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Taxonomic and Behavioral Notes on the African Ant, *Aenictus eugenii* Emery, with a Description of the Queen (Hymenoptera: Formicidae)

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Abstract: The East African army ant *Aenictus eugenii* Emery includes 1 subspecies and 3 varieties. One of these, *A. kenyensis* Santschi, is placed in synonymy, and a taxonomic history of the species is presented. The queen for the species is described for the first time and is compared with the 3 other known African *Aenictus* queens. Observations of *A. eugenii* foraging behavior show that it is a column raider and a specialized predator of ants, particularly the immature stages, that the workers move along the foraging trails in single file in small tandem groups and that they normally subdivide their prey only when it is larger than they.

Ants of the Old World genus *Aenictus* comprise the tribe Aenictini of the subfamily Dorylinae or "true army ants." The genus is represented by 34 species in the Indo-Australian region and by at least 15 species in Africa (Wilson 1964). Although Wilson (1964) taxonomically revised the genus for the Indo-Australian area, the known species in Africa are still spread among 60 nominal forms. Included in these are varietal and subspecies names that eventually must be dealt with if we are ever to appreciate the actual level of diversity achieved by this genus in Africa.

The Asian species are also better known behaviorly than their African congeners. Important biological studies of Asian species include those of Wheeler and Chapman (1925), Chapman (1964) and Schneirla and Reyes (1966, 1969). Biological observations of sub-Saharan species are limited to a recent study by Gotwald (1975) and to fragmentary reports by Brauns (1901), Arnold (1915), and Sudd (1959). Some biological information on African species can be gleaned from the original species descriptions, but much of the information is little more than anecdotal.

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Aenictus eugenii Emery is distributed throughout much of East Africa, although it is not frequently seen. During the past 4 years we have encountered the species only 6 times, but on 4 of these occasions, we were able to observe, to some extent, the behavior of the species. Dr. David H. Kistner, California State University, Chico, has kindly provided us with a series of workers and an associated queen of the species, and we are now able to describe the queen for the first time. We have also provided a taxonomic history of the species including a new synonym.

TAXONOMY OF THE SPECIES

Aenictus eugenii

Aenictus eugenii Emery, 1895, Ann. Soc. Entomol. Fr. 63: 17–18, worker. Type locality Makapan (Transvaal, South Africa). Types in the Museo Civico di Storia Naturale, Genoa, examined 1972.

Aenictus eugenii var. *kenyensis* Santschi, 1933, Bull. Ann. Soc. Entomol. Belg. 73: 100, worker. Type locality "Kiambou," Kenya. Cotypes in the British Museum (Natural History), London, examined 1972. New Synonymy.

Subsequent to Emery's description of *A. eugenii*, Santschi described for the species 3 varieties that he called *brazzai* (1910), *henrii* (1924), and *kenyensis* (1933), and Forel (1910) described one subspecies named *caroli*. In 1924, Santschi elevated *brazzai* to specific rank because it lacked the conspicuous clypeal teeth common to *eugenii*. Santschi (1924) described *henrii* as intermediate between *caroli* and the *eugenii* type specimens and based his description on the shape of the head and disposition of the clypeal teeth. His short description of *kenyensis* (1933), on the other hand, relied heavily on differences in overall coloration and on the length of the antennal scape, which he perceived as shorter than that of Emery's types. We have examined the type specimens of *eugenii* and *kenyensis* and cannot justify the existence of the latter as distinct within the species *eugenii*. Although the *kenyensis* type specimens are smaller than those of *eugenii*, they are alike in other respects.

We have also examined cotypes of *caroli* but are not prepared to deal with its status until types of other East African species are examined. This subspecies is small and equal in size to the smallest *eugenii* specimens that we examined from Kenya. While its pattern of punctation is like that of *eugenii*, it is entirely golden-yellow (the head and alitrunk of *eugenii* are reddish-brown).

The specimens of *eugenii* that we examined, excluding *caroli*, ranged in total length from 4.20 mm for specimens from Rhodesia to 3.51 mm for specimens from Kenya. Preliminary measurements suggest that worker size varies clinally with the largest workers representing the southern end of the cline.

Queen Description: Total length 10.55 mm, head length 1.53 mm, head width 1.62 mm, cephalic index 106, alitrunk length 2.20 mm, petiole length 0.72 mm, gaster length 6.10 mm, scape length 0.72 mm, length of petiolar node 0.67 mm, width of petiolar node 0.90 mm, hind femur length 1.35 mm, mandible length (from point of insertion to tip of apical tooth) 0.81 mm.

Habitus as in Figs. 1A and 1B. Head, alitrunk, petiole, gaster and appendages reddish-brown. Darkest on mandibles and dorsum and venter of gaster.

Head as in Fig. 1E. Head sutureless, without eyes, punctation or frontal carinae. Occipital margin (as in Fig. 1E) medially concave. Antennal fossae deeply impressed.

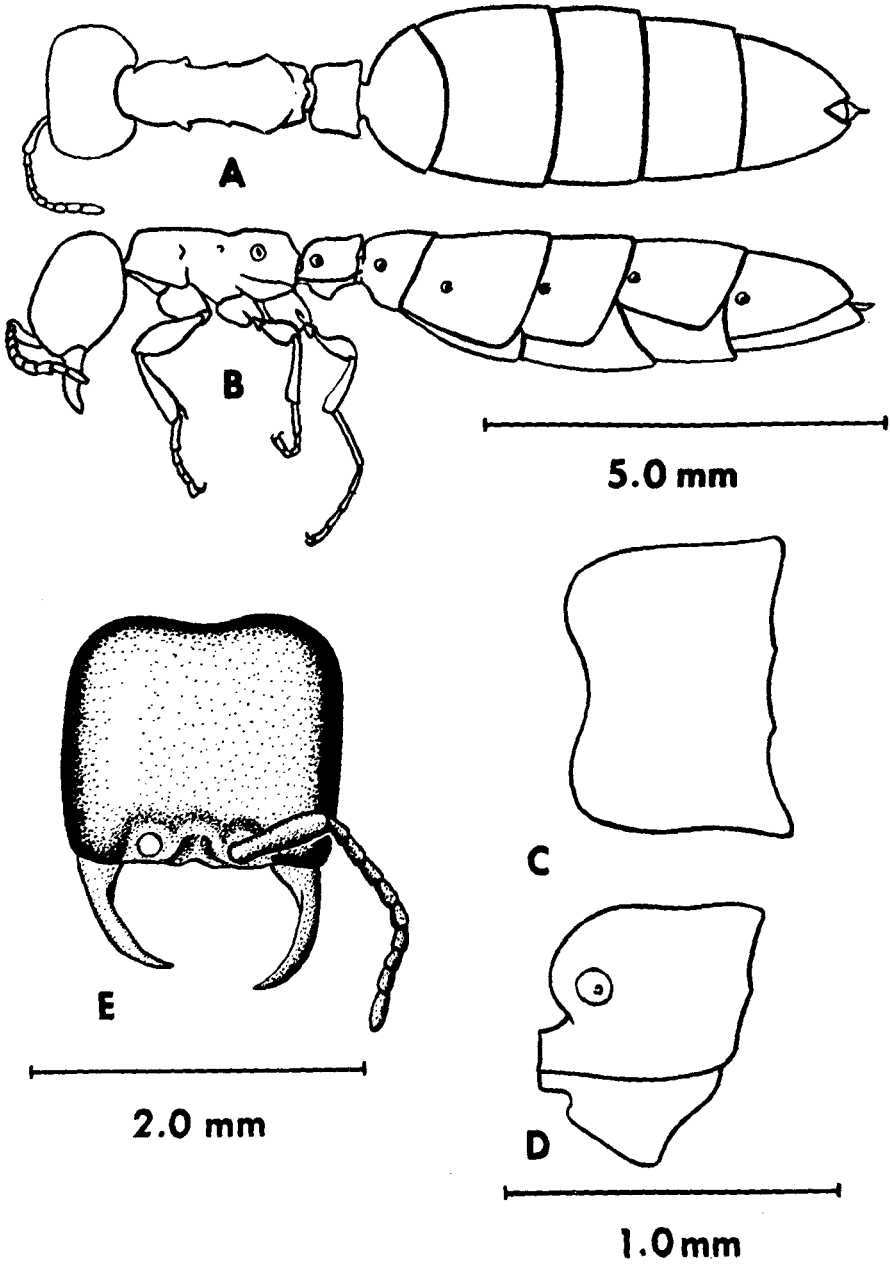

FIG. 1. External morphology of the queen of *Aenictus eugenii*, pilosity omitted. (A) General habitus, dorsal aspect; (B) general habitus, lateral aspect; (C) petiolar node, dorsal aspect; (D) petiolar node, lateral aspect; (E) head, dorsal aspect.

Clypeus medially emarginate, without teeth or other distinguishing characteristics. Antenna 10-segmented; scape short.

Alitrunk as in Figs. 1A and 1B. Alitrunk without conspicuous sutures or punctation. Meso- and metathoracic spiracles form raised, tubercle-like structures; propodeal spiracle conspicuous but not elevated. Distal margin of bulla covering metapleural gland orifice conspicuous, parallel to the longitudinal axis of the body and located directly beneath the propodeal spiracle. Declivity of the propodeum slightly concave.

Petiolar node as in Figs. 1C and 1D. Posterior lateral angles prominent; posterior third of petiolar dorsum smoothly concave between angles. Anterior margin of node, in dorsal view, concave. Subpetiolar process prominent, triangular, and directed caudally.

Gaster as in Figs. 1A and 1B. Integument of gaster without conspicuous punctation. Gaster with 5 visible segments; tergite of 5th segment deeply notched medially along the posterior margin. Tip of ovipositor (?) conspicuous.

Entire body shiny, without conspicuous punctation. Pubescence yellow, sparse, and most conspicuous in small patches on anterolateral angles of head, the mandibles, antennae, legs, and posterior margins of gastral sclerites; groups of setae elsewhere on pronotum, propodeum and petiole. Tarsal claws simple.

The queen was collected with a series of workers at Kundulungu, "Congo Republic," 20 March 1950, by N. Leleup. The queen, together with the workers, is deposited in the Musée Royal de l'Afrique Centrale, Tervuren, Belgium.

Each *Aenictus* species contains multiple phena (i.e. queens, workers, and males) and the correlation of these phena for any one species, unless found together in the same colony, is impossible. Because the males are common at light but seldom found with their colonies, a complicated synonymy exists. Wheeler (1930) pointed out that of the *Aenictus* species known in 1930, 28 were known from workers only, 48 from males only, 3 from males and workers only, and 1 from workers and females only. Associated phena must be found and described in order to solve this synonymic tangle.

Until 1930, only 3 *Aenictus* females or queens had been described, and all 3 were collected in Africa. The first *Aenictus* queen to be characterized was taken by André (1885) to be a doryline worker, which he named *Alaopone abeillei*. This "worker" was recognized to be a queen and placed in the genus *Aenictus* by Emery (1901), but the species rests solely on the single unassociated female originally described by André. The second African female described, *A. vaucheri* Emery (1914), also remains unassociated. However, the third queen to be characterized was taken with a series of previously described workers belonging to *A. congolensis* Santschi. This queen was described by Santschi (1917). The queens of *A. abeillei* and *A. vaucheri* were collected in northern Africa (Oran and Morocco respectively) while *A. congolensis* was taken at Lambarené, Gabon. The first *Aenictus* females from the Indo-Australian region were described by Wheeler (1930). Both, *A. martini* (= *gracilis* Emery) and *A. laeviceps* (Fr. Smith), were from the Philippines. The queen of *A. eugenii* is the fourth African *Aenictus* female described and only the second from subsaharan Africa.

The 4 described African queens range in total length from 8 mm (*abeillei*) to 14 mm (*congolensis*); all possess 10-segmented antennae, thoracic suturing is greatly reduced or absent, and they are either reddish-yellow (*abeillei*) or reddish-brown (*vaucheri, congolensis, eugenii*). The queen of *eugenii* is unique among the 4 in possessing the notched 5th gastral tergite. Although this notch is symmetrical and medial in location, it may be the result of injury to the queen. The African *Aenictus* queens are similar to one another and appear closely related. Females of Asian species, on the other hand, differ from the African forms in a significant number of details, and these differences prompted Wheeler (1930) to suggest "that they would seem to belong to a distinct genus. . . ." These differences are obvious in overall body shape and structure, and *A. laeviceps* even possesses a "minute ocellus in the

frontal groove" (Wheeler 1930). Other Indo-Australian queens now known include *A. aratus* Forel, *A. binghami* Forel, *A. ceylonicus* (Mayr), and *A. currax* Emery, and these queens exhibit complex variation (Wilson 1964). In general, the African females have a simplified, reduced structure, particularly in the head and thorax, where few sutures or sclerites are evident. The subpetiolar process is the only exception, since it is well-developed in the African forms and virtually absent in the Indo-Australian queens.

The female functional reproductive cycle in African species is not known. Of the 4 queens, only the *A. congolensis* specimen was physogastric, indicating that it was gravid at the time of its capture. The intersegmental membranes of this specimen were greatly stretched and the sclerites widely sparated (Santschi 1917). The other queen specimens, including *A. eugenii*, have unexpanded gasters that suggest a non-gravid phase for each.

BEHAVIOR OF THE SPECIES

The primary extra-nidal activities in which *Aenictus* workers are involved are foraging and colony emigration, but this investigation is restricted to foraging behavior. Observations of *A. eugenii* colonies were limited to columns of worker ants traveling to or from their nests, usually discovered crossing footpaths where the hard-packed soil and absence of litter forced their exposure. The 4 colonies studied were observed at Karen (nr. Nairobi), Kenya and were designated: KC-081 (26 July 1971), KC-111 (4 May 1972), KC-112 (19 Sept. 1972), and KC-113 (28 March 1973). All columns were presumed to be foraging, either because the workers carried prey or because in the absence of prey they were not engaged in carrying their own brood.

Workers of colony KC-081 (discovered at 0930 hrs) moved along several anastomosing trails in tandem groups of 2 to 10 or more individuals. The workers moved in single file, and the tandem groups on any one trail were often widely separated from one another. Because different groups used the same trails at different times, it was obvious that the trails were chemical.

Colony KC-111 was detected as a foraging column, several meters in length, raiding the nest of an ant of the genus *Pheidole*. Several small columns branched from the main trunk, and some of the *Aenictus* workers encountered termite workers, which they ignored. A single myrmecophile was collected and was tentatively identified as *Aenigmatopoeus sequax* Borgmeier, a phorid fly that is also a predator of the driver ant *Dorylus* (*Anomma*) *nigricans* var. *molestus* (Gerstaecker) (Kistner, personal communication).

Colony KC-112 was initially discovered at 0800 hrs (sky overcast, temperature 15.6°C) as a series of columns crossing a footpath and entering a flower garden. These columns branched from a base column of workers moving in single file, about 2 m long, that issued from a hole in the soil. At the end of each branch column, workers gathered, sometimes numbering in the hundreds, and proceeded to search an area approximately 30 cm square. The foraging workers moved swiftly in their search activity, and numerous workers returned along the original trail without evidence of booty. There were 5 to 7 such foraging groups which returned to the main column following completion of their

search. The foraging activities of the column continued until 1200 hrs. One raiding group attacked a nest of *Pheidole megacephala* (Fabricius), and although they attacked individual *Pheidole* workers none were killed or taken as prey. One branch column of returning workers carried booty consisting of ant brood that was brought up from a hole in the soil, presumably the opening to the prey species nest. Of the 13 prey individuals taken from the foragers, 12 were pupae, 1 was a larva, and all were equal in size to the foraging workers. The prey species belonged to the subfamily Myrmicinae (probably *Pheidole*). *Bengalia* flies gathered about the raiding groups and occasionally stole prey from the *Aenictus* workers. The main column could not be traced back to the nest.

Colony KC-113 was discovered at 0830 hrs as a main foraging column returning to the nest with booty. At 1030 hrs it was still moving large numbers of prey. Curiously, this column was traveling on a well-worn trail of *D.* (*A.*) *nigricans* var. *molesta*, and in fact, it passed directly over the active nest of this driver ant without conflict. Of the 286 prey units (whole individuals and/or pieces of individuals) collected from the returning foragers, all were ants or the subfamily Myrmicinae and all were imature forms. The prey units consisted of 101 whole larvae, 165 whole pupae, 7 pupal heads, 10 pupal gasters, 1 pupal alitrunk, and 2 pupae without heads. Of the 20 prey units that were pieces of pupae, 17 were from individuals that were obviously much larger than the *Aenictus* workers.

The foraging behavior of *A. eugenii* is like that of the West African species observed by Sudd (1959) and Gotwald (1975). The similarities are as follows: (1) workers commonly move in single file in small groups along the foraging trails; (2) *A. eugenii* is a specialized predator of ants, especially on the immature stages of ants of the subfamily Myrmicinae; (3) this species is a column raider, i.e. the terminal branches of a main foraging column each end in a small group of workers that search for and capture prey in a relatively small area; and (4) the foraging workers do not subdivide their prey before retrieval unless the prey individuals are larger than the foragers themselves. Only 2 behavioral observations on *A. eugenii* appear in the literature. Arnold (1915) observed a group of workers "marching in single file and carring larvae from under one large stone to another" (although he failed to identify the column as foraging or emigrating), and Santschi (1933) noted that his type series for *kenyensis* was attending a species of *Pseudococcus*. This latter observation implies that these workers were collecting honeydew, a behavior pattern recorded only once before for doryline ants (Arnold 1915).

Literature Cited

ANDRÉ, E. 1885. Species des Hyménoptères d'Europe et d'Algérie. Les fourmis. **2**: 838–840.

ARNOLD, G. 1915. A monograph of the Formicidae of South Africa. Ann. S. Afr. Mus. **14**: 1–756.

BRAUNS, J. 1901. Über die Lebensweise von *Dorylus* and *Aenietus* [sic]. Hymenopterol. Dipterol. **1**: 14–17.

CHAPMAN, J. W. 1964. Studies on the ecology of the army ants of the Philippines genus *Aenictus* Shuckard (Hymenoptera: Formicidae). Philipp. J. Sci. **93**: 551–595.

EMERY, C. 1895. Voyage de M. E. Simon dans l'Afrique australe. Ann. Soc. Entomol Fr. **64**: 15–56.

———. 1901. Note sulle doriline. Boll. Soc. Entomol. Ital. **33**: 43–56.

———. 1914. Contributo alla conoscenza delle formiche delle isole Italiane. Descrizioni di forme Mediterranee nuove o critiche. Ann. Mus. Civ. Stor. Nat. Giacomo Doria **6**: 244–270.

FOREL, A. 1910. Ameisen aus der Kolonie Erythräa. Zool. Jahrb. Abt. Syst. **29**: 243–274.

GOTWALD, W. H., JR. 1975. Behavioral observations on African army ants of the genus *Aenictus* (Hymenoptera: Formicidae). Biotropica, in press.

SANTSCHI, F. 1910. Formicides nouvesaux ou peu connus du Congo français. Ann. Soc. Entomol. Fr. **78**: 349–400.

———. 1917. Description d'une nouvelle reine de Formicidae du genre *Aenictus* Shuckard. Ann. Soc. Entomol. Fr. **85**: 277–278.

———. 1924. Description de nouveaux Formicides africains et notes diverses. II. Rev. Zool. Afr. **12**: 195–224.

———. 1933. Contribution a l'etude des fourmis de l'Afrique tropicale. Bull. Ann. Soc. R. Entomol. Belg. **73**: 95–108.

SCHNEIRLA, T. C., AND A. Y. REYES. 1966. Raiding and related behaviour in two surface-adapted species of the Old World doryline ant, *Aenictus*. Anim. Behav. **14**: 132–148.

———, AND ———. 1969. Emigrations and related behaviour in two surface-adapted species of the Old-World doryline ant, *Aenictus*. Anim. Behav. **17**: 87–103.

SUDD, J. H. 1959. A note on the behaviour of *Aenictus* (Hym., Formicidae). Entomol. Mon. Mag. **95**: 262.

WHEELER, W. M. 1930. Philippine ants of the genus *Aenictus* with descriptions of the females of two species. J. N. Y. Entomol. Soc. **38**: 193–212.

WHEELER, W. M. AND J. W. CHAPMAN. 1925. The ants of the Philippine Islands. Part I, Dorylinae and Ponerinae. Phillippine J. Sci. **28**: 47–73.

WILSON, E. O. 1964. The true army ants of the Indo-Australian area (Hymenoptera: Formicidae: Dorylinae). Pac. Insects **6**: 427–483.