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Morphological Studies of *Macaca fuscata*: VI. Somatometry

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ABSTRACT. Measurements of various parts of the head and body and weighing the body were carried out on about 170 adult Japanese monkeys (*Macaca fuscata*) and the results are noted with separate statistics for respective local groups. Intraspecific comparisons in the Japanese monkey and interspecific comparisons in macaques are discussed from the somatometrical point of view. Among macaques, the Japanese monkey has a comparatively large body, a very short tail, relatively wide biacromial and biiliac breadths, and markedly la ge intermembral and intercrural indices. The Japanese monkey itself shows various local variations. The most conspicuous difference is to be found between the so-called Yaku monkey living on Yaku islet (Yakushima), south of Kyushu, and the monkeys living in other parts of Japan, and, therefore, it is understandable that the Yaku monkey has been distinguished as a subspecies (*M. f. yakui*) of the Japanese monkey. The Yaku monkey has a somewhat small body, a relatively large head, wide hips, and slender hands and feet.

Between 1962 and 1968, we occasionally carried out somatometrical examinations on some groups of Japanese monkeys (*Macaca fuscata*) from various localities, and part of the results have been preliminarily reported in Japanese by IKEDA and HAYAMA (1964). As the last part of the "morphological studies of *Macaca fuscata*" (IWAMOTO, 1964, 1967; HAYAMA, 1965; IKEDA & WATANABE, 1966; SAHEKI, 1966), we will here present a general report, based on our entire data, which should be able to clarify the general somatometrical character of the Japanese monkey and some of its variations, yet the necessity of examining animals living in other districts, especially in the north-eastern or snowy areas of Japan, is left to the future.

MATERIALS AND METHOD

The animals on which our somatometrical examinations were carried out were divided into the eight groups shown in Table 1, mainly according to their native localities (See Fig. 1).

Somatometry was applied to temporarily anesthetized monkeys and in accordance with MARTIN's anthropological method (MARTIN & SALLER, 1957) as a rule (see also SCHULTZ, 1929, 1933a). Special metrical items adopted for this study are as follows (the numbers in parentheses correspond to those in Tables 3–6):

Sternum length (**5**): 'Suprasternale'—Lower end of the sternum.

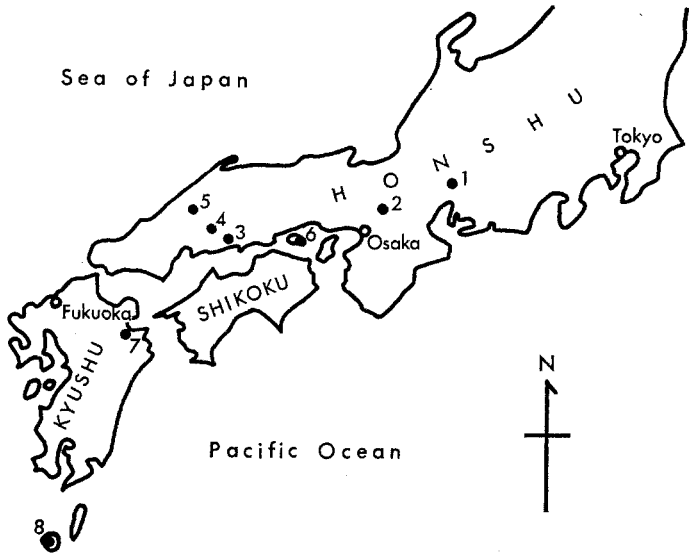

Fig. 1. Native and living places of the examined groups. (See Table 1 for numbers.)

Table 1. Examined groups.

Groups used in this paper	Native locality	State of group when examined
Arashiyama group	Arashiyama, Kyoto City, Kyoto Pref. (2)	Natural troop: provisionized for a long time.
Mihara group	Numata, Mihara City, Hiroshima Pref. (3)	Natural troop: provisionized only for a short time for the sake of capture.
Kochi group	Kochi near Mihara City, Hiroshima Pref. (4)	Natural troop: provisionized for a long time.
Hasumi group	Hasumi, Shimane Pref. (5)	Natural troop: provisionized only for a short time for the sake of capture.
Shodoshima group	Shodo Islet in Setonaikai inland sea, Kagawa Pref. (6)	Semi-natural troop consisting of animals caught from a big provisionized natural troop (Shodo I [ai] troop): breeded for a short time in a large open cage at Japan Monkey Centre at Inuyama City, Aichi Pref. (1)
Takasakiyama group	Takasakiyama, Oita City, Oita Pref. (7)	Natural troop: provisionized for a long time.
Ohirayama group	Yaku Islet (Yakushima), Kagoshima Pref. (8)	Artificially made free-ranging troop in Mt. Ohira, Inuyama City, Aichi Pref.; provisionized for a long time. (1)
Caged group	Yaku Islet (Yakushima), Kagoshima Pref. (8)	Caged group breeded for a long time by Japan Monkey Centre at Inuyama City, Aichi Pref. (1)

See Fig. 1 for numbers in parentheses.

Thorax length (**6**): 'Sprasternale'—The point on the surface of the abdomen which belongs to the line crossing between the median body plane and such transverse planes as pass through the lowest thorax borders on both sides of the abdomen.

Thigh length (**19**): The most lateral point of the Trochanter major—Upper end of the tibia on the lateral side of the knee-joint.

Thigh length (**19'**): The most lateral point of the Trochanter major in the Arashiyama, Mihara, and Hasumi groups, and the 'Iliospinale' in the Kochi group—'Tibiale.'

Foot breadth (**23**): The method used corresponds to that used for Hand breadth (**18**).

Morphological facial height (**32**): As the upper point, the median point between the inner eye corners ('Entokanthion') of both sides was adopted for all groups except for the Arashimaya group, for which the median point between the uppermost orbital borders of both sides was adopted.

Nasal height (**38**): The same upper point as the above-mentioned one for Morphological facial height (**32**) was adopted.

Measurements were carried out by the present author, Drs. J. IKEDA of Kyoto University, S. HAYAMA of Kyoto University (now at Tohoku University), and A. EHARA of Juntendo University (now at Kyoto University).

Such animals as have full dentition are regarded as adults and treated as objects of this study. Ages are known only for some of the animals, but we may say that our materials consist of mature monkeys of about six or seven years of age and older estimating from some of our individual cases, the related roentgenographic study by HAYAMA (1965), and reports on other macaques by SPIEGEL (1934), SCHULTZ (1933b, 1935), WAGENEN (1956), HAIGH and SCOTT (1965), NAPIER and NAPIER (1967), etc.

As for the statistics, the size (n), the mean ($\bar{x}$), and the standard deviation (square root of unbiased variance) (s), were calculated for each of the samples, and the mean and standard deviation are expressed in terms of kg for body weight, mm for the other measurements and % for indices. Obviously pregnant females were omitted from the statistics on body weight, but as a matter of fact only the Shodoshima group contained some such animals. Group differences in each somatometrical item were generally described respectively, according to such tables as shown, for example, in Table 2.

Table 2. An example of tables prepared for examinations of group differences.

Male

Anterior trunk length (3)	(n) $\bar{x}$	Ohira-yama	Caged	Mihara	Shodo-shima	Kochi	Arashi-yama	Takasaki-yama
Ohirayama	(8) 364	—			0.5	2.5	0.5	0.1
Caged	(19) 369		—		1.0		5.0	0.1
Mihara	(7) 383			—				0.5
Shodoshima	(22) 388	0.5	1.0		—			0.1
Kochi	(1) 400	2.5				—		
Arashiyama	(2) 403	0.5	5.0				—	
Takasakiyama	(8) 420	0.1	0.1	0.5	0.1			—

Confidence lebels of differences in the *t*-test (%) were indicated by 0.1, 0.5, 2.5, and 5.0 in squares. Blank squares mean $P(t) > 5\%$.

RESULTS

1. BODY WEIGHT AND DIMENSIONS

Males (Table 3)

In most measurements, the Takasakiyama group exceeds the other groups, but the monkeys of the Arashiyama group have larger bodies than the other groups, other than the Takasakiyama group. To the contrary, the three groups from Mihara, Ohirayama, and the Caged have a small mean in many measurements. In body size, the Shodoshima group appears to be intermediate among the groups compared, while we cannot judge how large the body size the Kochi group actually is because the sampling of this group was very small. Thus, the groups, except that of Kochi, may be arranged in order of general body size as follows: Takasakiyama>Arashiyama>Shodoshima>Mihara, Ohirayama, Caged. Provisionally standardizing this as the general group order, comparison of groups in body weight and various dimensions will be described respectively in the following.

Body weight (**1**): The mean of 14.5 kg in the Takasakiyama group is the largest, being significantly larger than every mean of the other four groups except the Arashiyama and Kochi groups. In this measurement, the above-mentioned general group order may in fact be changed since the Ohirayama group (12.1 kg) is not of the lower but rather of the intermediate order and, on the contrary, the Shodoshima group (10.9 kg) drops to a lower order, though the statistical significance in the difference between the mean of these two groups cannot be determined.

Sitting height and Anterior trunk length (**2**) et (**3**): In these two measurements also, the Takasakiyama (621 and 420 mm respectively) exceeds the other groups, showing significant differences to the other four groups, again except for the Arashiyama and Kochi groups. The smallest mean is found in the Ohirayama (570 and 364 mm) and the Caged (567 and 369 mm) groups. Therefore, concerning these two measurements, especially that of the anterior trunk length, we find a state that considerably conforms to the general group order.

Mammillojugular distance (**4**): It is a peculiar fact that the largest mean in this measurement is found in the Ohirayama group, contrary to the general group order.

Sternum and Thorax lengths (**5**) et (**6**): There are no distinct group differences except the significant one found in the latter measurement between the largest mean in the Shodoshima (213 mm) and the smallest in the Caged group (194 mm).

Tail length (**7**): This is especially short in the Mihara group (87 mm), which is significantly different from every other group except the Kochi (and the Arashiyama, for which data are lacking), while the Takasakiyama group has the longest tail (114 mm).

Bimammillary breadth (**8**): Contrary to the general group order, the Arashiyama group has the smallest mean (51 mm), though it shows significant differences only to the Takasakiyama (72 mm) and the Shodoshima (65 mm) groups. In the other respects, the general group order obtains.

Biacromial breadth (**9**): We may say that the general group order is found in this measurement.

Biiliac breadth (**10**): The Mihara group has a somewhat small mean (107 mm), though it shows a significant difference only to that of the Shodoshima (116 mm). The mean in all groups except the Mihara falls at 115±3 mm.

Bitrochanteric breadth (**11**): The largest mean is found in the Arashiyama group (150 mm); in the other groups (the data for the Takasakiyama group are lacking) it is 140±2 mm, except for 134 mm in the Mihara group.

Chest breadth and depth (**12**) et (**13**): The general group order may be commonly found in both these measurements, though the Mihara group has an especially small mean (100 and 112 mm respectively for both measurements), showing a contrast to the Takasakiyama group (126 and 137 mm).

Upper, Lower, and Total arm lengths (**14**), (**15**), et (**16**): In these measurements also, the general group order is found, except that the mean in the Caged group is not small but intermediate, resembling that of the Shodoshima group.

Hand length and breadth (**17**) et (**18**): In hand length there are no significant differences between any two groups, while in hand breadth we typically find the general group order.

Thigh and Leg lengths, and the Total length of thigh and leg (**19**, **19′**), (**20**) et (**21**, **21′**): We may say that the general group order is found in each of these measurements.

Foot length and breadth (**22**) et (**23**): In both measurements, the Mihara group is of the intermediate order similar to the Shodoshima; except for this point, the general group order is found.

Chest, Upper arm, and Thigh girths (**24**), (**25**), et (**26**): There are no remarkable group differences, except that the Takasakiyama group apparently tends to have a larger girth than the other groups.

Females (Table 4)

Generally speaking, there are not so many distinct group differences as are found in the males, except that the Caged and Ohirayama groups, especially the former have a comparatively small mean and the Arashiyama group a large mean in many of the measurements. In the following, results will be described respectively for each of the measurements.

Body weight (**1**): This is obviously lightest in the Caged group (7.4 kg), showing significant differences to all the other groups in which the mean body weight falls within a range of from 8 to 10 kg.

Sitting height and Anterior trunk length (**2**) et (**3**): In these measurements, the Caged group is smallest (502 and 330 mm respectively), showing highly significant differences to the other groups except the Ohirayama group, which is the next smallest (515 and 337 mm). The Shodoshima group seems to be medial in these measurements, though there are not always significant differences between this group and the other groups, except for the Caged and the Ohirayama groups. The groups other than the above-mentioned three groups have a similar mean in each of these measurements (about 530–540 and 360–370 mm).

Mammillojugular distance (**4**): Similar to the result obtained from the males, this is especially large only in the Ohirayama group (85 mm). In the other groups, except the

Arashiyama and Hasumi groups, for which measurement data are lacking, the mean falls at 66±3 mm.

Sternum and Thorax lengths (**5**) et (**6**): There are no obvious tendencies of group differences except that both measurements, especially the former, are longer in the Mihara group.

Tail length (**7**): This is particularly short in both the Hasumi (67 mm) and Mihara (77 mm) groups. The mean in these two groups does not show a statistical difference with each other, but it does a significant one to the mean of the other groups (89±4 mm) (data for the Arashiyama group are lacking).

Bimammillary breadth (**8**): Only the Shodoshima group has an especially large mean (69 mm), showing significant differences to the other groups, in all of which the mean is commonly about 50–60 mm.

Biacromial breadth (**9**): Here we find almost the same state as that found in the males: it is that in which we find the general group order itself, arranged as for the males.

Biiliac breadth (**10**): It is rather peculiar that this measurement is smallest in the Takasakiyama (95 mm), showing significant differences to many of the other groups and, on the contrary, that the Ohirayama has the largest mean (109 mm), showing significant differences to each of the other groups except the Arashiyama and the Mihara, which also have a large mean of 108 and 107 mm respectively.

Bitrochanteric breadth (**11**): This is smallest in the Caged group (118 mm) and comparatively larger in the Arashiyama and Shodoshima groups (131 and 130 mm).

Chest breadth and depth (**12**) et (**13**): In both measurements, the Ohirayama is distinctly small (101 and 103 mm) and the Mihara also has a small mean. Both the Takasakiyama and Arashiyama groups have a larger mean (113–118 mm), but they show significant differences only to some of the other groups.

Upper, Lower, and Total arm lengths (**14**), (**15**), et (**16**): Concerning the upper arm length, we find significant differences of various degrees between many pairs of groups, while in the lower arm length they are found almost only between the Ohirayama and each of the other groups. Generally speaking, from these three dimensions it is apparent that the Arashiyama and Hasumi groups have long arms (307 and 305 mm respectively for total arm length) and, on the other hand, the Ohirayama group has short arms (271 mm).

Hand length and breadth (**17**) et (**18**): The Shodoshima, the Caged, and the Ohirayama groups have a relatively small mean in these two measurements. In length, the Shodoshima has an especially small mean of 89 mm, which contrasts to the 93–99 mm mean of the other groups. In breadth, both the Ohirayama and Caged groups (34 and 35 mm respectively) shows significant differences to all of the other groups (38–40 mm)

Thigh and Leg lengths and Total length of thigh and leg (**19, 19′**), (**20**), et (**21, 21′**): It is remarkable that the Caged and the Ohirayama groups have quite small lengths in these measurements (275 and 281 mm respectively in total length). In the other groups, except the Kochi group, to which a particular method of measurement was applied, the mean is very similar (306–314 mm in total length).

Foot length and breadth (**22**) et (**23**): In these measurements also, the Caged and the

Ohirayama groups, especially the former, have a small mean. In foot length, the Shodoshima group also has a rather small mean.

Chest, Upper arm, and Thigh girths (**24**), (**25**), et (**26**): There are no remarkable group differences, except that the Caged group has an especially small girth compared with that of the other groups.

2. Head Dimensions

Males (Table 5)

As far as the male monkeys are concerned, not only in body weight and dimensions but also in head dimension the Takasakiyama group distinctly surpasses the other groups. Among the groups other than the Takasakiyama, there are not always marked group differences, although in many measurements the mean is comparatively smaller in the Yakushima and the Caged groups and larger in the Arashiyama group.

Total head height (**27**): The mean is larger in the Arashiyama and the Kochi groups (126 and 123 mm), smaller in the Ohirayama and the Caged groups (105 and 107), and intermediate in the other two groups (110–111 mm) (data on the Takasakiyama group are lacking). Statistically significant differences are found mainly between the Arashiyama group and each of the other groups.

Head length and breadth (**28**) et (**29**): Both measurements are larger in the Takasakiyama and Arashiyama groups (104–106 mm and 85–93 mm respectively for each measurement), and the Kochi groups, too, resemble those groups (102 and 88 mm) but hardly have significant differences with the other groups. In head length, the Shodoshima is the smallest (94 mm), showing a significant difference to each of the other groups, while the head breadth is the smallest in the Caged group (78 mm), showing a significant difference to each of the other groups except the Ohirayama (80 mm).

Head height (**30**): On the whole, the mean falls within the narrow range of 44 ± 3 mm. The mean in the Caged group (46 mm) is the largest and shows significant differences to both the Mihara (41 mm) and the Ohirayama (43 mm) groups, but we must be careful in accepting this result as intrinsic because head height is one of the measurements which are especially apt to be attended with technical error in somatometry.

Head modulus (**31**): This measurement is significantly large only in the Takasakiyama group (241 mm). The Kochi group also has a large mean (235 mm), but does not show any significant differences to any of the other groups (about 220 mm).

Morphological facial height (**32**): Except that the mean is especially large in the Arashiyama group (104 mm) because only for this group a somatometrical method different from that used with the other groups was adopted, there are no significant differences between any two groups, in which the mean is 78 ± 4 mm.

Bizygomatic breadth (**33**): The mean varies from 94 mm in the Mihara group to 101 mm in the Arashiyama group, but we cannot find any statistically marked significant group differences.

Bigonial breadth (**34**): The Takasakiyama group has the largest mean (66 mm) and shows significant differences to all groups except the Caged and Ohirayama groups

(66 and 62 mm). On the other hand, the mean of this measurement is smallest in the Kochi group (43 mm) and next smallest in the Mihara group (49 mm).

Internal and External biocular and Palpebral breadths (**35**), (**36**), et (**37**): Concerning these measurements, there are data only on certain groups. For the treated groups, we find that the Takasakiyama group surpasses the other groups in each of these three breadths.

Nasal height (**38**): Except for the Arashiyama group, in which the mean is especially large for the same reason mentioned concerning morphological facial height (**32**), the other groups resemble each other in having a mean nasal height of 49–52 mm.

Nasal breadth (**39**): This breadth is largest in the Takasakiyama group (23 mm) and smallest in the Ohirayama and Shodoshima groups (19 mm). The mean for the other four groups is intermediate.

Mouth breadth (**40**): We have data only on the Shodoshima, Caged, and Takasakiyama group, in which the last group has a significantly larger mean (48 mm) than the other two groups (44 mm).

Auricular length and breadth (**41**) et (**42**): Statistically marked differences are found between the Takasakiyama and the Mihara groups (having a larger mean of 48–51 mm and 34–35 mm for each measurement) and the Ohirayama and the Caged groups (having smaller means of 42–43 mm and 30–32 mm). The Kochi group, too, has a large mean for both measurement, but is not always significantly larger than the other groups because the sample size of the Kochi group is very small.

Females (Table 6)

In most head dimensions the Caged and the Ohirayama groups are smallest, while among the other groups there are not always marked group differences on the whole, though it may be said that the Arashiyama group is comparatively larger in many of these dimensions.

Total head height (**27**): It is apparent that the Caged and the Ohirayama groups are significantly smaller (97 mm) in these dimensions compared with the other four groups (102–105 mm) (data on the Takasakiyama and the Hasumi groups are lacking).

Head length (**28**): The mean is smallest in the Caged group (86 mm) and largest in the Arashiyama group (97 mm). The other six groups seem to be divided into the following two categories. One, comprising the Kochi, the Ohirayama and the Shodoshima groups, is that which has a smaller mean (89–90 mm) and the other, consisting of the Mihara, the Hasumi and the Takasakiyama groups, is that which has the larger mean (92–94 mm).

Head breadth (**29**): Concerning this measurement, there are almost no group differences except that both the Caged and the Ohirayama groups have such a small mean (70–71 mm) that they show statistically significant differences to all of the other groups (74–77 mm).

Head height (**30**): The mean is larger in both the Kochi and the Arashiyama groups (38–39 mm), in contrast with the other groups (42–45 mm), but a significant difference is found only between some pairs of groups.

Head modulus (**31**): This is smaller in three groups, the Caged, the Kochi, and the

Ohirayama (200–204 mm), as opposed to the other groups (208–214 mm) other than the Hasumi for which data on this measurement are lacking.

Morphological facial height (**32**): Among six compared groups, excepting the Caged and the Arashiyama, for which the measurements are lacking or got obtained by a special method, a statistically significant difference was found only between the Hasumi group, which has the largest height of 73 mm, and both the Shodoshima and the Ohirayama groups, which have the smallest mean of 68 mm.

Bizygomatic breadth (**33**): The mean ranges from 83 mm in the Caged group to 89 mm in the Hasumi group, and there are no marked group differences except those found between each of above-mentioned two groups respectively and some of the other groups.

Bigonial breadth (**34**): It is noticeable that the mean is especially small in the Hasumi group (40 mm), showing significant differences to groups other than the Kochi. From a comparison of the groups other than the Hasumi, we cannot deduce any statistically definite tendencies in group difference, although the mean itself is comparatively large in the Caged, the Ohirayama, and the Shodoshima groups (55–57 mm), and intermediate in the other four groups (45–52 mm).

Internal and External biocular and Palpebral breadths (**35**), (**36**), et (**37**): We have data only on certain groups and, as in the male, these breadths are largest in the Takasakiyama group.

Nasal height (**38**): Setting aside the Arashiyama group, to which a special method of measurement was applied, a significant difference is found only between the largest mean in the Kochi group (45 mm) and the smallest in the Ohirayama group (42 mm).

Nasal breadth (**39**): On the whole, there are no marked group differences; the mean ranges from 17 mm in the Shodoshima and Ohirayama groups to 20 mm in the Kochi group.

Mouth breadth (**40**): We have data only on the Caged, the Shodoshima, and the Takasakiyama groups and highly significant differences can be found between the first (37 mm) and each of the other two groups (40–43 mm).

Auricular length and breadth (**41**) et (**42**): In length, the seven groups other than the Hasumi, for which the data are lacking, can be divided statistically into three categories. The first, which has the largest mean (46 mm), contains the Arashiyama and the Takasakiyama groups, the second, having the smallest mean (38 mm), contains the Caged and the Ohirayama groups, and the other three groups, having an intermediate mean (41–42 mm), belong to the third category. In breadth also, a similar relation can be found between each of the groups, although statistically the group differences are not always definite and the Mihara group belongs not to the third but to the first category.

3. Body and Head Indices

Males (Table 7)

Between any two groups, there are some differences in all indices. On the whole, it is noticeable that the Ohirayama and the Caged groups have a tendency to show

larger differences from the other groups, especially from the Takasakiyama group, on many indices. The results of comparisons for each of the indices are as follows.

Relative body weights **(1)**/**(2)**^{3} et **(1)**/**(3)**^{3}: The mean of these indices is largest in the Ohirayama group (6.5 and 25.3% respectively for both indices) and smallest in the Mihara group (5.2 and 18.4%), although the latter shows significant differences from only a few of the other groups.

Relative mammillojugular distance **(4)**/**(3)**: This is significantly large in the Ohirayama group (25.7%) and contrarily small in the Mihara group (17.1%).

Relative sternum and thorax lengths **(5)**/**(3)** et **(6)**/**(3)**: The Takasakiyama group is conspicuous by its smallness in these indices (31.0% and 49.4%), showing significant differences between most of the other groups (about 34–35 and 53–55%). (For the Arashiyama group, the statistics of these indices are lacking).

Relative tail length **(7)**/**(3)**: In both of the Mihara and Kochi groups, this is especially small (22.6 and 23.3%), but statistically significant differences are found only between the former and each of the other groups (26.4–28.8%).

Relative biacromial breadth **(9)**/**(3)**: This index is comparatively large in both the Arashiyama (40.1%) and the Takasakiyama (38.6%) groups, each showing a significant difference from the Mihara group (34.6%). The other four groups have medial indices of 35.8–37.5%.

Relative biiliac breadth **(10)**/**(3)**: This is comparatively small in both the Takasakiyama (27.3%) and the Mihara (28.0%) groups, which show significant differences from each of the other groups (30.1–31.3%) other than the Arashiyama and the Kochi groups (28.7 and 29.5 cm).

Relative total arm length and Relative total length of the thigh and leg **(16)**/**(3)** et **(21, 21')**/**(3)**: We cannot find marked group differences in these indices except that only in the former index the Mihara group shows significant differences from each of the other some groups.

Relative chest girth and Chest index **(24)**/**(3)** et **(13)**/**(12)**: There are no obvious group differences, except that the mean in the Ohirayama group is comparatively large only in the former index, showing significant differences from each of the other groups.

Interbrachial index **(15)**/**(14)**: The mean is especially large in both the Kochi (119%) and the Mihara (115%) groups as against that of the other groups (103–109%), although only the Mihara group shows statistically significant differences from each of them.

Intercrural index **(20)**/**(19, 19')**: In this index also, the Mihara has an especially large mean of 104% as against that of the other groups (95–100%) other than the Kochi, to which an exceptional method of measurement was applied. The largeness in the Mihara group itself may be in a degree, due to the method of measurement, because the method applied to this group is somewhat different from that applied to many of the other groups.

Intermembral index **(16)**/**(21, 21')**: This index is largest in the Caged group (100%), showing significant differences from each of the other groups (92–96%). The mean in the Kochi group is especially small (76%), because only to this group a particularly exceptional method of measurement was applied.

Hand and Foot indices (**18**)/(**17**) et (**23**)/(**22**): It is noticeable that there are significant differences between the Ohirayama and the Caged groups (smaller indices of about 36 and 25% respectively for each of the indices) and the Takasakiyama and the Shodoshima groups (larger indices of 40–45 and 27%). The mean of the hand index is especially large in the Takasakiyama (45%), and significantly large also in the Arashiyama group (40%) as compared with the Ohirayama and the Caged groups, while the foot index in the Arashiyama is not large but rather small (25.1%) among the studied groups. The mean of the foot index is smallest in the Kochi group (24.9%), but not significantly so from any mean in the other groups.

Relative total head height (**27**)/(**3**): We cannot find any marked group differences for this index.

Relative head modulus (**31**)/(**3**): Both of the Ohirayama and the Caged groups have the largest mean for this index (61 and 60% respectively), showing significant differences between every other group (about 57%) except the Kochi (59%). (Statistics on the Arashiyama group are lacking.)

Cephalic index (**29**)/(**28**): Similar to the results obtained for the hand and the foot indices, there are significant differences between the Caged and the Ohirayama groups (80–82%) and the Takasakiyama and the Shodoshima groups (87–90%) respectively. The mean itself is comparatively small, too, in the Arashiyama (80%) and the Mihara (83%) groups and large in the Kochi group (86%), but these results are not statistically significant, perhaps by reason of the small sample sizes of these groups.

Sagittal cephalofacial index (**32**)/(**28**): There are no marked group differences except that the mean of this index is especially large in the Arashiyama group for reasons of the method of measurement.

Transverse cephalofacial index (**33**)/(**29**): The mean in the Takasakiyama group is smallest (107%), showing significant differences between all of the other groups (115–126%) except the Kochi (111%). Both the Caged and the Ohirayama groups have a comparatively large mean (126 and 122% respectively), but significant differences are found only between the former and some of the other groups.

Facial index (**32**)/(**33**): We cannot find any especially marked group differences except that the mean is especially large only in the Arashiyama group by reason of the method of measurement.

Nasal index (**39**)/(**38**): For this index also, we find few if any marked group differences.

Auricular index (**42**)/(**41**): The mean is comparatively large in the Kochi, the Takasakiyama, and the Arashiyama groups (about 67–69%), but almost insignificantly different from the other groups (72–76%).

Females (Table 8)

We may say that these group differences coincide fairly well with those in the male monkeys in many indices. The results of comparisons for each of indices are as follows.

Relative body weight (**1**)/(**2**)^3 et (**1**)/(**3**)^3: These indices are smallest in the Mihara group (5.3 and 18.3% respectively) and largest in the Ohirayama group (6.7 and

23.9%). The Hasumi group also has a comparatively small mean for each measurement (5.8 and 18.4%), showing significant differences with the Ohirayama group.

Relative mammillojugular distance (**4**)/(**3**): This is significantly large in the Ohirayama group (25.3%), as in the males, but the smallest mean is found not in the Mihara group but in the Takasakiyama group (17.5%), differing from that of the males.

Relative sternum and thorax lengths (**5**)/(**3**) et (**6**)/(**3**): The mean of these indices is smaller for the Kochi (the statistics obtain only for the former index), the Takasakiyama, and the Shodoshima groups (about 28–31 and 47–50% respectively for each of the indices) than for the other groups (about 32–34 and 52%; statistics on the Arashiyama group are lacking).

Relative tail length (**7**)/(**3**): Group differences are almost the same as found for the males except for the Hasumi group, on which research was performed only on the females. The mean is comparatively small in the Hasumi, Mihara, and Kochi groups (18.2, 22.2, and 23.5% respectively), especially in the Hasumi group, while it is large in the Caged and the Ohirayama groups (27.9 and 25.9%). We may say both the Shodoshima and the Takasakiyama groups have a medium relative tail length.

Relative biacromical length (**9**)/(**3**): This index is largest in the Takasakiyama group (38.7%), showing significant differences from the other groups, but not especially large in the Arashiyama group (34.6%), differing from the result obtained for the males. The smallest mean is found in the Mihara group (31.5%), as in the males, although it shows significant differences only from the Takasakiyama and the Shodoshima groups.

Relative biiliac breadth (**10**)/(**3**): The Takasakiyama has the smallest mean (26.2%), showing significant differences from many of the other groups, but the mean in the Mihara group is not especially small (29.3%), differing from the result obtained from the males. On the other hand, a comparatively large mean is found in both the Ohirayama and Caged groups (32.4 and 30.7%), which show significant differences from the mean of all or most of the other groups.

Relative total arm length and Relative total length of thigh and leg (**16**)/(**3**), et (**21**, **21′**)/(**3**): We cannot find any marked group differences for these indices, except that the Kochi group shows an especially large mean for the latter index because an exceptional method of measurement was applied to this group.

Relative chest girth and Chest index (**24**)/(**3**) et (**13**)/(**12**): The former index is comparatively large in the Ohirayama group (121%), especially when compared with the Mihara and the Caged groups (110–111%). For the chest index, we cannot find any conspicuous group differences.

Interbrachial index (**15**)/(**14**): We cannot find any especially marked group differences.

Intercrural index (**20**)/(**19**, **19′**): Except for the Kochi group, to which a special method of measurement was applied, the mean is smallest in the Shodoshima (92%) and largest in the Hasumi (107%), which show respectively significant differences from most of the other groups. We cannot say that the Mihara group (100%) has an especially large mean, although it was significantly large in the males of this group.

Intermembral index (**16**)/(**21**, **21′**): The mean in the Kochi group is especially small

(77%) due to the method of measurement. In the other groups, the Mihara has the smallest mean for this index (92%), while the Caged has the largest (102%), and they show significant differences from each other and from some of the other groups.

Hand and Foot indices **(18)**/**(17)** et **(23)**/**(22)**: These are the same as the results obtained from the males; the mean of each of these indices is comparatively small in both the Caged and the Ohirayama groups (about 37 and 25–26% respectively for each of the indices) and large in the Takasakiyama and the Shodoshima groups (43% and 27%), although the smallness in the Ohirayama group is statistically apparent only in the hand index. The Arashiyama group doesn't have an especially large mean for the hand index but rather a medial one (39%). The foot index is comparatively small in the Kochi group (25%) and large in the Arashiyama group (27%), which show significant differences from each other and from some of the other groups. Such group differences as these are not always consistent with the results found in the males.

Relative total head height **(27)**/**(3)**: We cannot find any group differences especially to be emphasized for this index.

Relative head modulus **(31)**/**(3)**: As in the male monkey, the largest mean of this index is found in both the Caged and the Ohirayama groups (60.7%), but, differing from the result in the males the smallest mean is found in the Kochi group (55.1%), showing significant differences from all other groups except the Arashiyama group.

Cephalic index **(29)**/**(28)**: The smallness of this index in the Arashiyama group (76%) is statistically very significant. In the other groups, significant differences can be found between both the Mihara and the Ohirayam groups (having a small mean of about 80%) and the Shodoshima, the Takasakiyama, and the Kochi groups (with a large mean of about 84%); for this index the main discrepancy between the sexes is that the mean of this index in the Caged group is apparently small only in the males, while it is medial in the females.

Sagittal cephalofacial index **(32)**/**(28)**: We cannot find any statistical differences between any two groups for this index.

Transverse cephalofacial index **(33)**/**(29)**: A comparatively small mean is found not only in the Takasakiyama group but also in the Kochi, the Mihara, and the Shodoshima groups (almost the same at about 112–114% in each group), although the smallness in the last group is not statistically highly significant. On the other hand, the other four groups have a larger mean of about 118–119%, though the Hasumi group shows only a slight significant difference from the Takasakiyama and the Kochi groups.

Facial index **(32)**/**(33)**: Statistical differences are not found between any two of the studied groups.

Nasal index **(39)**/**(38)**: For this index also, we cannot find any marked groups differences, the same situation that applied in the males.

Auricular index **(42)**/**(41)**: The mean is smallest in the Takasakiyama group (65.3%), showing significant differences from each of the other groups (the data on the Hasumi are lacking) except the Arashiyama and the Kochi groups, which also have a comparatively small mean (68–69%), while it is comparatively large in the Mihara and the Ohirayama groups (75–76%).

DISCUSSION

At first we must notice some of the defects with which the materials or data used for this study are accompanied. They are due to the fact that proper random sampling was inevitably neglected in selecting animals as materials, the measurements were carried out by several investigators, the examined animals for groups respectively may have been influenced more or less by unnatural or artificial living environments, and so on. Therefore, we will proceed with our discussion attempting to keep from the danger of being sticklers for the details of somatometrical results.

Generally speaking, it is generally agreed that indices should be more important than the measurements themselves for somatometrical comparisons. At least, we must be very careful with weight and body girth, because such measurements are especially susceptible to various environmental factors and seem to change in the monkeys with their aging even in the adult period (cf. WAGENEN, 1956; HAZAMA, 1964).

INTRASPECIFIC COMPARISONS

It is remarkable that both the Caged and the Ohirayama groups are comparatively small in many measurements, including those of the head. The same results are reported in the craniometrical study by IKEDA and WATANABE (1966) and in the roentgenographic study of hand bones by HAYAMA and AIKA (1967). In body weight and some of the other measurements the Ohirayama group show a rather large mean, but this is due to the apparently unnatural fattiness which has gradually become consipcuous in many adults since the artificial grouping and breeding of this troop at Inuyama. We may say that both the Mihara and Shodoshima groups, especially the former, have a somewhat small-sized body, although this characteristic cannot generally be found for most measurements as it can be in the first mentioned two groups.

On the other hand, the Takasakiyama and Arashiyama groups have comparatively large bodies. Strictly speaking, a large build is very obvious in the male of the Takasakiyama group, but the female of this group is not especially large in many measurements. In the Arashiyama group, the largeness of the male body is hardly significant, as a matter of fact, because the data on the male of this group are restricted to only two animals. It may be said that among the groups examined for this study, the monkeys of the Hasumi group, too, have a rather large body size as far as estimated from the results for some of the main measurements which could be obtained only from the females of this troop. In this connection it should be added that, estimating from certain records of 1970, the body weight of adult Japanese monkeys living on Koshima Islet, which is situated near the eastern coast of Southern Kyushu, is not especially small (a mean of about 12 kg in males and 8.5 kg in females), though the animals appear to be small when compared with Japanese monkeys of other districts.

Although group differences vary to a certain extent in all measurement, the greater part of the variety of differences should be reflected in the results of the indices, about which general discussions are taken up in the following. Figure 2 shows the intergroup relation in Anterior trunk length (3), to which great importance was attached in

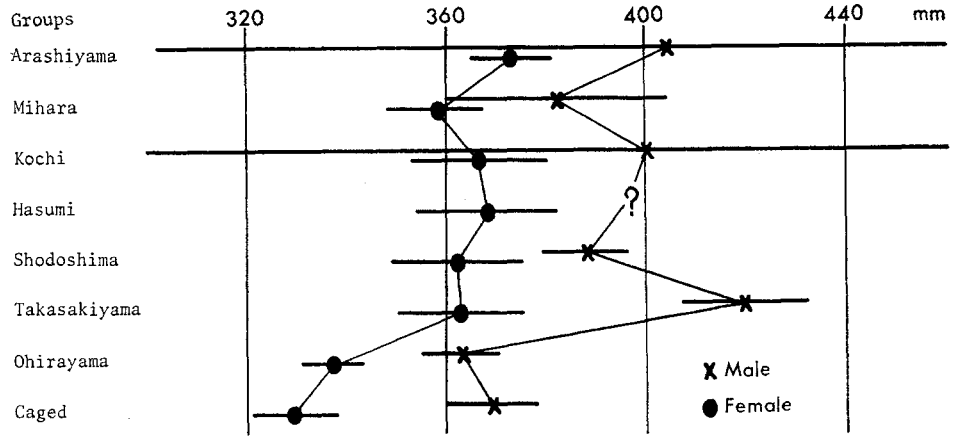

Fig. 2. Anterior trunk length (3). (Bold lines indicate the range of confidence at the 5% level of *t*-distribution.)

calculating the indices. The above-mentioned general intergroup relation in body size may be fairly well in this Figure.

In many indices also, both the Ohirayama and Caged groups resemble each other and thus differ from the other groups, though the exceptionally large mean in Relative body weights **(1)**/**(2)**^{3} et **(1)**/**(3)**^{3}, in Relative mammillojugular distance **(4)**/**(3)**, and in the Relative chest girth **(24)**/**(3)** only in the Ohirayama group is due to the unnatural fattiness, as mentioned above, or to the dangling of mammae as a result. The characteristic common to these two groups is found in the largeness of Relative tail length **(7)**/**(3)**, Relative biiliac breadth **(10)**/**(3)**, Relative head modulus **(31)**/**(3)**, Transverse cephalofacial index **(33)**/**(29)**, and the smallness of the Hand and Foot indices **(18)**/**(17)** et **(23)**/**(22)**. Cephalic index **(29)**/**(28)** is small in the male, and medial in the female.

Among the other six groups, the Takasakiyama might be said to have the most contrastive character to the Ohirayama and the Caged groups. This is due to their Relative biiliac breadth **(10)**/**(3)** and Transverse cephalofacial index **(33)**/**(29)** being small and the Hand and Foot indices **(18)**/**(17)** et **(23)**/**(22)** and the Cephalic index **(29)**/**(28)** being comparatively large. The latter three indices are also large in the Shodoshima group, and therefore this group also seems to be contrastive, after the Takasakiyama group, to the Ohirayama and the Caged groups. The Takasakiyama and the Shodoshima groups resemble each other; Relative tail length **(7)**/**(3)** is medial and Relative sternum and Relative thorax lengths **(5)**/**(3)** et **(6)**/**(3)** are small in both these groups.

For Relative biacromial and Relative biiliac breadths **(9)**/**(3)** et **(10)**/**(3)**, we can find such characteristic group differences as are illustrated in Figure 3, which shows that the Ohirayama and the Caged groups have relatively wide biiliac breadth, the Mihara group has a somewhat narrow biacromial breadth, and the Takasakiyama group wide biacromial and narrow biiliac breadths. In this respect, the Takasakiyama and the Shodoshima groups do not always resemble each other. Wide biacromial breadth in

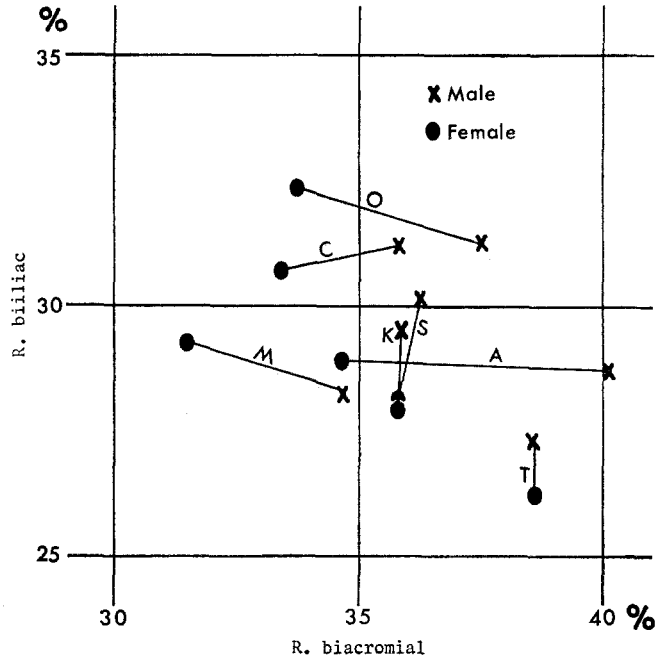

Fig. 3. Biacromial and Biiliac breadths (9)/(3) et (10)/(3). (A: Arashiyama, M: Mihara, K: Kochi, S: Shodoshima, T: Takasakiyama, O: Ohirayama, C: Caged groups)

the male of the Arashiyama group seems to be due to a sampling error from the very small sample size. In Relative bitrochanteric breadth (11)/(3) also, which is not shown statistically in this paper, both the Ohirayama and Caged groups are comparatively large.

As to Relative tail length (7)/(3), the Takasakiyama and the Shodoshima groups are rather close to the Ohirayama and the Caged groups, and this fact differs markedly from the above-mentioned general tendency of group differences. A relatively long or medial tail in these four groups is in contrast with the short tail of the other groups, all of which are living in the Chugoku district of Japan.

We should add some considerations on sex differences. Roughly speaking, the sex ratios in the measurements, which are defined for the present as percentages of means in the female to those in the male, fall in the range of $90\pm5\%$ in many of somatometrical items, except that the range is rather $85\pm5\%$ in the Takasakiyama group, as is recognizable for Anterior trunk length (3) in Figure 2.

As to sex difference in somatometrical indices, we cannot find any clear general tendencies of group differences, though they are to be found in some degree for some indices, as is recognizable for Relative biacromial breadth (9)/(3) in Figure 3. The main indices which generally show different means between sexes are the Relative sternum and thorax lengths (5)/(3) et (6)/(3), the Relative total arm length (16)/(3), the Relative total length of thigh and leg (21, 21')/(3), the Chest index (13)/(12), and the Sagittal cephalofacial index (32)/(28) in all of the groups except the Arashiyama,

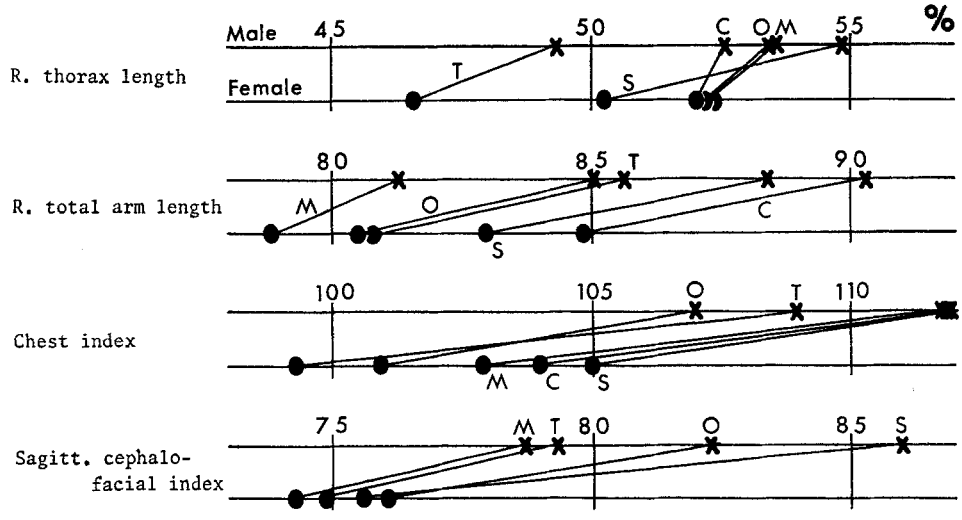

Fig. 4. Examples of marked sex differences in indices. (See Fig. 3 for the abbreviations.)

the Kochi, and the Hasumi, for which we have only a very small male sample. Every one of the above-mentioned indices is larger in the male than in the female, as was shown in Figure 4 for some of them. Sex difference in the Sagittal cephalofacial index **(32)**/**(28)** is due to the fact that the sex ratio is comparatively large in Head length **(28)** while small in Morphological facial height **(32)**. Sex differences in the other indices suggest that the male animal has a relatively long and thick chest and relatively long limbs compared with the female. In addition to the above-mentioned indices, both the Cephalic and Transverse cephalofacial indices **(29)**/**(28)** et **(33)**/**(29)**, and perhaps the Facial index **(32)**/**(33)** also, may be larger in the male than in the female, though it is statistically true not in all but only in some of the groups.

As a whole, it may be said that the Japanese monkey (*Macaca fuscata*) living on Yaku islet (Yakushima), which is represented by both the Ohirayama and the Caged groups in this paper, differs in many items of somatometrical measurements and indices from those living in the other districts of Japan and, therefore, may just as well be regarded as a subspecies (*M. f. yakui*) of the Japanese monkey from a somatometrical viewpoint, as has been the case generally. In other words, the characteristic of the monkeys on Yaku islet (the so-called "Yaku monkey") as a subspecies may be that it is a kind of dwarf type with a relatively large head, wide hips, and slender hands and feet. From among the other groups, all of which are "Japanese monkeys" in a narrow sense, we cannot choose any especially differentiated type. However, it might be said that the Takasakiyama and the Shodoshima groups, and especially the former, have a body form which is comparatively contrastive to that of the "Yaku monkey," though on the other hand these two groups obviously differ from each other in some indices and slightly resemble the "Yaku monkey" in others. In sex difference the Takasakiyama group is conspicuous in that only the male of this group has an obviously large body size as compared with each sex of the other groups. As to sexual differences in somatometrical indices, we cannot positively point out any marked group differences.

COMPARISONS WITH THE OTHER SPECIES OF MACAQUES

We should compare our somatometrical results on the Japanese monkey with those on other species of macaques, though statistically reasonable comparisons are hardly possible because of the lack of adequate reports. From among our statistics on the Japanese monkey, only the means which were obtained from samples of a comparatively large size will be used for the following comparisons.

First, general body size will be compared on the basis of such main somatometrical items as body weight, sitting height, and anterior trunk length. From Table 9 on body weight, we can state that the Japanese monkey, *Macaca fuscata*, has a comparatively large body for macaques, because males of over 8 kg and females of over 6 kg in body weight are rather rare in the Formosan monkey (*M. cyclopis*), the crab-eating monkey (*M. fascicularis*), the bonnet monkey (*M. radiata*), and the toque monkey(*M. sinica*), while they are very common in the Japanese monkey. The crab-eating monkey, the bonnet monkey, and the toque monkey have comparatively small body sizes among the macaques. In this respect both of the rhesus monkey (*M. mulatta*) and the pig-tailed monkey (*M. nemestrina*) seem to have a medial body weight among the macaques, though the mean body weight of 7-year-old rhesus monkeys, as mentioned by WAGENEN (1956) (11.0 kg for 6 males and 8.0 kg for 21 females) is not always smaller than that found in our statistics on the Japanese monkey.

As for sitting height (Table 10) also, we find almost the same tendencies of interspecific relations as those which were mentioned above concerning body weight. In addition, from Table 10 we may tentatively deduce that the lion-tailed monkey (*M. silenus*) is similar to the bonnet monkey (*M. radiata*), and that the stump-tailed monkey (*M. speciosa*) and perhaps the barbary ape (*M. sylvana*) are similar to the Japanese monkey in so far as only sitting height is concerned. The mean sitting height

Table 9. Weights (kg) of macaques. (The number of specimens referred to are enclosed by parentheses.)

Speies	Male	Female	Authors
M. assamensis	10.4–12.7 (3)		(NAPIER et al., 1967)
M. cyclopis	6.9–8.4 (7)	4.3–6.0 (5)	IWAMOTO*
M. fascicularis (=*irus*)	3.5–8.3 (32)	2.5–5.7 (17)	(NAPIER et al., 1967)
	3.9–5.9 (15)	2.5–3.6 (11)	WASHBURN, 1942
	5.8–10.3 (7)	2.1–5.7 (6)	SPIEGEL, 1956**
M. fuscata			The present report
Arashiyama group		8.7–13.6 (8)	
Mihara group	7.8–13.0 (7)	7.4–10.1 (9)	
Kochi group		8.3–11.3 (12)	
Hasumi group		8.3–10.5 (5)	
Shodoshima group	7.9–14.0 (23)	7.5–9.9 (15)	
Takasakiyama group	12.5–17.5 (8)	7.0–11.2 (11)	
Ohirayama group	10.2–15.0 (8)	7.0–12.8 (21)	
Caged group	8.6–14.0 (19)	5.5–9.2 (13)	
M. maurus	8.8–10.1 (2)	5.1 (1)	(NAPIER et al., 1967)
M. mulatta	5.6–10.9 (12)	4.4–10.7 (47)	(NAPIER et al., 1967)
M. nemestrina	6.2–14.5 (14)	4.7–10.9 (3)	(NAPIER et al., 1967)
M. radiata	5.7–8.9 (10)	2.9–4.4 (10)	(NAPIER et al., 1967)
M. sinica	4.4–8.4 (6)	3.4–4.3 (5)	(NAPIER et al., 1967)

* After records of the Japan Monkey Centre and the Primate Research Institute, Kyoto University.
** Statistics on animals 7–10 years old.

Table 10. Sitting heights (mm) of macaques. (The number of specimens referred to are in parentheses.)

Species	Male	Female	Authors
M. assamensis	559–650 (6)	528, 680 (2)	(NAPIER et al., 1967)
M. cyclopis	547, 549 (2)		IWAMOTO (unpublished)
M. fascicularis (=*irus*)	412–648 (24)	385–503 (7)	(NAPIER et al., 1967)
	405–466 (7)	353–440 (5)	SPIEGEL, 1956*
M. fuscata			The present report
Mihara group	519–648 (7)	520–573 (9)	
Kochi group		480–559 (12)	
Hasumi group		531–564 (5)	
Shodoshima group	535–607 (21)	481–546 (20)	
Takasakiyama group	590–639 (8)	504–564 (11)	
Ohirayama group	550–611 (8)	489–560 (21)	
Caged group	537–612 (19)	479–527 (13)	
M. mulatta	483–635 (15)	470–531 (17)	(NAPIER et al., 1967)
M. nemestrina	495–595 (10)	467–564 (3)	(NAPIER et al., 1967)
M. radiata	513–599 (11)	345–523 (13)	(NAPIER et al., 1967)
M. silenus	508–610 (5)	457 (2)	(NAPIER et al., 1967)
M. sinica	442–533 (5)	432–452 (3)	(NAPIER et al., 1967)
M. speciosa (=*arctoides*)	549–700 (8)	503–569 (6)	(NAPIER et al., 1967)
M. sylvana	559, 620 (2)	601 (1)	(NAPIER et al., 1967)

* Statistics on animals 7–10 years old.

Table 11. Anterior trunk length (mm) of macaques. (The number of specimens and the means referred to are in parentheses and brackets, respectively.)

Species	Male	Female	Authors
M. fascicularis (=*irus*) (*Cynomolgus fascicularis*)	203–316 (12) [242.0]	206–246 (7) [229.7]	MOLLISON, 1911*
(*M. philippinensis*)	(4) [260.0]	(3) [263.3]	SCHULTZ, 1941
(*M. irus*)	(10) [299.7]	(5) [270.6]	SCHULTZ, 1941
	283–323 (15) [304]	253–285 (11) [272]	WASHBURN, 1942
M. fuscata			The pressent report
Arashiyama group		356–387 (8) [373.4]	
Mihara group	346–427 (7) [382.7]	346–383 (9) [358.0]	
Kochi group		331–382 (11) [366.5]	
Hasumi group		356–383 (5) [369.0]	
Shodoshima group	349–436 (22) [388.1]	329–393 (20) [356.1]	
Takasakiyama group	398–444 (8) [419.9]	331–385 (10) [362.6]	
Ohirayama group	343–374 (8) [363.6]	310–369 (21) [337.0]	
Caged group	340–406 (19) [369.1]	308–350 (13) [329.8]	
M. maurus (*Cynopithecus niger* var. *maurus*)	200,323 (2) [261.5]	276,328 (2) [302.0]	MOLLISON, 1911*
M. mulatta	(7) [363.9]	(17) [337.8]	SCHULTZ, 1941
M. nemestrina	197–350 (7) [299.9]	276,310 (2) [293.0]	MOLLISON, 1911*
M. sinica (*Cynomolgus sinicus*)	267,282 (2) [274.5]		MOLLISON, 1911*
	(3) [324.7]	293 (1) [293]	SCHULTZ, 1941
M. speciosa (=*arctoides*)	298 (1) [298]		MOLLISON, 1911*
	314 (1) [314]		SCHULTZ, 1941

* Rearranged respectively for each sex by the present author.

in the 7-year-old rhesus monkeys (*M. mulatta*) (WAGENEN, 1956) (570 mm for 4 males and 512 mm for 21 females) is somewhat small as compared with that of the Japanese monkey, except for the females of the Caged group.

As to the anterior trunk length, comparable data are insufficient (Table 11), but we can find that this length is apparently the largest in the Japanese monkey, the least in the crab-eating monkey (*M. fascicularis*), and comparatively large in the rhesus monkey (*M. mulatta*), again a similar result to what was found concerning body weight and sitting height.

We cannot clearly deduce from Tables 9–11 whether or not there are interspecific differences of body size relating to sex difference in macaques, though we may tentatively point out that the sex ratio seems to be not much different from the $90\pm5\%$ for the length (sitting height and trunk length) and the $70\pm10\%$ for body weight generally, in each species of macaque.

Interspecific comparisons among macaques on some body indices were illustrated in Figures 5–8. For head indices, we cannot find enough appropriate data to attempt comparisons.

Relative tail length: From Figure 5, we are able to see that relative tail length varies greatly within the genus of *Macaca*. Among many species of macaque, the Japanese monkey has a very short tail, being about 20% of the body length, although the barbary ape (*M. sylvana*) especially, the Moor monkey (*M. maurus*), and the stump-tailed monkey (*M. speciosa*) have shorter tails.

Relative biacromial and biiliac breadths: These indices in some species of macaque were illustrated in Figure 6. The results on the rhesus monkey (*M. mulatta*) as reported by MOLLISON (1911) (the lower part in Fig. 6) and by SCHULTZ (1956) (the upper) show considerable differences. In any case, from Figures 3 and 6 we may

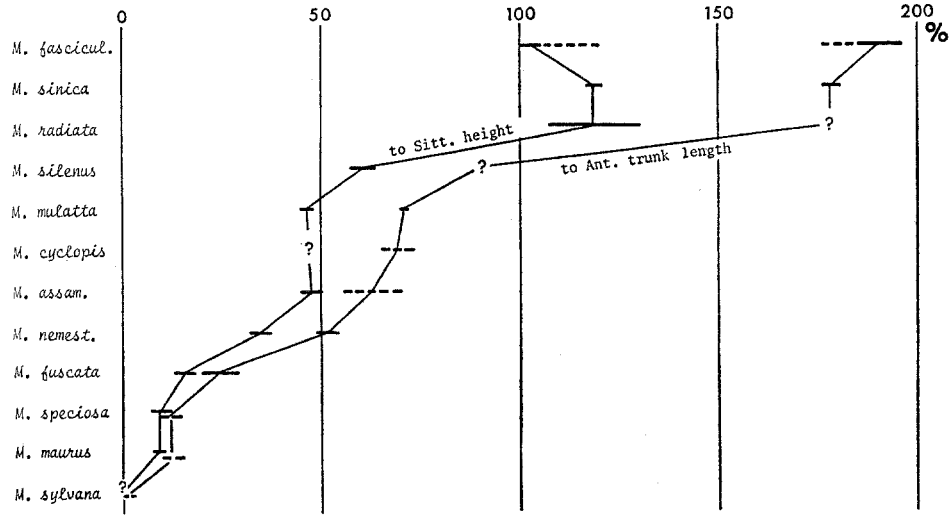

Fig. 5. Relative tail length. (Tentatively summarized after SCHULTZ, 1941, 1956; NAPIER & NAPIER, 1967; the present report; and the present author's unpublished data.)

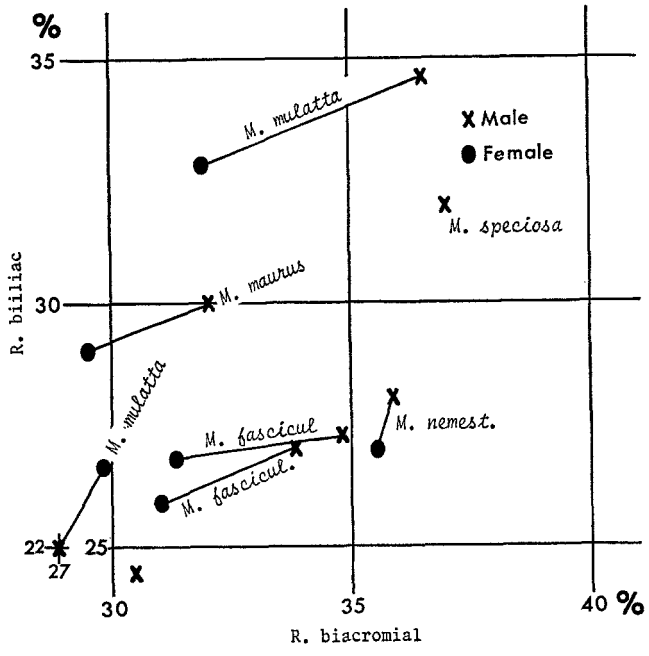

Fig. 6. Relative biacromial and biiliac breadths. (Tentatively summarized after MOLLISON, 1911; SCHULTZ, 1956. See Fig. 3 for the Japanese monkey.)

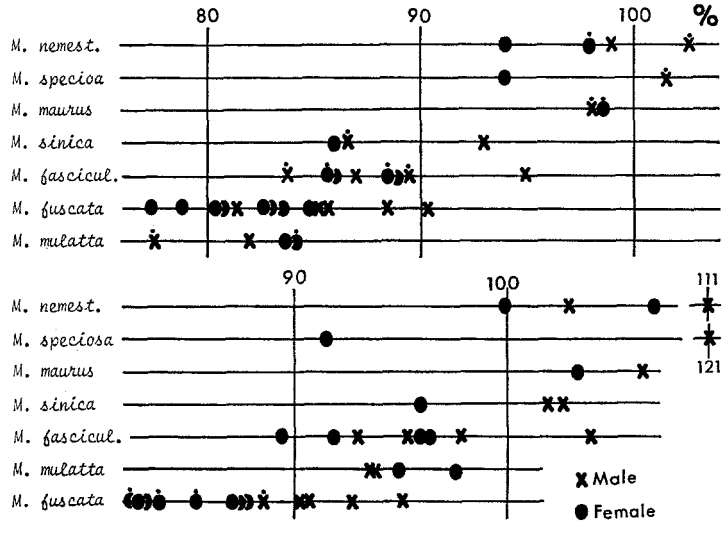

Fig. 7. Relative total arm length (upper) and total length of thigh and leg (lower). The dotted is slightly different from the others concerning metrical method. (Tentatively summarized after MOLLISON, 1911; SCHULTZ, 1941; and the present report.)

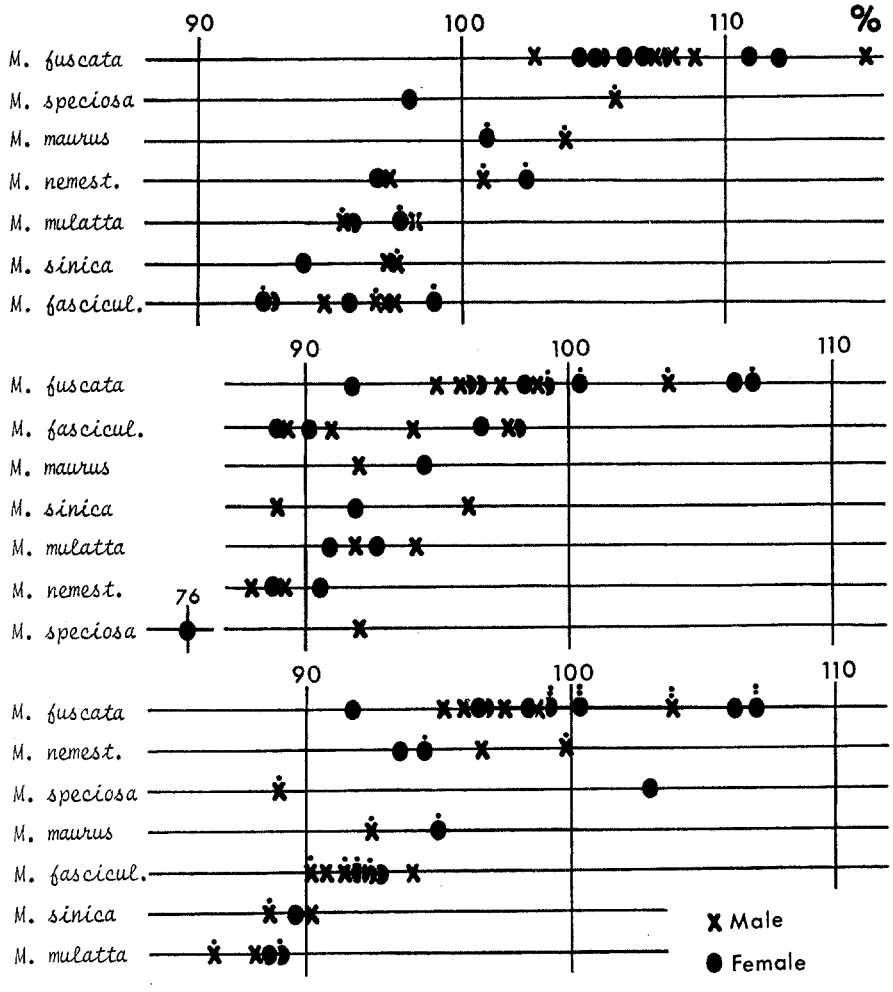

Fig. 8. Interbrachial (upper), Intercrural (middle), and Intermembral (lower) indices. The single- and the double-dotted are slightly different from each other and respectively from the others concerning the metrical method. (Tentatively summarized after MOLLISON, 1911; SCHULTZ, 1941; and the present report.)

tentatively estimate that in macaques the Japanese monkey has comparatively large relative biacromial and biiliac breadths, and additionally that generally, in macaques, the relative biacromial breadth is obviously larger in the male than in the female.

Relative total arm length and total length of thigh and leg: Data on these indices, which mean the percentages of upper arm length + lower arm length and thigh length+leg length to anterior trunk length, are very scant, as is shown in Figure 7, though those obtained from the smallest sample sizes were not omitted for any spieces except the Japanese monkey. The metrical method employed for the relative total arm length by MOLLISON (1911) and for the relative total length of thigh and leg of some groups by the present author differs slightly from that applied to the other

samples. From Figure 7 we can hardly deduce any marked interspecific differences, except that the pig-tailed monkey (*M. nemestrina*), the Moor monkey (*M. maurus*), and the stump-tailed monkey (*M. speciosa*) may be comparatively long-limbed. From this Figure we may say that in general differences in relative limb length due to difference in sex are to be found in macaques.

Interbrachial index: From the upper part of Figure 8, it may be seen that apparently only the Japanese monkey has a longer lower arm as compared with the upper arm, though this index seems to be rather large, too, in the pig-tailed monkey (*M. nemestrina*), the Moor monkey (*M. maurus*), and the stump-tailed monkey (*M. speciosa*).

Intercrural index: As is shown in the middle part of Figure 8, this index is also largest in the Japanese monkey, while, contrary to the above-mentioned result on the intermembral index, it is rather small in both the pig-tailed and the stump-tailed monkeys.

Intermembral index: This index is comparatively large in the Japanese monkey and perhaps in the pig-tailed and the stump-tailed monkeys also (the lower part of Fig. 8).

Two facts concerning the limb-proportions, summarized in the following, are very interesting to us.

(1) In macaques, the pig-tailed monkey (*M. nemestrina*) and the stump-tailed monkey (*M. speciosa*), and perhaps also the Moor monkey (*M. maurus*), have relatively long limbs and comparatively large interbrachial and intermembral and small intercrural indices, thus resembling the baboon (*Papio*) (see MOLLISON, 1911; SCHULTZ, 1957; NAPIER & NAPIER, 1967). In this connection, we recall that the pig-tailed monkey resembles the baboon in its general head form, as has been mentioned occasionally by other authors (BUETTNER-JANUSCH, 1966; VOGEL, 1966).

(2) In macaques, the Japanese monkey exhibits markedly large interbrachial and intercrural indices, thus resembling the terrestrial patas monkey (*Erythrocebus*). On the other hand, however, it differs not only from the patas monkey but also from the baboon in that it has relative short limbs (especially the lower limbs). Therefore, we must conclude that the Japanese monkey has especial body proportions peculiar to itself.

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