

THE SYSTEMATICS AND BIOLOGY OF THE SINGING QUAIL, *DACTYLORTYX THORACICUS*

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INHABITING a number of the complex forest communities of Mexico and northern Central America is a small, stout-bodied, large-footed, short-tailed, crested quail with a melodious voice. It is *Dactylortyx thoracicus*, the Singing, or Long-toed, Quail, about which little has been written, and whose biology and distribution have never been accurately described. It is the only species in the genus.

The Singing Quail is distributed as a forest bird from coastal plain to high mountains, from humid vapor forests to scrub forests that are largely deciduous and subject to extreme drying for part of the year; nevertheless, in many localities its ecological and altitudinal range is markedly limited. Complete discontinuities exist between most of the populations. Some of these discontinuities are of recent origin, whereas others have existed a much longer time; some of the narrowest of these may be among the oldest. Morphologically each isolated population has external characters differing from those of all other populations.

The closest relative of *Dactylortyx* is *Cyrtonyx* (Mearns' or Montezuma Quail), which it resembles somewhat in structure, especially that of the feet and the synsacrum (Miller, 1943). The genera are wholly unlike in coloration and ecological requirements. *Dactylortyx* is a terrestrial bird most characteristic of almost impenetrable forest thickets. In such places its rather somber but beautifully patterned plumage of gray, brown, black and chestnut is combined, by the presence of delicate lines, broad bars, stripes and faint vermiculations, into patterns that are beyond simple description. Only in the colors of the throat, malar region and superciliary line is there some boldness of pattern, but even this coloration blends so well with the forest floor that the bird is almost impossible to see.

These pattern characteristics apply to both sexes and to all plumages. As shown in the frontispiece, adult males have the chin, throat, cheeks and superciliary with some shade of chestnut contrasting with the grayish feathers of the breast, which are marked variably with lighter shaft streaks. In adult females the chin, throat, cheeks and superciliary are shades of gray contrasting with a faintly streaked chestnut breast, the gray usually extending onto the crown. In a few females some of the chestnut and rich brown colors of the male plumage are present on the head, and in a few males the head pattern approaches that of the female. In the juvenal plumage the sexes are not distinguishable with certainty. This plumage is most distinct from that of the adults in the black spotting on the feathers of the breast, sides and



SINGING QUAIL
(*Dactylortyx thoracicus pettingilli*)

Male (above), female, and two newly hatched chicks on heavily wooded slope above the Río Sabinas, near Gómez Farías, Tamaulipas, México. From a water-color painting made in the field on April 16, 1941, by George Miksch Sutton.

flanks; the head and throat pattern is similar to that in adult females. Downy young are rich brown to chestnut dorsally with a buffy superciliary line and a buffy stripe along the side of the rump; the cheeks are rich buff, the underparts mottled gray-buff and the bill red-brown.

Although more than a century has passed since the first specimens of this quail reached the United States and Europe, knowledge of its habits, of its behavior, and even of its plumages and distribution is fragmentary. Only within the last 24 years was the bird discovered in Honduras. The first specimens from Tamaulipas were taken only 15 years ago, those from San Luis Potosí and Quintana Roo even more recently. The accompanying map, Figure 1, illustrates clearly the restricted known range of this species—pin points on a vast area. This paucity of information stems from two major factors: at many points the forests inhabited by this species occur in very narrow belts which lie chainlike along rugged mountain slopes, and have been inaccessible or uninteresting to the collector; the elusive habits of this bird have defeated many who have found it and tried to collect and study it.

This study is based on examination of 181 specimens, field data gathered by both authors, field notes contributed by other biologists and references in the literature.

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BIOLOGY

Geographic Distribution.—The Singing Quail has been found in at least 83 localities in Mexico, Guatemala, El Salvador and Honduras (Fig. 1). We have examined specimens from 56 of these localities.

In eastern Mexico the species is known from southwestern Tamaulipas, eastern San Luis Potosí, northeastern Puebla and along the mountains of Veracruz south to Córdoba. It occurs also in central Campeche, in Yucatán and Quintana Roo, at a single locality on the border of Oaxaca and Chiapas and in several parts of Chiapas. To the northwest a single bird has been taken in Jalisco; and several series have been secured in the Sierra Madre del Sur in Guerrero. In Guatemala *Dactylortyx* is known to occur on at least three volcanoes, in several other cloud forest localities of the Pacific Cordillera, and in the northwestern part of the country. It has been noted and collected at only three localities in El Salvador and at three (possibly four) places in Honduras.

Although in Tamaulipas, San Luis Potosí, parts of Veracruz, Guerrero, the Sierra Madre de Chiapas, and perhaps in Yucatán and Quintana Roo, this quail may range rather continuously over hundreds of square kilometers, in other areas the total range of a population is restricted to a single small area or to several small, closely adjacent areas. Distances between populations in western Mexico exceed several hundred kilometers. On the other hand, two racially distinct populations in Honduras are clearly separated by a barrier about 20 kilometers wide.

Habitat.—The presence of *Dactylortyx* is not defined by mere altitude or life zones or other biotic distributional systems. The areas inhabited by this quail are extremely variable in climate, forest type and size. All the forest habitats have in common the presence of dense undergrowth for cover. Some populations range continuously through two, three or more vegetation types; other populations are restricted sharply to one vegetation zone, such as cloud forest. At the extreme southern end of the range of the species two of the small, isolated populations seem to be existing in suboptimal habitat, probably because the original preferred habitat (cloud forest) has been extirpated as a result of post-Pleistocene increase in temperature and drying and to disturbance by man. Current studies by Harrell on the biogeography of Middle American cloud forests demonstrate that such changes in climate are indicated by a great amount of disjunction of cloud forest fauna and flora and that these disjunctions must have been preceded by much wider distribution of cloud forest in this region of Central America. This condition is reflected in several of the small, isolated populations of this species restricted to mountain tops in Honduras and El Salvador in which random differentiation seems to be present; between these populations clinal relationships are not apparent. Thus, among the important factors affecting morphological differentiation in this species have been the types and extent of the forests and their associated climatic conditions. The following descriptions of the habitats of the different populations, although far from complete, serve as an introduction necessary to a study of the systematics of the species.

In southwestern Tamaulipas this quail occurs from the edge of the coastal plain at the base of the Sierra Madre Oriental at an altitude of approximately 300 feet to about 6,000 feet. The lower forest is a semi-deciduous type of tropical forest on steep slopes and is tall with dense crown in many places. Where there are openings, as along rocky outcrops, thickets of brush occur. At about 2,000 feet the forest begins to change, and at 3,000 feet it has become well developed oak-sweet gum (*Quercus-Liquidambar*) forest which can be considered the cloud forest of this region. In this tall (about 100 feet), dense forest, undergrowth is variable but most of the shrubby plants are not densely leaved. At altitudes between 4,000 and 4,800 feet, the oak-sweet gum is joined in some places by beech (*Fagus*) as an additional dominant; the underbrush here is somewhat more open. Above most of the oak-sweet gum there is a fairly abrupt change to open pine-oak forest. The transition from the beech type is somewhat less abrupt and is marked by narrow necks and patches of both types of forest. The pine-oak here consists of tall but well-spaced trees with underbrush frequently very dense. Occasionally patches of more mesic forest are found in small canyons and around springs, these spots characteristically having in them a few of the trees from the oak-sweet gum forest of lower elevations. The Singing Quail occurs in the mountainside tropical, the oak-sweet gum and beech areas. At higher elevations it is found in some of the mesic spots in pine-oak woods. It was recorded once in a forest of oak and madroño (*Arbutus*). Just above the Río Sabinas at the base of the Sierra Madre, it inhabits steep, thicketed slopes (Sutton and Pettingill, 1942). At elevations 3,000 feet higher, in the oak-sweet gum and beech forest, Harrell (1951 MS) found individuals throughout the forest area but with no special places of marked concentration. Apparently the habitat distribution in San Luis Potosí is similar to that in Tamaulipas.

In Puebla and Veracruz altitudinal limits are between 1,200 and 7,000 feet, approximately. Jalapa and Córdoba are representative of cloud forest elevations and Misantla, Papantla and Hacienda de los Atlixcos are in the Veracruz equivalent of the semi-deciduous tropical forest of Tamaulipas.

In Yucatán the species occurs primarily in the area classified by Leopold (1950) as tropical evergreen forest climax, but there are extensive recent disturbances of the forest which is now a second growth deciduous forest (Paynter, 1955). In Quintana Roo, Paynter (1955:83-84) has found *Dactylortyx* in lowland rainforest.

The single bird known from Jalisco probably came from Milpillas near San Sebastián, about which Goldman (1951:180) wrote as follows: ". . . Both sides of the deep canyon above Milpillas are clothed with a heavy oak forest, in which other trees and many shrubs also occur. The forest is a mixture of tropical and extratropical species, as might be expected from the location near the frost line at about 4,000 feet."

In Guerrero the Singing Quail is found in mountain forest mostly above 6,600 feet. This forest is pine-oak-fir with an abundance of alder (*Alnus*) in wet places and fir (*Abies*) most common at higher elevations where this quail was usually found “. . . in ravines of dense woods with an almost impenetrable undergrowth of shrubs and climbers” (Leopold and Hernandez, 1944; translated from Spanish).

Oak-sweet gum forest occurs above Niltepec, Oaxaca (Miranda and Sharp, 1950) and may be continuous in the mountains to above Santa Efigenia (Oaxaca-Chiapas border). *Dactylortyx* has been reported from the latter locality only.

In Chiapas this quail has been found at a number of localities, including Cerro Brujo where Miranda and Sharp (1950) reported the occurrence of an oak-sweet gum forest. Ernest P. Edwards (personal communication) found it in cloud forest containing sweet gum near El Fenix in the eastern edge of the state (see Edwards and Lea, 1955). Harrell found it in sweet gum forest from Jitotol to north of Rincon Chamula, and south of Ixtapa in a ravine more humid than the surrounding low, deciduous tropical woods. Specific habitats of birds from the Sierra Madre de Chiapas are not known, but many of the upper slopes are covered with a vapor forest similar to that of Honduras. Smaller areas of oak-sweet gum and pine-oak also occur in that region. Several plant communities are probably present near Socoltenango but we do not know in which type the specimens were taken. In the San Cristóbal region E. W. Nelson (MS notes in files of U.S. Fish and Wildlife Service) saw a covey in dense woods at about 9,500 feet at which elevation both pine and fir occur. The specimens collected were reported to have come from “. . . wooded hills to the north of the town [San Cristóbal].” *Dactylortyx* is known from Volcán de Tacaná (3,000 meters), at which altitude the dominant vegetation is fir forest in the more humid pockets (Faustino Miranda, 1952 and personal communication). The Volcán de Tacaná is physiographically a part of the volcanic system of Guatemala.

In Guatemala *Dactylortyx* has been found as low as 5,000 feet in heavy cloud forest (Saunders, 1950) and from 7,000 to 8,500 feet in “typical cloud forest” and in heavy oak and pine forest above Tecpam (Griscom, 1932).

Dickey and van Rossem (1938), writing about this bird in El Salvador, give its distribution as, “. . . oak association of the Arid Upper Tropical Zone on Volcán de San Miguel . . . vertical range . . . 2500 to 4000 feet . . . On Volcán de San Miguel during March, 1926, quail were sometimes flushed from the litter of leaves under the nearly leafless oaks on the southeast slope and were also, although rarely, found in the upper edge of the Lower Tropical Forest . . . On many parts of Mt. Cacaguatique . . . they showed a decided tendency to favor the coffee groves instead of their natural habitat in the oak scrub.”

On Mt. Cacaguatique cloud forest is restricted and it is absent on Volcán de San Miguel. There is, however, an abundance of cloud forest on the Volcán de Santa Ana group where this quail was found at a coffee *finca* in cloud forest on Cerro del Aguila at 5,000 feet (Marshall, 1943), and by Harrell in cloud forest on Volcán de Santa Ana at 7,000 feet.

Carr (1950) figures and describes the Hardwood Cloud Forest in Honduras as follows: "The truly primeval vapor forest is similar in superficial appearance to the most luxuriant tropical rainforest, but is almost wholly different in details of composition. On the average it is a mesic woods in which various species of oaks and *aguacates* usually predominate and with an epiphytic flora of often bewildering variety . . . The trees are large—often immense—and usually strongly buttressed . . ." There this forest extends from about 4,000 to 7,000 feet. The Singing Quail has been found in such forest on the San Juancito Mountains and on nearby Cerro Cantoral in Francisco-Morizan. On San Juancito Mountain Harrell heard many songs in second-growth cloud forest; he noted this species also in heavy virgin cloud forest there. A third area in which the species occurs is near Catacamas, Olancho, about which Carr (letter, April 2, 1951) writes as follows: "The 'cloud forest above Catacamas' is probably the vast *Agalta* forest of which there are several isolated sections. Thus, for zoogeographic purposes the label 'Catacamas' would mean very little. The Olancho cloud forests are generally similar to, but botanically somewhat more varied than those of the Pacific slope (including San Juancito)."

". . . elevations above 5,000 feet are in this section (of Honduras) nearly always covered with cloud forest; and on the northern slopes cloud forest may extend much farther down and may even intergrade with the Caribbean rainforest."

Behavior.—To field biologists who have encountered the Singing Quail in the field usually only two things are evident about the bird—its song and its escape tactics. Even the song has sometimes gone unrecognized, and the escape pattern, so sudden and dramatic, has been only briefly noted.

Dactylortyx is a terrestrial species; it has never been reported perching above the ground. Its large feet and long claws serve a dual purpose: for the scratching in litter and humus by which much of its food is obtained, and as an aid to its escape.

Harrell (1951 MS) observed foraging activities in the oak-sweet gum forest in Tamaulipas. The bird interrupted its picking; then, leaning to one side, it lifted the opposite leg and extended the foot far forward, even beyond the bill. With a single, long and powerful backward thrust, which carried the foot straight out behind the tail, the litter was torn and scattered by the strong claws. From the debris the bird picked edible material.

Little is known about the food habits of this species. Both vegetable and animal matter are taken from the surface as well as in the humus layer. Stomachs have contained plant bulbs, insects, larvae and seeds (Leopold and Hernandez, 1944); euphorbiaceous and leguminous seeds (Cole, 1906); seeds, insects and gravel (Dickey and van Rossem, 1938); beetles, centipedes, crickets and grubs (Harrell, 1951 MS).

The strong feet and legs serve also for escape. Although Singing Quail sometimes squat and remain still until almost stepped on, if pressed closely they run rapidly to cover, often in a zig-zag manner, especially if the terrain is irregular. When flushed, they depart suddenly on whirring wings, banking and turning neatly around rocks and trees. Flight distance depends upon proximity to cover; in our experience cover was always close at hand and the flight distance was about 50 to 75 yards, often less. Locating flushed birds again usually was impossible. By running or lying still they managed to remain undetected. Probably nearly all of the 200 or so specimens in museums were shot on the ground or were trapped.

In contrast to the observations of others, Harrell (1951 MS) found this quail to be rather tame and unwary in the undisturbed oak-sweet gum forest in Tamaulipas. The birds would often be unconcerned if he stood quietly 20 or 30 feet away. On one occasion four fully grown birds were observed feeding at a distance of about 80 feet; at the sound of his voice they stopped and became quiet but shortly resumed their activity.

Dusting pits were noted by A. W. Anthony (in Griscom, 1932) who found rounded depressions in the damp leaves along deep, shaded trails where flocks of these birds had dusted in the "rain forest" of Volcán San Lucas, Guatemala.

Flocks.—From the appearance of the first broods in spring until the beginning of the next breeding season this species is encountered most often in flocks of from four or five to a dozen birds. Composition of these flocks is not accurately known, but all age groups of both sexes are present. Small groups probably are families and the larger flocks may represent several family units. At the approach of the breeding season flocks break up, but even during the nesting period more than two adults may be found within a small area.

Population density.—The only population estimate available is that made by Harrell (1951 MS) during his census studies of the breeding birds of the Rancho del Cielo area in Tamaulipas. In climax oak-sweet gum forest at 3,600 feet there were approximately 3.5 pairs per 100 acres in each of two years.

Although even crude population estimates are impossible for nearly all of the other populations, the calculated total breeding populations of two subspecies are worthy of comment. As determined by calculating the total habitable area from descriptions and maps and applying the figure of 3.5 pairs per 100 acres, the total effective breeding populations of each of the races

salvadoranus and *taylori* (inhabiting the slopes of Volcán de San Miguel and Mt. Cacaguatique, respectively, in El Salvador) do not exceed 500 pairs. As has been pointed out, several of the isolated southern populations appear to have undergone random differentiation, a phenomenon of some small populations.

Songs and calls.—As pointed out by Sutton and Pettingill (1942), who first gave this bird the name Singing Quail, the loud, rhythmical outburst of song is its truly unforgettable feature. This song has also been described by Gaumer (in Boucard, 1883), by Anthony (in Griscom, 1932), by Marshall (1943), and by Harrell (1951 MS).

The first part of the song is a series of about four loud, penetrating whistles, which increase in frequency and pitch and seem to be an announcement of the start of a song; these whistles often are repeated by other birds. Sometimes an imitation of these notes will initiate singing in nearby birds. The last of these notes is followed immediately by the second part of the song, a series of three to six rapid phrases, each made up of notes of differing pitch, the middle ones higher and more definitely accented. The notes are described as staccato by Marshall (1943), and the phrase rendered as *che-vã-lieu-a* by Gaumer (in Boucard, 1883), as *cua-kaka-wak* by Anthony (in Griscom, 1932), as *pitch-wheeler!* by Sutton and Pettingill (1942), and as *tser-teé-lur* by Harrell (MS). These phrases are followed by a low twittering which is often not audible or may be absent. There is no evidence that the female sings.

Anthony, quoted by Griscom (1932), described perfect duetting between two captive birds kept in separate cages on different sides of a house in Guatemala.

Song is at its height during April and May, decreasing during the latter part of the summer, but some birds are still singing through the fall and into the winter as late as December 26 in Tamaulipas (Harrell, 1951 MS).

The common calls are faint twittering notes which apparently serve as a location call within a family or small group. On one occasion a call was heard from a bird in flight—*bdr—ddr—bdr—ddr* (Harrell, 1951 MS).

Breeding season.—The breeding period is long, extending from February through October or later. There is apparently no latitudinal or altitudinal correlation in date of initiation or in length of the breeding season. Tamaulipan birds begin to nest at about the same time as those in El Salvador.

Dactylortyx in Tamaulipas were in full song on March 12. A breeding male and a female with well-developed brood patch were taken there on April 11 and a female and her brood of newly hatched young on April 16 (Sutton and Pettingill, 1942). These birds must have begun their breeding activities more than a month before, in early March or late February.

In El Salvador Dickey and van Rossem (1938) found birds nearly ready to breed in the latter part of March. On Mt. Cacaguatique in that country

Marshall (1943) collected a female still in postjuvinal molt on January 6. The date of hatching of this bird must have been late September or early October. May-taken juveniles from Omilteme, Guerrero, indicate that the onset of the breeding season at that high-altitude locality is in February.

Paynter (1955), in describing the breeding season for birds inhabiting the deciduous forest of Yucatán, states, ". . . it appears that nesting extends from early May to early August." The onset of breeding may here correspond to the beginning of the rainy season in May following the three driest months of the year.

Most of the juveniles have been taken from May through July. This fact, together with the waning of song in late summer, and taking into account the many months through which adults have been found in postnuptial molt, suggests that not more than a single brood is usually raised per year.

The nest of this quail has never been described. The only description of eggs (presumably of this species) is that of Nehrkorn (1881), who stated that, "yellow clouds are distributed over the otherwise white eggs" (translated) which measured 31 x 25 mm.

Harrell, after close association with this species during several seasons, found it almost impossible to be sure of the number of young in each brood; usually only two to four were seen. Paynter (1955) reported that a female collected on May 7 was incubating five fresh eggs.

Molt.—As is expected in a species which has an extended breeding season, specimens of this quail show feather replacement during most of the year. The postnuptial molt begins in June and continues through at least the rest of the calendar year. During the months of July and August the greater part of the adult population is in molt, however. A male with black testes measuring 10 x 5 and 7 x 4 mm., taken on March 26 in Tamaulipas, has a few partly sheathed feathers on the breast, suggesting either a partial prenuptial molt or the final stages of the postnuptial molt.

Singing Quail in juvenal plumage have been taken as early as May and this plumage still is present as late as January. The last easily identified body feathers of this plumage appear as a collar of spotted feathers on the upper breast immediately below the throat patch.

The subadult plumage, which is worn through the first winter and first breeding season, is not readily recognizable by the two outer primaries and those greater primary coverts which may be retained from the juvenal plumage. We cannot agree with Dickey and van Rossem (1938:154) in their statement that the subadult may be determined by the spotted juvenal upper, greater primary coverts. Markings of any kind on the outer three or four of these coverts in the skins examined are negligible, and, when present, appear in all age groups; thus they constitute no valid criterion for age determination. We have found it difficult or impossible, too, to separate subadults on

the basis of the outer pair of primaries. In only a few specimens are the outer primaries *sharply* pointed. Several others may have had these feathers sharply pointed but the feathers now are broken and frayed. On the other hand we have a number of birds still in partial juvenal plumage that have the outer two primaries of each wing more rounded at the tips than are others that we believe to be fully adult.

Since the base of the bills of young birds is light, we have used this character in combination with the narrow outer primaries to determine the sub-adult age group.

Feather wear is slight and fading is negligible. Some birds have the tips of the primaries slightly worn and broken, apparently through natural wear; others have these feathers frayed and broken, but obviously from post-mortem handling.

SYSTEMATICS

Before discussing morphological variation within the species, several facts should be emphasized. First, we are dealing with an extremely sedentary, terrestrial bird which lives in a number of forest types of differing amounts of solar radiation, humidity, rainfall and temperature. Second, discontinuities exist between populations throughout the range of the species; some of them are very narrow, whereas others are broad. Gene flow between populations was in some cases cut off long ago; in others the break has occurred more recently. In some parts of the range gene flow occurs today through a major part of the total population. Third, the several separated populations vary tremendously in total numbers of individuals. Some of the long-isolated southern populations probably consist of no more than 400 or 500 pairs, whereas on the Atlantic slope some of the total effective breeding populations must be considered to be in the magnitude of hundreds of thousands of individuals.

Our studies show the presence of 17 subspecies among the known populations of this quail. Nine of these have been described previously, but one is without a valid name. Eight are described as new. One specimen probably represents another race but it is left without a name.

The species has been known to the taxonomist for little more than a century. Gambel described *Ortyx thoracicus* from Veracruz in 1848. Two years later John Gould (1850) published a description with a colored plate of *Odontophorus lineolatus* from a Lichtenstein manuscript name (*Perdix lineolata*) of a male and female in the Berlin Museum, but he gave no locality except "Mexico." In 1893 Ogilvie-Grant described a new genus, *Dactylortyx*, and recognized the priority of Gambel's name *thoracicus*. A revision of the genus by E. W. Nelson appeared in 1898 in which he described *devius* from San

Sebastián, Jalisco, and *chiapensis* from Chiapas and Guatemala, giving them specific rank. After comparing a male from Gineta Mountain, on the border of Oaxaca and Chiapas, with Gould's plate of *lineolatus*, Nelson concluded that this specimen belonged to that race (a subspecies of *thoracicus*) and gave the range of *lineolatus* the restricted locality "Gineta Mountain." Nelson's revision was based on eight specimens. In 1903 Nelson described *sharpei* from Yucatán and Campeche as a subspecies of *thoracicus*. All subsequent authors have recognized that the genus is monotypic. Dickey and van Rossem described *salvadoranus* from Volcán de San Miguel, El Salvador, in 1928. The description of *taylori* from Mt. Cacaguatique, El Salvador, by van Rossem appeared in 1932; and the description of *fuscus* from Honduras by Conover was published in 1937. These names were accepted along with the designated ranges of the subspecies until Friedmann, Griscom and Moore (1950) included in *fuscus* the birds from Guatemala and the Sierra Madre de Chiapas, thereby confusing the actual relationships of the populations in that part of the range of the species. Another subspecies, *paynteri*, was recently described from Quintana Roo by Warner and Harrell (1953).

All measurements are expressed in millimeters. Wing measurements are on the chord; culmen from base. Where measurements of five or more specimens are given, the standard error follows the mean. Weights are in grams.

Within *Dactylortyx thoracicus* the following subspecies may be recognized:

Dactylortyx thoracicus pettingilli new subspecies

Type: Adult male, No. 13019, collection of George Miksch Sutton; Rancho del Cielo, five miles northwest of Gómez Farías, Tamaulipas, Mexico; altitude 3,300 feet, in mountain cloud forest; March 21, 1949; collected by George M. Sutton; original number 153 in catalogue of Paul S. Martin.

Characters of male.—Compared to a single male of *D. t. thoracicus* (see Ridgway and Friedmann, 1946:382), grayer both above and below, interscapulars and feathers of the upper back with centers plainer gray, margins paler cinnamon-brown and vermiculations less distinct; shaft streaks of scapulars paler buff to nearly white, inner half of outer web much grayer; breast, sides of lower neck and upper abdomen pale buff to nearly pure steel gray (not buff-brown), margins suffused with pale buff, shaft streaks much narrower; sides very different, varying from grayish-buff to pale cinnamon with shaft streaks pale buff-gray and much broader and often edged with dark gray or black nearly to the tip, rest of feather barred with dark wavy bands; lower back, rump and upper tail coverts grayer.

Characters of female.—Compared to *thoracicus*, breast, sides of lower neck and abdomen more vinaceous; sides paler, shaft streaks broader and barring more distinct; upper back and scapulars grayer as in males; lower back and rump grayer; throat whiter, set off sharply from gray sides of neck.

Characters of juvenile.—Of four juvenile females taken in July (16, 19, 28) two are in nearly full juvenal plumage; the other two are about half through the postjuvenal molt. Compared to one juvenile female from Guerrero, buffier, less rufescent below, especially on upper breast; shaft streaks of upper breast broader and whiter; slightly grayer above; rump, upper tail coverts and tail lighter (less brownish). Differs from a

male from the Sierra Madre de Chiapas in grayer (less brown) lower back and rump; black spots on breast and sides about half the size of spots on the Chiapas specimen.

The natal plumage has been described and illustrated by Sutton and Pettingill (1942).

Remarks.—Six males and one female from San Luis Potosí are intermediate in coloration between *thoracicus* and Tamaulipas specimens of *pettingilli* but are closer to the latter. A male from Cerro Conejo is darkest; two from Xilitla are palest and closely resemble males from oak-sweet gum forest in Tamaulipas.

Measurements.—Males: Wing (19) 123.0–128.5 (125.72 ± 0.61); culmen (18) 17.0–18.7 (17.87 ± 0.05); tarsus (20) 31.5–34.4 (33.1 ± 0.20). Females: Wing (9) 119.0–126.1 (121.99 ± 0.88); culmen (10) 16.0–18.0 (16.99 ± 0.20); tarsus (10) 29.9–34.0 (32.02 ± 0.40). Weights: TAMAULIPAS: Males 180.0, 180.0, 185.0; females (juvs.) 115.0, 122.5, 125.0, 140.0, 146.0. SAN LUIS POTOSÍ: Males, 203.0, 205.0, 210.9, 218.1, 219.0; female, 206.0.

Range.—Forests (semi-deciduous tropical, oak-sweet gum and beech, and mesic areas in pine-oak; once recorded from oak-madroño) of the Sierra Madre Oriental of south-western Tamaulipas and southeastern San Luis Potosí from 300 to 7,000 feet.

Localities.—TAMAULIPAS: Gómez Farías region (near Río Sabinas, 2 males, 2 females, 2 natal; Rancho del Cielo, 5 miles N.W., 8 males, 5 females, 4 juv. females; La Joya de Salas; Carabanchel; the Nacimiento of the Río Sabinas); on trail from Ocampo to Tula. SAN LUIS POTOSÍ: Sabinito (1,200 meters), 1 male; Cerro Conejo, 1 male, 1 female; Aquismon region, mts. east of Rancho Moreno, 2 males; Xilitla region, 1 male; Rancho Ustapan, 1 male; Platanito, 1 male, 1 female; 8 mi. by highway E. of Santa Barbarita (3,900 ft.), 1 male; Xilitla region, Rancho Miramar Grande, juv. unsexed; Xilitla Gorge, 1 male; Cerro Miramar (6,400 ft.), 1 female; 6 mi. W. of Ahuacatlán (6,000 ft.), 1 male, 1 female; on highway 16 mi. E. of Ciudad del Maíz (4,500 ft.).

We name this race for Olin Sewall Pettingill, Jr., who collected the first specimens in Tamaulipas.

Dactylortyx thoracicus thoracicus (Gambel)

Ortyx thoracicus Gambel, *Proc. Acad. Nat. Sci. Philadelphia*, 4, 1848: 77 (Jalapa, Veracruz; type in collection of the Academy of Natural Sciences of Philadelphia).

The one male of this race available for examination is darker than males of *pettingilli* and *sharpei*, and does not approach the latter in width of ventral shaft streaks.

Three females of this race are darker than *pettingilli* and *sharpei*, and are less vinaceous on the breast and sides with less distinct light centers to the feathers than specimens from Chiapas. These three specimens, including the type, are old and seem to be somewhat "foxed," but the differences described are obvious and not the result of post mortem color change.

The fourth female, bearing original no. 159, was collected by Francis Sumichrast in December, 1865. The only other information on the original label is "Río Seco." Although there are several streams bearing that name in eastern Mexico, Sumichrast collected a number of birds on about that date at or near the river bearing that name which at one point lies only a few miles from Córdoba, Veracruz. Yet this bird differs markedly in color and size from a female from Córdoba and two from Jalapa. It is much darker throughout; the top of the head is blackish; the line above the eye, sides of neck and lower throat are dark gray; the white of the throat is much restricted (the female in this respect resembling *chiapensis* but is even darker); the wings are darker and the rump grayer. These differences suggest that this bird came from a population isolated from the Córdoba and Jalapa populations.

Measurements.—Male (1): Wing 129.0, culmen 16.2. Females: Wing (3) 122.0–130.4

(125.5); culmen (3) 16.6–18.0 (17.4); tarsus (3) 32.1–33.0 (32.5). (Río Seco, female: wing 120.4, tarsus 32.1, culmen 18.0).

Range.—Forests of the Sierra Madre Oriental and evergreen tropical and probably semideciduous tropical forests of adjacent lowlands in northeastern Puebla and central Veracruz. Altitudinal range and forest types are probably essentially similar to those inhabited by *pettingilli*.

Localities.—PUEBLA: Metlaltoyuca, 1 male. VERACRUZ: Papatla; Misantla; Hacienda de los Atlixcos; Jalapa, 2 females; Atoyac; Córdoba, 1 female; Cerro de la Defensa; Río Seco, 1 female.

Dactylortyx thoracicus sharpei Nelson

Dactylortyx thoracicus sharpei Nelson, *Proc. Biol. Soc. Wash.*, 16: 152, 1903 (Apazote, Campeche, Mexico; type in U.S. National Museum, Biological Survey Collection).

The small size in combination with over-all paleness distinguishes this race from all others except *paynteri*. Although similar to *paynteri* in size, males of *sharpei* are browner and the ventral shaft streaks narrower. Females are darker gray than *paynteri* on the forehead, over the eye and on the throat.

Within *sharpei* there is considerable difference between the type and males from Yucatán. The male (type) from Campeche is slightly darker on breast and sides; ventral shaft streaks are very narrow in the type, wider in Yucatán specimens. Yucatán males are closest to *paynteri*.

Measurements.—Males: Wing (5) 118.0–124.0 (121.62 ± 1.03); culmen (5) 18.0–19.5 (18.9 ± 0.25); tarsus (5) 31.0–33.0 (31.72 ± 0.36). Females: Wing (4) 115.0–120.5 (117.4); culmen (5) 17.0–17.4 (17.1 ± 0.07); tarsus (5) 29.0–31.0 (30.0 ± 0.32). Weights: one male, 202.0.

Range.—Tropical evergreen forest climax of lowlands of Campeche, deciduous forests in Yucatán and area of interdigitation of deciduous and evergreen forests in northern Quintana Roo. Altitudinal range probably not more than a few hundred feet.

Localities.—CAMPECHE: Apazote, near Yohaltún, 1 male, 2 females. YUCATÁN: Chichén Itzá, 3 males, 2 females; Xocempich (10 km. N. of Chichén Itzá), 1 male; Peto; Tizimín; "Yucatán," 1 male, 1 female. QUINTANA ROO: Carrillo Puerto (1 female examined by Raymond Paynter).

Dactylortyx thoracicus paynteri Warner and Harrell

Dactylortyx thoracicus paynteri Warner and Harrell, *Revista de la Sociedad Mexicana de Hist. Nat.*, 14:205, 1953 (published 1955) (12 km. W. of Bacalar, Quintana Roo, Mexico; type in Peabody Museum of Natural History, Yale University).

This is the palest of all races in coloration, especially of the breast and bellies of males and of gray areas of the head and throats of females. The ventral shaft streaks are broad and nearly pure white in males; females are light gray over the eye and very pale gray on the throat.

Measurements.—Male (type): Wing 122.5; culmen 18.0; tarsus 35.0. Females: Wing (2) 112.0, 119.5; culmen 16.5, 17.8; tarsus 30.2, 32.5. Weights: females 168.0, 193.6.

Range.—Lowland rainforest of south-central Quintana Roo, Mexico.

Localities.—QUINTANA ROO: 12 km. W. of Bacalar, 1 male; 24 km. N.W. of Xtocomo, 2 females; 46 km. W. of Chetumal; Laguna Chacanbacab.

Dactylortyx thoracicus devius Nelson

Dactylortyx devius Nelson, *Proc. Biol. Soc. Wash.*, 12:65, 68, 1898 (San Sebastián, Jalisco, Mexico; type in U.S. National Museum, Biological Survey Collection).

This race was described from a single male from Jalisco. The type is still the only specimen of this race, since the Guerrero birds, formerly included in *devius*, represent a distinct race. Critical examination of this specimen, which has the wings folded far down the sides so that most of the side feathers and part of the breast are covered, shows that the feathers of the breast have much of the webs light chestnut; the edges and a narrow area bordering the shaft streak grayer than in males from Guerrero; sides rich reddish-brown, becoming lighter on the flanks; shaft streaks so narrow as to be scarcely noticeable. The male of *devius* is the reddest of all males examined. In size and coloration it is closest to males from Guerrero, but, upon critical comparison with the male of *thoracicus* (Puebla), it shows also a close relationship with that bird in the sheen on the wings and in arrangement of the brown pigment in the color pattern. This similarity suggests a possible continuity of distribution across the plateau of Mexico during a time probably not earlier than Pleistocene. *Measurements.* Male (type): Wing 132.0; culmen 18.0; tarsus 33.3.

Range.—The single specimen was collected on March 17, probably in the canyon above Milpillas near San Sebastián at an altitude above 3,850 feet, in heavy oak forest.

Localities.—JALISCO: San Sebastián (Milpillas), 1 male (type).

Dactylortyx thoracicus melodus new subspecies

Type: Adult male, no. 98134, University of California Museum of Vertebrate Zoology; Omilteme, 30 kilometers west of Chilpancingo, Guerrero, Mexico; altitude 7,200 feet; weight 266.0 grams; November 2, 1944; collected by A. Starker Leopold; original no. 218.

Characters of male.—Differs from *devius* in having breast grayer, outer parts of webs duller, nearer pale buff to almost pure olive-gray in some specimens; shaft streaks of breast much broader (edged with blackish in three specimens); sides and flanks buffy to brownish-olive and shaft streaks much broader and very pale buff. It is distinguished from all other races principally by more brownish-olive breast and sides and buffier belly; it is also larger than all but birds from Guatemala.

Characters of female.—Differs most markedly from all other females by having entire underparts suffused with buff; middle of belly deeper buff, not whitish or pale buff.

Individual variation is well marked among the nine males examined. Two have the shaft streaks of the breast narrow; on five these are very wide. Three with broad shaft streaks have the shaft streak broadly edged (to 2 mm.) with blackish. The breast and sides of two are nearer fuscous; two are nearer light gray-buff; four have light chestnut on the feathers of the breast. Eight specimens of both sexes have much black spotting and chestnut on the mantle; eight others have little or none. Other marks of individual variation are present in both sexes, but the females show less than males.

The juvenal plumage is similar to *pettingilli* in black ventral spotting but differs in being browner above and below.

Measurements.—Males: Wing (9) 132.0–139.0 (135.06 ± 0.91); culmen (10) 18.0–19.0 (18.6 ± 0.13); tarsus (10) 34.0–37.0 (35.91 ± 0.31). Females: Wing (7) 129.0–134.0 (131.14 ± 0.72); culmen (6) 18.0–19.0 (18.5 ± 0.13); tarsus (7) 33.0–35.0 (34.2 ± 0.31). Weights: (Males) 235.0, 266.0.

Range.—Mountain forest of pine-oak-fir from 6,000 to 9,000 feet in the vicinity of Omilteme, Guerrero.

Localities.—GUERRERO: Sierra Madre del Sur; Omilteme, 9 males, 2 juv. males, 7 females, 1 juv. female.

Nelson (1898) restricted the locality of *Dactylortyx thoracicus lineolatus*

(Gould) to Gineta Mountain on the border of Oaxaca and Chiapas on the basis of certain similarities between one male from that mountain and the male illustrated in Gould's plate of the cotypes (male and female) which accompanied the description that gave only "Mexico" for locality (Gould, 1850). We made the same comparison but found fewer similarities between the male in Gould's plate and the two males from Gineta Mountain. At our request Dr. Erwin Stresemann kindly examined the records and the male cotype of *lineolatus* in the Berlin Museum and sent the following information: "The two cotypes of *Odontophorus lineolatus* Lichtenstein MS studied by J. Gould when preparing his monograph of the Odontophorinae (Berlin Mus. male Nr. 11614 and female 11615) were both collected by Ferdinand Deppe about 1829, male at Papantla (Veracruz), female at Misantla (Veracruz). The name *lineolatus* therefore applies to the race *D. thoracicus thoracicus*, leaving the 'Oaxacan Long-toed Quail' without a valid scientific name."

"Deppe's male is still kept in the Berlin Museum; but I cannot trace the female at present." (See also Stresemann, 1954:89).

As a new name for this subspecies we propose:

Dactylortyx thoracicus ginetensis new name

Type: Adult male, no. 472,630, American Museum of Natural History; Gineta Mountain (near Santa Efigenia), Oaxaca-Chiapas border, Mexico; November, 1880; collected by F. Sumichrast; original no. 137.

Characters of male.—Compared to *melodus*, paler (less brownish) below, shaft streaks of breast and sides broader, belly whiter, less buffy; top of head nearer pure olive-brown, chestnut on scapulars and tertials brighter.

The female is unknown.

Measurements.—Males (2): Wing 132.0, 133.5; culmen 16.2, 17.2; tarsus 32.0, 35.0.

Range.—Forested slopes of Gineta Mountain near Santa Efigenia, Oaxaca, near the border of Chiapas.

Localities.—OAXACA: Gineta Mountain, near Santa Efigenia, 2 males.

Dactylortyx thoracicus chiapensis Nelson

Dactylortyx chiapensis Nelson, *Proc. Biol. Soc. Wash.*, 12:65, 66-68, 1898 (San Cristóbal, Chiapas, Mexico; type in U.S. National Museum, Biological Survey Collection).

The range of this race becomes restricted to the type locality, San Cristóbal, Chiapas. E. W. Nelson (MS notes in files of U.S. Fish and Wildlife Service) wrote, "The three specimens secured were brought in by Indian hunters who killed them in the wooded hills to the north of the town. A small covey of these grouse was flushed in the dense woods at an altitude of about 9,500 feet on the mountain."

The type and one other male examined have the ventral shaft streaks very narrow, the breast, sides and flanks dark gray, near fuscous, with only a faint tinge of brown and buff. The single female examined is duller than females from other Chiapas localities and is paler than females from Guatemala.

Measurements.—Males (2): Wing 123.0, 125.0; culmen 18.0, 18.5; tarsus 35.0, 35.0. Females (1): Wing 127.5, culmen 17.5, tarsus 34.0.

Range.—Mountain forests of the central Chiapas highlands near San Cristóbal.

Localities.—CHIAPAS: Distrito Las Casas: San Cristóbal, 2 males, 1 female.

During March and April of 1952 Harrell heard the Singing Quail at the following additional localities in the central highlands of Chiapas: several places in remnants of sweet gum forest from 3 kilometers north to 11 kilometers south of Pueblo Nuevo Solistahuacán (near Jitotol and Rincon Chamula); in a ravine alongside the Interamerican Highway at the junction of the road to Ixtapa (about 12 kilometers south of Ixtapa and 27 kilometers east of Chiapa de Corzo).

Dactylortyx thoracicus dolichonyx new subspecies

Type: Male, University of Michigan Museum of Zoology no. 102,077; March 10, 1939; Cerro Ovando, Dist. Soconusco, Chiapas, Mexico; altitude 2,000 meters; collected by Pierce Brodkorb and Arthur E. Staebler; original no. 14,043 in collection of Pierce Brodkorb.

Characters of male.—Differs from *chiapensis* by having the breast, sides and flanks lighter gray suffused with pale buff or light chestnut; ventral shaft streaks broader; belly whiter; lower back, rump and upper tail coverts brownish-olive, less grayish; throat and line over eye deeper chestnut; wings averaging paler. Compared to *ginetensis*, breast, sides, top and sides of head and throat, lower back and rump darker, less olivaceous; ventral shaft streaks narrower; chestnut on tertials and scapulars reduced in extent by addition of black and gray markings.

Characters of female.—Differs from those of *chiapensis* by having lower breast and belly paler; markings of tertials darker, less reddish; rump and upper tail coverts darker brown; line above eye and sides of head darker gray.

Juvenile male.—Differs most obviously from all other juveniles by the large and very black ventral spots.

Measurements.—Males: Wing (16) 129.0–136.0 (132.19 ± 0.52); culmen (15) 17.0–19.0 (18.06 ± 0.15); tarsus (16) 34.0–36.5 (35.3 ± 0.22). Females: Wing (9) 123.0–130.0 (127.17 ± 0.64); culmen (9) 17.0–18.6 (17.58 ± 0.15); tarsus (9) 32.5–34.1 (33.61 ± 0.22). Weight: (Male) 241.5.

Range.—Forests of the Sierra Madre de Chiapas from about 4,000 to 9,000 feet.

Localities.—CHIAPAS: Dist. Tonalá: Catarinas, 1 male. Dist. Soconusco (Municipality of Escuintla): Mount Ovando, 10 males, 4 females; Santa Rosa, 2 males, 1 female; Finca Juárez, 1 male; Pico de Loro (40 mi. N.E. of Escuintla), 2 males; Peña Flor (1700 meters), 4 males; La Hacienda (900–1300 meters) 1 male, 1 natal female; Niquivil, 1 natal female. Dist. Moriscal (Municipality of Siltepec): Siltepec, 1 male; Malpaso, 2 males, 1 female; Honduras, 1 female; Porvenir, (Cerro Malé), 2 juv. males, 1 female; Letrero, 3 females; Barranca Honda, 1 female; La Cascada (900–1300 meters), 1 male, 2 females; La Frailesca (1300–1700 meters), 1 female.

Dactylortyx thoracicus moorei new subspecies

Type: Male; collection of Robert T. Moore, Zoological Laboratory, Occidental College no. 27,079 M-X"35; Cerro Brujo, Ocozocoautla, Distrito Tuxtla, Chiapas, Mexico; July 2, 1940; collected by Mario del Toro.

Characters of male.—Breast, sides and flanks grayer and paler than *chiapensis* and *dolichonyx* and with only faint buffy cast; shaft streaks on breast broad and white, wider than in *chiapensis* and averaging broader than in *dolichonyx*; differs from both in being lighter dorsally, especially on edges of inner webs of tertials and on outer webs of scapulars on which the shaft streaks are broader and whiter and adjacent parts of outer webs grayer. Color of crown variable but with a strong tendency toward loss of melanin or to restriction of melanin to centers of webs. In two specimens the crown is nearly entirely rich brown (not deep brown or chestnut), not brown-olive as in *ginetensis*.

Close to *ginetensis* in ventral shaft stripes but grayer (not olive-buff) below; crown browner; less chestnut on tertials. Close to *paynteri* in breast color but belly buffier; size larger.

In males crown color varies from nearly pure rich brown to pale gray-brown. Five have incomplete bars and longitudinal stripes on webs of some crown feathers. One has much white on the throat; all others have a little; but none is rich chestnut on the throat. There is also variation in the width of the ventral shaft streaks and in the amount of buff on breast, sides and belly. One male, apparently adult, shows two characters of the female plumage, considerable white on the throat, and a tinge of vinaceous on a few feathers of the breast.

Characters of female.—Compared to *chiapensis* and *dolichonyx*, paler and less bright both above and below, especially on breast, sides and rump.

Among females variation is most apparent in ventral streaking, breast color and in a tendency toward black spotting on the breast. Four have the shaft streaks of the breast visible, but they are buffy. Another female, apparently adult, from Socoltenango has these streaks broad and nearly white, and has also black spots, some resembling incomplete barring, on many breast feathers. This specimen is of additional interest in that it exhibits a tendency toward male plumage in the presence of gray in many breast feathers and of brown on several feathers of the throat patch. A few black spots are present on the breast feathers of the four other females also.

Measurements.—Males: Wing (11) 123.0–133.0 (127.45 ± 1.03); culmen (11) 17.0–19.0 (18.04 ± 0.16); tarsus (11) 31.1–34.0 (33.23 ± 0.22). Females: Wing (4) 121.0–127.0 (124.5); culmen (5) 17.1–18.5 (17.74 ± 0.24); tarsus (5) 32.0–34.5 (32.7 ± 0.46).

Range.—Known only from mountain forests of Cerro Brujo and near Socoltenango, central Chiapas.

Localities.—CHIAPAS: Distrito Tuxtla: Cerro Brujo, Ocozocoautla, 8 males (1 marked female), 3 females. Distrito Comitán: Socoltenango, 3 males (1 marked female), 2 females.

We name this race for Robert T. Moore.

Dactylortyx thoracicus edwardsi new subspecies

Type: Adult male, no. 13,020, collection of George Miksch Sutton; El Fenix, 5 miles northwest of Monserrate, Distrito Tuxtla, Chiapas, Mexico; altitude approximately 5,000 feet in high cloud forest undergrowth; August 5, 1952; collected by Ernest P. Edwards; original no. 1473 in catalogue of Ernest P. Edwards.

Characters of male.—Closest to *moorei* but darker on crown; upper back and wings deeper chestnut; lower back and rump darker (more olivaceous); buff on inner edge of tertials darker; medial tertials with black extending to near edge of feather across buffy edge, giving spotted effect to buffy edge; gray on upper breast with less buffy suffusion (near pure gray); ventral shaft streaks wider and longer than in nine of eleven specimens of *moorei*. Darker and less olivaceous than *ginetensis*; darker above and ventral shaft streaks broader than in *dolichonyx*.

The two adult males examined are similar in crown color but the second differs from the type by being browner on upper back, wings, rump, upper tail, breast and sides; both have a few pure white feathers on the throat.

Characters of female.—Close to *moorei* but upper back, wings, rump and upper tail darker, less brown; slightly less vinaceous on breast; sides and flanks grayer, less brown; middle of belly less buffy; paler than *chiapensis* and *dolichonyx*.

One of the females is slightly browner on the lower back and rump than the other.

Both have much light reddish-brown on the lower throat and sides of head and neck, and a little chestnut on the forehead.

Two juveniles are less buffy below than *pettingilli* and *melodus* and the ventral spots are larger and blacker; breast spots smaller than *dolichonyx*.

Measurements.—Males (2): Wing 128.0, 132.0, culmen (1) 17.8, tarsus 34.0, 34.4. Females (2): Wing 122.0, 126.5; culmen (1) 17.0; tarsus 32.0, 32.0.

Range.—Cloud forest, 5,000 feet, near El Fenix, 5 miles northwest of Monserrate, Chiapas.

Localities.—CHIAPAS: Distrito Tuxtla: El Fenix, 2 males, 2 females, 1 juv. male, 1 juv. female.

We name this race for Ernest P. Edwards.

Dactylortyx thoracicus calophonus new subspecies

Type: Subadult male; Museum of Comparative Zoology, Harvard University, No. 145,696; Quezaltenango, Guatemala, altitude 8,500 feet; November 18, 1919; collected by Austin Paul Smith; original number 19,078.

Characters of male.—Darker than *dolichonyx*; top of head and line above the eye, mantle, back, wings and rump darker rich brown; underparts darker, more brownish; ventral shaft streaks narrower. Two males (Tecpam and Volcán de Fuego) are lighter than the two others examined (Quezaltenango and Tecpam) but have even narrower ventral shaft streaks. Much larger than *fuscus* from which it is further distinguished by lighter crown, line above eye, back, wings and rump; ventral shaft streaks are broader. From *chiapensis* it differs by being larger, browner above and below but with much less chestnut on the wings.

Characters of female.—Compared to *dolichonyx*, darker and duller (less bright) on breast and sides, belly darker; line over the eye and sides of head darker gray; rest of upper parts slightly darker. Differs from *chiapensis* by having the throat much darker gray; breast and belly darker; lower back and rump browner. Differs from *fuscus* (one female) by being paler throughout.

Measurements.—Males: Wing (4) 133.0–137.0 (135.5); culmen (4) 18.0–18.5 (18.1); tarsus (4) 36.0–38.0 (36.7). Females: Wing (3) 126.0–129.0 (127.7); culmen (3) 17.0–17.1 (17.1); tarsus (3) 32.2–35.0 (33.8).

Range.—Mountain forests of the volcanoes of southeastern Chiapas (Volcán de Tacaná) and southern Guatemala, 5,000 to 10,000 feet.

Localities.—CHIAPAS: Volcán de Tacaná (3,000 meters), 1 female. GUATEMALA: Volcán de Santa María, 1 female; Quezaltenango, 1 male; Tecpam, 2 males, 1 female; Volcán de Fuego, 1 male; Volcán San Lucas; Dueñas; near Patzun; Finca Helvetia, 12 miles north-northeast of Retalhuleu on the Pacific slope of Volcán de Santa María (Saunders, 1950). The species was observed in captivity by A. W. Anthony (Griscom, 1932:108) at Finca Perla located northeast of the Cuchumatanes Mountains near the border of Chiapas; Saunders (1950) reported the occurrence of this quail at Nebaj. It is doubtful that birds from these last two localities belong to this race.

Dactylortyx thoracicus subspecies

A male taken at 5,000 feet in a coffee finca in cloud forest on Cerro del Aguila, Dept. Santa Ana, El Salvador, in coloration is close to one male of *salvadoranus* and two males of *taylori*, but is lighter gray on the breast, sides, belly, wings, back and rump; and by these same characters is markedly different from *calophonus*. Without question it is closest to *salvadoranus* and *taylori*, but is completely isolated from both. The measurements of the specimen are: Wing, 128.2; culmen, 18.4; tarsus, 33.0. Harrell observed

this species in cloud forest at 7,000 feet altitude on Volcán de Santa Ana which is closely adjacent to Cerro del Aguila.

Dactylortyx thoracicus salvadoranus Dickey and van Rossem

Dactylortyx thoracicus salvadoranus Dickey and van Rossem, *Proc. Biol. Soc. Washington*, 41:129, 1928 (Volcán de San Miguel, alt. 4,000 feet, Dept. San Miguel, El Salvador; type in Dickey Collection, University of California at Los Angeles).

Males are darker gray, less brown, than *taylori*. The single female is darker and duller than the five females of *taylori* examined; the cheeks are grayer, not brownish; the sides and especially the flanks are darker.

Measurements.—Males (2): Wing 126.0, 128.2; culmen 17.6, 17.9; tarsus 33.6, 33.9. Female (1): Wing 124.0; tarsus 33.2.

Range.—Oak association (2,500–4,000 feet) of Arid Upper Tropical Zone and rarely in upper edge of Lower Tropical Forest on Volcán de San Miguel, Dept. San Miguel, El Salvador.

Localities.—EL SALVADOR: Volcán de San Miguel, 2 males, 1 female.

Dactylortyx thoracicus taylori van Rossem

Dactylortyx thoracicus taylori van Rossem, *Trans. San Diego Soc. Nat. Hist.*, 7:151, 1932 (Mt. Cacaguatique, 3,500 feet, Dept. San Miguel, El Salvador; type in Dickey Collection, University of California at Los Angeles).

This race is closest to *salvadoranus* and the bird from Cerro del Aguila, El Salvador. The five males examined are paler and browner than *salvadoranus*, especially the type and one other taken by van Rossem on the southwest slope. The other three, taken on the north slope by another expedition, are grayer and with ventral shaft streaks broader; one is scarcely distinguishable from the type of *salvadoranus* but is slightly brighter on the wings and rump. Six females (one in postjuvenile molt) are readily distinguishable from *salvadoranus* by their lighter throats and sides of heads which are tinged with reddish brown, by brighter reddish breasts, sides and bellies, and by browner, less fuscous, wings and backs. The females, especially one adult and one juvenile (in molt), have some reddish on the throat feathers and on the sides of the head.

Males of *taylori* are very different from those of *fuscus*, being much paler and browner. Females are paler and brighter than females of *fuscus*.

Measurements.—Males: Wing (5) 125.0–134.0 (129.0 ± 1.5); culmen (5) 18.0–19.1 (18.72 ± 0.21); tarsus (5) 31.8–34.0 (32.8 ± 0.40). Females: Wing (5) 121.0–124.0 (122.36 ± 0.59); culmen (5) 17.6–18.2 (17.9 ± 0.11); tarsus (5) 31.5–33.0 (32.4 ± 0.29).

Range.—Oak and coffee association of the Arid Upper Tropical Zone and probably in the limited cloud forest on Mt. Cacaguatique, El Salvador.

Localities.—EL SALVADOR: Mt. Cacaguatique, 5 males, 5 females, 1 juv. female.

Dactylortyx thoracicus fuscus Conover

Dactylortyx thoracicus fuscus Conover, *Proc. Biol. Soc. Washington*, 50:73, 1937 (Alto Cantoral, Tegucigalpa, Honduras; type in H. B. Conover Coll., Chicago Natural History Museum).

This race, here restricted to the Alto Cantoral region of Honduras, is the darkest of all races of this quail. The two males examined are much darker than *calophonus* from Guatemala and are much smaller. The top of the head is nearly black, the ventral shaft streaks scarcely visible on one and very narrow on the other; the wings, back, rump and underparts are deeper fuscous, much less brownish. These differences are even greater when the birds are compared with *taylori* and *salvadoranus*.

The single female of *fuscus* differs from females of *dolichonyx* and *calophonus* by being

much darker. It is somewhat similar to the female of *salvadoranus* and a female from Catacamas, Honduras, being intermediate between them in coloration.

Measurements.—Males (2): Wing 129.0, 129.0; culmen 16.5, 16.5; tarsus 35.1, 36.7. Female (1): Wing 125.4, culmen 17.0, tarsus 34.5.

Range.—Cloud forest of the Alto Cantoral district of Tegucigalpa, Honduras.

Localities.—HONDURAS: Department of Tegucigalpa: Cantoral, 1 male; Alto Cantoral, 1 male (type), 1 female.

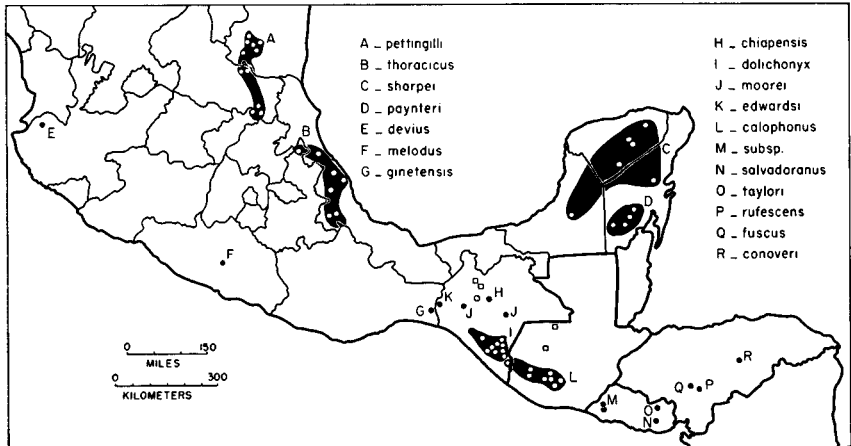


FIG. 1. Map showing the geographic distribution of *Dactylortyx thoracicus*.

Dactylortyx thoracicus rufescens new subspecies

Type: Subadult female, no. 161,030, Museum of Comparative Zoology, Harvard University; Rancho Quemado (San Juancito Mountains, Dept. Tegucigalpa), Honduras, March 13, 1932; collected by C. F. Underwood.

Characters of female.—Brighter red above and below than all other races; closest to *chiapensis* in breast color but redder, abdomen more buffy, sides of throat and head much paler gray, the feathers washed with reddish-buff in the type; chin and throat whitish, not gray, with a distinct buffy wash on lower throat; mantle redder; lower back, rump, upper wing coverts and secondaries rich golden ochraceous, not grayish buff. Approaches *taylora* most closely in color of throat and sides of head; otherwise it is brighter red throughout. Differs most strikingly from *fuscus* (1 female) and from two females from Catacamas, Honduras, in being much lighter, brighter red, on the mantle, wings, sides of neck, breast and flanks.

The male is unknown.

Remarks.—The distinctive, red coloration of the females of this race was noted even in the field by Harrell who saw clearly and without binoculars this character in a female at a distance of about 15 feet on August 8, 1954, in the cloud forest on San Juancito Mountain.

Measurements.—Females (3): Wing 123.0–129.5 (126.2), culmen (2) 17.5, 18.0; tarsus 31.2–34.3 (32.9).

Range.—Hardwood cloud forest (4,000–7,000 ft.) on the San Juancito Mountains, Department of Tegucigalpa, Honduras.

Localities.—HONDURAS: Department of Tegucigalpa: San Juancito, 2 females; Rancho Quemado, 1 female (type).

Dactylortyx thoracicus conoveri new subspecies

Type: Adult male, testes "½ enlarged"; H. B. Conover Collection no. 12,666 (Chicago Natural History Museum); Catacamas, Department of Olancho, Honduras; September 29, 1937; collected by C. F. Underwood.

Characters of male.—Three males examined (nos. 12,665–6–7, H. B. Conover Collection; one just completing the postjuvinal molt) resemble *sharpei* and *pettingilli* most closely, but chestnut above the eye and on the throat less bright, some feathers showing much white toward the base; chestnut on crown restricted to edges of a few feathers; breast darker gray, sides darker and finely barred; belly grayish-white, not buffy. From *fuscus*, the geographically nearest race (from which we have males), it differs by being much lighter and grayer, not dark fuscous.

Another male (H. B. Conover Collection no. 12,664) which has almost completed the postjuvinal molt, although bearing the same locality name on the label, is so different from the birds already described that, even taking into account individual variation, it probably came from another locality. The new feathers of the throat and superciliary area are dark chestnut in this bird; it is as dark dorsally as *fuscus*, and is close to that subspecies in ventral coloration, but is browner on the sides. Since the vast Agalta forest above Catacamas is divided into several isolated sections (Archie Carr, *in litt.* 1951), the locality "Catacamas" might refer to more than one population.

Characters of female.—One (no. 12,668, H. B. Conover Collection) is closest to *fuscus* and *salvadoranus* but darker throughout and with more reddish on throat patch than *salvadoranus*; very similar to *fuscus* but slightly darker reddish on breast; top of head blacker.

Another specimen (Conover Collection, no. 12,663; in the last stages of postjuvinal molt) has tawny-chestnut on the throat and in front of the eye. The new plumage resembles quite closely that of the adult, but is darker. This specimen is apparently a female but in the amount of chestnut in the throat patch and above the eye it resembles a male.

Remarks.—All of the Catacamas specimens are placed in the race *conoveri* although we are not certain that the females and the dark males came from the same forest locality as the light gray males; these dark birds may represent another isolated population and may not belong to the race *conoveri*.

We name this race in honor of the late H. B. Conover who suggested (Hellmayr and Conover, 1942:284) that the pale males from Catacamas might not belong to *fuscus*.

Measurements.—Males (3): Wing 124.5–131.0 (127.8) (dark bird 125.0), culmen 18.0–18.9 (18.5) (dark bird 17.1), tarsus 33.3–34.0 (33.5) (dark bird 35.0). Female (1): Wing 131.5, culmen 17.5, tarsus 34.9. Conover no. 12,663, female (?), imm.: Wing 126.0, culmen 17.2, tarsus 36.2.

Range.—Forests (probably cloud forest above), Catacamas, Department of Olancho, Honduras.

Localities.—HONDURAS: Department of Olancho: Catacamas, 4 males, 2 females.

DISCUSSION

The high degree of plasticity observed in the Singing Quail is not unexpected when consideration is given to the wide range of soil, climate and veg-

etation types and the altitudinal range occupied by this sedentary species, and to the degree of isolation of a number of its populations. Within the species there are demonstrable correlations of size with altitude and of plumage coloration with humidity; but these correlations do not extend to all populations. There are also clines in color. The largest individuals of *Dactylortyx thoracicus* are found in the populations occupying the high mountains of Guerrero (*melodus*), the Sierra Madre de Chiapas (*dolichonyx*) and the Guatemalan volcanic system (*calophonus*). The smallest birds occur near sea level in Campeche, Yucatán and Quintana Roo. While the palest races occur on the Yucatán peninsula, only a part of the population of *sharppei* inhabits the drier deciduous forest near the northern tip; *D. t. paynteri* is found in rainforest. Since the rainforest birds are in contact over a broad area with the populations of the drier parts of the peninsula, their resemblance to *sharppei* in paleness is not surprising. The darkest birds are all from humid mountain forests, the extremes occurring on Cerro Cantoral (Honduras), "Catacamas" (Honduras, females only) and in the Guatemalan volcanic system.

The most obvious cline is in coloration in the races of the Atlantic slope extending from Tamaulipas into Honduras; the gray of the breast and belly of the males is the best example. The races involved are *pettingilli*, *thoracicus*, *sharppei*, *paynteri* and *conoveri*. This group contains the only examples of probably continuous ranges between subspecies; these are between *pettingilli* and *thoracicus* and between *sharppei* and *paynteri*. The olivaceous tinge and broad ventral shaft streaks of males of *melodus* also are found in *ginetensis*, with the broad shaft streaks reappearing in *dolichonyx*, *edwardsi* and *moorei*. Thus, on the Atlantic slope and lowlands there is a cline which is continuous across the north side of the Isthmus of Tehuantepec, whereas on the Pacific slope, populations are more isolated and clinal relationships are less clearly defined. Here, topography and associated climatic conditions have created stronger barriers to *Dactylortyx*. On the other hand, on the basis of specimens so far examined, clinal relationships are not apparent among the southeasternmost populations, especially between females of the races *fuscus* and *rufescens* and between males of *fuscus* and *conoveri*. This condition was readily noticeable when all of the specimens were laid out in the laboratory in physiographic and geographic order. It is in these closely adjacent but completely isolated and probably small populations that random differentiation appears to have occurred.

The Balsas Basin has likely been a major barrier to the spread of *Dactylortyx*. The single bird from Jalisco (*devius*) bears a closer resemblance to specimens from the Sierra Madre Oriental than it does to *melodus* of Guerrero. This resemblance suggests a past continuity across the Transvolcanic Belt or an area further north rather than one across the Balsas Basin. This

is weak evidence but results of current studies of the genera *Philortyx*, *Callipepla* and *Colinus* add support to this hypothesis. Other peculiarities in the evolution and biogeography of this forest-inhabiting, disjunct species are becoming more clearly interpretable through current studies on the grassland-inhabiting *Colinus* species. In the region under discussion both the geographic and ecological distributions of the two genera are largely complementary; and, although their paleo-climatic histories are identical, their ecologies are different. Even more important is that their evolutionary histories are very different, particularly with respect to time of occurrence of similar events in each. For instance, the development and decline of discontinuities between populations as the result of climatic change have occurred in opposite order in these two genera. Thus, at present there exist the disjunct populations of *Dactylortyx* comparable to the condition which prevailed among *Colinus* populations during cooler and/or moist climates of the past and the concomitant existence of more continuous forest in Mexico and northern Central America. The breakdown of these forest "bridges" to *Dactylortyx* (which act as barriers to *Colinus*) has resulted in increasing isolation of *Dactylortyx* populations; but to *Colinus* this breakdown has meant the re-establishment of contact zones between formerly isolated populations. Some of these populations had undergone major differentiation. The current comparative study of these complementary populations and those of the other Odontophorinae are beginning to prove valuable aids in systematics and biogeography of Middle America.

SUMMARY

The Singing, or Long-toed, Quail inhabits a number of forest types from near sea level to about 10,000 feet in Mexico, Guatemala, El Salvador and Honduras. Many of the populations are disjunct. The habitats occupied are extremely variable in climate, forest type and areal extent. Some dense undergrowth for cover is essential. Some populations occur in two, three or more vegetation types; others are restricted to a single type. These vegetation types include deciduous forest, semi-deciduous tropical forest, tropical evergreen forest, rainforest, oak-sweet gum cloud forest, mesic areas in pine-oak, pine-oak-fir-alder, oak-*aguacate* vapor forest, second growth cloud forest and coffee groves in areas of limited natural forest.

Knowledge of biology and behavior of the Singing Quail is fragmentary. It escapes by short, rapid flights or by running or both. Much of its food of seeds, bulbs and invertebrates is obtained by scratching in the litter and humus.

Flocks of as many as 12 individuals of both sexes and all age groups have been observed. Even during the breeding season more than two adults may be present in a small area. During two breeding seasons approximately 3.5

pairs per 100 acres were found in climax oak-sweet gum forest in Tamaulipas. Estimates based on this figure for the total populations of each of two isolated volcano populations in El Salvador do not exceed 500 pairs.

The breeding season, which extends from February through October or later, is similar for all populations except for indications that in the deciduous forest of Yucatán it may be delayed until May following the three driest months. No nest has been described, but a female was reported to have been incubating five eggs; usually broods have had two to four young. The post-nuptial molt begins in June and continues through at least the end of the year; during July and August most of the adult population is in molt. No completely satisfactory criteria were found for separation of first year from older birds.

Song and other vocal notes are described. The song is usually in two parts: a series of about four loud, penetrating whistles followed by three to six rapid phrases of notes of differing pitch.

The taxonomic history of *Dactylortyx thoracicus* is reviewed. Nine races had previously been described but one race without a valid name is given the name *ginetensis*. The following eight new subspecies are described: *pettingilli*, *melodus*, *dolichonyx*, *moorei*, *edwardsi*, *calophonus*, *rufescens* and *conoveri*.

Over a part of the range of the species there are size and color correlations with altitude and climate respectively, the largest birds living at higher altitudes, the smallest near sea level. The darkest birds are cloud forest inhabitants; the palest occur on the Yucatán peninsula in both deciduous forest and rainforest. Color clines are strongest in the largely continuous Atlantic slope populations and are weaker among the Pacific slope and interior Chiapas populations. Clinal relationships are not apparent among some Honduras populations. In some of these small populations random differentiation seems to be present.

The race *devius* from Jalisco exhibits some characters of the Sierra Madre Oriental populations suggesting a former connection with the eastern populations across the Transvolcanic Belt rather than across the Balsas Basin with *melodus*.

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