"A quantitative analysis gave the following figures, the process being carried on with the greatest care:

| | Liter. | Hundredths. |
|---|---|---|
| Water | 908.50 | 90.850 |
| Casein | 19.45 | 1.945 |
| Butter | 17.00 | 1.700 |
| Sugar of milk | 51.30 | 5.130 |
| Fixed salts | 3.75 | 0.375 |
| | 1,000.00 | 100,000 |

"The result proves that the liquid in question is a true milk, and that this milk does not differ from that of horses in general, except by the presence of a little more fat, which diminishes its density. Possibly the predominance of fat is due to the fact that the milk remained a long time in the mammæ, and that the casein underwent a regressive change. Otherwise it is a liquid almost entirely composed of olein."

Subsequent to the time of this observation my friend, Mr. Epifanio Jimenez, brought to Guanajuato a mule five years old, which gave about a liter of milk daily for four months. The animal was taken away again, however, so that I was unable to examine it.

I have been made aware of an additional fact. I received milk from two mules of the Hacienda de Luna, near Guanajuato, in February, 1880. It is salt, very fat, and whiter than that of which an analysis has been given. The facts which I obtained are as follows: One mule is fifteen years old, the other eighteen. The first furnishes milk at all times of the year, and has done so from the time it was purchased. The second mule has been under observation only a month. Neither has given birth to young. The quantity of liquid given by the first animal is 250 grams per day; by the second, a liter or a liter and a quarter.

GUANAJUATO, *November* 24, 1880.

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## ON LAGOPUS MUTUS, LEACH, AND ITS ALLIES.

By LUCIEN M. TURNER.

The following paper is based upon an examination of the specimens contained in the National Museum collection, to which I have been kindly allowed access by Professor Baird. A sufficiency of material alone can demonstrate to a certainty the relationship of birds subject to almost daily mutations of plumage as are exhibited in the various species of the genus *Lagopus*.

It is well known that individual birds of this genus differ greatly, though they inhabit a restricted locality, such as a single mountain. The birds from the lowlands are larger and have a looser plumage,

while those from the more elevated localities are perceptibly smaller and have a denser, closer fitting plumage.

During the winter season the entire plumage is white with the exception of the tail, and in some of the males of *L. mutus*, also the greater number of the females, a black stripe from the base of the side of the bill produced through the eye to the auricular region. This black stripe, however, varies in position and distribution. When nearly obsolete it occupies the auricular region, and when greatly developed is continuous across the forehead of the bird, and is even present in the summer plumage of some females. This feature is specially characteristic of the winter plumage alone, however, and at this season it is almost impossible and even hazardous to assert that this or the other example is to a certainty this or that race. The table of measurements proves only such variability of size as may be met with in individuals of any other series of birds belonging to the same species.

The summer plumage is assumed at variable periods of the months of April, May, or even in early June, according to the locality. The moult for the summer is usually shown first on the head and neck, followed by the lower back, sides, breast, middle back, flanks, and abdomen, in the order named. The abdomen and chin are the last areas to show the complete moult. The parts named are also the first to assume, in the order given, the white winter plumage.

During the time of the summer plumage scarcely a single day passes but that the general color of the feathers is not modified by the appearance or loss of some feather. How, then, is it possible to state just where the plumage of an individual shall constitute the summer stage when it is scarcely possible to find two birds of the same sex, age, and locality which do not differ in an appreciable degree of coloration, and where there are no other characters on which to base a comparison? In the examples just compared I find the plumage of birds from Norway, France, Switzerland, and two localities in the "Barren Grounds" of Arctic America which do not vary in an essential color, and the pattern of coloration scarcely more divergent than will be found in birds of the same sex from the same locality of either region mentioned.

The birds from the western coast of Arctic America and the easternmost Aleutian Islands do not, so far as I can see, differ appreciably from the European specimens in point of plumage during the breeding season. The males perhaps show a slight variation in shade of the ground color, but not in an essential degree. Hence the American and the European bird should be separated only as races, if at all, although most authors who have separated the American bird have distinguished it as a species by a binomial appellation—*Lagopus rupestris* (Gm.) Leach.

It seems to me, however, that the European birds *mutus* and *alpinus* should constitute, as is held by many authors, but a single species having the name *Lagopus mutus* Leach, while the American bird may

be recognized as a fairly definable race to be called *Lagopus mutus rupestris* (Gm.) Ridgw.*

The most striking variation of coloration is to be found in the examples from Greenland and Cumberland Gulf. If the summer plumage is to be taken as the consideration which shall constitute a species or race in this genus, then the birds from Greenland and Cumberland Gulf should be recognized as a definable form, for which the name *Lagopus mutus reinhardti* (BREHM) should be used, unless the Iceland bird should prove to be identical (and this I have had no opportunity of verifying), in which case the birds of all the localities named above should then receive the name *Lagopus mutus islandorum* FABER.

The birds procured by me at Atkha Islands (Aleutian chain) present still greater variations of coloration, and appear to represent a well-marked local race, for which I propose the name *Lagopus mutus atkhensis.*

The following descriptions of summer specimens, together with the table of comparative measurements, will help to establish the relationship of the four races recognized in this paper:

**1. Lagopus mutus** (*typicus*).

No. 34120, Lapland (67° N.), ♂, ad., July 17, 1855.

Head and neck dusky, with light gray tips to many of the feathers, and others having an obscure yellowish-brown spotting near, but anterior, to the gray. The back, rump, tail-coverts, and scapulars very dusky, much vermiculated with grayish and fulvous, the rump having a tendency to zigzag, fine markings almost approaching bars on the lower portion. Jugulum and breast having few light yellowish-brown spots, especially on upper breast and sides of the neck. The sides and flanks are strongly but sparsely barred with dusky and light buff. Tail entirely black. This example is identical in plumage with No. 33546, ♂, marked "T. *lagopus*," from Norway, summer; and with 43686, ♂, marked "*L. rupestris*," from the Barren Grounds of Arctic America, late spring.

No. 33547 ♂, ad., labeled "*L. alpinus*," Norway, July 9, 1862.

Head black, feathers narrowly tipped with brownish-yellow; entire neck black, the feathers tipped with pure gray; upper back black with narrow bars of light fulvous; back and rump black with fine dots of gray and fulvous, which latter disappear on the lower rump and upper tail-coverts, where replaced with small gray dots, and each feather tipped with a narrow crescentic band of grayish white. Jugulum and sides black with fine dots of white and buff, inclined to spotting. The tendency to produce bars is in this example nearly obsolete. The tail with a rather broader tip of white than in other specimens.

No. 34119, ♀, ad., "*L. alpinus*," Lapland, July, 1855, and No. 18897, ♀, ad., "*L. mutus*," France, late spring.

* See "Hist. N. Am. Birds," vol. iii, pp. 456, 462.

These two females are only distinguishable, the one from the other, by a slight variation in the shade of the yellowish-brown. The bird from France is a little lighter in color than the other; the tendency to produce distinct bars of black, alternating with yellowish-brown, is very well marked, while on the inferior surface there is a somewhat distinct tendency to broader gray tips to the feathers. These markings are so little different from the pattern of coloration of the other specimens that it is not easy to exactly define the points of discrepancy.

No. 56825, ♀, ad., "*L. mutus*," Switzerland, summer.

General color above similar to No. 44582, "*L. rupestris*," Barren Grounds of Arctic America. The yellowish-brown is lighter and the bars narrower. The black bars also narrower and somewhat broken into dots or spots. The ends of most of the feathers of the upper parts, jugulum, breast, sides, and flanks, broadly tipped with white. The best expression to define the coloration of this example in contradistinction to No. 44582, is to state that it (the Switzerland bird) is paler.

No. 33549, ♀, ad., "*T. lagopus*," Norway, June 11.

No. 856, ♀, yng., "*T. lagopus*," Norway (nearly two-thirds grown).

These two birds are conspicuous for the finer, narrower bars of yellowish-brown and black. The back, rump, tail-coverts, shoulders, sides, and upper part of the flanks distinctly tipped with white on the greater number of the feathers. The jugulum and upper breast less marked with the white tips of the feathers, but more distinctly barred with black and the yellowish-brown.

2. Lagopus mutus rupestris (Gm.) Ridgw.

No. 2855, Barren Grounds of Arctic America, ♂, ad., summer. Crown blackish, with white tips to some of the feathers, others very narrowly tipped with faint yellowish-brown. Neck and sides of head with greater area of white on tips of feathers. Back, rump, and tail-coverts very dusky with fine vermiculations of fulvous and gray, having but little tendency to barring. The upper breast, sides, and jugulum barred with black and very light fulvous, some of the feathers broadly tipped with gray.

No. 43675, ♀, ad., Fort Yukon, Alaska, June, 1864.

Head, entire neck, sides, breast, flanks, and abdomen light yellowish-brown, distinctly barred with black. Back, rump, and upper tail coverts very distinctly barred with bright yellowish-brown, each feather of the upper parts broadly tipped with a crescentic margin of grayish. The tail merely tipped with whitish.

No. 80100, ♀, ad., Gens de Large Mountains, Arctic America. This example presents a lighter yellowish-brown coloration, occupying a slightly greater area than No. 43675, and the black bars being more restricted in width are not less conspicuous and the tips of the feathers more grayish. No other essential differences can be distinguished.

Catalogue No. 73488, Unalashka, May 18, 1877.

♂ ad. The ground color of back, scapulars, rump, and upper tail-coverts dark liver-brown, the nape and crown light reddish brown barred with black, and on the back and other posterior parts very finely and densely vermiculated with black, producing the dark liver-brown general aspect. The jugulum similar to the crown and nape, but with the black bars broader and more distinct, but becoming finer and less distinct on the upper breast. The wing, including primaries, secondaries, and some of the tertiaries white, with few scattered feathers of same pattern of coloration as the upper back. The longer upper tail-coverts are somewhat darker than the color of the back, owing to the finer vermiculation of the black and brown colors. Chin and lower sides of head white. The black stripe from base of side of bill is much spotted with white. The lower breast, abdomen, and under tail-coverts white. Tail black, with very narrow tip of white, and decidedly rounded in outline.

Catalogue No. 73489. Unalashka, May 18, 1877.

♀, ad. Upper parts, including head, neck, and upper tail-coverts bright brown-ochre, the tips of each feather either brighter or else white, coarsely barred, having a tendency to spotting with black, which, on elevating the superincumbent feathers, is greater in area on each side of the shaft. The lower parts, including foreneck, breast, and sides, bright yellow-ochre with sparser, but more regular bars of black. The wings, including primaries and secondaries, white. The wing-coverts similar to the coloration of the hind neck. The flanks and sides broadly barred with black and light yellowish-ochre. The lower tail-coverts very distinctly barred with black and yellowish-ochre, the latter color finely dotted with black and narrowly tipped with white. Abdomen white. The claws black with light edges and tip. Tarsus and toes of both sexes covered with fine white downy feathers containing few bristles.

No. 43682, ♀, ad., Arctic coast, east of Fort Anderson, H. B. 7, July 25, 1867.

This example is in full breeding plumage and scarcely differs in any regard from No. 43675 and No. 80100 from near the same region.

**3. Lagopus mutus reinhardti** (Brehm) Turner.

No. 20346, ♂, ad., Sukkertoppen, in lat. 65° 22′ N. and long. 53° 05′ W. on the West coast of Greenland, July 24, 1860; marked *L. reinhardti.* Ground color grayish-fulvous, minutely dotted with black and fulvous-brown, nowhere producing bars, except on jugulum, upper breast, and sides of neck, where these bars are very narrow, and of black and yellowish-brown color.

No. 20347, ♂ ad, (from the same locality as the preceding example) marked *L. reinhardti.* Is similar to the preceding, but has a more grayish ground color and greater tendency to barring on the rump, some of the tail-coverts, upper breast, sides of neck and jugulum. The tendency to produce bars is scarcely evident in No. 20346.

No. 70997, ♀, yng., Niantalik, Cumberland Gulf.

No. 70998, ♀, ad., Niantalik, Cumberland Gulf, August 10, 1876.

No. 20345, ♀, ad., Sukkertoppen, West coast of Greenland.

All of these birds are labeled *L. rupestris*, but are so entirely different in plumage that they should be referred to *L. reinhardti* BREHM, or else to *L. islandorum* FABER, should these two prove to be the same bird, a statement which I am not prepared to make, as there are no accessible specimens of the Iceland bird with which to compare them.

The birds from Niantalik and Sukkertoppen present such great distinctions from the corresponding plumage of *rupestris*, that they should be recognized as distinct from *rupestris*. The pattern of coloration in these three birds is not appreciably different in the adult birds from the two localities separated by an expanse of water, which would hardly admit them being considered as a rare bird in those respective localities.

The crown, hind neck, back, rump, and upper tail-coverts black, each feather distinctly edged with white, many of the feathers obscurely marked with short bars of light fulvous-gray, most conspicuous on wing-coverts and sides of neck The entire lower parts black, with buffy bars distinctly alternating with the black bars, each feather tipped with gray. The under tail-coverts show the bars very plainly. The breeding plumage of this bird is very similar to the corresponding plumage of the female of *Canace canadensis*.

**4. Lagopus mutus atkhensis** Turner.

Catalogue No. 85597. ♂. May, 29, 1879. Ground color of upper parts light olive-brown, altogether lighter than in the corresponding plumage of *rupestris*. The whole surface very finely and densely vermiculated with black. The tips of many of the feathers lighter and more grayish, with very narrow crescentic terminal bar of whitish. The ground color of head and nape above is more yellowish than that of the back. The crown spotted with black. Ground color of foreneck, jugulum, and upper breast light fulvous or yellowish-brown, distinctly and somewhat regularly barred with black. The upper breast, sides, and flanks similar, but more finely and distinctly barred with dusky. The wings, lower breast, abdomen, and under tail-coverts pure white. The inferior upper tail-coverts in this example are little lighter than the rump, simply the obliteration of the prevailing ground color of the back. Tail black and decidedly truncate (not rounded as in *rupestris*), and narrowly tipped with white.

No. 85598. ♂. Same locality, June 7, 1879.

This example of few days later plumage presents no appreciable difference from the one of May 29, 1879. The extent of the white on the upper breast is little greater. The dusky shaft of the wing quills is quite conspicuous in both examples. The black patch from base of bill is continuous around the eye, and embraces the auricular region. The tarsus and toes are only moderately feathered, and have but few bristly terminating feathers. The claws are long and narrow, black at their in-

sertion, and white tipped and edged. The bill is pure black, as is also the iris.

Catalogue No. 85600. May 29, 1879, ♀ adult.

Ground color of head, neck, breast, sides, flanks, and upper tail-coverts light brown-ochre, paler and much less rusty than in corresponding plumage of *rupestris*. The upper parts irregularly barred with black. The most of the feathers tipped with a crescentric bar of white, the black bar immediately preceding which is much broader than the others. The fore part of the back is irregularly spotted with black. Crown spotted with black, the feathers tipped with yellowish-white. Jugulum and breast more sparsely but regularly barred with black. The sides and abdomen similarly, but more broadly, barred with black and light yellowish-brown. But few feathers of white occur on the breast and abdomen. The under tail-coverts are very distinctly barred with black and light yellowish-brown, the tips of the upper tail-coverts and tail have a narrow band of pure white. The wings white, the dusky shaft extending not quite to the tips. The tarsus and toes are but slightly feathered. The claws black, with white edge and tips. The bill and iris black.

Example No. 85599 is similar.

When I first obtained these birds I was struck with the apparent greater size and also the difference in the shape of the bill and claws. These birds frequent the low lands, where, amongst the rank grasses and weeds, a nest, composed of grasses and other plants, is loosely arranged. The number of eggs reaches as high as seventeen, though I never found more than fifteen in a single nest. The eggs are much darker in color than those of *L. albus* and but little inferior in size. I had a number of eggs of this bird, but they were broken *in transitu*.

The following tables of measurements of specimens in the National Museum collection will serve to show the differences of size and proportions which, to a certain degree, distinguish the several races of this species:

*a*.—MUTUS.

| Catalogue number. | Locality. | Sex and age. | Gape. | Nostril to tip of maxilla. | Culmen. | Gonys. | Height of maxilla at nostril. | Tail feathers. | Tarsus. | Middle toe. | Middle toe claw. | Wing. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33547 | Norway | ♂ ad | .80 | .45 | .80 | .38 | .19 | 4.10 | 1.23 | 1.14 | .46 | 8.00 | July 9, 1862. |
| 33545 | .....do | ♂ ad | .85 | .41 | .70 | .30 | .30 | 4.30 | 1.23 | 1.10 | .55 | 7.50 | Apr. 25, 1862. |
| 33546 | .....do | ♂ ad | .80 | .40 | .75 | .30 | .19 | 4.30 | 1.22 | 1.00 | .55 | 7.60 | July —, ——. |
| 34114 | Norway, 63° N | ♂ ad | .82 | .41 | .80 | .30 | .20 | 4.00 | 1.30 | .90 | .65 | 7.80 | Jan., 1832. |
| 34113 | .....do | ♀ ad | .70 | .38 | .71 | .29 | .17 | 3.50 | 1.11 | .85 | .58 | 7.70 | Jan., 1832. |
| 34120 | Lapland, 67° N | ♂ ad | .83 | .40 | .81 | .30 | .18 | 4.30 | 1.20 | 1.00 | .40 | 7.50 | July 17, 1855. |
| 34119 | .....do | ♀ ad | .80 | .40 | .72 | .30 | .20 | 3.90 | 1.10 | .98 | .40 | 7.00 | July —, 1855. |
| 33549 | Norway | ♀ ad | .80 | .40 | .73 | .30 | .19 | 3.70 | 1.15 | 1.00 | .40 | 7.30 | June 11 ——. |
| 50820 | Switzerland | ♀ ad | .80 | .36 | .72 | .30 | .21 | 4.00 | 1.20 | .85 | .60 | 7.60 | Winter. |
| 18897 | France | ♀ ad | .80 | .34 | .71 | .30 | .19 | 4.00 | 1.20 | 1.08 | .45 | 7.40 | Late summer. |
| | Average ♂ | | .81 | .40 | .76 | .31 | .19 | 4.10 | 1.23 | 1.00 | .53 | 7.50 | |
| | Average ♀ | | .77 | .38 | .72 | .30 | .19 | 3.80 | 1.14 | .98 | .46 | 7.30 | |

*b*.—REINHARDTI.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20346 | Sukkertoppen, Greenland | ♂ ad | .80 | .40 | .71 | .28 | .17 | 4.40 | 1.10 | .98 | .39 | 7.70 | July 24, 1860. |
| 79081 | Greenland | ♂ ad | .80 | .43 | .75 | .33 | .20 | 4.00 | 1.10 | .88 | .62 | 7.80 | Winter. |
| 76127 | Goothaab, Greenland | ♂ ad | .80 | .40 | .78 | .30 | .20 | 4.10 | 1.23 | .93 | .44 | 8.00 | May, 1878. |
| 30370 | Rigolet, Labrador | ♂ ad | .80 | .38 | .71 | .30 | .21 | 4.00 | 1.16 | .83 | .50 | 7.50 | Winter. |
| 20347 | Sukkertoppen | ♂ (?) ad | .87 | .43 | .70 | .35 | .20 | ..... | 1 20 | 1.10 | .40 | 7.50 | July (?). |
| 20345 | Sukkertoppen | ♀ ad | .80 | .35 | .73 | .31 | .19 | 3.75 | 1.10 | .90 | .35 | 7.40 | On nest, July 24, 1860. |
| 70998 | Niantalik, Cumberland Gulf | ♀ ad | .79 | .38 | .80 | .30 | .19 | 3.60 | 1.20 | 1.10 | .40 | 7.30 | Aug. 30, 1876. |
| 30371 | Rigolet, Labrador | ♀ ad | .78 | .38 | .75 | .31 | .20 | 3.90 | 1.15 | .80 | .40 | 7.30 | Winter. |
| | Average ♂ | | .82 | .40 | .73 | .31 | .19 | 4.10 | 1.16 | .91 | .49 | 7.70 | |
| | Average ♀ | | .79 | .37 | .76 | .31 | .19 | 3.75 | 1.15 | .90 | .45 | 7.35 | |

*c.*—RUPESTRIS.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2585 | Barren grounds | ♂ ad | .80 | .38 | .80 | .31 | .19 | ..... | 1.10 | .90 | .52 | 7.20 | Summer. |
| 43686 | Barren grounds | ♂ ad | .76 | .38 | .80 | .30 | .20 | 4.20 | 1.20 | 1.00 | .70 | 7.30 | Late spring. |
| 31643 | Fort Anderson | ♂ ad | .70 | .40 | .70 | .31 | .17 | 3.80 | 1.28 | 1.00 | .70 | 7.50 | Feb., 1863. |
| 31633 | Fort Rae | ♂ ad | .80 | .37 | .75 | .30 | .19 | 3.90 | 1.10 | .98 | .68 | 7.50 | Jan. 28, 1863. |
| 43675 | Fort Yukon, Alaska | ♂ ad | .70 | .40 | .75 | .37 | .19 | 4.20 | 1.18 | .92 | .50 | 7.80 | Jan., 1864. |
| 50056 | Gens de Large Mountains, Arctic America | ♂ ad | .80 | .36 | .75 | .30 | .19 | 3.90 | 1.20 | .95 | .70 | 7.20 | Winter. |
| 73221 | St. Michaels, Alaska | ♂ ad | .85 | .38 | .75 | .30 | .20 | 4.00 | 1.28 | 1.00 | .60 | 7.60 | Mar. 15, 1876. |
| 73488 | Unalashka Island, Alaska | ♂ ad | .77 | .37 | .75 | .34 | .19 | 4.60 | 1.31 | .98 | .56 | 7.75 | May 18, 1877. |
| 44582 | Barren grounds | ♀ ad | .80 | .38 | .80 | .30 | .20 | 3.60 | 1.12 | .90 | .68 | 7.50 | June 23, 1864. |
| 19876 | Fort Rae | ♀ ad | .80 | .35 | .70 | .30 | .18 | 4.00 | 1.10 | 1.00 | .45 | 7.20 | |
| 43682 | Arctic coast, E. of Fort Anderson | ♀ ad | .80 | .35 | .71 | .30 | .17 | 3.70 | 1.10 | .90 | .45 | 6.80 | July, 1865. |
| 80100 | Gens de Large Mountains, 200 miles NE. of Fort Yukon | ♀ ad | .80 | .36 | .71 | .32 | .17 | 3.40 | 1.16 | .92 | .62 | 7.10 | Summer. |
| 43675 | Fort Yukon, Alaska | ♀ ad | .85 | .38 | .70 | .31 | .20 | 3.90 | 1.16 | 1.00 | .61 | 7.00 | June, 1864. |
| 61626 | Unalashka Island | ♀ ad | .80 | .36 | .75 | .31 | .18 | 4.20 | 1.20 | 1.00 | .58 | 7.20 | Dec. 14, 1871. |
| 73489 | Unalashka Island | ♀ ad | .80 | .37 | .71 | .31 | .18 | 4.50 | 1.00 | 1.00 | .45 | 7.10 | May 18, 1877. |
| | Average ♂ | | .77 | .38 | .76 | .32 | .19 | 4.10 | 1.21 | .97 | .62 | 7.50 | |
| | Average ♀ | | .80 | .37 | .71 | .30 | .18 | 3.90 | 1.10 | .94 | .55 | 7.10 | |

*d.*—ATKHENSIS.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 85597 | Atkha Island | ♂ ad | .94 | .44 | .87 | .35 | .22 | 4.25 | 1.37 | 1.06 | .75 | 7.82 | May 29, 1879. |
| 85598 | .....do | ♂ ad | .89 | .44 | .87 | .37 | .25 | 4.25 | 1.32 | 1.06 | .57 | 7.82 | June 7, 1879. |
| 85599 | .....do | ♀ ad | .89 | .44 | .82 | .37 | .23 | 4.00 | 1.19 | 1.12 | .57 | 7.87 | June 7, 1879. |
| 85600 | ..... do | ♀ ad | .88 | .44 | .83 | .36 | .25 | 4.00 | 1.37 | 1.09 | .56 | 7.50 | May 29, 1879. |
| | Average ♂ | | .91 | .44 | .87 | .36 | .24 | 4.25 | 1.34 | 1.06 | .65 | 7.82 | |
| | Average ♀ | | .89 | .44 | .83 | .36 | .24 | 4.00 | 1.28 | 1.10 | .57 | 7.69 | |

WASHINGTON, D. C., *April* 9, 1882.