Population properties of individual bird growth and development are poorly explored, although such investigations at the level of species are common (also in Russia, e.g., Poznanin, 1979). Other ontogenetic properties studied at the level of populations include fluctuating asymmetry of bilateral structures and the correlation of morphological characteristics. These two aspects are the aim of the present investigation.

Investigation of fluctuating asymmetry is relevant since it is a manifestation of the specific form of variability—intraindividual—and one of the main indices of ontogenetic stability (homeostasis). In addition, the asymmetry level reflects the rate of genetic coadaptation, since it notably increases after hybridization at the level of genetically distinct intraspecific forms or closely related species (Mather, 1953; Zakharov, 1987; Biotest…, 1993).

Analysis of intraindividual differences in bilateral plumage characteristics performed by various researchers yielded the following results: a feedback between the asymmetry level of certain secondary sexual characteristics in males and their genetic quality has been proposed in swallows (Hirundo rustica) and zebra finch (Moller, 1990; Swaddle and Cuthill, 1994); the relationship between the asymmetry level and quality of the habitat where bilateral structures of blackbird (Turdus merula) nestlings were developed has been revealed (Moller, 1995); and different timing of autumn migration of willow-ren (Phylloscopus trochillus) with a different level of asymmetry have been shown (Rintamaki et al., 1995).

This points to promising investigation of fluctuating asymmetry phenomenon in birds under various ecological aspects. Such investigation cannot be limited to plumage characteristics. Properties of leg folidosis can be quite informative in this case. The number of horny plates on the elements of the right and left legs is sometimes different, and this is a fluctuating type of asymmetry (Vengerov and Ivanova, 1995).

In terms of biometry, statistical correlation means the relationship between variables. In terms of biology correlation is the relationship between various characteristics in the organism as a whole. Two biological levels of mutual relations between parts of the organism are recognized. The first one is ontogenetic level when the relations are manifested during individual development; they are called correlations. The second level is phylogenetic when the relations are manifested during evolutionary transformation of the organism parts; they are called coordinations (Shmal’gauzen, 1982). There are grounds to believe that the correlations of definitive exterior characteristics revealed in the animals by statistical methods reflect ontogenetic correlations based on morphogenetic and ergonic mutual relations of the developing organism and body parts.

Investigation of correlations between four metric characteristics of passerines (Passeriformes) demonstrated a certain species-specificity related to flight performance (Terent’ev, 1970). Analysis of 18 exterior characteristics in the tree sparrow (Passer montanus) revealed the main correlating groups, the gender difference in the power of links between parts of the flying machine (Rostova and Chetverikova, 1981; Chetverikova, 1985).

Coordinated variability of the exterior characteristics in rock-pigeons (Columba livia) featured pronounced accordance between phenotypic and genotypic correlations (Johnson and Johnston, 1990). Hence, interpretation of the intraspecific group differences in the level and structure of correlations is valid.
in terms of selection. Changed correlations between morphological characteristics have been revealed by comparison of wild and chase forms of mallard (Anas platyrhynchos) (Fokin et al., 1990) as well as male common rosefinch (Carpodacus erythrinus) that survived or died during migration and wintering (Bjök- lund, 1992). Considering the high heritability of most metric properties, one can assume that phenotypic correlations reflect genotypic ones in birds.

MATERIALS AND METHODS

The material was collected in the Voronezh Biosphere Reserve, which is located on the border between Voronezh and Lipetsk districts and partially in the city of Voronezh.

The fluctuating asymmetry of leg foliosis meristic characteristics was evaluated in 18 passerine species; correlations of exterior qualitative characteristics have been studied in 20 species of this order. The mean sample volume was 49 and 30 specimen for foliosis and exterior characteristics, respectively. The measurements and account of meristic characteristics were carried out on live birds released after ringing.

In passerines, the horny plates cover the anterior and posterior parts of the metatarsal bone and the upper part of digits. We analyzed the plate number variability only on the second, third, and fourth digits as the most unambiguously recognizable and accountable. The pattern of leg plating is similar in the studied species, which allows both intra- and intraspecific comparisons within the same community. The analyzed samples were composed of males and females of ad (two and more years) and sad (about a year) ages. Merging the gender groups is valid, since they have similar values and patterns of asymmetry. This resulted in fluctuating asymmetry indices for the whole population integrating manifestations for various generations; the mean number of asymmetric characteristics per specimen was used as a qualitative test (Posledstviya..., 1996). It is calculated as the total number of asymmetric characteristics for each specimen divided by the sample volume (including the specimen lacking the asymmetry). In our example, the top value of this index cannot exceed 3 for three studied characteristics.

The following metric characteristics were used to study the correlations: length (1) and width (2) of the wing; forearm length (3); width, length, and height of the beak (4–6); and length of sternal crest (7), tibia (8), metatarsal bone (9), third digit (10), tail (11), and second and fourth digits (12 and 13). The above characteristics were measured after Vinogradova et al. (1976) and Chemyakin (1988) within an accuracy of 0.1 mm.

Structural analysis of morphological characteristic correlations was performed using Terent’ev’s correlation pleiads method (Terent’ev, 1959, 1960). The pleiads were revealed on a correlation cylinder using the moving level method. All links of a given section level were plotted on a correlation ring by lines of different weight reflecting the power of their differentiation. In addition to the correlation pleiads method, the system of characteristics mutual relations can be studied by factorial analysis. One of its variants—the method of principal components—is used most. The factorial pleiads match or are similar to the correlation pleiads; however, they can be of independent interest in conditions of low-contrast of the relation levels (Shmidt, 1985). Previous parallel analysis of the correlation structure of avian morphological characteristics by the above two methods indeed demonstrated a high similarity of the results (Vengerov, 1997). This is why analysis was reduced to the method of Terent’ev’s correlation pleiads in this work.

RESULTS AND DISCUSSION

The minimum and maximum mean number of asymmetric characteristics per characteristic (MNAC) is 0.18 and 0.75, while the MNAC average for all 18 species is 0.46 (table). Let us divide the considered species into three groups corresponding to low (0.18–0.39), medium (0.4–0.59), and high (0.6–0.75) asymmetry. The first group includes nuthatch (Sitta europaea), song thrush (Turdus musicus), chaffinch (Fringilla coelebs), house sparrow (Passer domesticus), oxeye (Parus major), and yellowhammer (Emberiza citrinella); the third group includes robin (Erithacus rubecola), pied flycatcher (Ficedula hypoleuca), and siskin (Spinus spinus); the nine resting species form the largest second group. In most cases, the differences between species in the first and third groups are significant.

One can see that ecologically and taxonomically diverse species fall into the same groups; however, their similarity in an important property—the level of phylopatry—can be seen. We understand phylopatry as the return of the birds to their birthplace or former nesting site after wintering; habitat up to 5 km across is considered as a birthplace of small birds (Sokolov, 1991).

Two representatives of the group with minimum asymmetry—nuthatch and house sparrow—are sedentary or partially migrating birds. Their relation to the birth or nesting site is most pronounced among all considered species. Oxeye and (to a lesser extent) yellowhammer are similar in this respect. Chaffinch and song thrush are migratory birds; the first one features one of the highest levels of phylopatry (Sokolov, 1991). The data available on song thrush do not suffice for final conclusions; but it is at least not among the species with low phylopatry.

By contrast, in the case of the robins falling into the third group, the young birds do not return to their birthplace and the adult ones change their nesting site annually. Permanent exchange of nesting sites is specific for certain Fringillidae birds including the siskin with the