NOTES ON THE MOSQUITOES OF NEPAL: II. NEW SPECIES RECORDS FROM 1991 COLLECTIONS

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ABSTRACT. In 1991, intensive mosquito collections were accomplished in six districts of eastern Nepal, representing the terai, inner terai, foothills and mountains. Specimens belonging to the subgenus *Diceromyia* of *Aedes* and 18 species in five genera were identified as new country records, and some were found in each of the six districts. Collection sites and literature sources for identification of these species are detailed. *Mimomyia intermedia*, collected in Makwanpur District in 1990, is also reported here.

INTRODUCTION

A project was undertaken in 1991 to study the mosquito fauna of Nepal with the following objectives: 1) to increase knowledge of species occurring in the country and learn basic facts about their biology; 2) to relate the Nepal mosquito fauna to the zoogeography of Culicidae in the Oriental Region; 3) to associate ecological changes in Nepal to changes in the mosquito fauna; and 4) to correlate the findings with prevalence of mosquito-borne diseases and known vectors. In this first report we are giving results of collections made during June to October, 1991, in six districts of Eastern Nepal. Two were in the outer terai (lowland area), one in the inner terai (river valley between the Churia Range and the Mahabarat Range of the high Himalaya Mountains). The other three were in the Himalaya Mountains, the part called the "Midlands" by Hagen (1960), i.e., with elevations between 500 and 2,000 m. Four camps, each lasting an average of 19 days, were established. At each, field collections were processed. Some adults were mounted for study, others were saved in pill boxes; many immatures were individually reared, and exuviae or whole larvae and pupae were preserved in MacGregor's solution.

The first camp was in Dhanusa District in the midst of a secondary forest at 326 m elevation. By crossing the nearby Churia Range to the north, the Kamala River Valley, the inner terai of Sindhuli District at 430 m elevation, was visited. The second camp was at the edge of a virgin forest at 126 m in the terai of southeasternmost Jhapa District. From this location we also travelled north to Ilam District in the mountains, where collecting occurred up to 1,208 m.

The other two camps were in mountainous terrain. Camp 3 was situated under a large Banyan tree (*Ficus himalayensis*) in Manthale, Ramechhap District, in the valley of the Tama Kosi River at an elevation of 560 m; however, mosquitoes were sampled up to an altitude of 1,378 m. Camp 4 was highest at an altitude of 1,345 m in Rumjatar, Okaldunga District, and work extended up to 1,849 m.

We are reporting here 18 new country records: 11 in the genus *Aedes* Meigen, two in *Armigeres* Theobald, one each in *Culex* Linnaeus and *Mimomyia* Theobald, and three in *Uranotaenia* Lynch Arribalzaga. In addition, a species of the subgenus *Diceromyia* Theobald was recovered for the first time. The *Mimomyia* record was collected in Makwanpur District during 1990; however, since this is a new record for Nepal, we include it here. More *Aedes* species were collected because the sampling was concentrated in container-type habitats, such as tree holes and bamboo stumps. Geographic distribution of the new country records is as follows: terai only—five, inner terai only—one, mountains only—

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eight, terai and mountains—two, inner terai and mountains—two.

With the increase in the fauna reported here and those listed by Pradhan and Darsie (1990) and Darsie et al. (1991), a total of 150 mosquito taxa are now known from Nepal. Results of mosquito surveys in the western and eastern Himalayan regions of India were given by Ramachandra Rao et al. (1973) and Bhat (1975). They recorded in adjacent areas of India some of the species we are including here as new country records for Nepal. Ahmed (1987) and Harrison et al. (1991) published lists of mosquito species occurring in Bangladesh and Thailand, respectively. If the species reported as new to Nepal were not listed for those countries in the geographic distribution by Knight and Stone (1977), it is noted below. In the following collection data, F = adult female and M = adult male, and the elevation of each locality is given in meters (m). Voucher specimens will be deposited in the National Museum of Natural History, Smithsonian Institution.

CONFIRMED NEW COUNTRY RECORDS

Aedes (*Diceromyia*) *iyengari* Edwards

Ramechhap District, Kudar, 580 m, IX-9–91, 1M, resting outdoors in shade near bamboo; *Okaldunga District*, Sangure Rumjatar, 1,300 m, IX-21–91, 1F, 1M, resting in rock crevices in deep shade.

Note: This is the first species of the subgenus *Diceromyia* to be collected in Nepal. Diagnosis was made from Reinert's (1970:10, Figs. 2,9) descriptions of the very distinctive females and male genitalia. It was reported from Bangladesh by Ahmed (1987:190).

Aedes (*Finlaya*) *christophersi* Edwards

Okaldunga District, Chilauna, 1,801 m, IX-23–91, 1M, reared from pupa, ex chocolate-colored water from tree hole; Okaldunga, 1,849 m, IX-25–91, 1M, resting outdoors on vegetation.

Note: No adequate description of the male genitalia has been published, Barraud (1934:195, Fig. 37) illustrated only the gonostylus and claspette. Therefore the recognition of this species from two males depended on Barraud's non-genitalic description. The presence of knee spots on all femora is diagnostic. Ramachandra Rao et al. (1973:1435) reported collecting this species at 1,700 m in Himal Pradesh.

Aedes (*Finlaya*) *gilli* Barraud

Ramechhap District, Helipani, 1,200 m, VIII-31–91, 1M, Ramechhap, 1,378 m, IX-5–91, 1M, reared from pupa; *Okaldunga District*, Chilauna, 1,801 m, IX-23–91, 4M, all reared from pupae, ex very turbid, chocolate-colored water from tree holes.

Note: Barraud (1934:198) stated: "Hypopygium does not show any marked modification." Therefore diagnosis was based on Barraud's non-genitalic characters. He must have missed the long, stout, basal, mediodorsal spine on the gonocoxite which is quite unique. Bhat (1975:1594) recorded a female from Dehra Dun District of Uttar Pradesh at 480 m elevation.

Aedes (*Finlaya*) *novoniveus* Barraud

Ilam District, Ilam, 1,208 m, VII-25–91, 1M, reared from larva, ex bamboo; *Okaldunga District*, Rumjatar, 1,345 m, IX-14–91, 1M, reared from pupa, ex bamboo; IX-20–91, 2M, reared from pupae, ex bamboo; Okaldunga, 1,849 m, IX-24–91, 1M, reared from pupa, ex rock hole; IX-25–91, 5M, reared from pupae, ex bamboo.

Note: Only males of this species were collected, mostly associated with bamboo stumps and all taken at altitudes above 1,200 m. The genitalia were mounted and descriptions and illustrations by Barraud (1934:211, Fig. 44), Colless (1958:479; 1959:174) and unpublished notes and drawings of K.L. Knight have convinced us that identification is correct. The upper and lower dorsomesal areas of the gonocoxite are covered with short setae and the basal ridge is weakly developed.

Aedes (*Finlaya*) *poicilius* (Theobald)

Dhanusa District, Bardiaghot, 326 m, VII-14–91, 1F, collected feeding on the senior author at 1930 h.

Note: The description of Knight and Laffoon (1946:221) was employed in its diagnosis. It is the only *Aedes* species in the Indian subcontinent with spotted wings. It has been recorded from Darjeeling and Jalpaiguri districts of West Bengal State by Ramachandra Rao et al. (1973:1438) at 150–450 m elevation.

Aedes (*Finlaya*) *prominens* Barraud

Sindhuli District, Tallo Ranibas, 430 m, VII-8–91, 1F, reared from larva, ex bamboo; Junga, 430 m, VII-9–91, 1M, resting on vegetation; VII-10–91, 1F, 1M, reared from larvae, ex tree hole; *Ilam District*, Ilam, 1,208 m, VII-25–91, 1M, reared from pupa, ex bamboo; *Jhapa District*, Kanchanbari, 126 m, VII-29–91, 4F, 1M, reared from pupae, ex tree hole; VIII-2–91, 1F, attracted to humans; VIII-7–91, 2F, reared from larvae, ex stump hole; *Ramechhap District*, Ramechhap, 1,378 m, VIII-31–91, 1F, attracted to humans; *Okaldunga District*, Chilauna, 1,801 m, IX-18–91, 6F, 3M, reared from larvae and pupae, ex tree hole; IX-19–91, 2F, reared from pupae; ex tree hole; IX-26–91, 3F, reared from larvae, ex turbid, brown-colored water from tree hole; Rumjatar, 1,345 m, IX-20–91, 7F, 5M, reared from larvae and pupae, ex tree hole; Okaldunga, 1,849 m, IX-23–91, 2F, resting on vegetation; IX-24–91, 2F, 1M, reared from pupae, ex bamboo; Rumjatar Matillo, 1,300 m, IX-26–91, 3F, resting on vegetation.

Note: We found *Ae. prominens* to be the most common of the species new to Nepal being reported here. The 47 specimens, some collected at all four camps, demonstrates that this species does not have an altitudinal predilection. It is one of the two species with patches of long erect scales on the venter of the abdomen, the other is *Ae. khazani* Edwards. The two are separated by Barraud's (1934:156) key character, i.e., pale-scale patch on the postpronotum, present in *Ae. prominens* and absent in *Ae. khazani*.

Secondary characters mentioned for *Ae. prominens* by Barraud (1934:169) are pale scales on lateral lobes of the scutellum and pale scaling over the hindtibiotarsal joint. These were found to be very variable. For example, no pale scales on the scutellum or the apex of the hindtibia occurred in 20 females, pale scales on the scutellum only in four females and pale scales on both scutellum and hindtibia in three females. Among the males all but one had pale scales on the scutellar lobes, while eight had dark-scaled hindtibiae and five had at least some pale scales at the tibial apex. Harrison et al. (1991:203) have recorded it from Thailand.

Aedes (*Finlaya*) *simlensis* Edwards

Ramechhap District, Ramechhap, 1,378 m, IX-4–91, 1F, resting outdoors on vegetation.

Note: Identification was based on the description in Barraud (1934:198). It is characterized by absence of femoral knee spots and with midfemur dark anteriorly except at base. This species has been noted by Bhat (1975:1595) from the western Himalayas at 1,800 m.

Aedes (*Finlaya*) *unicinctus* Edwards

Okaldunga District, Okaldunga, 1,849 m, IX-24–91, 1F, reared from pupa, ex bamboo; Okaldunga Army Camp, 1,849 m, IX-24–91, 1F, reared from larva, 1M, reared from pupa, ex tree hole; IX-25–91, 1F, reared from pupa, ex bamboo.

Note: Diagnosis was made using descriptions in Barraud (1934:170, Fig. 37). As its name implies, the hindtarsi bear a single pale-scaled band. The illustration of the male genitalia shows only the phallosome. A more complete description is needed. This species was found at 1,800 m and 2,480 m in the western Himalayas, according to Bhat (1975:1596). It was reported for the first time in Thailand by Harrison et al. (1991:200).

***Aedes (Stegomyia) annandalei* Theobald**

Jhapa District, Kanchanbari, 126 m, VII-30–91, 1F, reared from larva, ex bamboo stump.

Note: A collection of 14 specimens were all tentatively identified as this species until study of the male genitalia gave a clue that they were not *Ae. annandalei*. Using the descriptions of Mattingly (1965) and Huang (1977), only one proved to be *Ae. annandalei* while the other 13 were determined to be *Ae. craggi*.

***Aedes* (*Stegomyia*) *craggi* (Barraud)**

Sindhuli District, Jhunga, 430 m, VII-7–91, 1F, reared from pupa, ex bamboo; *Ilam District*, Ilam, 1,208 m, VII-25–91, 1F, reared from pupa, ex bamboo; *Jhapa District*, Sunwai, 480 m, VIII-5–91, 1F, reared from pupa, ex bamboo; *Karkarvitta*, 126 m, VIII-10–91, 8F, attracted to humans; Okaldunga District, Kuwapani, 1,300 m, IX-15–91, 1F, reared from larva, ex bamboo; Rumjatar, 1,345 m, IX-19–91, 1M, reared from pupa, ex bamboo.

Note: Identification was made from descriptions by Huang (1977:22, Figs. 9C,D; 10C,D). Also see comments under *Ae. annandalei*.

***Aedes* (*Verrallina*) *uniformis* (Theobald)**

Jhapa District, Kanchanbari, 126 m, VIII-2–91, 3F, 2M, resting on vegetation in forest.

Note: This small, dark mosquito represents the first species of Section B, subgenus *Verrallina* (Reinert 1974:17), to be found in Nepal. The very distinctive male genitalia are adequately described by Barraud (1934:281, Fig. 68). The female genitalia are illustrated by Reinert (1974:Fig. 21; 1984:81).

***Armigeres* (*Leicesteria*) *digitatus* (Edwards)**

Jhapa District, Sunwai, 430 m, VIII-5–91, 1F, attracted to humans in bamboo thicket.

Note: The description by Thurman (1959:98) was used in the diagnosis of this species. The scutum projecting over the head is characteristic. Ramachandra Rao et al. (1973:1439) listed this species from Sikkim at an elevation of 1,220 m. It was reported from Bangladesh by Ahmed (1987:192).

***Armigeres* (*Leicesteria*) *inchoatus* Barraud**

Okaldunga District, Rumjatar, 1,345 m, IX-19–91, 1M; IX-29–91, 1M, resting outdoors among bamboo plants.

Note: Descriptions by Barraud (1934:328) and Thurman (1959:100) assisted in the recognition of this species. The male genitalia are distinctive. Ahmed (1987:192) recorded it from Bangladesh.

***Culex* (*Eumelanomyia*) *castrensis* Edwards**

Ramechhap District, Kudar, 560 m, IX-10–91, 1F, resting outdoors on vegetation.

Note: The work of Sirivanakarn (1972:33) was consulted in the diagnosis of this species. The abdominal terga and sterna are dark-scaled and the lower mesepimeral seta is present.

***Mimomyia* (*Mimomyia*) *intermedia* Barraud**

Makwanpur District, Hetaura, 466 m, I-7–90, resting outdoors on vegetation at the bank of the Karra River.

Note: The presence of complete yellow-scaled transverse bands on abdominal terga III-VII and an incomplete band on II places our specimen in the taxon *Mi. intermedia* instead of *Mi. chamberlaini* (Ludlow). The taxon, *Mi. intermedia*, was originally considered a variety of *Mi. chamberlaini* by Barraud (1929:1055) but was raised to specific rank by Mattingly (1957:34). Darsie et al. (1990:125) reported *Mi. chamberlaini* based on an identification in which no voucher specimen was retained. Therefore, it is not known which of these two species was seen.

***Uranotaenia* (*Pseudoficalbia*) *bicolor* Leicester**

Dhanusa District, Bardiaghot, 326 m, VII-1–91, 1F, reared from pupa, ex ground pool;

Ramechhap District, Bhorlaphedi, 580 m, IX-6–91, 1F, resting outdoors on vegetation.

Note: These specimens agree with the description by Peyton (1977:41, Fig. 2). The unique dark and light brown integumental pattern on the pleura is diagnostic.

Uranotaenia (*Pseudoficalbia*) *nivipleura* Leicester

Jhapa District, Soragandhi, 100 m, VII-31–91, 1F, resting outdoors in forest; Kanchanbari, 126 m, VII-2–91, 1M, resting outdoors in forest; *Ramechhap District*, Ramechhap, 1,278 m, VIII-31–91, 1F, resting in animal shelter; *Okaldunga District*, Rumjatar, 1,345 m, IX-29–91, 2F, resting outdoors on vegetation.

Note: This species is easily recognized by the yellow marginal line on the scutum clothed with white narrow scales. Its coloration of rust-brown scutum and pale yellow pleura is quite striking (Peyton 1977:92). Bhat (1975:1592) recorded this species in the western Himalayas at elevations of 630 m and 1,800 m, confirming our observations that it occurs at a wide altitudinal range.

Uranotaenia (*Uranotaenia*) *testacea* Theobald

Dhanusa District, Bardiaghot, 326 m, VII-1–91, 2F, reared from pupae, ex ground pool.

Note: This is one of the few Oriental *Uranotaenia* with hindtarsomeres 4,5 and part of 3 pale-scaled. A pleural line of bluish-white broad scales is also characteristic (Barraud 1934:59, 74; Baisas 1935:67).

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