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DESCRIPTION OF THE PUPA OF *ARMIGERES* (*LEICESTERIA*) *OMISSUS* (EDWARDS) AND A KEY TO THE LARVAE AND PUPAE OF THE *ARMIGERES* OCCURRING IN NEPAL (DIPTERA: CULICIDAE)

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Abstract.—The pupa of *Armigeres omissus* (Edwards) is described for the first time. Keys to the larvae and pupae of *Armigeres* species occurring in Nepal are added.

Key Words: *Armigeres omissus,* pupa, keys, Nepal

The pupal stage of species of the subgenus *Leicesteria,* genus *Armigeres* occurring in Nepal were described by Darsie (1998). Subsequently, a female of *Armigeres* (*Leicesteria*) *omissus* (Edwards) was discovered in the collection of Nepal mosquitoes at the Florida Medical Entomology Laboratory, Vero Beach, FL, a new country record. Its pupa was briefly described by Delfinado (1966) and Baisas (1974). A more detailed description follows, based on specimens from Thailand since none are available from Nepal.

With this account, the pupae of all species of *Armigeres* from Nepal have now been described (Ramalingam 1987; Toma et al. 1994; Darsie 1998, 2000). Inasmuch as a detailed study of the larvae was a necessary part of the pupal verification, a larval key is also included. This is a revision of a key by Darsie and Pradhan (1990). Since then, four species have been added to the fauna, i.e., *Ar.* (*Arm.*) *theobaldi* Barraud (Pradhan and Darsie 1990), *Ar.* (*Lei.*) *inchoatus* Barraud and *Ar.* (*Lei.*) *digitatus* (Edwards) (Darsie et al. 1992) and *Ar.* (*Lei.*) *omissus,* herein.

The pupa of *Ar. omissus* possesses the generic and subgeneric characters given be Darsie (2000). It is readily distinguished from pupae of the Nepal *Armigeres* species by a combination of: the absence of seta 1-P, the paddle fringe extending to near the base, seta 6-II-V with thin branches and seta 1-II with 17 or fewer branches.

METHODS AND MATERIALS

For procedures used in this study refer to Darsie (1998). No pupae of *Ar. omissus* were found in my collection from Nepal, but specimens were borrowed from the Walter Reed Biosystematic Unit, National Museum of Natural History (NMNH), Smithsonian Institution, with accompanying larval exuviae for species verification. In the description below br means branches and Le and Pe mean exuviae of the fourth instar larva and pupa, respectively.

DESCRIPTION

Armigeres (*Leicesteria*) *omissus* (Edwards) (Fig. 1)

Position and size of setae as figured, range and modal number of branches in Table 1. *Cephalothorax:* Setae 1,3-CT long to very long, thin, usually single (1,2); 6-CT 0.53–0.82, $\bar{x}$ 0.66 length of 7-CT; trumpet brown, reticulate, length 0.5–0.6 mm, index 1.54–2.50, $\bar{x}$ 2.05. *Abdomen:* Seta 1-II moderately long, with 10–17 br; 2-V-VII

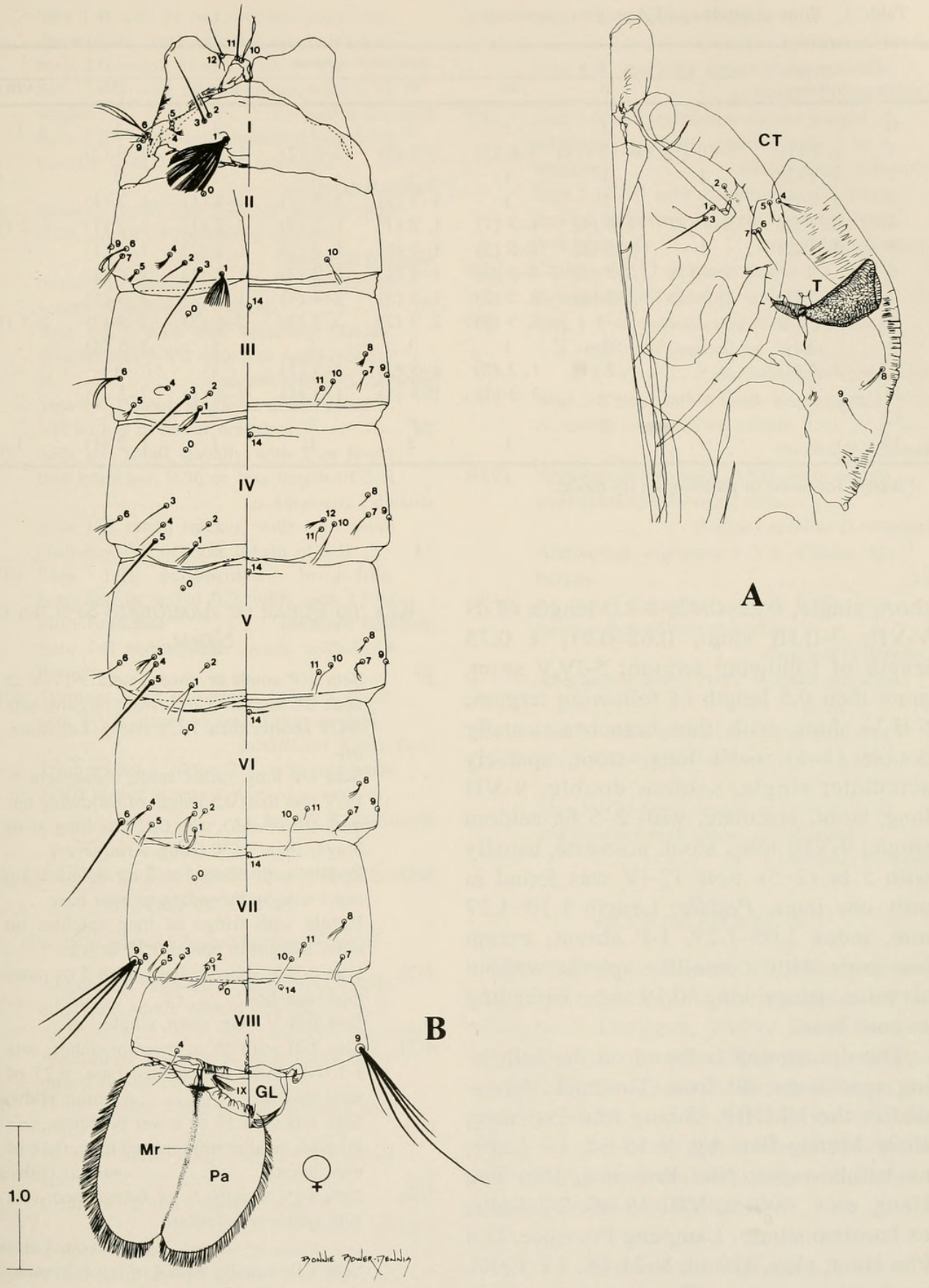

Fig. 1. Pupa of *Armigeres* (*Lei.*) *omissus*. A, Cephalothorax (left side). B, Metanotum and abdomen (dorsal left, ventral right). Abbreviations: CT = cephalothorax; GL = genital lobe; Mr = paddle midrib; Pa = paddle; T = respiratory trumpet.

Table 1. Pupa chaetotaxy of *Armigeres omissus*.

Seta	Cephalo thorax	Abdominal segments I	II	III	IV	V	VI	VII	VIII
0	–	–	1	1	1	1	1	1	1
1	1, 2 (1)[1]	5–10 (?)	10–17 (14)	2–8 (3)	2–5 (3)	2–6 (2)	1–3 (2)	2, 3 (2)	–
2	1–4 (2)	1	1	1	1	1	1	1	–
3	1, 2 (1)	1	1	1	1–7 (3)	2–5 (4)	1–3 (1)	1, 2 (1)	–
4	2, 3 (2)	2–4 (3)	2–6 (4)	1–3 (1)	1, 2 (1)	1, 2 (2)	1–3 (1)	1, 2 (1)	1, 2 (1)
5	1–3 (2)	1	2–5 (2)	1–5 (3)	1–3 (1)	1, 2 (1)	1, 2 (2)	1, 2 (1)	–
6	1	1–4 (?)	2–7 (2)	3–5 (3)	1–4 (2)	1, 2 (2)	1, 2 (1)	1–4 (1)	–
7	1, 2 (1)	1, 2 (2)	2–5 (2)	2, 3 (2)	1–3 (3)	2–4 (4)	1–3 (2)	1–3 (1)	–
8	1–3 (2)	–	–	2, 3 (3)	2, 3 (2)	2, 3 (3)	2–6 (3)	2–8 (?)	2–5 (5)
9	1	1	1	1	1	1	1	1–5 (2)	–
10	1–4 (2)	–	1, 2 (1)	1, 2 (2)	1–3 (2)	1–3 (1)	1	1	–
11	1	–	–	1–3 (1)	1–3 (1)	1–3 (1)	1–3 (1)	1–3 (2)	–
12	1	–	–	–	–	–	–	–	–
14	–	–	–	1	1	1	1	1, 2 (1)	1

[1] Range followed in parenthesis by mode.

short, single, 0.22–0.40, $\bar{x}$ 3.0 length of 1-V-VII; 3-II,III stout, 0.62–0.91, $\bar{x}$ 0.75 length of following tergum; 5-IV,V stout, more than 0.5 length of following tergum; 6-II-V short, with thin branches, usually double (1–5); 6-VI long, stout, sparsely aciculate, single, seldom double; 9-VII long, stout, aciculate, with 2–5 br, seldom single; 9-VIII long, stout, aciculate, usually with 5 br (2–5). Seta 12-IV was found in only one pupa. *Paddle:* Length 1.10–1.27 mm, index 1.05–1.29, 1-P absent, except one pupa with a seta-like spicule without alveolus, fringe long, 0.19 mm, extending to near base.

The description is based on the following specimens, all from Thailand, deposited in the NMNH: Chiang Mai Province, Huey Muang Ban Ay, V-15-64, 1♀ LePe, ex bamboo pot; Nan Province, Ban Pha Hang, elev. 400 m, VIII-19-66, 2♀ LePe, ex bamboo stump; Lampang Province, Doi Pha Huat, elev. 420 m, V-21-68, 1♀ LePe, ex bamboo stump. The Nepal specimen was collected in Jhapa District, Kanchanbari, VIII-2-91, 1♀, resting outdoors on vegetation in primary forest (coll. no. 111-x128).

Key to Pupae of *Armigeres* Species of Nepal

1. Seta 1-P small or absent; seta 5-IV-V at least 0.5 length of following tergum; seta 6-CT shorter than 7-CT (subg. *Leicesteria*) 2
– Seta 1-P long, rather stout, if not, seta 5-IV,V less than 0.5 length of following tergum (*theobaldi*); seta 6-CT as long as or longer than 7-CT (subg. *Armigeres*) . . . 8
2(1). Paddle with fringe of long spicules on outer margin extending to near base . . . 3
– Paddle with fringe of long spicules on outer margin in apical 0.75 or less 6
3(2). Seta 6-II-V short, usually with 2 or more thin branches 4
– Seta 6-II-V long, stout, single 5
4(3). Seta 1-II with 28 or more branches; seta 1-I with thick unbranched base, 0.27 of total length . . . . . *digitatus* (Edwards)
– Seta 1-II with 17 or fewer branches; seta 1-I with smaller unbranched base, 0.18 of total length . . . . . *omissus* (Edwards)
5(3). Seta 3-IV usually 5- or 6-branched; seta 1-II sparsely aciculate . . . . . *annulitarsis* (Leicester)
– Seta 3-IV usually with 4 or fewer branches; seta 1-II densely aciculate . . . . . *magnus* (Theobald)
6(2). Seta 1-II with 24 or more branches; paddle with large external lobe; seta 1-II-VII subequal to seta 2 . . . . . *dolichocephalus* (Leicester)

– Seta 1-II with 21 or fewer branches; paddle without large external lobe; seta 1 at least 2.0 length of seta 2 on V–VII 7
7(6). Seta 3-CT with thin branches; seta 6-VI single . . . . . *inchoatus* Barraud
– Seta 3-CT with stout branches; seta 6-VI usually with 2 or more branches . . . . . *dentatus* Barraud
8(1). Setae 3-II, III and 5-IV, V shorter than 0.25 length of following tergum . . . . . *theobaldi* Barraud
– Setae 3-II, III and 5-IV, V longer than 0.5 length of following tergum 9
9(8). Seta 1-CT with thin branches, usually double; seta 9-VII with 9 or more branches . . . . . *aureolineatus* (Leicester)
– Seta 1-CT stout, single or double; seta 9-VII with 8 or fewer branches 10
10(9). Seta 1-II small, usually with 5 or fewer thin branches, 0.36 or less length of 3-II . . . . . *kuchingensis* Edwards
– Seta 1-II much thicker, with 6 or more branches, 0.5 or more length of 3-II . . 11
11(10). Seta 1-II pedunculate, brush-like, branched in apical 0.7, with with 17 or more branches . . . . . *durhami* Edwards
– Seta 1-II pedunculate or not, with 6–14 branches 12
12(10). Trumpet short and broad, index 1.2–1.7; seta 3-VII closer to seta 4 than to seta 1 . . . . . *subalbatus* (Coquillett)
– Trumpet long, index 2.3 or greater; seta 3-VII closer to seta 1 than to 4 . . . . . *kesseli* Ramalingam

Key to Fourth Instar Larvae *Armigeres* Species of Nepal

(Partially adapted from Macdonald 1960)

1. Abdominal segment X with dorsal saddle and very small ventral sclerotized plate . . . . . *magnus* (Theobald)
– Abdominal segment X with dorsal sclerotized saddle only 2
2(1). Comb scales fringed with subequal spinules 3
– At least some comb scales with apical spine 8
3(2). Comb with more than 25 scales . . . . . *inchoatus* Barraud
– Comb with fewer than 25 scales 4
4(3). Comb with 18–25 scales . . . . . *annulitarsis* (Leicester)
– Comb with fewer than 18 scales 5
5(4). Most comb scales rather pointed apically, point fringed with subequal spinules . . . 6
– Comb scales rounded apically, fringed with subequal spinules 7
6(5). Seta 1-X on saddle or close to it . . . . . *durhami* Edwards
– Seta 1-X distinctly removed from saddle . . . . . *subalbatus* (Coquillett)
7(5). Seta 1-III-VI reaching posterior margin of following segment; seta 6-I with 3 or 4 branches . . . . . *kuchingensis* Edwards
– Seta 1-III-VI only reaching basal 0.25 or less of following segment; seta 6-I with 5–9 branches . . . . . *kesseli* Ramalingam
8(2). Comb with 11 or fewer scales 9
– Comb with 12 or more scales 10
9(8). Seta 1-S very small, with 2 or 3 branches; 1-X small, not inserted on saddle . . . . . *aureolineatus* (Leicester)
– Seta 1-S long, rather stout, single; seta 1-X strong, inserted on saddle . . . . . *theobaldi* Barraud
10(9). Abdominal segments I-VII with prominent tubercles bearing setae . . . . . *dolichocephalus* (Leicester)
– Abdominal segments I–VII without tubercles 11
11(10). At least abdominal sterna II–IV with large patch of fine spicules . . . . . *digitatus* (Edwards)
– Abdominal sterna II–IV without spicules 12
12(11). Seta 5-VIII with 3 or more fine branches; comb scales with 2 or more apical spines . . . . . *omissus* (Edwards)
– Seta 5-VIII stout, single or double; most comb scales with single apical spine . . . . . *dentatus* Barraud

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