

NOTES ON THE MOSQUITOES OF NEPAL IV. RESULTS OF THE 1994 COLLECTING IN THE MIDWESTERN REGION, INCLUDING NEW COUNTRY RECORDS AND VOUCHER CONFIRMATION (DIPTERA, CULICIDAE)

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ABSTRACT. During 1994, field studies were conducted in the Midwestern Region of Nepal. Two camps were located in the "inner terai," low mountain valleys between the Churia Range and the Mahabarat Lekh. A third camp was in the mountains at Jumla. Visits were made to 2 high mountain sites, Simikot, Humla District, and Rara National Park. The result from all these sampling sites was the recovery of 6 new country records, 5 in the genus *Aedes* and 1 in the genus *Heizmannia*. Some mosquitoes in the Nepal checklist had no voucher specimens. Locality data are given for 9 of these. Biodata on another species that is quite rare in Nepal are given.

INTRODUCTION

An intensive survey of the mosquitoes of Nepal has been underway for 3 of the past 4 years (Darsie et al. 1992, 1993), with the major objective to document the presence, habitat, and distribution of resident species. Detailed objectives of the project and descriptions of major topographical features were provided by Darsie et al. (1992). Our survey in 1994 was confined to the "Midwestern Development Region" in the western part of Nepal (Fig. 1). This region is composed of, from south to north, the following distinct zones: 1) the outer terai, which consists of lowland areas with minimum altitudes of approximately 150 m; 2) the Churia (or Siwalik) Range, with altitudes to 850 m; 3) the inner terai, consisting of low mountain valleys of about 600 m; and 4) an extensive Himalayan Midlands Zone, mostly ranging from 1,000 to 4,000 m. Although the Midwestern Region contains relatively fewer peaks than central and eastern Nepal, it does have several prominent mountain peaks, for example, Saipal (7,025 m) and Kanjiroba (6,880 m). Certain zones, for example, parts of Dolpo, are relatively arid, but as is the case for much of Nepal, aquatic habitats abound during the monsoon. Most of the region's monsoonal precipitation enters the drainage systems of the Karnali and Bheri rivers. The Midwestern Region has several large parks, including Bardiya National Wildlife Reserve, Shey-Phoksundo National Park, and Rara Lake National Park.

Our 1994 survey sampled mosquito habitats from all major zones. The project included nearly 3 months of fieldwork, 3 separate base camps, and a total of 405 collections. Because we were particularly interested in inner terai, 2 camps of 21 days each were established at Tulsipur, Dangdeokhuri District, and at Birendranagar (Surkhet), Surkhet District. High-altitude mosquitoes are another focus of our project, so our third camp was established in the Himalayan Midlands Zone, at the town of Jumla (2,344 m). This camp, which lasted 22 days, permitted numerous collections at elevations above 2,000 m, in Jumla, Mugu, and Dolpo Districts. Visits to Simikot, Humla District, and Rara Lake National Park, Mugu District, both of which are above 3,000 m, allowed comparisons with 1992 collections from Mustang District (Darsie et al. 1994).

NEW COUNTRY RECORDS

The species listed below were collected during our 1994 survey of the Midwestern Region and represent new country records for Nepal. In the following entries, district names are written in upper case and field collection numbers in brackets. With the addition of these 6 species, our 3-year investigation of Nepal mosquitoes has contributed a total of 38 new country records (Darsie et al. 1992, 1993).

Aedes (Diceromyia) micropterus (Giles)

BANKE, Kusum, 436 m, VIII-10-94, 3 ♀, 1 ♂ reared from larvae, *ex treeholes* [793, 794, 796], associated with *Aedes albopictus* (Theobald), *Aedes assamensis* (Theobald), *Aedes thomsoni* (Theobald), *Toxorhynchites splendens* (Wiedemann).

This is the second species of the subgenus *Diceromyia* found during our surveys. The other

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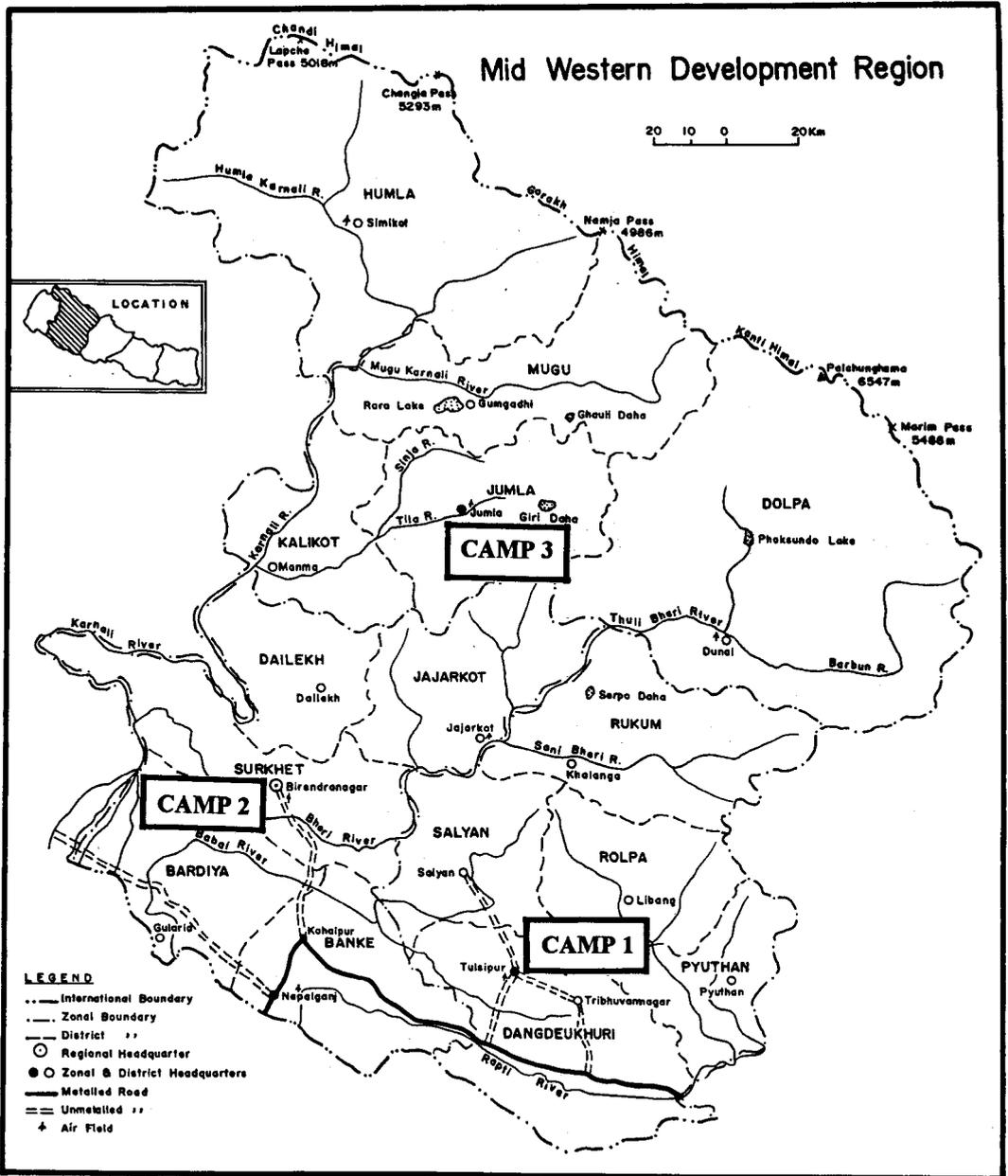


Fig. 1. Map of the Midwestern Region of Nepal, showing the location of the 3 camps during the 1994 fieldwork.

species, *Aedes iyengari* Edwards, was reported from Nepal by Darsie et al. (1992). The type localities for *Ae. micropterus* are Allahabad and Lucknow, United Provinces, India (Barraud 1934), about 200 km southwest of our collecting site. The species is apparently confined to the northern Indian subcontinent.

***Aedes (Finlaya) oreophilus* (Edwards)**

HUMLA, Simikot, Bhigaudoko Chhal, 2,000 m, VIII-25-94, 1 ♀ reared from pupa, *ex* ground pool with leaves near Humla Karnali River [1019], heavily shaded, associated with *Aedes pulchriventer* (Giles), *Culex vagans* Wiedemann,

Culex viridiventer Giles; Lali Gaun, near Lali Khola, 2,500 m, VIII-26-94, 2♀, 1♂, reared from pupae, *ex* treehole [1022], associated with *Aedes albolateralis* (Theobald), *Aedes suffusus* Edwards, *Culex pallidothorax* Theobald, *Cx. viridiventer*.

This species has a disjunct distribution in the western Himalayas (Barraud 1934), in Japan (Tanaka et al. 1979), and in Korea (Chow 1973). Barraud recorded it only from treeholes, but Tanaka et al. confirmed that it may also breed in ground pools containing dead leaves.

Aedes (Finlaya) suffusus Edwards

HUMLA, Lali Gaun, 2,500 m, VIII-26-94, 2♀ reared from pupae, *ex* treehole near Lali Khola [1022], associated with *Ae. albolateralis*, *Ae. orophilus*, *Cx. pallidothorax*, *Cx. viridiventer*; JUMLA, Jumla, Kabre, 2,850 m, IX-13-94, 6♀, resting on walls and attracted to humans in guest house [966].

Barraud (1934) found this species in treeholes above 2,185 m in the western Himalayas, whereas Bhat (1975) collected a single female attracted to humans at an elevation of 460 m. This species is restricted to northern India and Nepal (Knight and Stone 1977).

Aedes (Aedimorphus) taeniorhynchoides (Christophers)

DANGDEUKHURI, Tulsipur, Dudhuri, 660 m, VIII-11-94, 2♀, feeding on pig at 2000 h [798]. Other species in same collection were *Anopheles fluviatilis* James, *Anopheles subpictus* Grassi, *Anopheles annularis* Van der Wulp, *Anopheles culicifacies* Giles, *Anopheles vagus* Doenitz.

This species is found in India, Pakistan, and Sri Lanka and probably does not occur in Thailand, Vietnam, and China as previously claimed (see Reinert 1973). It was reported to breed in ground pools by Barraud (1934); however, the larva and pupa have not been described.

Aedes (Aedimorphus) vexans (Meigen)

JUMLA, Jumla, Rajpalta, 2,656 m, IX-11-94, 1♀, resting on bushes [946], in the same collection were *Anopheles gigas simlensis* (James), *Anopheles willmori* (James), *Culex jacksoni* Edwards, *Culex theileri* Theobald, *Cx. pallidothorax*; Khalanga, 2,438 m, 1♀ reared from pupa, *ex* small ground pool near Jhugad Khola [960], associated with *An. gigas simlensis*, *Cx. jacksoni*, *Cx. theileri*; Jumla, 2,400 m, IX-9-94, 1♂, reared from pupa, *ex* ground pool in paddy field [931], associated with *Cx. jacksoni*; IX-23-94,

10♀, *ex* biting collection on water buffalo [1011], in same collection were *An. fluviatilis*, *Cx. theileri*.

It was not surprising to find this species in Nepal. It was recorded at a height of 3,125 m in Tibet and also as common in northern and central India (Barraud 1934). Nagpal and Sharma (1987) listed it from Assam, Ahmed (1987) from Bangladesh, and Harrison et al. (1991) from Thailand. The Asian distribution is actually part of its range in the Holarctic and Oriental regions mentioned by Knight and Stone (1977).

Heizmannia (Heizmannia) demeilloni (Mattingly)

DANGDEUKHURI, Tulsipur, Rana Village, 660 m, VIII-8-94, 2♂, reared from pupa, 1♂ reared from larvae, *ex* treehole [778], associated with *Aedes gardnerii imitator* (Leicester), *Heizmannia himalayensis* Edwards.

This species is represented by 3 males, 2 with associated pupae and one with associated larva and pupa. The latter forms the basis for our identification. The larva and pupae agree with the descriptions of Mattingly (1970). He described the species as new from specimens collected in Burma and Thailand. However, his larva had no setae 5,6-C. Our larva does have them, setae 5-C are triple and double and both setae 6-C are double, with one branch thick, the other thin and shorter, all setae are medium length. Mattingly regarded *H. demeilloni* to be closely related to *H. himalayensis* and our undescribed, mounted male genitalia does resemble Barraud's (1934) description and illustration of the gonostylus but otherwise is very different. The genitalia will be described later. This find extends the species' range by *ca.* 1,400 km west.

RECORD OF SPECIES FORMERLY WITHOUT VOUCHERS

Darsie and Pradhan (1990) listed 12 species that had been recorded by Dr. N. Burgess and kindly given to us in a personal communication. However, there were no voucher specimens for confirmation. We have found 9 of the 12, which are here verified:

Aedes (Finlaya) khazani Edwards

ILAM, Ilam, 1,208 m, VII-25-91, 1♀, *ex* bamboo stump [88]; JHAPA, Kanchanbari, 250 m, VII-24-91, 1♀, *ex* stump hole [90]; OKALDUNGA, Chilaune, 1,800 m, IX-17-91, 2♀, *ex* pools among roots of banyan tree [205]; Okaldunga town, 1,849 m, IX-23-91, 1♀, *ex* bamboo

stump [244]; KASKI, Pokhara, Lamachaur, 1,000 m, VII-29-92, 1 ♀, resting on vegetation [317]; Pokhara, Prithvi Highway, 791 m, VII-31-92, 1 ♀, *ex* bamboo stump [341].

Anopheles (Cellia) nivipes (Theobald)

JHAPA, Kanchanbari, 250 m, VIII-2-91, 1 ♀, attracted to humans [111]; KASKI, Pokhara, Male Patan, 915 m, VII-28-92, 2 ♀, *ex* rice paddy [301].

This species has not been reported in India (Ramachandra Rao 1981) but Reid (1968) believed that it occurs in Assam. Our Nepal specimens were identified using the key in Darsie and Pradhan (1990), which has good characters for separating the species from its close relatives, *Anopheles pallidus* Theobald and *Anopheles philippinensis* Ludlow.

Armigeres (Leicesteria) annularis (Leicester)

KASKI, Pokhara, Arghan, 791 m, VII-30-92, 4 ♀, *ex* bamboo stump [331]; DANGDEUKHURI, Rajapur Village, 660 m, VII-26-94, 1 ♀, *ex* bamboo stump [635].

Armigeres (Leicesteria) dentatus Barraud

JHAPA, Kanchanbari, 250 m, VIII-2-91, 5 ♀, collected in forested area [111]; KASKI, Pokhara, Male Patan, 915 m, 1 ♀, resting on bamboo bushes [299].

Armigeres (Leicesteria) dolichocephalus (Leicester)

All collections from bamboo stumps. SINDHULI, Jhunga, 518 m, VII-7-91, 1 ♀ [46]; VII-10-91, 1 ♀ [65]; VII-10-91, 1 ♀ [66]; Chandanpur, 518 m, VII-16-91, 1 ♀ [79]; DHANUSA, Sasapur, 329 m, VII-13-91, 1 ♀ [72]; KASKI, Pokhara Arghan, 791 m, VII-30-92, 4 ♀ [331]; Pokhara, Prithvi Highway, 791 m, VII-31-92, 2 ♀ [341].

Armigeres (Leicesteria) magnus (Theobald)

This species, reported by Darsie et al. (1991) from Nawalpur, Makwanpur District, has been identified in 15 collections as follows, and apparently bamboo stumps are obligatory for the development of its immatures. SINDHULI, Ranibas, 518 m, VII-5-91, 1 ♂, *ex* bamboo stump [30]; Jhunga, 518 m, VII-7-91, 1 ♂, *ex* bamboo stump [45]; VII-7-91, 1 ♂, *ex* bamboo stump [46]; VII-10-91, 2 ♀, *ex* bamboo stump [65]; VII-10-91, 1 ♀, *ex* bamboo stump [66]; ILAM,

Ilam, 1,208 m, VII-25-91, 1 ♀, *ex* bamboo stump [88]; JHAPA, Dialo Village, 126 m, VII-27-91, 1 ♀, *ex* bamboo stump [91]; Kanchanbari, 250 m, VIII-2-91, 7 ♀, resting on vegetation in forest [111]; RAMECHHAP, Kudar, 550 m, VIII-25-91, 1 ♀, *ex* bamboo stump [136]; OKALDUNGA, Rumjatar, 1,345 m, IX-10-91, 4 ♀, resting in bamboo [212]; IX-21-91, 1 ♀, *ex* cowshed [224]; IX-21-91, 1 ♀, *ex* bamboo stump [225]; IX-21-91, 2 ♀, *ex* bamboo stump [226]; IX-28-91, 1 ♀, resting in bamboo bushes [285]; KASKI, Pokhara, 915 m, VII-27-92, 1 ♀, resting in bamboo bushes [291]; Arghan, 791 m, VII-28-92, 5 ♀, *ex* bamboo stump [331].

Armigeres (Armigeres) kesseli Ramalingam

SINDHULI, Jhunga, 518 m, VII-10-91, 1 ♀, *ex* bamboo stump [65]; DHANUSA, Sasapur, 152 m, VII-13-91, 1 ♀, *ex* bamboo stump [72]; JHAPA, Kanchanbari, 250 m, VIII-2-91, 1 ♀, resting on vegetation in forest [111]; Dialo Village, 126 m, VII-27-91, 1 ♀, *ex* bamboo stump [91]; RAMECHHAP, Kudar, 550 m, VIII-25-91, 1 ♀, *ex* bamboo stump [136]; OKALDUNGA, Rumjatar, 1,345 m, IX-19-91, 1 ♀, resting on vegetation [212]; IX-20-91, 1 ♂, *ex* bamboo stump [216]; X-1-91, 2 ♀, feeding on cattle [288]; X-2-91, 2 ♀, resting on vegetation [289]; Okaldunga, 1,849 m, IX-25-91, 2 ♀, resting on vegetation [253]; KASKI, Pokhara, 915 m, VII-27-92, 1 ♀, *ex* 100-liter drum [292]; DANGDEUKHURI, Tulsipur, 663 m, VII-24-94, 1 ♀, attracted to human [623]; VII-25-94, 2 ♀, *ex* hollow log; Naminagar, 663 m, VIII-6-94, 2 ♀, resting on river bank [732]; SURKHET, Chhincha Village, 1,200 m, VIII-15-94, 6 ♀, 1 ♂, *ex* wood trough [817]; Hattisude Village, 668 m, VIII-19-94, 1 ♀, 1 ♂, *ex* banana axil [842]; Pipariya Village, 660 m, VIII-19-94, 1 ♂, *ex* banana axil [848]; DAILEKH, Dailekh Bazaar, 1,543 m, 2 ♂, *ex* broken pot [853]; VIII-19-94, 2 ♂, *ex* bamboo stump [857].

Coquillettidia (Coquillettidia) crassipes (Van der Wulp)

JHAPA, Kanchanbari, 250 m, VIII-2-91, 1 ♀, 8 ♂, resting on vegetation in forest [111]; BANGKE, Nepalganj, 156 m, VIII-13-94, 1 ♂, *ex* pond with *Eichornia* sp. [807].

Mimomyia (Mimomyia) chamberlaini Ludlow

KAPILVASTU, Shivapur, 119 m, IX-13-92, 1 ♀, *ex* pond full of *Eichornia* sp. [581]; IX-16-92, 1 ♀, *ex* pond with *Eichornia* sp. [596].

OTHER SPECIES

Culiseta (Culiseta) niveitaeniata (Theobald)

The only previous records of this species were collections in 1958 and 1961 (Joshi et al. 1965). In 1994 it was collected as follows: MUGU, Nauli, N of Ghurchi Laagna, 3,400 m, IX-14-94, 1 ♀, *ex* temporary ground pool [968], associated with *Cx. pallidothorax*; IX-14-94, 2 ♀, *ex* seepage spring [969], associated with *Cx. viridiventer*; Rara Lake, south side, 3,000 m, IX-16-94, 1 ♂, 1 ♀, *ex* seepage [977], associated with *Cx. jacksoni*, *Culex vagans* Wiedemann; DOLPO, Kaigaun, Balasa, 3,188 m, IX-16-94, 1 ♂, *ex* seepage [993]; Kaigaun, Chote Kholo, 3,031 m, IX-19-94, 1 ♀, *ex* seepage [1003], associated with *Cx. theileri*.

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