DALE J. OSBORN
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Habitats, Flora, Mammals, and Wasps of Gebel 'Uweinat, Libyan Desert

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ABSTRACT

Osborn, Dale J., and Karl V. Krombein. Habitats, Flora, Mammals, and Wasps of Gebel 'Uweinat, Libyan Desert. *Smithsonian Contributions to Zoology,* 11:1–18, 1969.—The habitats at Gebel 'Uweinat, Libyan Desert, at the juncture of Egypt, Libya, and Sudan, are described and illustrated by photographs. Annotated lists are presented of the 55 species of plants collected there, 6 species of mammals, and 30 species of wasps.

Gebel 'Uweinat, the "mountain of little springs," lies in the Libyan Desert where the boundaries of Egypt, Sudan and Libya meet (Figure 1). Remote and difficult of access, this mountain area is practically unexplored biologically. Following are descriptions of the area, a general account of plant distribution, and annotated lists of plants, mammals, and wasps collected by the authors during a four day visit to 'Uweinat in April 1967.

The eastern portion of 'Uweinat, which includes the summit at 1934 meters (6345 feet) altitude, (latitude 21°54′ N, longitude 24°58′ E), is Nubian sandstone. Underlying the sandstone is igneous rock which forms the western portions of the mountain (Ball, 1927; Sandford, 1933; Said, 1962). The high southeastern sandstone plateaus have their bases buried in a talus forming the pediment of a broad, sloping alluvial plain (Figure 2). In contrast, on the western end of 'Uweinat, granite cliffs have weathered into piles of exfoliated boulders rising steeply from level plains (Hassanein Bey, 1925; Shaw, 1934).

The "springs" of 'Uweinat are actually rock basins (*guelta*) beneath the boulders in the west (Hassanein Bey, 1924b) and a series of springs and small pools in a narrow, winding gorge (*karkur*) in the southeast. The springs occur where impervious porphyries hold up water that has percolated down through sandstone (Ball, 1928). Rainfall replenishes these sources of surface water every seven to ten years (Peel, 1939).

In 1923 Hassanein Bey (1924a, b; 1925) located 'Uweinat, previously known as Owana, a legendary place halfway along a camel road from Merga to Cufra where there was green grass after rain and a well (King, 1913; Shaw, 1934). Hassanein Bey, who reached this pastureland two years after rain had fallen, found ample grazing for his camels and an abundance of water in four rock basins in the boulder cliffs. For want of a better term, these reservoirs in the rocks were called springs. Hassanein Bey's reports include geological and botanical notes, some observations on mammals, and descriptions and photos of prehistoric rock art and the native Goraan.

The succession of explorations to 'Uweinat since Hassanein Bey is documented in papers in the Geographical Journal, particularly those of Bagnold (1933, 1939), Peel (1942), and Williams and Hall (1965). Although no expedition has remained there for more than a few days at a time, an impressive amount of data has accumulated on the geology, geomorphology, and archaeology. Were it not for the efforts of W. B. K. Shaw (1931; Shaw and Hutchinson, 1931, 1934) we would have little knowledge of the flora. At the time of our visit, information on the mammalian fauna was more meager and that of the wasp fauna nonexistent.

During April 1967, a United States Naval Medical Research Unit Number Three (NAMRU–3) expedition visited 'Uweinat for the purpose of obtaining mammals and their ectoparasites and botanical specimens. Krombein accompanied the expedition to make a general collection of insects. We were accompanied and assisted by personnel of the NAMRU–3 Medical Zoology Department, a representative of the Egyptian Ministry of Health, and a field party from the Egyptian Desert Reclamation Department, Kharga Oasis. Our route from El Kharga was southward via Bir Kurayin (Kreyim) and Dibis; thence westward via Bir Misaha to Gebel 'Uweinat. The two week stay we had anticipated at 'Uweinat was shortened to four days due to lack of water. The bitter water in the pools of Karkur Murr, as the name *murr* indicates, was undrink-

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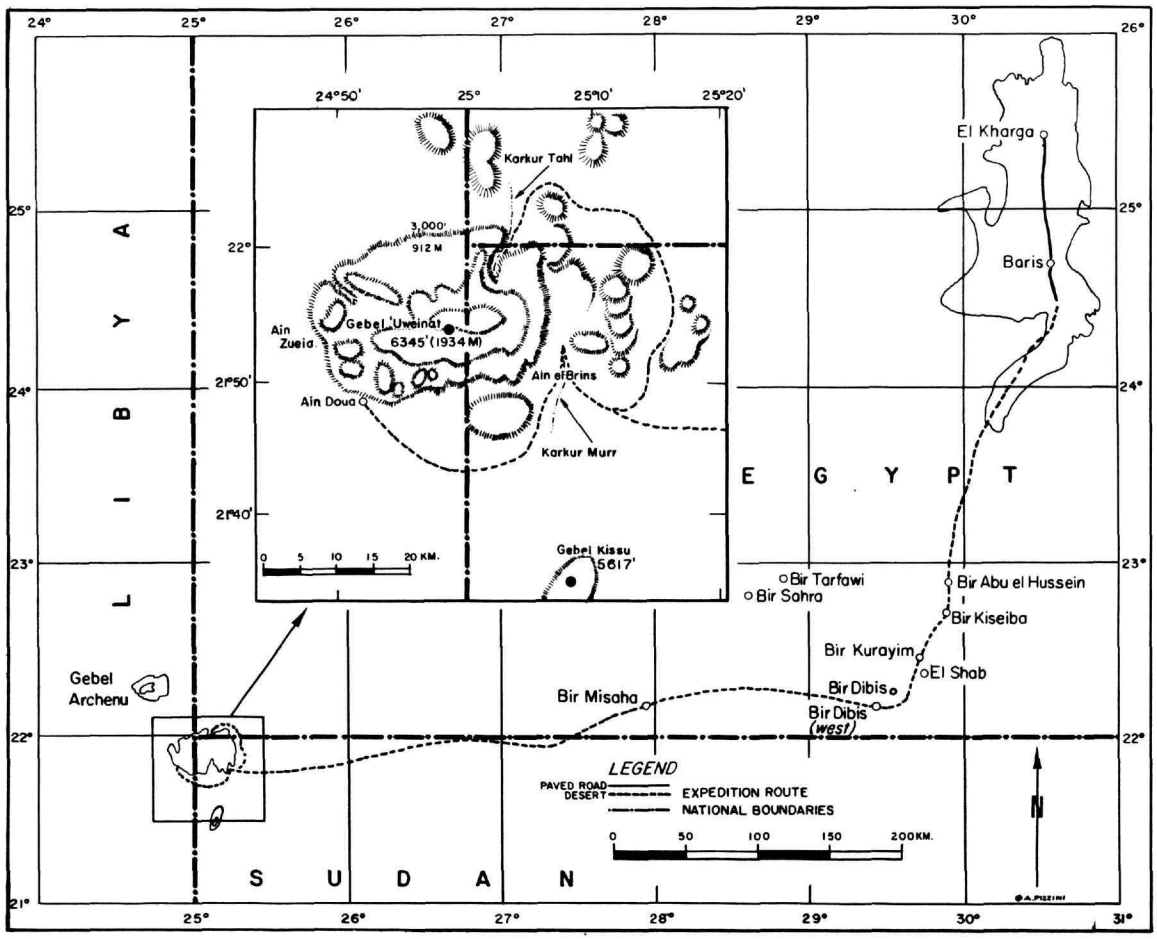

FIGURE 1.—Map of Gebel 'Uweinat and adjacent country, showing route of expedition from El Kharga to Gebel 'Uweinat.

able. Libyan soldiers stationed at Ain Doua (Ain el Gazal) (Figure 1) did not have sufficient water to support us and reported that other water sources were exhausted.

Thus, collecting was concentrated in Karkur Murr in Sudan and in another wadi twelve kilometers west. A brief trip was made to Karkur Tahl in Egypt. Insect collecting was carried on in Karkur Murr only.

ACKNOWLEDGMENTS.—The expedition was made possible largely through the facilities of NAMRU-3, Cairo. We are indebted to Mr. Ibrahim Helmy Mohamed, Technician, NAMRU-3, for attending to the many details preceding departure of the expedition and for his able assistance in the desert. The proficiency of Mr. Mohamed el Nawawi, Egyptian Ministry of Health, in handling administrative details at El Kharga is greatly appreciated.

Mr. James Vanderbeek, Manager, Pan American Oil Company, Cairo, obligingly loaned us a truck and driver. The Egyptian Desert Reclamation Department assisted us by hauling gasoline and other supplies and by providing accommodations in El Kharga and at Bir Kurayim.

The assistance of the specialists who identified the plants and wasps collected by the expedition is acknowledged in each of those sections of this report.

The senior author's work is from Research Project MF 12.524.009-3008B, Bureau of Medicine and Sur-

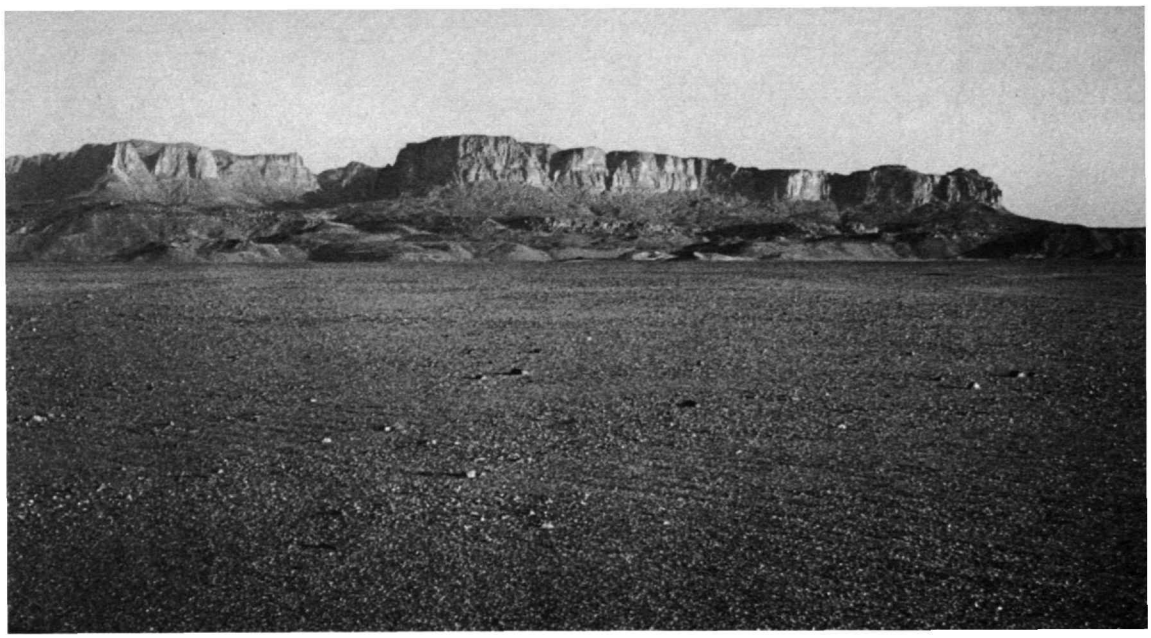

FIGURE 2.—Sandstone plateaus of Gebel 'Uweinat. View north-northwest from alluvial plain.

gery, Department of the Navy, Washington, D.C.; his efforts were supported in part by Office of Naval Research Contract Nonr 4414(00) NR 107–806 with Field Museum. The opinions and assertions contained herein are the private ones of the authors and are not to be construed as official or reflecting the views of the Department of the Navy or of the naval service at large.

The junior author's field work was supported by Smithsonian Research Foundation Grant SFC–7–0056.

Lastly, we thank the workers and guides without whose help the expedition could never have progressed.

Discussion

PHYSICAL FEATURES OF THE KARKURS.—Karkur Murr, on the gradually sloping plain, is a meandering streambed of soft sand (Figures 3, 4) ending in a shallow mud pan about 20 kilometers south of the mountain.

In the mountain, Karkur Murr is a steep-sided gorge with a broad, deep alluvial fan of sand, rubble and rounded boulders. The bedded channel starts here as a rock-strewn ravine (Figure 5). Half a kilometer inside the plateau the gorge narrows abruptly. Sandstone blocks fallen from high walls clutter the steeply ascending rocky floor (Figure 6). About one kilometer inside the gorge are a number of pools bordered with encrustations of salt—Ain el Brins (Prince Spring) on some maps; Ain Murr on others (Figure 7). Bagnold (1931, 1935) reported more pools higher up, but our party failed to reach them.

A short tributary from the east joins the main gorge shortly above the alluvial fan (Figure 5). Below the dry waterfall at the beginning of this canyon there is a shallow, salty pool (Figure 8).

Twelve kilometers west of Karkur Murr is an unnamed wadi which, in contrast with Karkur Murr, has a level, boulder strewn gravel floor that penetrates about two kilometers into the plateau.

Karkur Tahl in the northeast is a long, winding valley with a sandy floor (Figure 9). Wind has sculptured the cliffs, accumulated sand at their bases, and closed the wide mouth of Karkur Tahl with a high drift.

Karkur Ibrahim, in the northwest, visited by Hassanein Bey (1924a, b; 1925) and others, has a long, winding, level, gravel floor strewn with big stones and bordered by steep boulder cliffs.



FIGURE 3.—Karkur Murr. Meandering streambed in alluvial plain. Vegetation: *Acacia flava, A. raddiana,* and *Panicum turgidum.* View south with Gebel Kissu in background 30 km distant.

Rainfall: Rain was recorded at 'Uweinat in 1921, fall of 1927, spring of 1934, and June 1960 (Williams and Hall, 1965). According to the soldiers at Ain Doua, rain had fallen more recently, probably in 1962, in the southeastern section of the mountain. The blooming and fruiting vegetation in Karkur Murr (Figures 3–5), in contrast with the dead, broken grass and desiccated acacias of Karkur Tahl (Figure 9) indicated that rainfall was sporadic.

Rains are reported to be violent and of short duration. Trees may be uprooted and carried out onto the plains from Karkur Murr. The basins south and west of 'Uweinat are known to become filled with water to depths of two meters (Kemal el Din, 1928).

Vegetation: The flora of Gebel 'Uweinat is Indo-Saharan, not Mediterranean or montane (Shaw, 1931), and includes genera and species common in the wadis of the granitic Red Sea Mountains of Egypt.

The mud pans on the plains support a scattering of *Acacia flava* and *Crotalaria thebaica,* two specimens of the tree *Maeura crassifolia,* stands of grasses (*Aristida* spp.) and patches of *Colocynthis vulgaris* (Shaw and Hutchinson, 1934).

A few specimens of *Crotalaria thebaica, Farsetia ramosissima, Aerva persica,* and several species of *Aristida* have been found in runnels in the plains and the hilly country east of 'Uweinat. Concentrations of vegetation are in the wadi beds, particularly the alluvial fan of Karkur Murr, excepting mesophytes around pools.

Species collected high in the cliffs are *Pulicaria crispa, Lavendula stricta, Heliotropium ramosissimum, H. undulatum, Cleome droserifolia* and *Maeura* sp. (Shaw and Hutchinson, 1931, 1934).

THE FLORA OF THE KARKURS.—The meandering streambed of Karkur Murr contains tree and shrub acacias (*Acacia raddiana* and *A. flava*) and the large,

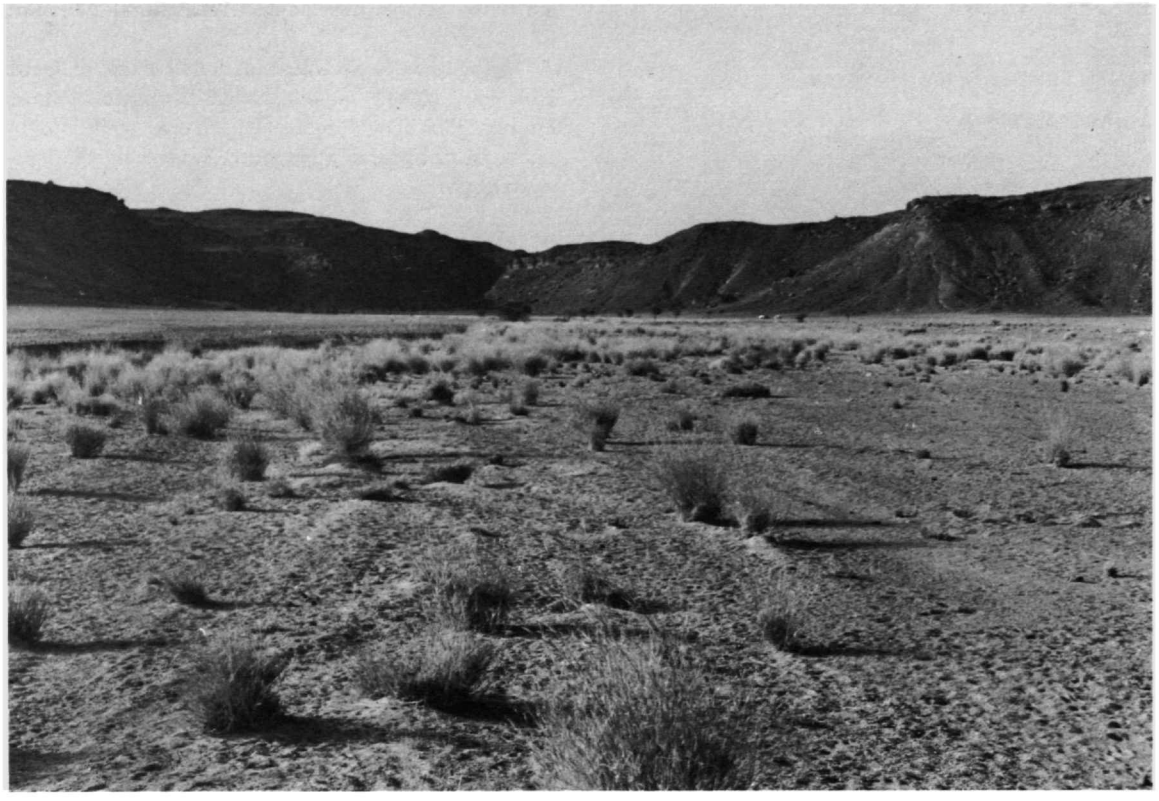

FIGURE 4.—Karkur Murr. Meandering streambed in alluvial plain. View north from same location as in Figure 3. Note mouth of canyon in center background.

coarse bunch grass, *Panicum turgidum* (Figures 2, 3). There are occasional patches of ground gourd (*Colocynthis vulgaris*) and a few prostrate *Euphorbia granulata.*

Individual *Cassia italica, Trichodesma africanum, Cleome droserifolia, Aerva persica, Pulicaria crispa* and species of *Fagonia* occur mainly along the edges of the streambed and on terraces of rubble and coarse gravel. *Pulicaria crispa* and *Aerva persica* increase noticeably in frequency in the rock-strewn ravine and sandy patches of the alluvial fan. The numbers of *Acacia* spp. and *Panicum turgidum* decrease in these zones and further inside the canyons. *Colocynthis vulgaris* occurs sparingly among the rocks. About 15 additional species occur in the canyon, exclusive of the 7 growing beside pools. These are discussed in the annotated list with plants collected in the wadi twelve kilometers west of Karkur Murr.

The vegetation of Karkur Tahl (Figure 9) at the time of our visit consisted of numerous large acacia trees or *tahl* (*Acacia raddiana*) and dry, broken grass (*Panicum turgidum*).

Hassanein Bey (1924a, p. 355) described Karkur Ibrahim as patterned with tufts of grass (probably *P. turgidum*), mimosa trees (*Acacia* sp.) and small shrubs whose leaves smelled like peppermint (probably *Lavendula stricta*). "At intervals the ground is carpeted with creeping plants of the colocynth, expanses of green leaves dotted with brilliant yellow globes like grape-fruit."

Kemal el Din (1928) listed the following plants from the beds of the karkurs: *Tamarix mannifera* (*T. nilotica*) (Fam. Tamaricaceae), *Cornulaca monocantha* (Fam. Chenopodiaceae), *Leptochloa bipinnata* (*Desmostachya bipinnata*) (Fam. Gramineae) and *Acacia raddiana* (Fam. Leguminosae). According to

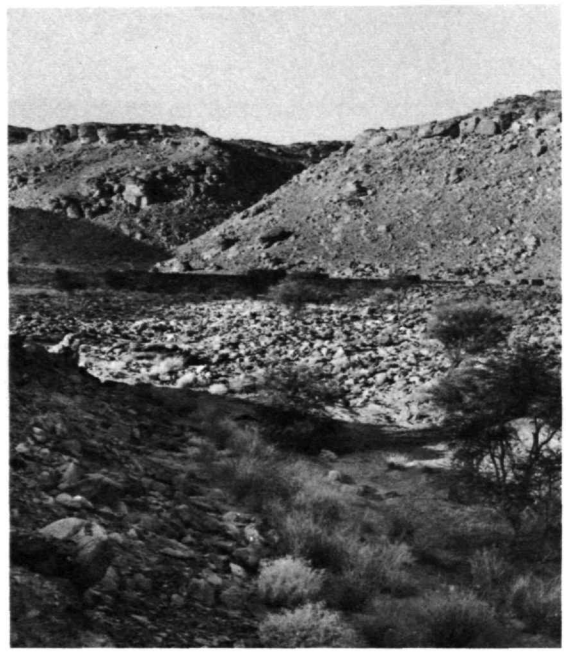

FIGURE 5.—Karkur Murr. Bedded channel in alluvial fan. View north-northeast. Stone huts are visible on the terrace in the background. Note the whitish *Aerva persica*.

Newbold (1928) the main vegetation of the valleys of 'Uweinat was *Acacia, Tamarix,* and *Cornulaca.*

Tamarix and *Cornulaca* were not among the plants collected in Karkur Murr, Karkur Tahl, Karkur Ibrahim, or at Ain Zueia by the 1932 collecting party (Bagnold, 1933; Shaw and Hutchinson, 1931, 1934) and by Osborn in 1967. The presence of *Desmostachya* (p. 11) at 'Uweinat is also questionable.

Annotated List of Plants

The following list of 55 plant species from the 'Uweinat area is arranged by families according to Täckholm et al. (1956). Annotations are from Shaw (1931), Shaw and Hutchinson (1931, 1934) and observations of D. J. Osborn. Osborn's collection of 45 species, taken 9–12 April 1967, includes 33 species and four varieties not reported previously from 'Uweinat.

Dr. Vivi Täckholm, Chairman, Department of Systematic Botany, Cairo University, identified the specimens, excepting species of *Fagonia,* which were handled by Dr. Nabil el Hadidi, also of Cairo University, and species of *Convolvulus,* which were determined by Dr. Fatma Sa'ad, Agricultural Museum, Cairo.

Duplicate collections are in the herbaria of Cairo University (CAI) and the Field Museum of Natural History, Chicago, Illinois (F). Species collected by Shaw in 1931 and September–November 1932 are starred (*).

COMPOSITAE

**Pulicaria crispa* (Forsskål) Bentham and J. D. Hooker f.: Karkur Murr. In all parts of wadi, particularly area of coarse alluvium and sand. Flowering. Shaw (1931): "High up K. Tahl, 3000 ft., low herb 1 ft. high. Found at Kissu."

**P. undulata* (Linnaeus) Kostel: Karkur Murr and wadi 12 km west. In canyons and rocky parts of wadis. Shaw (1931): "Uweinat, about 2200 ft., dry watercourse."

CUCURBITACEAE

**Colocynthis vulgaris* Schrader: Vernacular names, *handal,* colocynth or ground gourd. Karkur Murr. Fruits and flowers present. Common according to

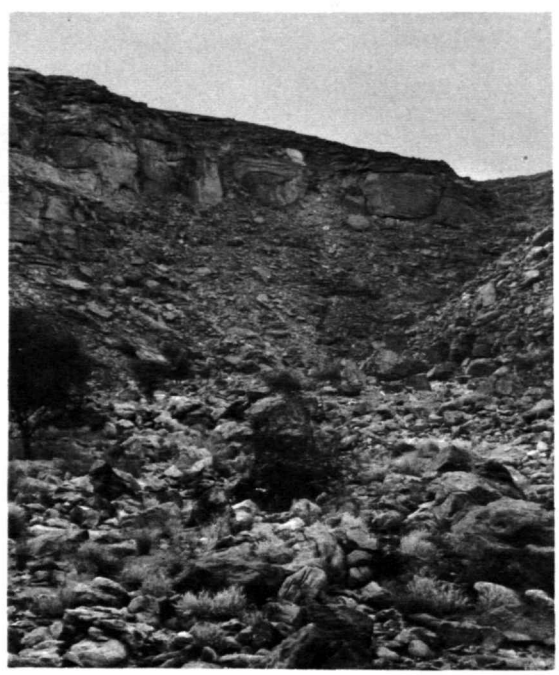

FIGURE 6.—Karkur Murr. Narrowing rocky canyon.



FIGURE 7.—Ain Murr (Ain el Brins). Rock pools in Karkur Murr. Note salty encrustations.

Hassanein Bey (1925), who wrote that the dried seeds were used to make *abra,* a staple food of the Goraan, after prolonged boiling to remove the bitterness. Common on the plain around the mountain (Shaw, 1934). Green gourds are eaten by Barbary sheep (Mason, 1936) and gazelle; the dry seeds and pulp are eaten by rodents (Osborn's observations) contrary to the opinion of P. A. Buxton (1923).

OROBANCHACEAE

Cistanche tinctoria (Forsskål) G. Beck: Specimen is probably this species, but it lacks flowers. Karkur Murr from somewhere above the pools. Usually parasitic on shrubs of Chenopodiaceae. Host in this case not known. Collected by guide.

LABIATAE

**Lavendula stricta* Delile (*L. coronopifolia* Poiret): Shaw (1931) wrote: "Uweinat, about 6000 ft., rocky gorge on mountain top, 6 ins. high."

BORAGINACEAE

Heliotropium ramosissimum (Lehmann) DeCandolle: Karkur Murr. Flowering.

**H. undulatum* Vahl: Shaw (1931) wrote: "on cliff top, about 4000 ft., low plant 8 ins. high. About 6000 ft., rocky gorge on mountain top, about 6 ins. high."

Trichodesma africanum (Linnaeus) R. Brown var. *abyssinicum* Brand: Karkur Murr and wadi 12 km west. Closely browsed by gazelles where accessible.

CONVOLVULACEAE

Convolvulus austro-aegyptiacus Abdallah and Sa'ad: Karkur Murr. Flowering. All species collected were protected by large boulders in canyon.

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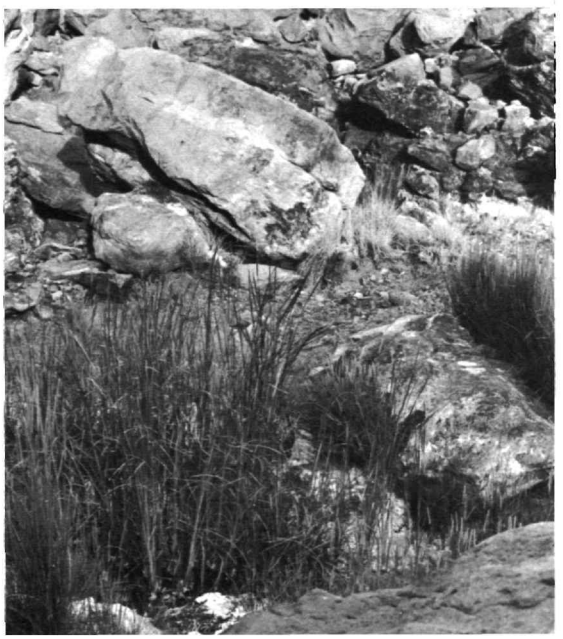

FIGURE 8.—Karkur Murr. Pool in eastern tributary. Note *Typha australis* and *Imperata cylindrica*.

Convolvulus cancerianus Abdallah and Sa'ad: Karkur Murr. Flowering.

Convolvulus prostratus Forsskål: Karkur Murr. Flowering.

ASCLEPIADACEAE

**Pergularia tomentosa* Linnaeus: Solitary plant in barren, washed gravel about 14 km west of Karkur Murr. Typical habitat. Flowering. Shaw (1931): "about 3,000 ft. shrub 2 ft. high, with milky juice."

PRIMULACEAE

Samolus valerandi Linnaeus: Karkur Murr. Rocky canyon.

TILIACEAE

Corchorus depressus (Linnaeus) Christensen: Karkur Murr. Among boulders. Flowering.

EUPHORBIACEAE

Euphorbia granulata Forsskål: Karkur Murr. Bedded channel and sandy areas in canyons. Flowering and fruiting.

ZYGOPHYLLACEAE

Fagonia arabica Linnaeus: Soft sand of runnel in hilly country east of Gebel 'Uweinat on track to Karkur Tahl (Figure 1). The spiny clovers usually grow in sandy or gravelly areas.

F. arabica Linnaeus var. *tilhoana* (Maire) Maire: Karkur Murr. Flowering.

F. indica N. Burman f.: Karkur Murr and runnels in hills east of Gebel 'Uweinat.

F. thebaica Boissier var. *violacea* Boulos: Runnels in hills east of Gebel 'Uweinat.

Tribulus longipetalus Viviani: Karkur Murr and wadi 12 km west. Listed as an annual by Täckholm et al. (1956).

**T. mollis* Ehrenberg ex Schweinfurth: According to Shaw (1931): "Uweinat about 2000 ft., in sandy bed of Wadi, prostrate over sand."

LEGUMINOSAE

**Acacia flava* (Forsskål) Schweinfurth (*A. ehrenbergiana* Hayne): Vernacular name, *sayaal*. Karkur Murr. Shrub or small tree (Figure 3). Flowering. Shaw (1931): "Shallow pans of dried mud on plain west of J. Uweinat. Uweinat, above and below 2200 ft., dry watercourse, tree up to 12–15 ft."

**A. raddiana* Savi (*A. tortilis* Hayne pro parte): Vernacular name, *tahl*. Karkur Murr. Fruiting. Large tree; particularly in Karkur Tahl, for which the valley was named (Figure 9). Shaw (1931): "tree 25 ft. high, 2000–4000 ft."

Argyrolobium saharae Pomel: Karkur Murr. Alluvial fan. Closely browsed by gazelles. Fruiting.

**Cassia italica* (Miller) Lambert ex Steudel (*C. obovata* Colladon): Karkur Murr and wadi 12 km west. Seeds eaten by rodents. Flowering. Shaw (1931): "Uweinat, about 1000 ft., sandy bed of wadi, 12–18 ins. high."

**Astragalus vogelii* (Webb) Bornmüller: According to Shaw (1931): "Uweinat, about 2200 ft., dry watercourse, semi-prostrate."

**Crotalaria thebaica* (Delile) A. P. de Candolle: Karkur Murr in sand. Flowering. Closely browsed by gazelles where accessible (Figure 10) but not in rocky canyon above alluvial fan. Shaw (1931): "20 miles south of Uweinat, about 1750 ft., drainage line on stony plain west of J. Uweinat."

**Lotononis platycarpa* (Viviani) P.-Sermolli: Shaw (1931) noted: "Uweinat, about 2200 ft., in dry watercourse, creeping over sandy surface."

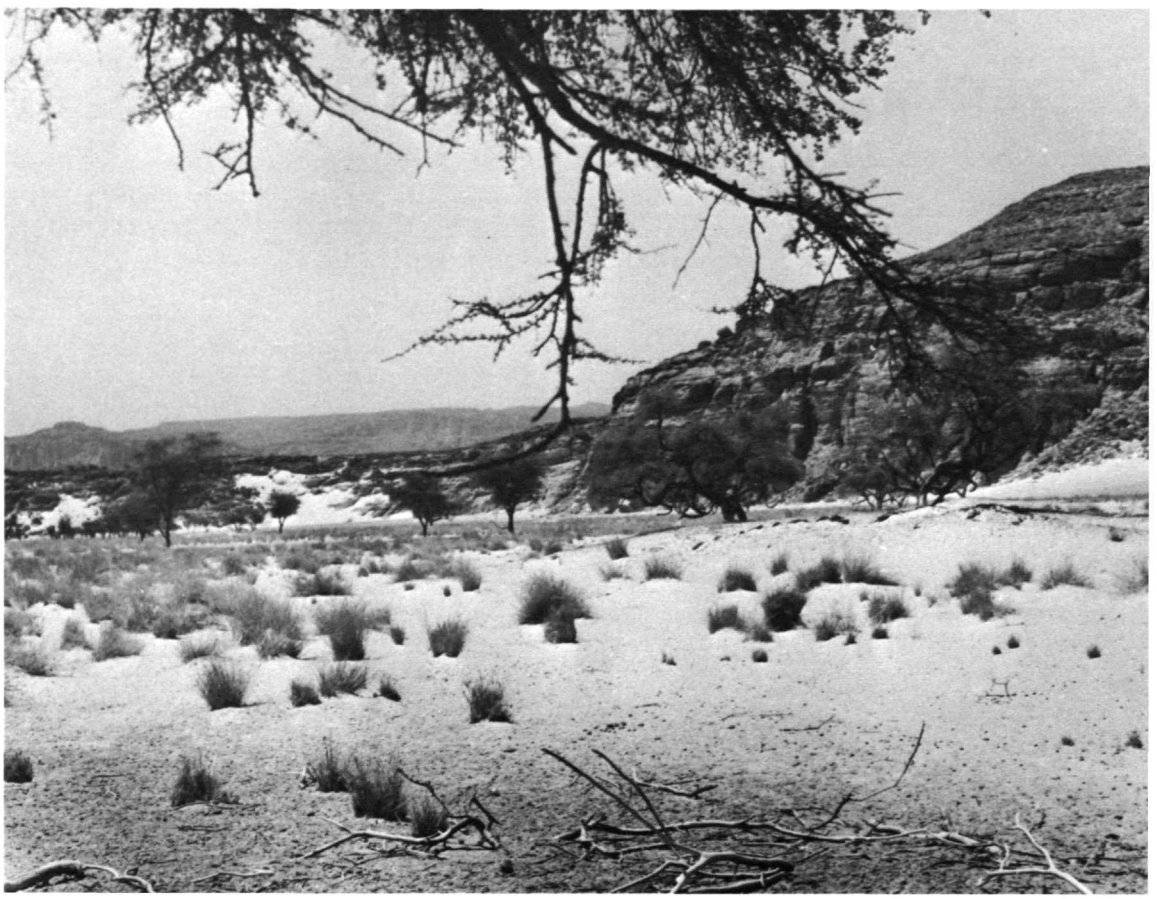

FIGURE 9.—Karkur Tahl. Note evidence of wind action—drifted sand and sculptured rocks. Trees are *Acacia raddiana;* grass, *Panicum turgidum.* View southwest.

Indigofera sessiliflora De Candolle: Karkur Murr, rocky canyon. Flowering and fruiting.

Parkinsonia aculeata Linnaeus: Small tree at base of boulder cliff, Ain Doua, Libya (Figure 1). Flowering. Exotic tree introduced into Sudan (Täckholm, personal communication).

CRUCIFERAE

Farsetia ramosissima Hochstetter ex Fournier: Karkur Murr and runnels in hills east of Gebel 'Uweinat. Closely browsed by gazelles. Fruiting.

**Morettia philaena* (Delile) A. P. deCandolle: Karkur Murr. In rocky parts of wadi. Flowering. Shaw: "near G. Kissu, 20 miles south of Oweinat, about 1500 ft."

CAPPARIDACEAE

Cleome chrysantha Decaisne: Karkur Murr and wadi 12 km west.

**C. droserifolia* (Forsskål) Delile: Karkur Murr. Shaw (1931): "high up Karkur Tahl; stiff aromatic herb 18 in. high. In sand among rocks of dry watercourse, about 2050 ft."

**Maerua crassifolia* Forsskål: According to Shaw (1931): "20 miles southwest of Uweinat, about 1750 ft., a solitary tree, 15 ft., in drainage line on stony plain" and "shallow pans of dried mud west of Uweinat." Shaw (1931) remarked that he saw a tree "about 3000 ft. up on the great central cliff. . . . It reminded me of *Maerua rigida*(?) of the



FIGURE 10.—Karkur Murr. Specimen of *Crotalaria thebaica* closely browsed by gazelles. Without interference the species grows to a height of 40 to 50 cms. Rod is divided into 10-cm units.

Sudan." All the brittle leaves had fallen from the specimen when he returned to camp.

AIZOACEAE

Limeum viscosum Fenzl: Karkur Murr in canyon. Flowering.

NYCTAGINACEAE

Boerhaavia diandra Linnaeus: Wadi 12 km west of Karkur Murr. Flowering.

B. diffusa Linnaeus var. *viscosa* (Choisy) Cufodontis: Wadi 12 km west of Karkur Murr.

AMARANTHACEAE

**Aerva persica* (Burman) Merrill var. *bovei* (Webb) Chiovenda: Karkur Murr. Gravel terraces and among rocks (Figure 5). Eaten by rodents in wadi west of Karkur Murr. Flowering. Shaw (1931): "In drainage line on plain near south foot of Gebel Oweinat, about 1500 ft., bushy herb 3 ft. high. About 2000 ft., wadi bed, in clumps 2–3 ft. in diam., 2 ft. high."

URTICACEAE

Forskohlea tenacissima Linnaeus: Karkur Murr. Growing in protection of boulders (Figure 11). Flowering.

JUNCACEAE

Juncus subulatus Forsskål: Karkur Murr. Beside pools in wet, salty sand. Fruiting.

**J. arabicus* (Ascherson and Bucheneau) Adams. (*J. maritimus* var. *arabicus* Ascherson and Bucheneau ex Boissier): From notes of Shaw (1931): "Uweinat, about 2050 ft., on salty ground near rock pool of dry watercourse, 1½–2 ft. high."

PALMAE

Phoenix dactylifera Linnaeus: Karkur Murr beside pools (Figure 7). Stunted date palms reported by Bagnold (1931). A battered piece of palm trunk about one foot in diameter was found by Osborn wedged between rocks near the pools.

GRAMINEAE

Eragrostis aegyptiaca (Willdenow) Delile: Karkur Murr. Wet sand beside pools. Flowering.

**Phragmites communis* (Linnaeus) Trinius: Karkur Murr. Wet areas beside pools. Fruiting. Photographed at Ain Zuweia by Kemal el Din (1928) and reported from one of the "springs" by Hassanein Bey (1925). Shaw (1931): "Uweinat, about 200 ft. Wadi bed, near rock wall, up to 7 ft. high."

Polypogon monspeliensis (Linnaeus) Desfontaines: Karkur Murr, beside pools.

Aristida zittelii Ascherson. Sandy runnels in hills east of Gebel 'Uweinat.

**A. plumosa* Linnaeus: Karkur Murr. Occasional in all habitats. Shaw (1931): "Uweinat, frequent around foot and out on plain, common elsewhere, the most common grass in heart of the Libyan Desert, in small drainage lines in sand and often on sand dunes, in small tufts up to 18 ins. high."

A. funiculata Trinius and Ruprecht: Karkur Murr. Dried specimens in sand, alluvial fan.

A. meccana Hochstetter: Wadi 12 km west of Karkur Murr.

Aristida spp. were noted (Shaw and Hutchinson, 1934) on the mud pans west of Gebel 'Uweinat.

**Panicum turgidum* Forsskål: Karkur Murr (Figures 3, 4) chiefly in the sandy bed of the lower wadi. Clumps 1 m high. Fruiting. Shaw: "the most frequent plant in the wadis. Found at Kissu."

Imperata cylindrica (Linnaeus) Beauvois: Karkur Murr. Beside pools (Figure 8). Flowering.

**Desmostachya bipinnata* (Linnaeus) Stapf: Shaw (1931) wrote: "Uweinat, about 2200 ft., wadi bed, near rockwall, 2–3 ft." This grass resembles *Imperata cylindrica* when out of flower (Täckholm et al., 1956) and Shaw's specimens could have been incorrectly identified. His collection was apparently from the site where Osborn collected *Imperata,* but saw no inflorescences of *Desmostachya.*

TYPHACEAE

Typha australis Schumacher and Thonning: Karkur Murr. Pool in eastern tributary (Figure 8). Flowering.

Annotated List of Mammals

The following list includes six species collected at Gebel 'Uweinat by D. J. Osborn and I. Helmy and four species whose occurrence there is questionable.

Order RODENTIA

Gerbillus (*Gerbillus*) *g. gerbillus* (Oliver): Common or lesser gerbil. Ten specimens were trapped beside *Panicum turgidum* in the sandy wadi bed (Figures 3, 4) of Karkur Murr. This hairy-footed gerbil lives in sandy areas of the desert wherever there is vegetation.

Gerbillus (*Dipodillus*) *campestris patrizi* (de Beaux): Large North African gerbil. Three were collected from among boulders and sandstone blocks and one from the sand and rock area of the alluvial fan (Figures 5, 6).

Although "preferred" habitats of bare-footed gerbils are cliffs and rocky areas, they have been taken in virtually all habitats including "mesic sedge pockets in the interior of palm groves" in Libya (Ranck, 1966). In Egypt the species has been collected from Siwa Oasis fields, fig groves, and Mediterranean coast salt marshes (Hoogstraal, 1963).

Happold (1966, 1967b) trapped *G.* (*D.*) *c. venustus* (Sundevall) in isolated volcanic and granite hills in northern Sudan. He observed that only the larger hills with many crevices and cracks offered suitable habitat.

Ranck (1966) reported *G.* (*D.*) *c. patrizi* (de Beaux) from Cufra Oasis.

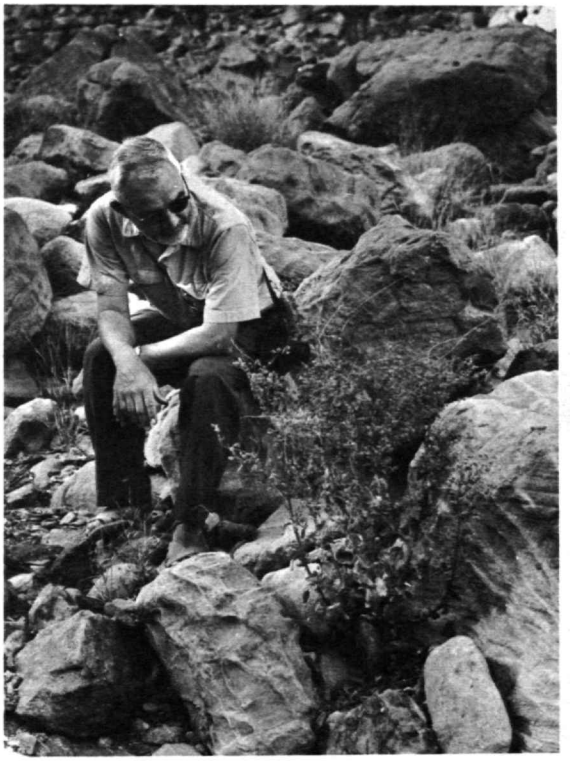

FIGURE 11.—Karkur Murr. Unbrowsed specimen of *Forskohlea tenacissima.* Note clumps of *Panicum turgidum* in the background.

Acomys cahirinus viator Thomas: Spiny mouse. Eight were collected from among rocks and sandstone blocks (Figures 5, 6) in the same area as *G.* (*D.*) *campestris.* Happold (1967b) trapped *A. c. cineraceus* Fitzinger and Heuglin together with *G.* (*D.*) *c. venustus* (Sundevall) in rocky hills in northern Sudan. Ranck (1966) reported *A. c. viator* Thomas from El Barcat and Cufra Oases, Libya.

Jaculus deserti rarus Ranck: Jerboa. This subspecies was described from material from Ain Zueia, Libya (Figure 1) by Ranck (1968). One specimen from Karkur Murr was caught among *Panicum turgidum* in the wadi bed (Figure 3).

The distribution of this subspecies is not com-

pletely known, but like *J. j. jaculus,* it frequents the same habitats as *Gerbillus gerbillus.*

Jaculus j. jaculus (Linnaeus): Two specimens were from Karkur Murr on the rubble strewn plain near the wadi bed (Figure 3).

Order CARNIVORA

Vulpes rueppelli rueppelli (Schinz): Rüppell's sand fox. Four sand foxes were trapped in various places along the wadi bed and in the gorge. The species inhabits rocky wadis, oases, and vegetated areas near wells. Bagnold (1939) was impressed with the indifference of this fox toward his camp in Karkur Tahl.

Fennecus zerda Zimmermann: Fennec. Kemal el Din (1928) listed the fennec as occurring in the 'Uweinat area. Although the species occurs throughout the Libyan Desert no evidence of fennecs was seen in the areas visited around 'Uweinat.

Order ARTIODACTYLA

Addax nasomaculatus (Blainville): Addax. Kemal el Din (1928) found the mummified carcass of an addax 100 km west of 'Uweinat. This animal probably occurred previously in the 'Uweinat area and perhaps still migrates there periodically from the south for grazing. Toschi (1954) listed the addax from Cufra and other Libyan localities. Setzer (1957) considered it to be one of the rarest mammals in Libya.

Northward movements of Sudan addax herds depend on the availability for grazing of *gizzu,* grasses and shrubs which become green after rains (see Rattray, 1960, p. 50). Large herds of addax, oryx, gazelle, and ostrich, for example, were seen by Shaw (1936) in northwestern Sudan at about 18° N in 1932, but very few were seen in 1935 when the country was drier.

Until about 1900 the addax inhabited the semi-desert west of Alexandria, Egypt (Flower, 1932).

Oryx dammah (Cretzschmar): Saber-horned oryx. Until about the middle of the eighteenth century this animal occurred in the Western Desert of Egypt a few miles west of the Nile River and Delta (Flower, 1932). Like the addax it has retreated southward, but following years of heavy rain might move as far north as 'Uweinat. In Karkur Tahl there is a prehistoric rock painting in color of an oryx hunt (Almásy, 1936).

Gazella dorcas dorcas (Linnaeus): Dorcas or common gazelle. Gazelles were seen in the meandering streambed of Karkur Murr. Two females and a newly born male were collected in the wadi 12 km west of Karkur Murr. One animal was shot when it attempted to run past us as we approached the end of the wadi bed. Wilkinson (1832) and H. M. B. Buxton (1895) remarked on gazelles running back past their pursuers when wadis they were following became steep and rocky.

Gazelles in the wadi bed browsed *Trichodesma africanum* to the level of the sand. Green gourds of *Colocynthis vulgaris* were found partly eaten and *Crotalaria thebaica* (Figure 10) and *Farsettia ramosissima* were closely browsed.

Kemal el Din (1928) commented on the paleness of gazelles at 'Uweinat. Although some we saw appeared pale, specimens were typical of the species.

Ammotragus lervia (Pallas): Barbary sheep, *aoudad* or *waddan.* No evidence of this species was found except several pairs of old horns near stone huts in Karkur Murr (Figure 5). Plants near pools and large specimens of browse plants (*Trichodesma africanum* and *Forskohlea tenacissima*) which were inaccessible to gazelles were untouched (Figure 11).

Barbary sheep at 'Uweinat were mentioned by Hassanein Bey (1925), Kemal el Din (1928) and Bagnold (1931). Despite occupation by personnel of the Sudan Government Defense Force in 1934 (Shaw, 1936), sheep continued to thrive in Karkur Murr and Karkur Tahl (Bagnold, 1939). Bagnold noted that after a few days, sheep, foxes, and gazelles took little notice of the human camp. A photograph of a sheep from Karkur Tahl appeared in Almásy's (1936) paper. One young female sheep was seen by Setzer (personal communication) in 1961 on a northwestern outlier of Gebel 'Uweinat.

Italians who used 'Uweinat as a refueling station in the 1940s (Bagnold, 1945) may have decimated the Barbary sheep population.

Until the early 1900s the Barbary sheep occurred over a large part of North Africa, including the plateaus and mountains of the Eastern Desert of Egypt and both sides of the Nile in Upper Egypt (Sclater, 1895; Flower, 1932). Today it is known to exist only in the remotest areas of Libya (Setzer, 1957) and northern Sudan (Happold, 1967a).



FIGURE 12.—Malaise trap suspended from two *Acacia raddiana* on the bedded channel below the broad alluvial fan.

Annotated List of Wasps

(Hymenoptera: Aculeata)

All of the insects were collected in Karkur Murr, Gebel 'Uweinat by K. V. Krombein, who acknowledges with gratitude the assistance of the following specialists in identification of the wasps: Dr. D. Guiglia, Museo Civico di Storia Naturale, Genova, Italy (Tiphiidae); Dr. H. Priesner, Linz, Austria (Pompilidae); Dr. W. J. Pulawski, Zoological Institute, Wroclaw, Poland (Sphecidae); Dr. O. W. Richards, Imperial College of Science and Technology, London, England (Masaridae); Dr. A. Giordani Soika, Museo Civico di Storia Naturale, Venezia, Italy (Eumenidae in part, *Tachyancistrocerus* and *Cyrtolabus*); Dr. F. Suárez, Instituto de Aclimatación, Almería, Spain (Mutillidae); Dr. J. van der Vecht, Division of Systematic Zoology, Leiden University, Netherlands (Eumenidae in part, *Eumenes* and *Chlorodynerus*); Dr. St. Zimmermann, Wien, Austria (Chrysididae).

The majority of the 7602 insect specimens collected, including uniques, are in the collection of the United States National Museum. Duplicate wasp specimens are in the collections of the specialists listed above and in that of the Société Entomologique d'Égypte. All insects bear locality labels as follows: "SUDAN: Gebel Oweinat/Wadi Ain el Brins/April 9–12, 1967/Karl V. Krombein."

Several different techniques were employed in collecting insects. A hand net was used both on the alluvial fan of Karkur Murr and in the narrow gorge leading to Ain el Brins; most of these specimens were taken on the foliage or flowers of the various plants but some were crawling on the ground when collected. A Malaise trap was suspended from two acacias in the bedded channel below the broad alluvial fan (Figure 12) and operated 10–12 April. An ultraviolet (=black light) trap was operated all night at three stations, one night on the bedded channel (Figure 12), one on the broad alluvial fan of Karkur Murr, and near one of the rock pools, Ain el Brins, with salt-encrusted margins (Figure 13).

ANALYSIS OF THE WASP COLLECTIONS.—The 'Uweinat wasps represent 30 species in the following

TABLE 1.—*Comparison of sphecid wasp faunas, Gebel 'Uweinat (Sudan), Tibesti (Chad), Fezzan (Libya), and Hoggar (Algeria)*

Genera	*Gebel 'Uweinat, Sudan*	*Tibesti, Chad*	*Fezzan, Libya*	*Hoggar, Algeria*
Ammophila	–	7	7	–
Sphex	–	1	2	1
Philanthus	1	4	4	–
Pseudoscolia	–	–	1	–
Cerceris	–	5	2	1
Ammatomus	–	–	1	–
Gorytes	–	–	2	–
Stizus	–	4	4	–
Bembecinus	–	–	–	1
Bembix	1	3	2	3
Liris	1	3	4	1
Tachytes	–	–	2	–
Tachysphex	2	2	7	7
Prosopigastra	1	1	–	1
Parapiagetia	–	2	1	–
Gastrosericus	1	1	–	–
Palarus	–	–	1	–
Miscophus	3	–	3	2
Psen	1	1	1	–
Diodontus	–	–	1	2
Dasyproctus	–	–	–	1
Oxybelus	–	2	3	2
TOTAL	11	36	48	22

families: Chrysididae, 3; Tiphiidae, 1; Mutillidae, 2; Masaridae, 1; Eumenidae, 5; Pompilidae, 7; Sphecidae, 11. Collections over longer periods or at different times of the year should establish the presence at 'Uweinat of some representatives of the families Bethylidae, Scoliidae, and Vespidae also.

The distribution of species in most of these families is very poorly known. However, de Beaumont (1952, 1956) recorded the species of Sphecidae collected by A. Giordani Soika in the Hoggar area of southern Algeria and by K. M. Guichard in several areas in Libya including the Fezzan and in the Tibesti area of Chad. The Hoggar, Fezzan, and Tibesti areas are Saharan, and comparisons are made between the sphecid faunas collected in those areas and at Gebel 'Uweinat in Table 1. Giordani Soika collected at six localities in the Hoggar, 15–30 April 1950. Guichard's collections of wasps in Tibesti were made at eleven localities on eleven days during 7 March–11 April 1953. In the Fezzan, Guichard collected wasps during eleven days at nine localities in several years as follows: 24 February 1941; 11 April–9 May 1952; 11 November 1952; and 2–27 February 1953. Table 1 summarizes the number of species in several genera of Sphecidae obtained in these three areas and at Gebel 'Uweinat, 9–12 April 1967.

One is immediately impressed by the absence of Sphecinae from the 'Uweinat collections. These are large conspicuous wasps and could not have been overlooked. Presumably collections made at another period would include several species of this subfamily. The same remarks apply to such genera as *Philanthus, Cerceris, Stizus,* and *Bembecinus* which are absent or only poorly represented in the 'Uweinat collections. One would expect also that 'Uweinat should have more species of *Tachysphex* than are presently known, and that such genera as *Oxybelus* and *Diodontus* will be found there eventually.

Comparing the 'Uweinat sphecid fauna with that occurring in the other areas, it may be noted that the single species of *Philanthus* occurs in both Fezzan and Tibesti, as is true also of the *Psen.* The single taxa of *Bembix, Liris,* and *Prosopigastra,* and the three taxa of *Miscophus* have not been taken yet in the Hoggar, Fezzan, or Tibesti areas. The single species of *Gastrosericus* has been collected in Tibesti; it is very widely distributed and should be found eventually in Fezzan and Hoggar.

The single sphecid known only from 'Uweinat is the newly described *Miscophus heliophilus* Pulawski.

Family CHRYSIDIDAE

Hedychridium species. 1 ♂. Zimmermann considers this to be an undescribed species.

Chrysis (Chrysis) minutissima Radoszkowski. 1 ♂. Recorded previously from Egypt and Palestine.

Chrysis (Chrysis) species. 7 ♂. Mostly collected in Malaise trap. Zimmerman considers that this also is an undescribed species.

Family TIPHIIDAE

Myzinella patrizii Guiglia. 1 ♀, 16 ♂. Most specimens in Malaise trap, a few males flying around low flowering plants. This is the first known female of the genus *Myzinella* Guiglia and was described recently (Guiglia, 1968). *M. patrizii* has been taken previously only in Libya (Cufra, the type-locality) and Egypt (Dakhla Oasis and Kom Oshim, Fayum).



FIGURE 13.—Ultraviolet light trap near one of the rock pools, Ain Murr (Ain el Brins).

Family MUTILLIDAE

Apterogyna aegyptiaca Invrea. 1 ♀. Collected from the ground in early evening walking toward ultraviolet light trap on bedded channel below alluvial fan. This species was known previously only from the type-locality, Fayed, Egypt.

Tricholabioides niloticus Suarez. 1 ♂. Flying low over ground in early evening toward ultraviolet light trap on bedded channel below alluvial fan. This was known previously only from the type-series collected by Krombein in Egypt (El Kharga in Kharga Oasis and Kom Oshim, Fayum).

Family MASARIDAE

Quartinia nubiana Richards, or species very close thereto. 1 ♀, 1 ♂. On flowers of *Fagonia* sp. The male was unknown previously. The species was described from females from the Nubian Desert, Egypt. Richards notes that the specimens from 'Uweinat are not quite identical with the type-series in the British Museum.

Family EUMENIDAE

Cyrtolabus gracilis (Kohl). 10 ♀, 8 ♂. Some specimens visiting *Acacia flava* flowers. This species is widely distributed in desert areas, having been recorded from Sinai, Nubian Desert, Sudan, and southern Algeria (Hoggar, Tassili d'Ajjer).

Cyrtolabus saharensis (Giordani Soika). 1 ♂. The species was described from southern Algeria (Hoggar, Tassili d'Ajjer).

Eumenes emarginatus dimidiatipennis Saussure. 1 ♂. This widespread taxon has been recorded from Algeria, Egypt, Somalia, Arabia, Palestine, Iran and India.

Tachyancistrocerus serenus (Giordani Soika). 5 ♂. Some visiting *Acacia flava* flowers. This species is known to occur in Algeria (Hoggar, Tassili d'Ajjer), Libya (Fezzan), Egypt (Siwa) and Palestine.

Chlorodynerus chloroticus (Spinola). 1 ♀, 2 ♂. On *Acacia flava* flowers. This abundant species occurs at a number of localities in Egypt, and has also been recorded previously from southern Algeria, Sudan, Sinai, and Palestine.

Family POMPILIDAE

Most specimens of spider wasps were collected in the Malaise trap although a few specimens were collected while running over the ground. All species were known previously from Egypt.

Agenioideus arenicola (Priesner). 1 ♂. Priesner (1955, p. 72) noted that *arenicola* is common especially in the desert wadis east of Cairo and Helwan, and later (1960, p. 68) records it from Luxor.

Agenioideus arenicola form *fuscifemoralis* (Priesner). 1 ♀. Priesner (1955, p. 72) did not cite any locality for this form.

Agenioideus rhodosoma (Kohl). 2 ♂. Priesner (1955, p. 71) noted that this species occurs chiefly in desert wadis near the Nile, and that males were common and visited the inflorescences of *Pennisetum dichotomum*.

Pompilus tomentosus Priesner. 2 ♂. Priesner (1955, p. 108) described this from specimens from Kafr Hakeem on the Cairo-Suez Road, Kosseima, Sinai, and Wadi Aideb, Gebel Elba Sudan Government Administration area. He suggested (in litt.) that this species probably belongs to a new genus, but he has withheld publication pending association of the as yet unknown female.

Tachyagetes (*Tachyagetes*) *arabicus* (Priesner). 5 ♀. Priesner (1955, p. 119) described this from material from Wadi Hof, Helwan, and Wadi Digla, Cairo.

Tachyagetes (*Dasyagetes*) *secretus* (Priesner). 1 ♂. This was described (Priesner, 1955, p. 127) from Kerdasa and Wadi El Tih, and recorded later (Priesner, 1960, p. 73) from Abu Rowash, Giza.

Gonaporus alfierii Priesner [=*Xenaporus tenellus* Priesner, new synonymy *teste* Priesner]. 1 ♀, 7 ♂. Priesner (1955, p. 200) described *alfierii* from females from a number of localities in Egypt, and *tenellus* (p. 204) from males from several localities.

Family SPHECIDAE

Philanthus coarctatus Spinola. 12 ♀, 4 ♂. Most specimens were taken on or near flowers of *Aerva persica*, a few on *Pulicaria crispa* blooms. This common species is widely distributed in North Africa and occurs also in Arabia and Israel.

Bembix oculata soror Dahlbom. 3 ♂. Flying rapidly near the ground and in Malaise trap. This taxon has been taken at a number of localities in Egypt.

Liris cleopatra de Beaumont. 2 ♀, 1 ♂. This species was known previously from a few specimens from Egypt (Giza, Luxor) and Palestine (Revivim, Wadi Zahara).

Tachysphex deserticola de Beaumont. 3 ♂. This species is widely distributed in Egypt and occurs in the Nubian Desert and in Libya (Cyrenaica).

Tachysphex luxuriosus Morice. 1 ♀, 2 ♂. This has been taken at several localities in Egypt (Maadi, Kom Oshim, Gebel Asfar, Mallaha) and also in the Nubian Desert and Libya (Cyrenaica, Tripolitania).

Prosopigastra (*Homogambrus*) *laevior* Morice. 1 ♀. This uncommon species has been taken near Cairo and Saqqara, Egypt, and in Morocco.

Gastrosericus waltlii Spinola. 1 ♀, 3 ♂. This very common, widely distributed species is known from Morocco, Algeria, Libya, Egypt, Cyprus, Rhodes, southwest Russia, and Mongolia.

Miscophus ctenopus Kohl. 2 ♀. Captured running over ground. This widely distributed desert species has been recorded from Arabia, Egypt, Sudan, Libya, Algeria, Morocco, and Spanish Sahara.

Miscophus heliophilus Pulawski. 1 ♀. Captured in Malaise trap. The species has been described recently (Pulawski, 1968) from this unique specimen.

Miscophus nigripes Honoré. 6 ♂. This common desert species is widely distributed in Egypt, but has not been recorded previously outside of that country.

Psen (*Mimesa*) *sublaevis* de Beaumont. 1 ♂. This uncommon species is known from a few localities in Chad (Tibesti), Libya (Fezzan), and Canary Islands.

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In *taxonomic keys,* number only the first item of each couplet; if there is only one couplet, omit the number. For easy reference, number also the taxa and their corresponding headings throughout the text; do not incorporate page references in the key.

In *synonymy,* use short form (taxon, author, date, page) with a full reference at the end of the paper under "Literature Cited." Begin each taxon at the left margin with subsequent lines indented about three spaces. Within a taxon, use a period-dash (.—) to separate each reference. Enclose with square brackets any annotation in or at the end of the taxon. For *references within the text,* use the author-date system: "(Jones, 1910)" or "Jones (1910)." If the reference is expanded, abbreviate the data: "Jones (1910, p. 122, pl. 20: fig. 1)."

Simple *tabulations* in the text (e.g., columns of data) may carry headings or not, but they should not contain rules. Formal *tables* must be submitted as pages separate from the text, and each table, no matter how large, should be pasted up as a single sheet of copy.

Illustrations (line drawings, maps, photographs, shaded drawings) can be intermixed throughout the printed text. They will be termed *Figures* and should be numbered consecutively; however, if a group of figures is treated as a single figure, the individual components should be indicated by lowercase italic letters on the illustration, in the legend, and in text references: "Figure 9*b*." If illustrations (usually tone photographs) are printed separately from the text as full pages on a different stock of paper, they will be termed *Plates,* and individual components should be lettered (Plate 9*b*) but may be numbered (Plate 9: figure 2). Never combine the numbering system of text illustrations with that of plate illustrations. Submit all legends on pages separate from the text and not attached to the artwork.

In the *bibliography* (usually called "Literature Cited"), spell out book, journal, and article titles, using initial caps with all words except minor terms such as "and, of, the." (For capitalization of titles in foreign languages, follow the national practice of each language.) Underscore (for italics) book and journal titles. Use the colon-parentheses system for volume, number, and page citations: "10(2):5–9." Spell out such words as "figures" and "plates" or "pages" when used alone).

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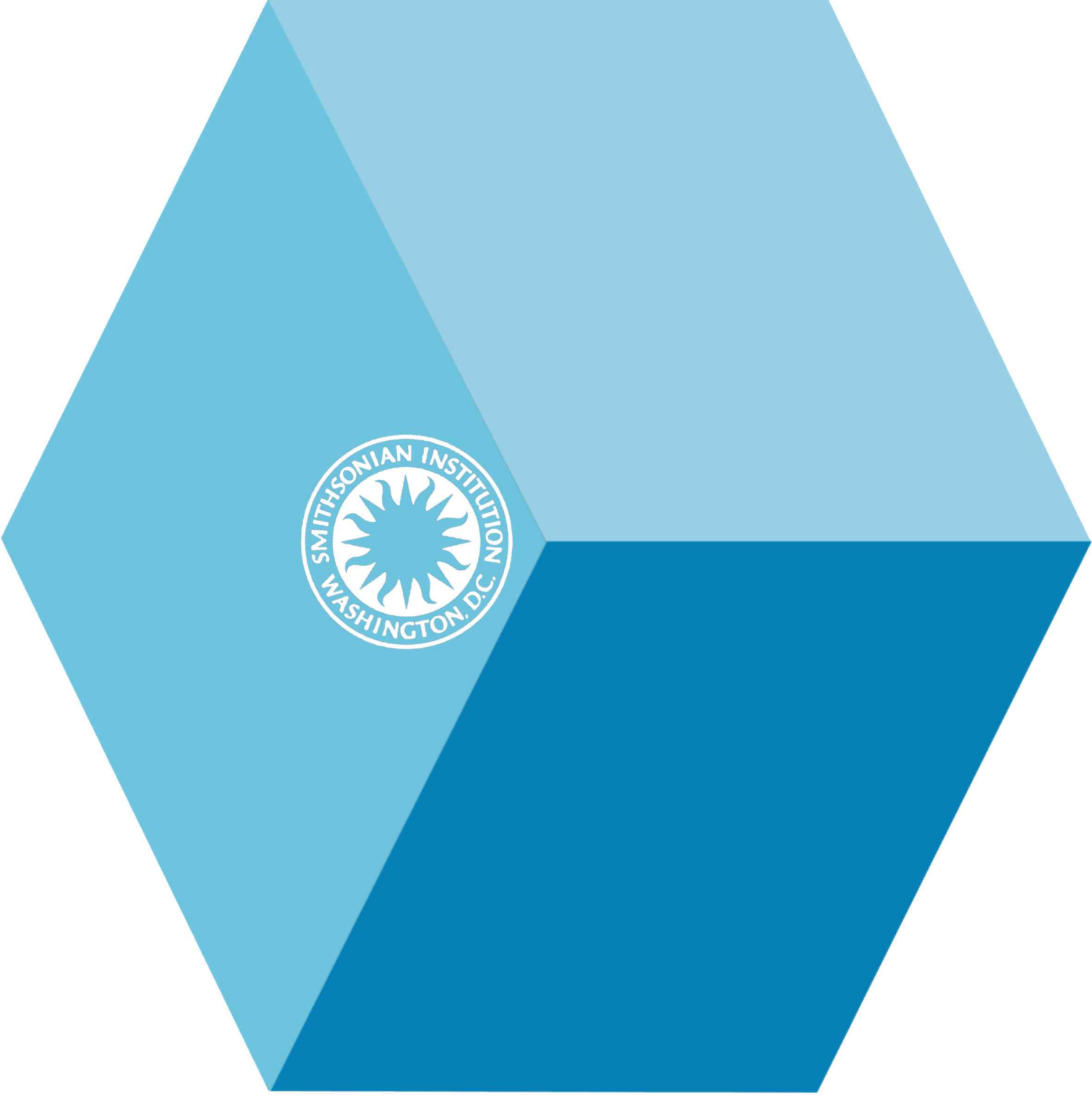
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