

On the Zoology and Botany of the Altai Mountains.

By H. J. ELWES, F.R.S., F.L.S.

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It would be impossible, within the limits at my disposal, to give more than a brief sketch of the results of the journey which I undertook during the summer of 1898; but as the Altai Mountains are almost unknown to English naturalists, and as I am not aware that any Englishman has previously visited or written anything about that country, I think it will be of interest to point out what a wonderful field for research exists, within three weeks' journey of England, and one which is practically less known to naturalists than many parts of Central Africa.

The country is so extensive, and the season for travelling so short, that I was only able to visit a portion of it. So far as I am aware, the only travellers who have written on the natural history of the country, are Pallas, whose great work is well-known, though now rather out of date; Ledebour and Bunge, who 60 years ago compiled an excellent account of the botany of the Altai; Helmersen, who has described the geology of the country; and Tchihatcheff, a well-known Russian traveller, who published an account of his travels in French in 1852. The few English travellers who have preceded me, so far as I know, are Major Cumberland and Mr. St. George Littledale, both of whom went there solely for sport; and Mr. Rew, who last year made a rapid ride *viâ* Kusnetsk, Kobdo, and Uliassutai to Irkutsk. Since the first half of this century I am not aware of any zoologist who has written, except in Russian, anything of much importance about the Altai; and though no doubt there are many valuable memoirs on various parts of the country in the Russian language, especially relating to the geology and mineralogy, the majority of travellers who have gone to Siberia recently have passed along the main high road to Irkutsk, leaving the Altai far to the south of them. My late friend Seebohm, who visited Siberia especially to study ornithology, confined his exploration to the lower valley of the Yenesei river; and one of the ideas which he expressed to me, and which made me specially anxious to visit Siberia, was that the Yenesei valley formed probably the most natural boundary

between the Eastern and Western Palæarctic, or, as it is now more properly called, the Holarctic Region. This idea was not confirmed by my own observations, for I found many species of butterflies and some birds which were previously only known from Dauria and Amurland; and I think that if any boundary can be fixed, it must be sought west of the Altai Mountains.

By the Altai Mountains I understand the western extension of the great mountain-range between Semipalatinsk and Irkutsk, which is divided from the mountain-ranges of Turkestan by the Irtysh river, and from the Himalayas and the great mountain-ranges of Central Asia by the Gobi Desert and Mongolia. The southern part of this range, known as the Great Altai, is in Chinese territory and is at present very little known. I may add that the political boundary between Russia and China follows roughly, or is supposed to follow, what I daresay geographers thought was the southern watershed of the Obb and Yenesei rivers, but as a matter of fact the whole of the upper waters of the Yenesei are in Chinese territory. One of our objects was to visit this great mountain valley, containing the headwaters of the Yenesei, which is almost unknown to the Russians themselves, though Clements and one or two other travellers have passed through parts of it, and it is annually visited by a number of fur-hunters and gold-miners. The upper region of the Yenesei, from the sources of the Kemchik to Lake Kossogol, including the great valleys of the Beikem and Ulukem between the Tannu-ola mountains and the Russo-Chinese frontier, is almost uninhabited, and unknown except to those in search of fur and gold, though in a general way its outlines are reproduced on the map. On reaching St. Petersburg, I made every endeavour to get information as to the possibilities of visiting this country, and as to what had been done recently by Russian travellers. I was introduced to M. Beresowsky, who had accompanied Potanin in two of his journeys right through Mongolia to China, and had collected what information he could. The result of these enquiries, and what I was told by M. P. P. Semenov, Vice-president of the Russian Geographical Society, who was most friendly to me, tended to show that the greater part of these valleys were almost impassable in summer; because the mountains were covered with dense forests, and the valleys were very marshy, intersected with numerous streams and rivers which were difficult to cross with horses. I was also informed,

and afterwards found it to be the case, that the higher regions of the Altai were liable to excessive rains and snow-storms in summer, making it a very difficult country for horses to traverse. Tchihatcheff (the only writer so far as I know who has crossed from the head-waters of the Tchuja to the head-waters of the Abakan, the principal western tributary of the Yenesei in Siberia) has stated that to cover a distance of about 200 miles cost him six weeks' hard travelling, and the loss of about half of the 150 horses with which he started. This will give an idea of the difficulties of an explorer in some parts of this country.

But to return to the question of what should properly be called the Altai Mountains. I would draw the line eastwards at the boundary of the Government district of the Altai, which is somewhat east of the water-parting between the tributaries of the Yenesei on the east and those of the Obb on the west. I do not include all those eastern mountains which are known by the names of Sayansk, &c., and stretch away as far as the south-west end of Lake Baikal, though they are from a physical point of view part of the Altai.

Until two years ago the journey to Siberia was one which had to be undertaken in the winter, for the roads are almost impassable when the snow is melting in spring. But now the railway enables one to do in comfort in ten days what formerly entailed three weeks or a month of hard sledging.

Although my special object was an investigation of the Lepidoptera, a subject at which I have been chiefly working of late years, I was also anxious to collect birds and plants as well; and if M. Beresowsky had not left us just when the real work of collecting began, I should have done much more in that direction. My companion, Mr. Fletcher, very kindly assisted me during the leisure time he could spare from the pursuit of the Wild Sheep, which was the special object of his journey; and I have in consequence been able to bring home a very fine and complete collection of Butterflies, including specimens of about 200 species. I also made a collection of Altai plants, but unfortunately, after they were packed and sent off, the horse that carried them went down in one of the numerous rivers the crossing of which is the principal difficulty of travelling in the Altai. When I subsequently unpacked them, they were almost entirely spoilt; but as Mr. Littledale had made a good collection the year before,

which was presented to Kew, I am able, with the permission of the Director of the Royal Gardens, and the kind assistance of Mr. J. G. Baker, to exhibit specimens of a few of the most interesting.

The language is a difficulty not easily overcome by English travellers, for though Russian is of course spoken all over the Russian Dominions, yet the inhabitants of the frontier districts are Tartars, Mongols, and Kirghiz; and when all communications have to be made through two uneducated interpreters in languages which they do not understand perfectly themselves, it is not easy to get accurate or full information on any subject.

There is no difficulty in getting leave from the Russian authorities, with proper introductions, to visit any part of Western Siberia, and in fact I was seldom asked for a passport the whole time I was in the Altai. The Chinese in Mongolia are also very civil and friendly to travellers provided with passports; and the only difficulty which prevented us from extending our journey far into the Chinese dominions was the lack of time, and the unwillingness of the Russian subjects to run the risk of having their horses stolen by the Kirghiz, who are subject only to Chinese authority.

We left Moscow on the 18th of May, 1898, and, travelling by rail without stopping, reached the crossing of the Obb river in six days and nights. The whole of our route between the Ural Mountains and the Obb lay through an immense flat plain, parts of which are marshy and more or less clothed with birch woods, and wherever the soil is dry enough a considerable amount of cultivation is seen. Large quantities of wheat were stored at the railway-stations for export, but I believe the price is now insufficient to enable Siberian wheat to be profitably exported to England.

Spring had hardly set in when we reached the Obb river, though it had been quite hot at Moscow; and almost the only flowers which I noticed in the Steppe were a blue-and-yellow anemone (*Anemone patens*), closely allied to if not identical with *A. Pulsatilla*, and the brilliant yellow flowers of *Adonis vernalis*. On reaching the Obb river, we had to wait two or three days for a steamer to take us up to Barnaoul, which is the chief, indeed I may say the only, town in the whole of the Altai Government. From there we drove in two days across the Steppe to Biisk, which, although a place of 18,000 inhabitants, is really a large

and very dirty village rather than a town. As this is the last place, however, of any importance towards the Chinese frontier, it is the centre of a large trade in wool, tea, and furs. A Dutch fur-trader whom we found there showed us a collection of furs he had made during the previous winter. Though in the early days of the Russian conquest valuable furs were in such abundance in this part of Siberia that all the taxes were paid in them, the better kinds have now become very scarce, and the only skins which we saw in great quantity were those of the Yellow Marmot of Mongolia, which are now exported in enormous quantities at a very low cost, and I believe are dyed in Europe to imitate the fur of the Mink. We must have passed 400 or 500 horse and camel loads of them on the road between Biisk and the frontier.

All up the valley of the Obb are large villages, some of them over a hundred years old, and sometimes two or three miles long, and the peasants seem for the most part prosperous and wealthy, according to a Russian peasant's ideas of wealth; but we were informed that the country was so far filled up to the foot of the mountains that there was no more room for emigrants on a large scale, except in the forest country to the eastward, and most of the emigrant trains that we saw on the railway were going farther to the East, into the districts of Krasnoyarsk and Irkutsk.

At Biisk, which we reached on the last day of May, there were signs of spring. The birch and poplar trees were just opening their buds, and here we obtained our first view of the outlying spurs of the Altai Mountains; the country between Barnaoul and Biisk, which from the map one would suppose to be mountainous, being grassy rolling downs of low elevation. After some delay in getting horses, we fairly entered the mountains on June 6th, and at once found an immense improvement from a naturalist's point of view in the appearance of the country. Many of our well-known old garden flowers such as peonies, erythroniums, rhododendrons, and anemones were in full bloom, while in some parts the ground was completely covered with the flowers of *Iris ruthenica*. Butterflies also began to appear; and though I did not get any worth mentioning until we reached Ongodai, which is four long days' drive through the mountains, I could see that the country was of far greater interest than anything we had hitherto passed through.

The Obb river divides just below Biisk into two great branches—

the Bija, which flows out of Lake Teletskoi, and the Katuna, which rises on the Chinese frontier in the great mountain called Bielucha, which is over 10,000 feet high.

Ongodai is about 180 miles from Biisk, and is the last place on the trade route to Kobdo in Mongolia where Russians are settled. It lies in the valley of the Ursul river—a broad valley of steppe-like character, whose waters flow into the Katuna, one of the two great sources of the Obb river. The character of the country thus far is much like that of Colorado. The slopes exposed to the south are arid, and covered with dwarf plants and dry grass, while the slopes facing north are wooded, in some places very thickly, with larch, while spruce grows in the flat, marshy bottoms of the valleys.

We entered the country of the Altai Tartars shortly before reaching Ongodai. They are mostly nomads, and from their appearance are probably nearly akin to (if not identical with) the tribes from whom the Ottoman Turks originally sprung. Though Tchihatcheff, who spoke Turkish, says he could not understand their language or make himself understood, yet I recognized the few Turkish words I know for common objects, and the appearance of some of the men is exactly like that of the Turks of Asia Minor. They have enormous herds of horses, one chief owning as many as six or eight thousand, and live in summer in movable 'yurts' or tents, covered with felt on wicker frames, like those of the Kirghiz, whilst in winter they live in pyramidal huts covered with larch bark, which resemble in form the lodges of the North-American Indians.

From Ongodai we had to carry all our baggage on horseback, for beyond this the road is impassable, even for country carts, and there was considerable delay in getting horses sufficient for our outfit, for the spring had been very severe, and most of the working horses had already left with merchandise for Kobdo. A day's journey beyond Ongodai, we crossed the valley of the Katuna in a deep rocky gorge, about 3000 feet above the sea, by a ferry of log canoes, whilst the horses were all made to swim over. After crossing the Katuna we passed over a mountain, about 5000 feet high, and descended again into the Katuna valley, close to its junction with the Tchuja river, which we followed for six days nearly to its source in a great open valley lying about 6000 feet above the sea, and known as the Upper Tchuja Steppe. In this Steppe was a sort of frontier market-place, called Kuch

Agatch, where the Chinese and Russian traders formerly met for purposes of barter, and a small Russian custom-house is maintained here, whose superintendent was the only Russian official we saw anywhere beyond Ongodai.

Large numbers of horses and camels and a few sheep and yaks are pastured in the Tchuja valley. The yaks that I saw appeared to be larger and of a finer breed than those I have seen in the Himalayas. The camels were all of the double-humped Asiatic variety.

Having reached Kuch Agatch, we got a fresh lot of horses and Tartars to go into the mountains lying south of the Tchuja Steppe, where we expected to find the great Wild Sheep (*Ovis ammon*, Linn.), some of whose heads I now exhibit. This is the finest and largest wild sheep in the world, although its horns are not equal in spread to those of *Ovis Poli* of the Pamir.

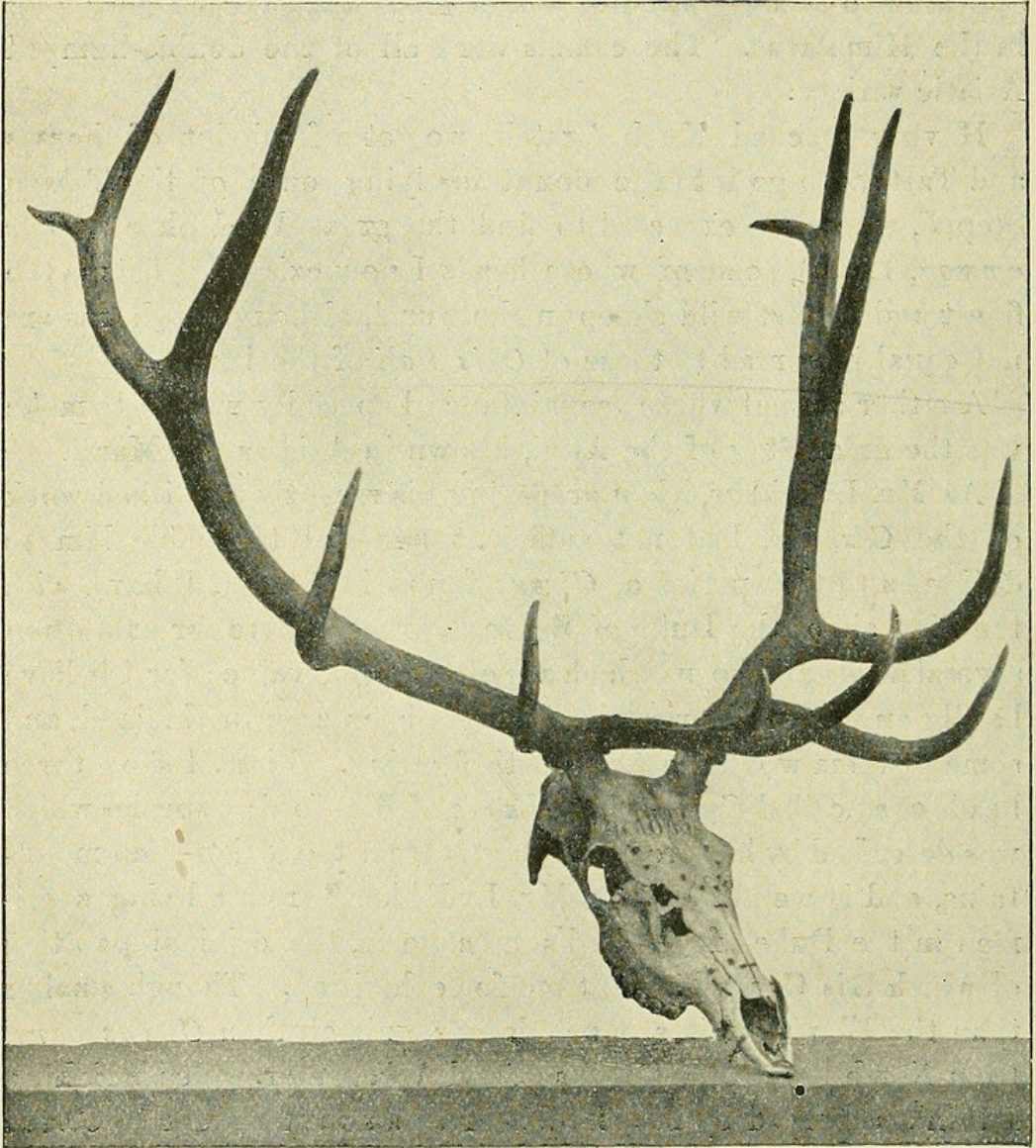
Another animal whose acquaintance I specially wished to make was the great Stag of the Altai, known in Asia as the Maral.

As Mr. Lydekker, when preparing his recently published work on the *Cervidæ*, had not sufficient material to enable him to decide as to the species of *Cervus* found in Siberia, I have, with the kind aid of the Duke of Bedford, brought here for exhibition several heads and horns which are of scientific value; for I believe hardly any from Siberia have hitherto been seen in England, and some of them would be well worth figuring. First, I show three heads of so-called *Cervus eustephanus* of Blanford; a species which was described by him from shed horns from the Thian-shan mountains, and is well figured by Mr. Lydekker* from a living specimen in the Duke of Bedford's menagerie, the original painting of which His Grace has lent me for exhibition. Though smaller than the Wapiti, it is a much larger animal than *Cervus maral* from North Persia, the Caucasus, and Asia Minor, which is rightly, I think, regarded by Mr. Lydekker as an Eastern race of *Cervus elaphus*. A head (fig. 1) which was brought by Regel from the Thian-shan mts., though not a large one, is typical in character of this species; whilst the other two (figs. 2 & 3), which I procured in the Altai, are not so typical, and, as I thought at first, had more resemblance to the horns of the European Red Deer. Mr. Blanford, however, has convinced me that they are nearer in character to those of *Cervus eustephanus*. This species has

* 'Deer of all Lands,' 1898, pl. vi. p. 105.

now become scarce in a wild state in the Russian Altai owing to the number which are shot by the native and Russian hunters, who sell their horns, if killed while "in the velvet," at high prices to the Chinese. They are, however, kept alive in parks at several

Fig. 1.



Cervus asiaticus, var. *songarica*, Severtzoff.

= *Cervus eustephanus*, Blanford.

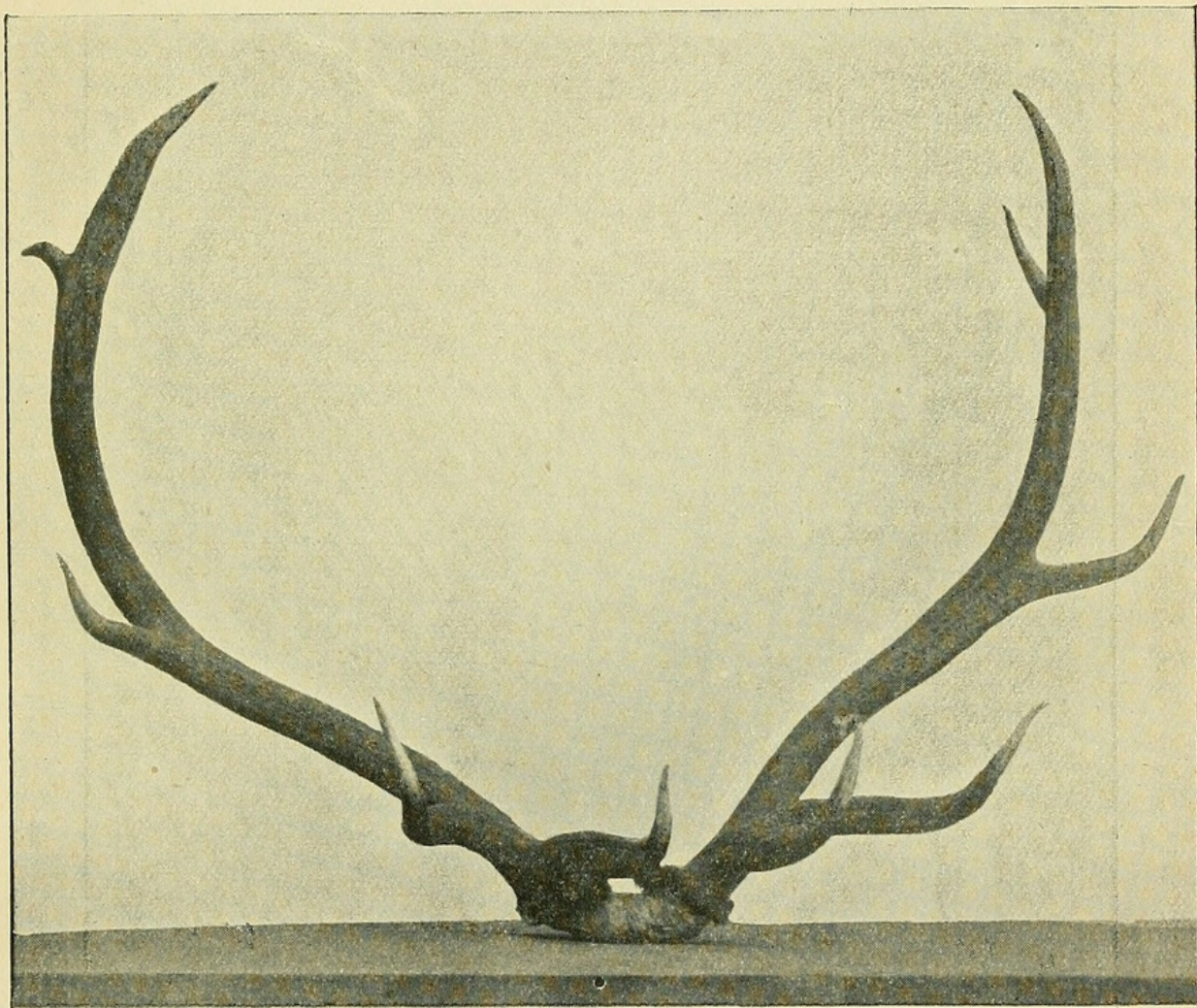
From the Kuldja district. (Regel.)

places in the Altai for the sake of their horns, which are annually cut for sale, and which sometimes realize as much as 100 roubles a pair at the rate of 10 roubles a pound.

The killing of these deer has now been prohibited by the

Government in the Altai district, and we never saw the animal in a wild state, and though we picked up horns, shed many years previously, in the high treeless mountains south of the Tchuja valley (one of which I exhibit to-night to show what a large size they attain), I believe that they are now very scarce except in the heavily wooded country east of the Katuna. In

Fig. 2.

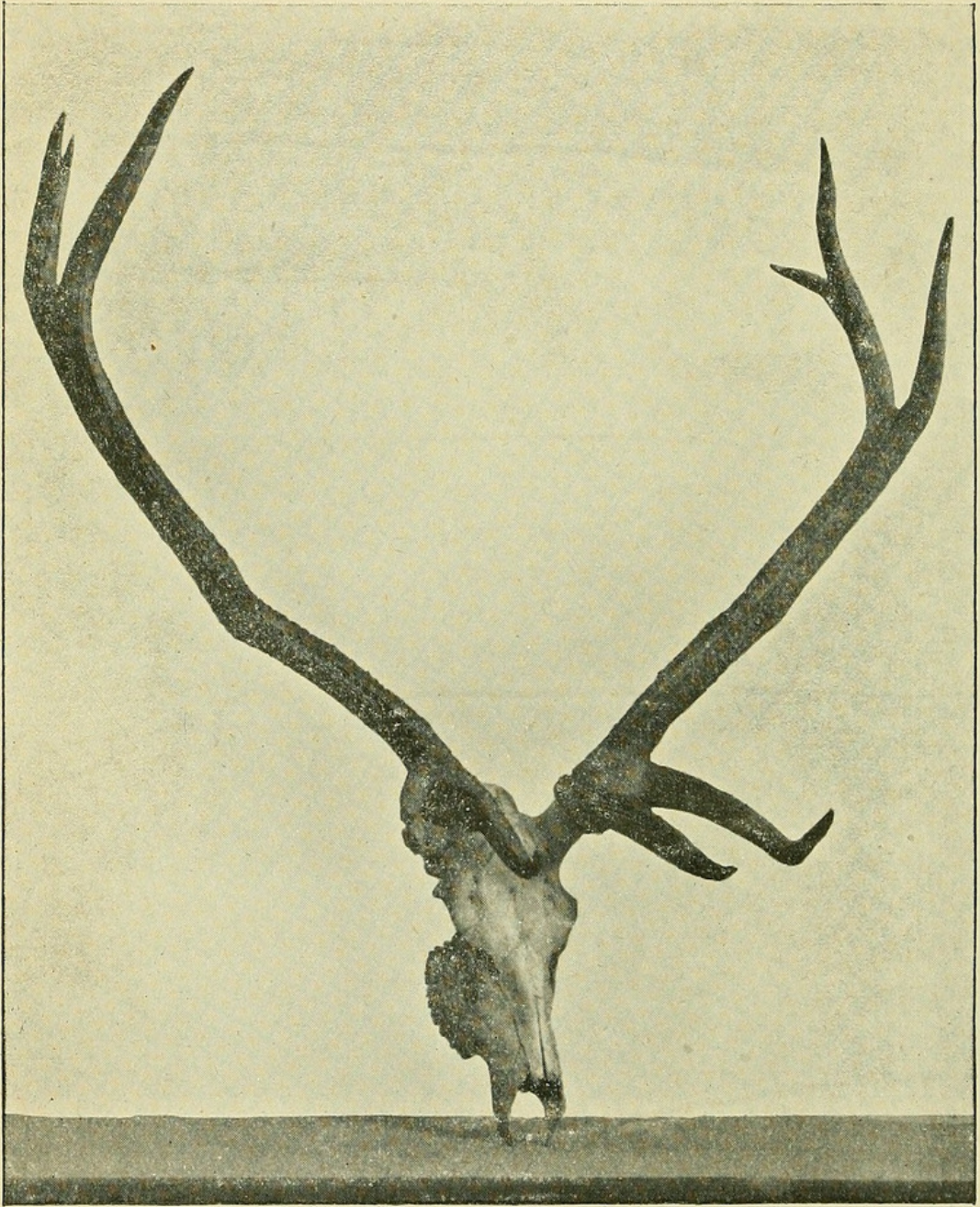


Cervus asiaticus, var. *sibirica*, Severtzoff. From the Altai. (Elwes.)

the Yenesei and Abakan valleys this deer, or a nearly allied form of it, is much more numerous; and I saw some horns from the Yenesei valley in the St. Petersburg Museum which I thought had much more resemblance to those of *Cervus elaphus*, having a distinct cup or crown of 6 or 7 times branching from the same point on the beam, as in large old specimens of the Red Deer,

quite unlike the horns of *Cervus eustephanus*, in which there is no cup-like formation on top, and in which, as in the Wapiti, the main beam is deflected backwards; the 4th tine, usually the

Fig. 3.



Cervus asiaticus, var. *sibirica*, Severtz. Bought at Barnaoul. (Elwes.)

largest, points forwards and all the upper points are nearly in the same plane.

Severtzoff, in the Proceedings of the Moscow Society of Naturalists, vol. viii. p. 2 (1873) (translated from the Russian in

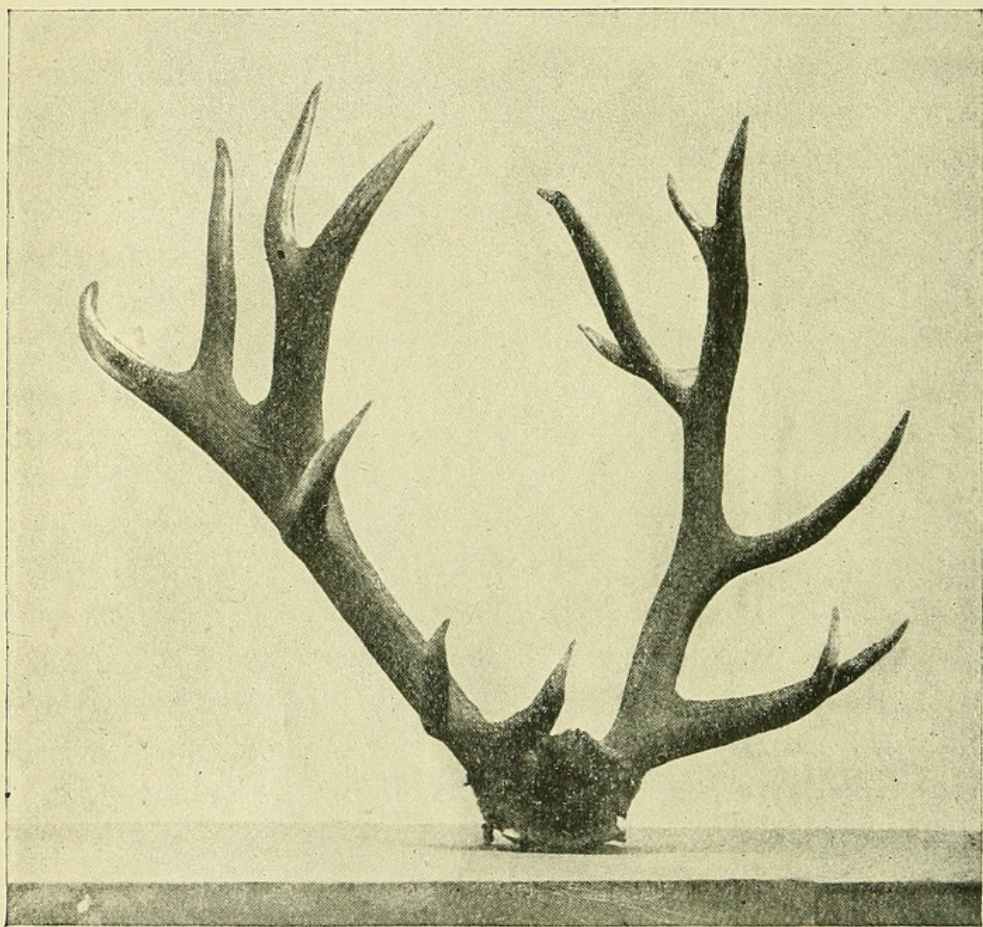
Ann. & Mag. Nat. Hist. 4th ser. 1876, vol. xviii. p. 386), was the first to call attention to the resemblance between the Stag of the Thian-shan, which he calls *Cervus maral*, and the Wapiti: he divides the Asiatic species into two forms, which he calls—" (a) *sibirica*," from the Altai, the Yenesei, and the wooded hills of the Sayansk and Transbaikal mountains, and " (b) *songarica*," from the Thian-shan. Mr. Blanford, describing *Cervus eustephanus* (Proc. Zool. Soc. 1875, pp. 637-640), has alluded to Severtzoff's memoir ('Turkestanski Jevotni,' p. 108), which being in Russian he could not follow, and therefore could not say whether the form described as var. *songarica* is identical with *eustephanus* or not. Now, however, that both he and Mr. Lydekker admit its identity, it seems to me that the name *soongarica* having priority should be used, though Mr. Lydekker styles this race *Cervus canadensis asiaticus*.

With regard to Severtzoff's var. *sibirica*, however, it is impossible at present to decide its exact relationship to the others. I am able to exhibit four pairs of horns which have been lately sent by Herr Hagenbeck of Hamburg to the Duke of Bedford, which were procured by Herr Dörries in the Chingan mountains and from the Sutschan river in Manchuria, which Mr. Lydekker, who has seen them, considers to belong to the race which he calls *Cervus canadensis Luehdorfi*. This race he regards as more nearly related to the Western Wapiti, from the Pacific coast, Washington, and Vancouver's Island, than to the Thian-shan or Altai race. He had seen no adult male or horns of this form when he published his work, 'The Deer of all Lands;' and though all these four pairs (evidently those of adult stags) are much smaller than any race of the Wapiti with which I am acquainted, they certainly to some extent show the horn character of the Wapiti, rather than that of the Red Deer (figs. 4 & 5). If it be admitted that they belong to a race of *Cervus canadensis*, we have this curious fact in geographical distribution, namely, that the race of the Western American coast more nearly resembles the Eastern Asiatic race than it does the Rocky Mountain race, which latter, on the other hand, has resemblance to the Altai and Thian-shan race, most widely separated from it in point of distance*.

* Since this paper was read I have received from Herr Hagenbeck another head procured by Dörries in the mountains south of Lake Baikal, which probably belongs to the same race as the Altai Deer, fig. 6 (p. 36).

Another point which should be taken into consideration in deciding the specific relations of these Deer, is the peculiar call of the stags in the rutting time. The Red Deer in all its forms, both in Europe and Asia, utters at this season a deep hoarse roar, ending in three or four loud grunts; which may be imitated by the human voice with the aid of a conch-shell or glass bottle.

Fig. 4.



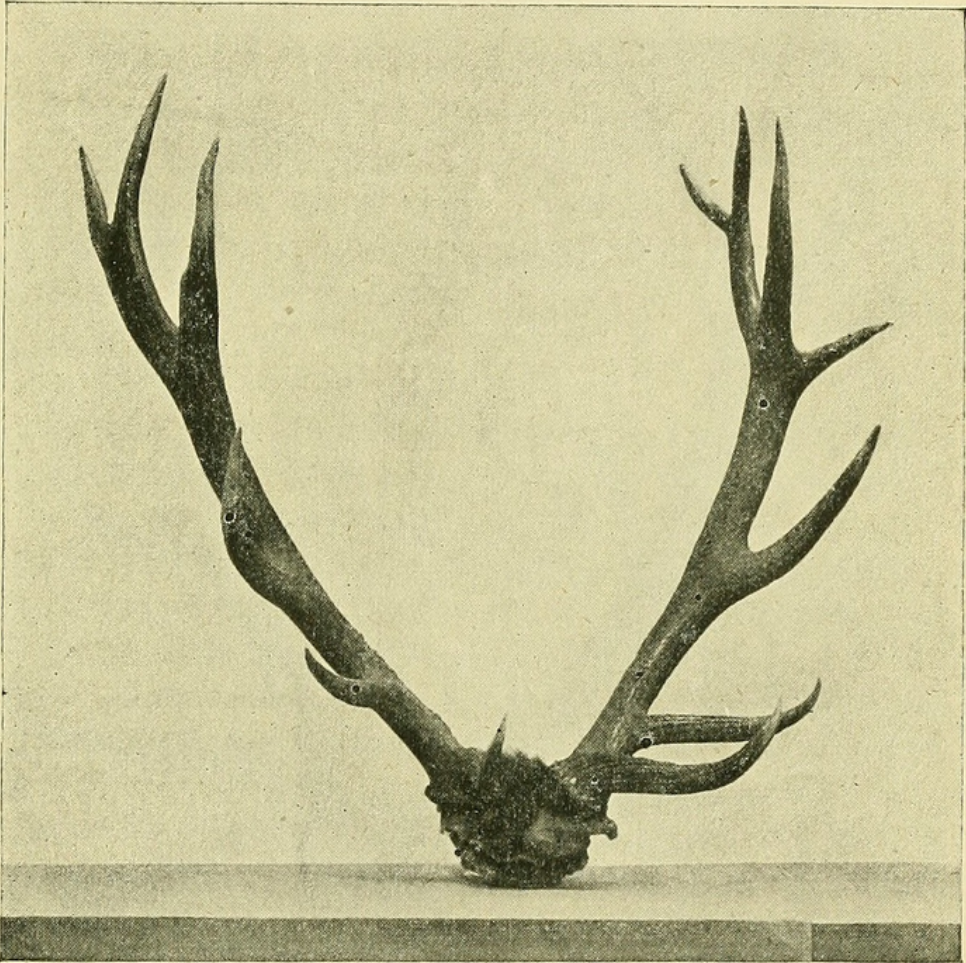
Cervus asiaticus, var. *Lühdorfi*, Bolau.
From the Sutschan river, Manchuria. (Dörries.)

On the other hand, the Wapiti in all its races (Asiatic and American) has a very different cry, which is described by hunters as a whistle. Although I have never listened to this cry myself, I have heard hunters in the Altai imitate it with the hollow stem of a plant, whilst in America a tin whistle is used for the same purpose. Radde who, in his well-known and valuable work on the natural history of Amur-land, regards the Stag of the East Sayansk mountains and Dauria as a race of *Cervus elaphus*,

mentions this peculiar cry and reduces it to musical notation *. Now though such a fact as this may be looked upon as trifling by some naturalists, I venture to think that, as in the case of the song of birds, the cry of an animal is a point of material value in deciding the question of specific alliance.

If, on examination, M. Büchner should consider that the horns

Fig. 5.



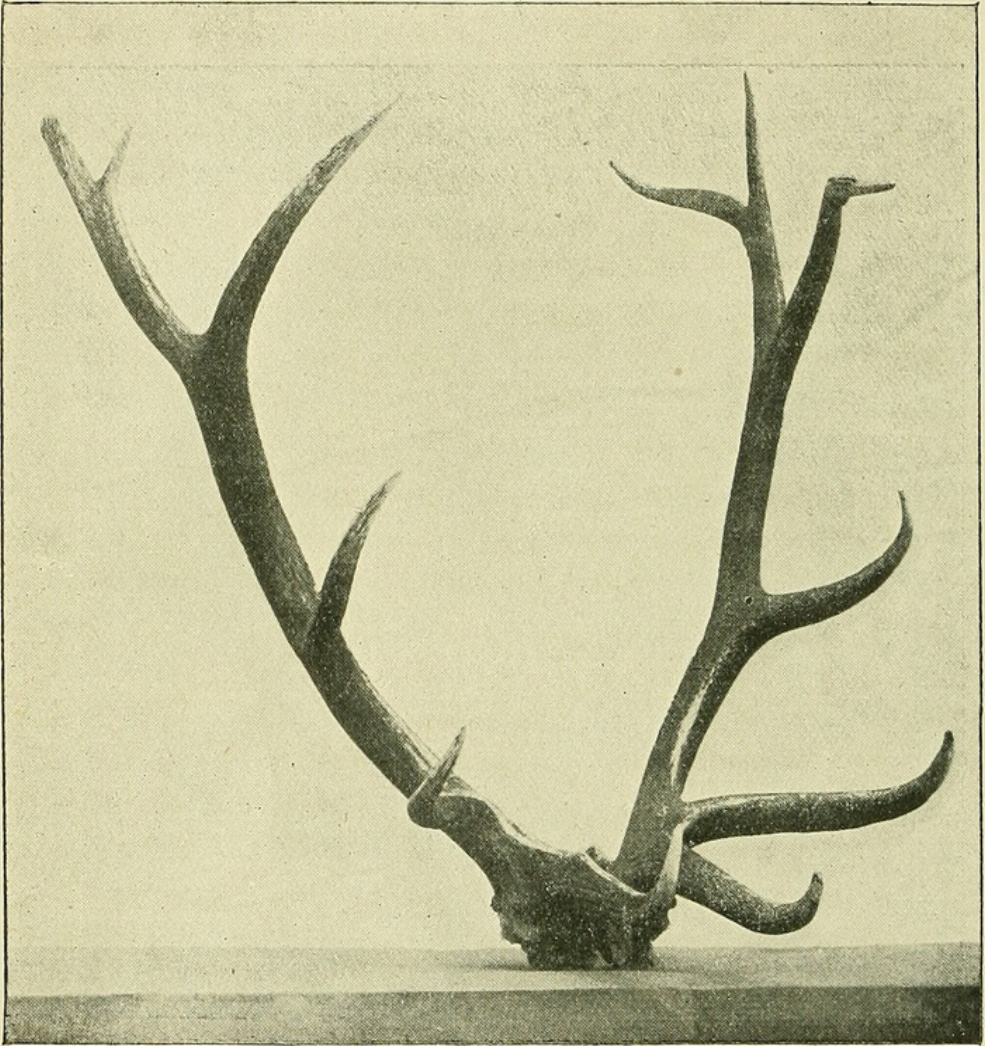
Another example of *C. Lühdorfi*. From the same source as fig. 4.

from the Yenesei, of which I have spoken, belong to a race different from that of the Altai and Thian-shan, and are also different from that found on the Amur and in Manchuria, and if it should prove that this race, notwithstanding that its horns

* Mr. J. E. Harting informs me that the notes indicated by Radde (*op. cit.*) accurately express the call of the Wapiti as heard by him repeatedly in the Regent's Park Zoological Gardens, and are quite unlike the call of the European Red Deer.

occasionally assume an elaphine character, is a race of *Cervus asiaticus*, then I think the synonymy and distribution of the Asiatic races will stand as follows, though I confess that no characters can be given by which these races can be exactly defined, and probably they will be found to intergrade.

Fig. 6.



Cervus asiaticus, var. *sibirica*?

From mountains south of Lake Baikal. (Dörries.)

CERVUS CANADENSIS ASIATICUS vel CERVUS ASIATICUS, *Severtzoff*.

(a) Var. *songarica*, *Severtzoff*, *Turkest. Jevotn.* p. 109 (1873).

Cervus eustephanus, *Blanford*, *P. Z. S.* 1875, p. 637.

C. canadensis asiaticus, *Lydekker*, *Deer of all Lands*, p. 104 (1898).

Hab. Thian-shan Mts. of Kuldja ; South Altai.

(b) Var. *sibirica*, Severtzoff, l. c.

Cervus elaphus, var., Radde, Reisen im Süden von Ost-Sibirien, 2 vols. (1862-63).

Hab. Altai; ? Yenesei Valley, E. Sayansk, Transbaikalia; Dauria; ? Upper Amur.

(c) Var. *Luehdorfi*.—*Cervus Luehdorfi*, Bolau, Abhandl. Ver. Hamburg, vii. p. 33 (1880).

C. canadensis Luehdorfi, Lydekker, *op. cit.* p. 102.

C. isubra, Noack, Humboldt, viii. p. 6, fig. 5 (1889).

Hab. North and East Manchuria, Sutschan river.

As Herr Büchner, of the St. Petersburg Museum (where alone can be found sufficient material on which to decide the question at issue), has declined at present to express an opinion on a subject which he considers should be monographically treated, it seems the more desirable to place on record the views above suggested.

The Ibex of the Altai, *Capra sibirica*, Pallas, the head and horns of which I exhibit, is nearly allied to the Himalayan Ibex, and is common in some parts of the mountains, though very difficult to get at in summer. The Elk was formerly more numerous in the northern districts, but has now become extremely rare; and the single head which I brought back resembles those which I have seen from European Russia, differing somewhat in the set of the horns from the Elk of Norway.

The Roe, *Capreolus pygargus*, Pallas, is very common in some parts of the Altai and Sayansk mountains, and is a very much larger and finer animal than the European Roe. I was at one time under the impression that the wide spread of the horns was a peculiarity of this species; but it would appear, from the nine heads which I have brought for exhibition—six from the Upper Yenesei valley, and three from the Altai—that this peculiarity is by no means constant, and that there is nothing but their size to distinguish them, so far as I see, from the European race.

The Musk Deer is also very abundant near the upper limit of forest growth, and is snared in quantities by the natives. We saw as many as 200 skins in one merchant's store.

Reindeer are said by Radde to occur in some parts of the eastern Sayansk range, where they are also kept in a domesticated

state, but so far as I could ascertain they do not exist in any part of the Altai.

Birds were not so numerous as I expected, although Cranes and Ducks were plentiful in the marshes of the Kurai and Tchuja Steppes. I was astonished to find a Scoter breeding here, which proves to be the species described as *Oidemia Stejnegeri*, and which is an inhabitant of the N.W. American coasts and North Pacific. It has never been hitherto procured, as I am informed by M. Alpheraky (who is at present engaged on a monograph of the Anatidæ of the Russian Empire), farther west than the Upper Amur.

Game-birds were very scarce, though I observed Capercaillie, Ptarmigan, and Quail, and in the highest and barest parts of the mountains the magnificent *Tetraogallus altaicus* was not uncommon, though very hard to approach. The only one which I got within shot of was a hen bird with a brood of young ones, and she fluttered along the ground before me just as a ptarmigan would do in similar circumstances.

I also saw a single pair of *Perdix barbata*, Pallas, with newly hatched young, on July 18 in a marshy larch wood at about 6000 feet elevation—a most unlikely place, as I should have thought, in which to find such a bird. I do not think that the Eastern Capercaillie (*T. urogalloides*) is found in the Altai. The Capercaillie I saw were apparently the same as those of Europe, though in the Southern Ural there is a well-marked variety with a white breast, which may be specifically distinct.

No ornithologist, so far as I know, has yet worked out the birds of the Altai, and there are few other regions in Europe or Asia of which it can now be said that they are unknown to the members of the British Ornithologists' Union. One fact, however, may be mentioned, as it bears upon the question raised recently by Mr. Hartert as to the migration of the Siberian Nutcracker, which he considers to be a distinct variety from the European one. As we rowed down Lake Teletskoi on the 4th of August, we saw large flocks of Nutcrackers which were evidently migrating, and though their migration may not have extended beyond the Altai Mountains, yet from the great abundance of edible seed of *Pinus cembra*, which were just becoming ripe, I could not see any reason to account for this. In Europe the Nutcracker is a solitary and not a migratory bird, and yet the regular occurrence of Asiatic Nutcrackers in Eastern Europe

shows that the Siberian one must be at any rate partially migratory. Those who wish to study the birds of this country should go early and stay late in the year, for the height of summer is not the time for collecting. I have no doubt, however, that one who would give up his whole time to it might get very valuable results; and I am certain, that even the plants, which have hitherto received a greater share of attention than any other branch of Natural History, are by no means worked out.

Next to the Wild Sheep, to whose pursuit I devoted ten days of my stay in the mountains, I gave most time to the Butterflies, which, though comparatively scarce until about the 5th of July, then began to appear in great profusion. I was particularly pleased to discover here a number of species hitherto known only from the Upper Amur and from Lapland, among them some most interesting species of *Eneis*, *Erebia*, *Argynnis*, and *Lycæna*. I found, however, hardly any of the peculiar types which occur in the various mountain-ranges of Turkestan southwards; and it seems, from a general review of the Butterflies of the Altai, that the European element is dominant, with a large admixture of species belonging to Eastern and Northern Siberia. I must say, however, that the majority of these are confined to the high bare mountains above timber-line. The collections made by Kindermann in 1851-52 (which have been described by Lederer) and by Ruckbeil in the south-western parts of the Altai (which are in Herr Tancre's collection) are of a much more typically European character, and do not contain a large number of the more interesting species which I obtained.

As I have already given some account of my collection of Lepidoptera from the Altai at a meeting of the Entomological Society, and propose to publish a full account of them in the 'Transactions' of that Society, I need only remark that the number of Butterflies known from the Altai district amounts to about 180, of which I took about 140 myself in two months. Of these about 40 are not found in Europe. 109 are also found in the Amur region. 92 were also taken in the Kentei mountains of East Mongolia, which is the only place in that country of whose butterflies we have a fair list. 78 were found by M. Alpheraky in the mountains of Kuldja, which in point of distance are much nearer than the Kentei mountains; and out of above 200 species included by Grun-Grishimailo in his list of

Butterflies from the Pamir region, only 51, or about one-quarter of the species, are also found in the Altai. As compared with any area of similar extent in Europe or Asia, this number of species is surprisingly large; and as Kindermann in two seasons only took about 90 species, and Ruckbeil about the same, as against the 140 which I myself collected, it shows that the South-western Altai, where they both worked, is not nearly so rich and has not nearly so much of an Oriental character as the South-eastern Altai, where most of my collection was made.

In the 20 years during which I have collected butterflies, I have never got nearly so many species in so short a time, and must attribute my success to the fact that when travelling on horseback I always had a net in my hand and never passed a likely spot without giving it a trial.

As for Moths, I was not able to do much myself. First, because at the high elevation at which most of our time was spent there were not many night-flying species, or at all events very few came to our lights. Secondly, because I was generally too tired to sit up at night to collect. But having received since I returned home the collection made by M. Beresowsky at Ongodai, and having gone through the list of Moths made by Kindermann, I do not think they are as numerous in proportion to the Butterflies as they are in the Alps or Himalayas.

Of the plants I cannot say much, because, although they have been pretty fairly worked out by Ledebour, yet a very intimate knowledge of the Flora of Turkestan and Eastern Siberia, as well as that of Europe, would be necessary to enable one to say how the distribution of plants coincides with that of birds and butterflies.

The Fauna and Flora are also materially influenced by the very peculiar climate of the Altai, which has great extremes of heat and cold, and is subject to heavy thunderstorms, which fall as snow and hail in the higher regions, almost daily throughout the summer. During the whole of the two months we were in the mountains, we only had seven or eight days quite free from rain or snow. These heavy storms seem mostly to come from the eastward, and from the high mountains, at the source of the Kemchik river, which is the westernmost tributary of the Yenesei. To show what sort of climate it is, I may mention that there were large beds of unmelted snow close to our camp, at about 7000 feet, all through July. On almost every clear

night it froze, and on the 17th of July snow fell to the depth of 8 or 10 inches at this elevation, and though the hot sun and dry atmosphere very rapidly melted it, we were assured by the inhabitants that the summer was too short to make it worth their while to graze sheep there, and that as early as the middle of August snow might be expected to fall and lie in the higher mountains. Tchikatcheff, in his journey from the Tchuja Steppe to the Abakan, the principal northern tributary of the Yenesei, also met with heavy snowstorms in June and July.

When we left England we had the intention of passing through North-western Mongolia and returning either by the upper valley of the Yenesei river, which is almost entirely unexplored, or, if we found that impossible, of going eastwards by the shores of the great Lake Kossogol to Irkutsk. But as we found no people who could act as guides in either of these directions, we were obliged to give up anything like real exploration. There is, however, no difficulty in travelling from Kuch Agatch through Mongolia, *viâ* Kobdo, Uliassutai, and Lake Kossogol to Irkutsk. Mr. Rew informed me that the Wild Horse (*Equus Prejvalskii*) was to be found in the desert between Kobdo and Uliassutai, and I was in great hopes of procuring a specimen of this animal which, so far as I know, has not been seen by any Englishman. M. Grum-Grishimailo, the celebrated Russian traveller, who has spent eight years in exploring Central Asia, and who is the only European who has actually seen the Wild Horse in its own country, assured me that the animals spoken of by Mr. Rew must be the Wild Ass, as the nearest point to the Altai at which he found the Wild Horse was about 15 days' hard travelling south from Kobdo, near Guchen, and as that country is almost inaccessible in summer on account of the want of water, time would not allow us to visit it.

Though the geographical results of this journey are therefore unimportant, the extra time given to collecting in the Altai was of the greatest possible advantage, and though a great deal may be done whilst travelling on horseback, if you stop every time you see a new or apparently new species, yet fast travelling is incompatible with collecting.

Our return journey from the Mongolian frontier took us through a very different and most interesting part of the Altai. Leaving the Tchuja valley by the Kurai pass, we crossed the mountains to the north of it into a valley through which flows a

tributary of the Bashkaus river, which, after its junction with the Tchulishman river, flows into the great Lake Teletskoi, a deep mountain-lake about 60 miles long, out of which flows the Bija river, the principal eastern source of the Obb.

Before quitting the Tchuja Steppe, however, I must make some remarks upon the character of the country we saw from the tops of the mountains at the sources of the Obb. These mountains are above 6500 feet, absolutely bare and treeless, though three or four species of willows are found along the streams up to about 7500 feet. They consist of steep, shaly mountains surrounded by great rolling downs of grass. From the tops of these mountains, at about 9000 feet, we could see the sources of the Irtysch and the Kemchik, which latter flows into the Yenesei, and of the Kobdo river, which loses itself in the Mongolian desert. Eighty or ninety miles to the southward we could see the high snow-peaks of the Southern or Mongolian Altai range, which have, according to the accounts of Russian travellers, dense forests on their sheltered slopes. I am informed that the Beaver occurs there, as it certainly does in the Sayansk mountains near the source of the Yenesei.

To give an idea of the Alpine flora of the South-eastern Altai, I may mention a few of the plants which were most conspicuous for their beauty near our camp on the Darkoti, or Tachety river as Tchikatcheff spells it, 30 miles south-west of Kuch Agatch, at about 7000 feet. I have never, either in the Alps of Europe, in the Sikkim Himalaya, in Colorado, California, or anywhere else, seen such a perfect natural garden of beautiful alpine flowers as I saw here in the middle of July. Among the most conspicuous were the lovely *Primula nivalis*, Pall., which strongly resembles *P. Parryi* of Colorado; *Dracocephalum grandiflorum*, which grew in sheets of cærulean blue; *Polemonium pulchellum*; *Gentiana altaica*; *Pedicularis verticillata*, *P. foliosa*, *P. comosa*; *Allium sibiricum*, or *senescens*, the most ornamental of its genus; *Linum cæruleum*; *Iris tigridia*, Bunge; *Pyrethrum pulchellum*; a lovely blue *Corydalis* growing in wet places, which Mr. Baker cannot name, and which may be new; a beautiful *Aquilegia*, named *A. glandulosa* at Kew, but much finer than that plant as we know it in our gardens; several pretty species of *Astragalus*, *Lloydia serotina*; and many well-known Arctic and high Alpine plants, such as *Papaver alpinum*, *Draba ochroleuca*, and *Saxifraga oppositifolia*, which were found

as high up as 8500 feet, where the flora and scenery reminded one strongly of the high fjeld of Norway, and *Dryas octopetala*, which covered the curious dry gravelly ridges on the hill-sides in many places.

Flying over these marshy alpine flower-gardens were some of the rarest and most beautiful butterflies of Siberia, the European Alps, and Lapland, many of them also found on the Alps of Colorado, such as *Parnassius Eversmanni* and *P. delius*, *Erebia lappona*, *E. ero*, *E. tyndarus*, and *E. maurisius*, *Eneis bore* and *E. sculda*, *Argynnis Kefersteini*, *A. freya*, and *A. frigga*, *Colias mongola*, *Lycæna orbitulus* and *L. pheretes*. Whilst on the higher and more rugged mountain-tops were herds of the great Wild Sheep and Ibex, Marmots, and Alpine Hares.

The Kirghiz, who were pasturing large herds of mares in this neighbourhood, on whose milk converted into kumiss they almost entirely live, had taken from the nest to train for falconry two young falcons which I believe to be *F. sacer*; but a rare species or variety known as *Falco altaicus*, allied to the Peregrine, also occurs in the country.

The only vegetables which we had during our stay at these altitudes were rhubarb (*R. Rhaponticum*) and wild onions; but the Tartars were also fond of the young stem of a species of *Heracleum*, which was too strong for my taste.

The larch, *Larix sibirica*, ascended here to a little over 7000 feet. I saw young trees at this elevation about $1\frac{1}{2}$ diameter and 7 feet high, which showed 25 years' growth; and a very remarkable stunted old larch, 3 feet in diameter and not more than 20 feet high, which must have been many hundreds of years old. Away from these there was no fuel but willows and dry horse dung, the common fuel of Mongolia and Tibet.

The change in the scenery and character of vegetation, fauna, and insects was most marked on crossing the watershed between the Tchuja and Bashkaus valleys. It seemed as though in one day we had passed from Asia into Europe, for a number of plants, such as *Linnæa borealis*, *Saxifraga umbrosa*, and various *Ericaceæ*, familiar to me in the Alps, which I had not previously seen, were found there; whilst ferns, which are conspicuous by their absence in the dry Tchuja valley, had also become abundant. Instead of thin larch forests, about which you could everywhere ride on horseback, we found dense forests of *Pinus sylvestris*,

Pinus Cembra, and spruce forests which exceed in their impassability anything I have ever seen, even in British Columbia.

When we reached the north end of Lake Teletskoi, we found the grass and herbaceous vegetation very high and rank, forming a most marked contrast to the dry stunted grasses of the Tchuja Steppe and the hills around it. Aconites, delphiniums, thistles, wild hops, and many other plants grew 6 or 8 feet high; but though many species of moths were seen, butterflies were much less numerous and interesting, most of them being common European species.

As there is no track passable for horses along the western shores of Lake Teletskoi, we had to traverse it in a boat, and it took two days of hard rowing. The western shore of this lake is so steep and rocky that in many places you cannot land for several miles, and we had great difficulty in hauling our boat ashore during a sudden storm which sprung up and threatened to swamp us. Along the whole western shore of this great lake there is not a single vestige of man's presence, and the forest is so dense, rocky, and impassable, that I do not think it would be possible for a man on foot to make more than four or five miles a day in summer, though these forests are no doubt more easily traversed in winter on snow-shoes by fur-hunters. The shores of Lake Teletskoi were formerly a favourite resort of the Elk, Deer, and Bear, but they are now much diminished since firearms have become common. There is something in the climate of this region which, as Helmersen remarks, must be very exceptional, for we were assured by the inhabitants, as he was, that ice rarely remains on the lake for more than a month at a time, whereas the Obb river is frozen up during three or four months every winter.

The inhabitants of the country round Lake Teletskoi, and probably of the Bija valley, are of an apparently different race to the Altai Tartars, and are called Teleutes; in physique they appear to be much poorer, and nothing like so healthy and vigorous. They cultivate a little spring rye and oats in the valleys, and are now mostly Christianised to a certain extent by Russian missionaries, whereas the Altai Tartars and Kirghiz are either mussulmans or worshippers of spirits. All these natives are very much addicted to drink, and the chief, or Saisan, through whom we procured horses and men for our different

journeys, though nominally a Christian, was not free from this failing.

As to the remarkable absence of glaciers in the Altai, a few words seem desirable. At the sources of the Katuna, where the mountains are higher and steeper than they are in the South-eastern Altai, I believe glaciers are larger and more abundant; but the only place where we saw what could really be called a glacier was in a high mountain south of the Kurai Pass. Their scarcity is probably accounted for by the extremely dry climate and light winter snowfall of the higher mountains. Notwithstanding the extreme cold, the snowfall in the Upper Tehuja valley is so light that horses can procure food on the mountains all through the hardest winter, whereas in the low country around Lake Teletskoi and the Bija valley they have to be fed on hay.

When we reached the north end of Lake Teletskoi, we had four days' hard riding down the Bija valley before we reached a country over which carts could travel. This valley is remarkable for its magnificent forests of pine, *Pinus sylvestris*, which exceed anything I have ever seen before. In some places I counted as many as 20 or 30 trees to the acre, of an average girth near the ground of from 6 to 10 feet, and carrying their girth higher up than I have ever previously seen, so that at a height of 80 or 100 feet the tree would still be over a foot in diameter. The Russians, however, who, as described by a well-known German forester, are "everywhere and at all times true wasters and destroyers of forests," are making rapid inroads upon this magnificent timber, which is felled and floated down the Bija and Obb for supplying the towns and villages in the Steppe country northwards. Fire also is rapidly wasting many of the hill-sides, and when the pine has been burnt off, its place is usually taken by poplar and birch.

The climate of this Bija valley is evidently very much damper than that of the country to the southwards, and we had the greatest difficulty in getting our horses through some of the marshy forests. The horses in the Altai are, however, capable of going where even ponies in the Rocky Mountains could hardly scramble, and where the road is too steep and slippery to get a foothold, will clamber up through the thick brushwood with dense undergrowth and herbaceous plants higher than their heads on an incline of at least 30 degrees. To give an idea of their endurance, I may state that one day we rode the

same horses from 9 A.M. till 9.30 P.M., without halting more than a few minutes, none of them being apparently the worse for it, and a sucking foal following its mother during the whole journey. The horse which I rode accomplished the last hour of the journey at a canter in the dark.

In conclusion I would strongly urge upon any one who may think of visiting the country, that a knowledge of the Russian language is almost indispensable; and considering the large amount of valuable material which is practically buried in Russian scientific journals, I am surprised that so few English naturalists have hitherto thought it worth their while to do what many young Army Officers, for military purposes, now do every year.

Some Observations on the Caudal Diplospondyly of Sharks.
By W. G. RIDEWOOD, D.Sc., F.L.S., Lecturer on Biology
at St. Mary's Hospital Medical School, London.

[Read 19th January, 1899.]

It is a well-known fact in Ichthyology that in Selachian fishes the vertebræ of the tail are twice as numerous as the caudal segments, delimited by the spinal nerves and the intermuscular septa.

The first clear reference to this remarkable phenomenon occurs, curiously enough, in Götte's memoir on the development of the Fire-bellied Toad (*Bombinator*), (6. p. 418, footnote). It has since been remarked upon by von Ihering (9. pp. 220-236), Hasse (7. p. 21), Balfour (1. p. 455), Schmidt (15. p. 756), Mayer (13. pp. 262-267), Gadow (4. pp. 194-196), and others.

To each myomere and neuromere there occur two centra, two pairs of crural plates, two pairs of intercrural plates, and four neural spines. The two centra are similar*, as also are the hæmal arches and the neural spines, but the crural plates are alternately imperforate and perforated by the ventral nerve-root, while a similar relation exists between the intercrural plates and

* Except in *Galeus*, in which they are alternately slightly longer and shorter.



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