Biotecnologie Veterinarie, Qualità e Sicurezza degli Alimenti, Università di Parma, Italy

² Associazione Provinciale Allevatori, Parma, Italy

Corresponding author: Alberto Sabbioni. Dipartimento Produzioni Animali, Biotecnologie Veterinarie, Qualità e Sicurezza degli Alimenti. Via del Taglio 8, 43100 Parma, Italy – Tel.: +39 0521 032625 – Fax: +39 0521 032611
Email: alberto.sabbioni@unipr.it

RIASSUNTO – Evoluzione delle caratteristiche morfologiche del cavallo Bardigiano. Sono stati elaborati i dati relativi alle misure lineari (altezza al garrese, circonferenza toracica e dello stinco, lunghezza della spalla) e agli indici morfologici (i. di anamorfoosi, i. dattilo-toracico) di 3668 cavalli Bardigiani iscritti al LG, nati fra il 1955 ed il 2001, al fine di mettere in evidenza l'evoluzione nel corso degli anni delle caratteristiche morfologiche. È stata messa in evidenza una iniziale riduzione dell'altezza al garrese, che negli ultimi 30 anni tende però a rimanere costante, una diminuzione significativa della circonferenza toracica ($P < 0,05$), dello stinco ($P < 0,001$), dell'indice di anamorfoosi ($P < 0,05$) e dell'indice dattilo-toracico ($P < 0,01$). Le variazioni sono apparse più intense nei maschi. La morfologia verso la quale l'indice di selezione attuale si orienta, determinerà la produzione di animali più leggeri e di tipo mesomorfo.

Key words: horse, Bardigiano, morphology, measures.

INTRODUCTION – The Bardigiano horse is a local breed of the province of Parma. Since the institution of the Stud Book in 1977, the breed has improved its diffusion and is currently present with 110 stallions and over 1700 mares in 43 provinces in Italy and beyond that in Germany, Switzerland and Hungary. The selection of the horses had as objective initially the maintenance of typical traits, while currently it is oriented towards the production of horses with conformation suitable for the use as saddle and light draught and for equine tourism. Moreover the horses must supply convenient meat production at a low cost (AA.VV., 2004). The selection indexes, adopted since 1993, are the IGA (genetic index for height at withers) and the IGG (global genetic index), studied to improve the morphology of the horses, according to the ideal values of the breed (Fioretti *et al.*, 2003).

MATERIAL AND METHODS – Data concerning the linear measures (height at withers, chest and cannon circumference, length of shoulder), the anamorphosis index (chest circumference²/height at withers) and the dactylo-thoracic index (cannon circumference*100/chest circumference), the total score and the genetic indexes of 3668 Bardigiano horses enrolled in the Stud Book, born between 1955 and 2001, were elaborated. The horses were measured at an age between 2 and 19 years (mean±SD: 4.5±2.6 years); the variations of the morphologic characteristics were estimated by submitting data to covariance analysis (SAS, 1999-2001), following a linear model with the fixed effects of the province (6 classes, of which five are represented by the typical breeding area - Parma, Piacenza, La Spezia, Genova and Massa -, and one that includes all the remaining areas), the herd within province (1284 classes), the sex (2 classes), the year of birth (6 classes), the interaction sex*year of birth and the age (days) at measurement as a covariate. Therefore the correlations between linear measures and total score, IGA and IGG, within class of birth year, were calculated.

RESULTS AND CONCLUSIONS – Table 1 shows the results of the covariance analysis lead on the linear measures and the morphologic indexes. R² varied between 0.44 (dactylo-thoracic index) and 0.60 (length of

shoulder). The effects of sex, province and herd were always significant at different levels; the year of birth was not significant ($P>0.05$) for the height at withers, while the age at measurement did not significantly influence ($P>0.05$) the length of the shoulder. The interaction sex*year of birth was significant ($P<0.01$) only for cannon circumference.

Table 1. Analysis of Covariance.

| Source | Sex | Year | Province | Herd (Province) | Sex*Year | Age | Error |
|------------------------|------------|---------|------------|--------------------|--------------------|------------|-------|
| DF | 1 | 5 | 5 | 1283 | 5 | 1 | 2367 |
| Height at withers | 330.5*** | 12.0 | 21.1* | 13.7*** | 10.5 | 149.0*** | 9.2 |
| Chest circumference | 3636.6*** | 146.2* | 1665.8*** | 90.5*** | 83.6 | 2820.5*** | 58.0 |
| Cannon circumference | 81.4*** | 5.8*** | 5.1*** | 0.5*** | 1.6** | 7.0*** | 0.4 |
| Shoulder length | 239.0*** | 95.4*** | 25.6** | 10.4*** | 15.0 | 8.4 | 7.1 |
| Anamorphosis Index | 15826.8*** | 976.1* | 11111.6*** | 523.6*** | 660.2 [§] | 14000.7*** | 344.2 |
| Dactylo-thoracic Index | 2.1** | 0.9** | 4.6*** | 0.3*** | 0.4 | 2.7*** | 0.2 |

§: $P<0.10$; *: $P<0.05$; **: $P<0.01$; ***: $P<0.001$.

Table 2 shows the least square means (\pm SE) of the linear measures and of the morphologic indexes. The values reported for horses born before 1972 were always more variable than those of all other classes. This is likely due to the low number of animals in that class and to the initial introduction into the stud book of animals with typical breed traits, even if not with homogeneous morphologic characteristics. Subsequently such behaviour has been abandoned and values have been maintained within narrow limits of variability. The height at withers, initially high in males (143.2 cm) has decreased since the '70s, and has then been maintained consistently around 140.5 cm. In females the values were more constant. The chest circumference has decreased in males by approximately 4.3% in last 30 years, while in females it has remained almost at the same values. The variations were confirmed by the index of anamorphosis, which has decreased in males but not in females. The cannon circumference has decreased by approximately 6.3% in males and by approximately 2.1% in females, determining, in the two sexes, analogous modifications of the dactylo-thoracic index. Measurement of the shoulder started in this breed in 1985; its length has decreased, above all in males, but this measure is largely influenced by conformation (reduction of chest circumference) and by measurement protocol.

Table 2. L.s. means (\pm SE) of body traits in stallions and mares in relation to birth year.

| Year of birth | <1972 | 1972-81 | 1982-86 | 1987-91 | 1992-96 | 1997-01 |
|---------------------|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Stallions | | | | | | |
| Number | 4 | 54 | 50 | 60 | 74 | 110 |
| Height at withers | cm 143.2 \pm 1.6 | 140.5 \pm 0.5 | 140.7 \pm 0.5 | 140.6 \pm 0.4 | 140.2 \pm 0.4 | 140.7 \pm 0.4 |
| Chest circumference | cm 189.5 \pm 4.1 | 185.8 \pm 1.3 | 183.2 \pm 1.3 | 183.6 \pm 1.1 | 182.2 \pm 1.1 | 181.3 \pm 0.9 |
| Cannon circumferen. | cm 20.8 \pm 0.4 | 19.9 \pm 0.1 | 20.1 \pm 0.1 | 19.8 \pm 0.1 | 19.4 \pm 0.1 | 19.5 \pm 0.1 |
| Shoulder length | cm - | - | - | 69.0 \pm 1.6 | 67.3 \pm 0.5 | 64.9 \pm 0.4 |
| Anamorphosis Index | 251 \pm 10 | 246 \pm 3 | 239 \pm 3 | 240 \pm 3 | 237 \pm 3 | 233 \pm 2 |
| Dactylo-thoracic I. | 11.0 \pm 0.3 | 10.7 \pm 0.1 | 11.0 \pm 0.1 | 10.8 \pm 0.1 | 10.7 \pm 0.1 | 10.8 \pm 0.1 |
| Mares | | | | | | |
| Number | 142 | 746 | 566 | 700 | 657 | 505 |
| Height at withers | cm 139.2 \pm 0.5 | 139.7 \pm 0.2 | 138.8 \pm 0.2 | 138.8 \pm 0.2 | 138.6 \pm 0.2 | 138.8 \pm 0.2 |
| Chest circumference | cm 176.2 \pm 1.3 | 178.5 \pm 0.5 | 177.9 \pm 0.5 | 178.2 \pm 0.4 | 177.5 \pm 0.4 | 177.0 \pm 0.5 |
| Cannon circumferen. | cm 19.1 \pm 0.1 | 19.1 \pm 0.0 | 19.0 \pm 0.0 | 18.9 \pm 0.0 | 18.7 \pm 0.0 | 18.7 \pm 0.0 |
| Shoulder length | cm - | - | 64.2 \pm 1.6 | 64.0 \pm 0.7 | 64.2 \pm 0.2 | 62.7 \pm 0.2 |
| Anamorphosis Index | 223 \pm 3 | 229 \pm 1 | 228 \pm 1 | 229 \pm 1 | 228 \pm 1 | 226 \pm 1 |
| Dactylo-thoracic I. | 10.8 \pm 0.1 | 10.7 \pm 0.0 | 10.7 \pm 0.0 | 10.6 \pm 0.0 | 10.6 \pm 0.0 | 10.6 \pm 0.0 |

The results are in agreement with those reported by Catalano and Martuzzi (1994). The evolution of morphology in the Bardigiano breed, except for height at withers, is analogous to that shown in Italian Haflinger by Caroli *et al.* (1991) and by Falaschini *et al.* (2003).

Correlations (table 3) between total score and height at withers, chest circumference and length of shoulder have become higher and more significant with the increase of the birth year, while those with the cannon circumference have decreased. This means that the highest scores in the recently born animals are attributed to those with higher body development and skeleton fineness. The correlations between the two genetic indexes and height at withers, chest circumference and length of shoulder have been maintained high and significant ($P<0.01$) during the study period, while those with cannon circumference were reduced ($P<0.05$) with the increase of birth year. This indicates that new generations are selected toward a taller and lighter horse, in agreement with results obtained by Fioretti *et al.* (2003).

Table 3. Correlations between measures, morphological score and genetic indexes in relation to birth year.

| Year of birth | <1972 | 1972-81 | 1982-86 | 1987-91 | 1992-96 | 1997-01 |
|----------------------|---------|---------|---------|---------|---------|---------|
| Total score | | | | | | |
| Height at withers | 0.009 | -0.057 | 0.170** | 0.341** | 0.501** | 0.566** |
| Chest circumference | 0.318** | 0.340** | 0.269** | 0.379** | 0.391** | 0.406** |
| Cannon circumference | 0.176* | 0.003 | 0.168** | 0.147** | 0.181** | 0.134** |
| Shoulder length | - | - | 0.401 | 0.469** | 0.491** | 0.500** |
| IGA | | | | | | |
| Height at withers | 0.847** | 0.876** | 0.876** | 0.906** | 0.858** | 0.805** |
| Chest circumference | 0.377** | 0.325** | 0.268** | 0.286** | 0.362** | 0.284** |
| Cannon circumference | 0.313** | 0.150** | 0.227** | 0.297** | 0.344** | 0.100* |
| Shoulder length | - | - | 0.594 | 0.544** | 0.398** | 0.399** |
| IGG | | | | | | |
| Height at withers | 0.716** | 0.748** | 0.714** | 0.724** | 0.643** | 0.645** |
| Chest circumference | 0.295** | 0.251** | 0.221** | 0.258** | 0.372** | 0.334** |
| Cannon circumference | 0.288** | 0.115** | 0.126** | 0.168** | 0.301** | 0.089* |
| Shoulder length | - | - | 0.513 | 0.582** | 0.411** | 0.431** |

*: $P<0.05$; **: $P<0.01$.

In conclusion we can affirm that during the last 30-40 years the morphology of the Bardigiano horse has changed, with a reduction of the chest and cannon circumference. The height at withers, after an initial drop, showed a not significant reduction until 1996 and then a slight and not significant rise. The variations appeared more intense in males. The reduction of height at withers is currently contrasted by selection indexes and in future also by the introduction in the breed of horses with 25% of Arab blood. The morphology towards which the selection indexes are oriented, will determine the production of lighter animals of a mesomorphus type.

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REFERENCES – AA.VV., 2004. <http://www.apa.pr.it/home.htm>. Caroli, A., Canavesi, F., Bagnato, A., Miglior, F., Gandini, G., 1991. Evoluzione morfologica del cavallo Avelignese, pp. 685-694 in Proc. 9th ASPA Congr., Rome. Catalano, A.L., Martuzzi, F., 1994. Diffusione, variabilità morfologica ed evoluzione della razza cavallina Bardigiana. Ann. Fac. Med. Vet. Parma, 14:121-132. Falaschini, A., Rizzi, S., Pasquini, M., 2003. Morphological evolution of the Haflinger horse. Ital. J. Anim. Sci., 2:595-597 (suppl. 1). Fioretti, M., Catalano, A.L., Rosati, A., Martuzzi, F., 2003. A genetic global index for Bardigiano horse selection, pp. 422 in Proc. 54th EAAP Congr., Rome. SAS, 1999-2001. SAS/Stat User's Guide, ver. 8.02. SAS Institute Inc., Cary, NC, USA.