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DESCRIPTIONS OF ULTIMATE INSTAR LARVAE OF FIVE HIGHER ALTITUDE *TRITHEMIS* SPECIES IN SOUTHERN AFRICA (ANISOPTERA: LIBELLULIDAE)

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Last instar larvae of *T. arteriosa, T. dorsalis, T. furva, T. kirbyi ardens* and *T. stictica* are described, illustrated and keyed. These are fairly common spp., whose ranges overlap above 200 m a.s.l. in Natal, South Africa.

INTRODUCTION

Trithemis spp. are among the most numerous of dragonflies at the middle and higher altitudes in southern Africa. They are associated with both still and running water, and often occur conspecifically.

The adults are well-known, and good keys are available (PINHEY, 1951, 1970). The larvae are virtually unknown, with a few inadequate descriptions and no comparative keys. This paper provides detailed descriptions of the larvae of the commonly encountered *Trithemis* spp. at the middle and upper altitudes in Natal, South Africa. It has not been possible to cover all *Trithemis* spp. of the southern African subregion, as the larval habitats have not been discovered and/or there are not yet confirmed identifications of larvae of the rarer and more localized species.

SITES AND METHODS

Most specimens were from sites above 200 m a.s.l. in Natl. The *T.kirbyi ardens* (Gerst.) were

from Hoedspruit in the Eastern Transvaal lowveld.

All material described here is from last instar exuviae, collected in the field and reared through in the laboratory. Species deteminations were from the teneral imago, with the exception of *T. kirbyi ardens*, most of which were collected as larval exuviae from Hoedspruit in the Eastern Transvaal, in association with a large number of young flying adults in the absence of other *Trithemis*.

Exuviae were stored in 75% ethyl alcohol and drawn using a stereomicroscope and camera lucida (<50x magnification). All measurements were to the nearest 0.1 mm using a micrometric eye-piece. The following measurements were made: dorsal view: total body length, abdomen width, distance between tips of lateral abdominal spines, epiproct width, anal pyramid width, antennae length (straight), distance between antennae insertion (i.e. distance between central axis of first antennal segment); - ventral view: abdomen length, mask length and width (after being cut at the postmentum level and laid out, but not flattened); - lateral view: epiproct and cercus and prementum lengths.

Distances between antennae axes are specified here. Previous descriptions have not specified which antennal distances were measured. With these *Trithemis* the distance between outer edges of first antennal segments were as much as 0.3 mm more, and inner edges 0.2 mm less, than the distance between the axes.

TERMINOLOGY

CORBET's (1953) terminology for the labium was adopted, although the premental setae of these *Trithemis* spp. decreased steadily from the external to the medial zone, and so no setae could be called 'small' sensu CORBET (1953). Each series is composed of setae of different lengths, and 'short' is defined here as those setae from half way along the external edge to the middle zone of the prementum, of which the outer one is less than 2/3 the length of adjacent 'normal-length' setae. However, the distinction between 'short' and 'normal' setae is usually determinable only with exact microscope measurements.

In addition to the familiar palpal setae, these *Trithemis* also had another line of setae along the outer margin of the palpus. These setae, which we term here 'marginal setae' were either needle-like or ogival. PINHEY (1962) also used the term 'marginal setae', but referred to the whole labium, giving no further specifications. The marginal setae here therefore, differ from those of Pinhey. Figure 2 illustrates 'short premental setae' and 'marginal setae' of palpus, as used in this paper. Abdominal segments ranged from S1 to S10.

MORPHOLOGICAL DESCRIPTIONS OF LARVAE

TRITHEMIS ARTERIOSA (BURMEISTER, 1839)

Figures 1-2

Material. - 2 ♂, Hilton, Natal, XI-1988; 1 ♂, ditto, 9-I-1980.

The larva of this species was mentioned by BARNARD (1937) as "indistinguishable from that of *Helothemis dorsalis*", with neither description nor drawings. PINHEY (1961) made reference to the *T. arteriosa* larva in BARNARD's (1937) paper. PINHEY (1962) gives a fairly comprehensive description of the larva from a female exuviae. AGUESSE (1968) also refers to the *T. arteriosa* larva, but only in passing in a key. Here a more comprehensive description than hitherto available is given.

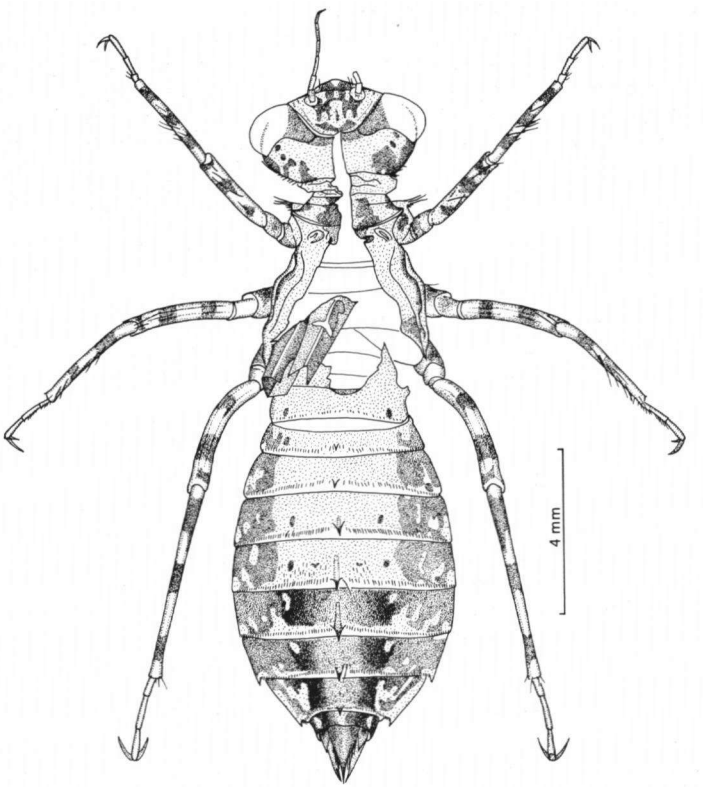

Fig. 1. *Trithemis arteriosa* (Burm.), ultimate instar larva.

DESCRIPTION. - Body length 16.5-17.0 mm, colour dark brown, moderately setose. Antennae 7-segmented, the third segment longest. Antenna length 2.8-2.9 mm, distance between insertions 1.1. mm.

Mask length 4.5-4.6 mm, width 3.4-3.8 mm, articulation between prementum and postmentum at the level of the mesocoxae. Distal margin of median premental lobe with a central group of two spiniform setae and two lateral groups of 7-9 spiniform setae, regularly spaced. Premental setae 10+10 - 10+11 (six long and 3-4 short). Prementum length 3.4-3.6 mm.

Palpus with dark spots, 8-9 crenations on distal margin, each with groups of 1-3 spiniform setae, 5-6 spiniform setae near the articulation with prementum, palpal setae 6 & 7 or 7 & 7 (in the case of 7, the first setae near the articulation are very short), a marginal line of 11-15 ogival setae greater than 1/2 but not reaching 3/4 of the palpus, movable hook slender, as long as palpal setae.

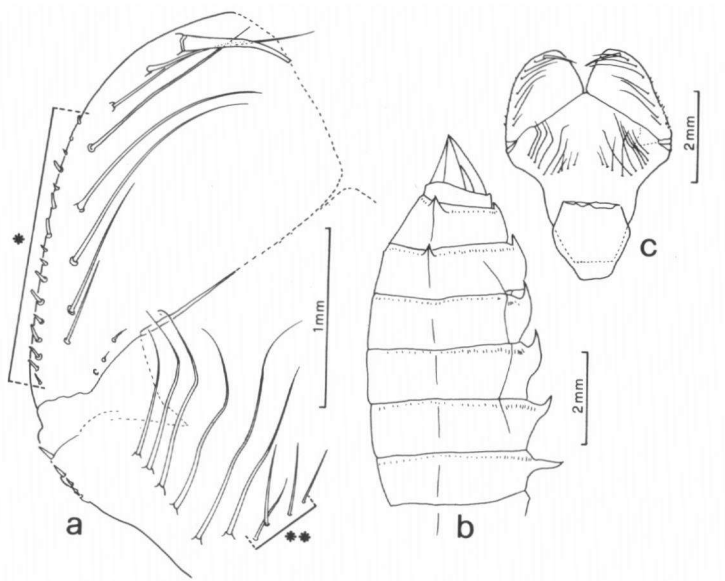

Fig. 2. *Trithemis arteriosa* (Burm.), ultimate instar larva: (a) premental and palpal setae; - (b) abdomen, lateral view; - (c) mask. - [*: marginal setae of palpus; - **: short premental setae.]

Thorax with only a few setae on the leg insertions. Legs with scarce setae, each femur with two dark bands and 1-3 bands on each tibia. Metatibia length 5.2-5.8 mm.

Abdomen length 9.5-9.7 mm, width 5.1-5.4 mm, S6 is the largest segment. Lateral spines on S8 and S9, those on S8 the largest. Distance between the tips of spines 4.1-4.2 mm for S8, and 2.1-2.2 mm for S9. Dorsal spines on S9-S3, those on S6 the largest. Wing sheath length unknown. Dark, transverse dorsal bands on S10-S7.

Anal pyramid moderately setose. Pyramid in dorsal view as long as or a little longer than S10, pyramid width 1.2-1.3 mm. Epiproct length 1.4-1.5 mm, width 0.8 mm. Paraprocts as long as epiproct, and all with incurved apices. Cercus length 0.6 mm.

TRITHEMIS DORSALIS (RAMBUR, 1842)

Figures 3-4

Material. - 1 ♀, Lions R., Natal, 21-XII-1988; - 1 ♀, Hilton, Natal, 8-II-1989; - 1 ♀, Balgowan, Natal, 5-III-1989.

BARNARD (1937) gave a brief description of this species as *Helothemis dorsalis* (Ramb.). PINHEY (1959) referred to BARNARD (1937), while PINHEY

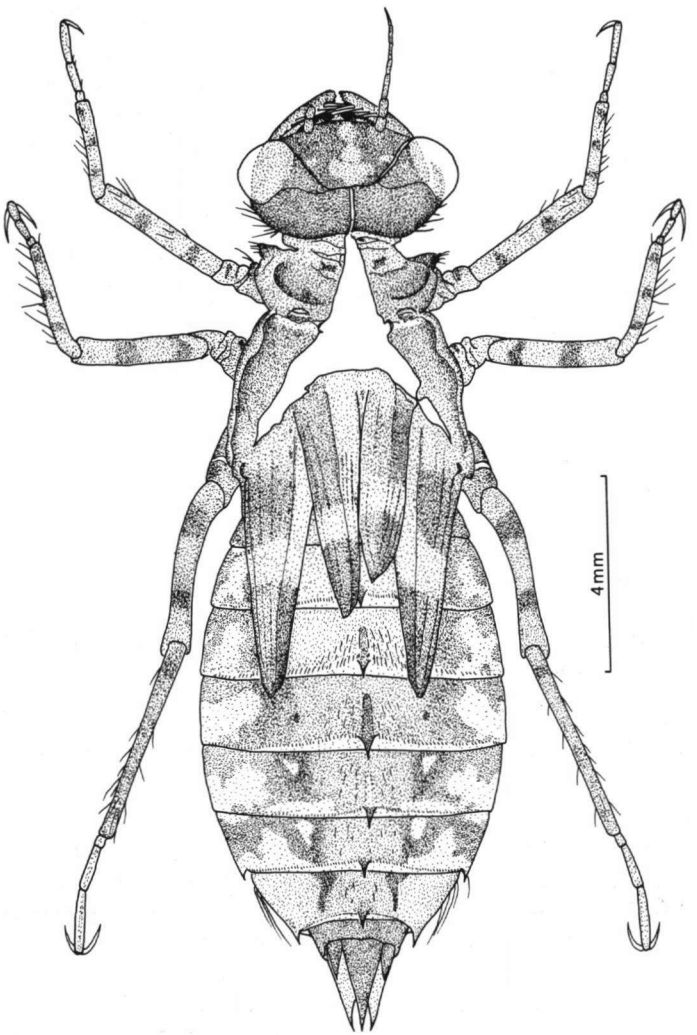

Fig. 3. *Trithemis dorsalis* (Ramb.), ultimate instar larva.

(1961) added further notes from a female exuvium. A more comprehensive description is given here.

DESCRIPTION. - Body length 16.5-19.0 mm, colour light brown, moderately setose. Antennae 7-segmented, the third segment longest, antenna length 2.8-3.2 mm, distance between insertions 1.2-1.3 mm.

Mask length 4.2-4.9 mm, width 3.3-3.8 mm, articulation between prementum

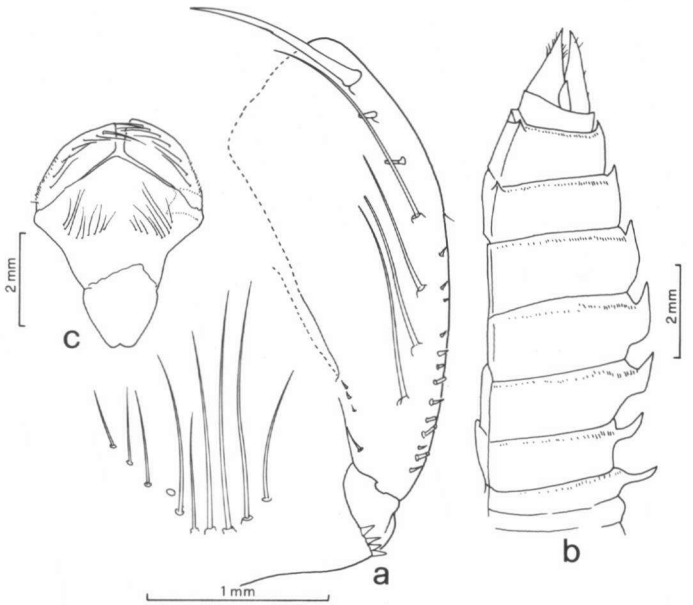

Fig. 4. *Trithemis dorsalis* (Ramb.), ultimate instar larva: (a) mask; - (b) premental and palpal setae; - (c) abdomen, lateral view.

and postmentum at level of mesocoxae, distal margin of medial premental lobe with a central group of two spiniform setae and two lateral groups of 9-11 spiniform setae, regularly spaced. Premental setae 9+9, 9+10, 10+11 (6-7 long and 3-4 short).

Palpus with dark spots, 8-9 crenations on distal margin, each with groups of 1-5 spiniform setae, 3-6 spiniform setae near articulation with prementum. Palpal setae 6 & 6; a marginal line of 12-15 ogival setae reaching about ½ length of palpus. Movable hook slender, as long as palpal setae. Prementum length 3.6-3.9 mm.

Thorax with setae present only at leg insertions. Legs with some long setae. Two dark bands on each femur, and 1-3 bands on each tibia. Metatibia length 5.7-5.8 mm.

Abdomen length 9.6-11.8 mm, width 5.6-6.3 mm, S6 the largest segment. Subequal lateral spines on S8 and S9. Distance between tips of lateral spines 4.3-4.5 mm for S8, 2.3-2.4 mm for S9. Dorsal spines on S9-S3, those on S6 largest. Wing sheaths reaching halfway or to distal margin of S6. Transverse dark dorsal bands on S10-S7.

Anal pyramid fairly setose. Pyramid in dorsal view a little longer than S10+S9. Pyramid width 1.4 mm. Epiproct length 1.7-1.8 mm, width 0.9 mm. Paraprocts as long as epiproct, all with incurved apices. Cercus length 0.6 mm.

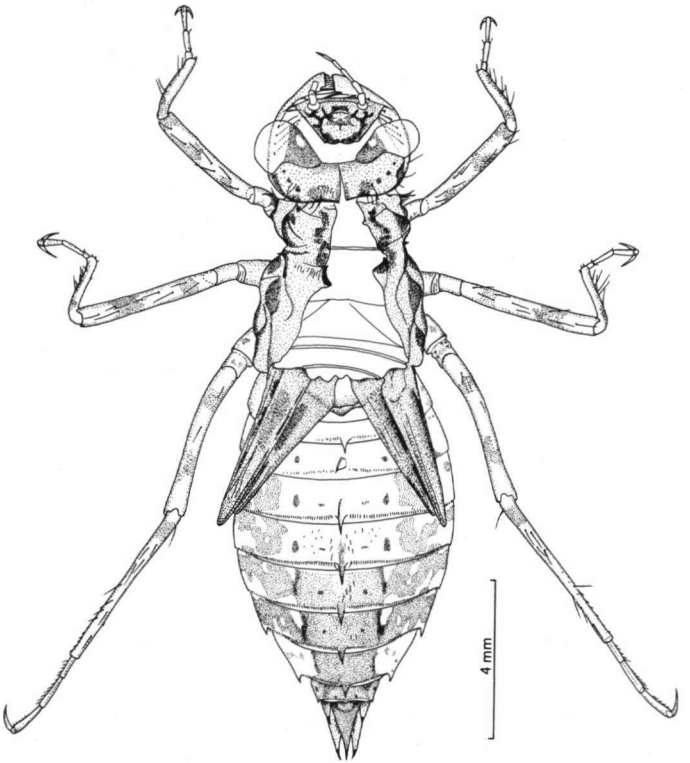

Fig. 5. *Trithemis furva* Karsch, ultimate instar larva.

TRITHEMIS FURVA KARSCH, 1899

Figures 5-6

Material. - 2 ♂, 2 ♀, Albert Falls, Natal, 21-II-1989; - 1 ♀, Ashburton, Natal, 14-I-1991; - 1 ♀, Botanic Gardens, Pietermaritzburg, 28-I-1991.

The larva has not been described previously.

DESCRIPTION. - Body length 16.5-19.0 mm, colour light brown, almost glabrous. Antennae 6- or 7-segmented, the third to sixth segments longest, antenna length 2.4-2.8 mm, distance between insertions 1.1-1.4 mm.

Mask length 4.6-5.0 mm, width 3.5-3.8 mm, articulation between prementum and postmentum at the level of the mesocoxae. Premental setae 8+8, 8+9 or 9+9 (5-6 long and 2-4 short) or 9+13 (6 long, with the more numerous line with three long setae out of alignment with the others). Distal margin of median premental lobe with a central group of two spiniform setae and two lateral groups of 9-12 spiniform setae, regularly spaced. Prementum length 3.6-4.0 mm.

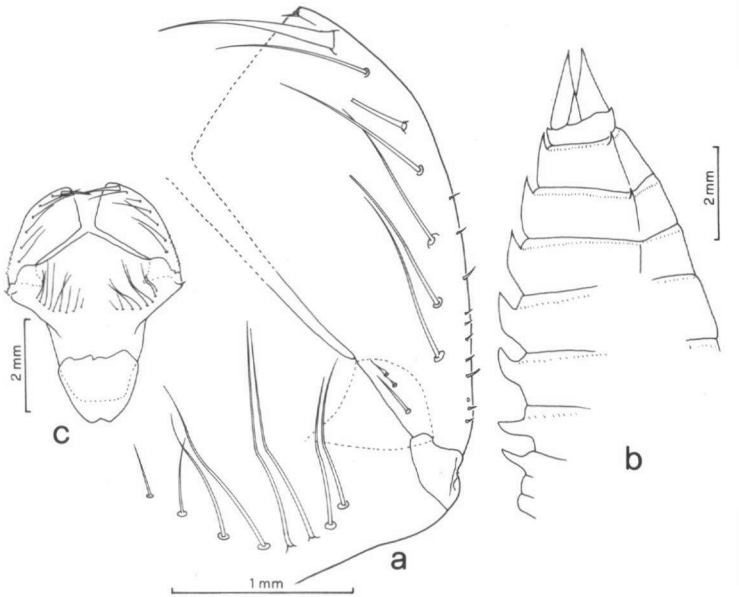

Fig. 6. *Trithemis furva* Karsch, ultimate instar larva: (a) mask; - (b) premental and palpal setae; - (c) abdomen, lateral view.

Palpus without or with few dark spots, 7-9 crenations on the distal margin, each with groups of 1-3 spiniform setae, 3-4 small spiniform setae near the articulation with the prementum, palpal setae 6 & 6 - 6 & 7 - 6 & 8 (in the case of 8, two setae are more slender than the others), a marginal line of 9-15 slender or truncate setae, reaching little more than ½ the length of the palpus, movable hook slender, a little longer than the palpal setae.

Thorax with only some setae at the leg insertions. Legs glabrate, two dark bands on each femur, one or two bands on each tibia. Metatibia length 5.3-6.0 mm.

Abdomen length 9-11 mm, width 5.9 mm, largest segment S6. Lateral spines on S8 and S9, spines almost equal in length. Distance between tips of lateral spines 3.9 mm - 4.5 mm for S 8, and 2.2-2.4 mm for S9. Dorsal spines on S9-S3, that of S6 the largest. Wing-sheaths reaching halfway or to the posterior margin of S6. Transverse dark dorsal bands on S10-S7, lightest in their middle area.

Anal pyramid slightly setose. Pyramid distinctly longer than S10 and S9 in dorsal view, pyramid width 1.2-1.4 mm. Epiproct length 1.6-1.9 mm, width 0.9 mm. Paraprocts as long as epiproct, all with incurved apices. Cercus length 0.6-0.7 mm.

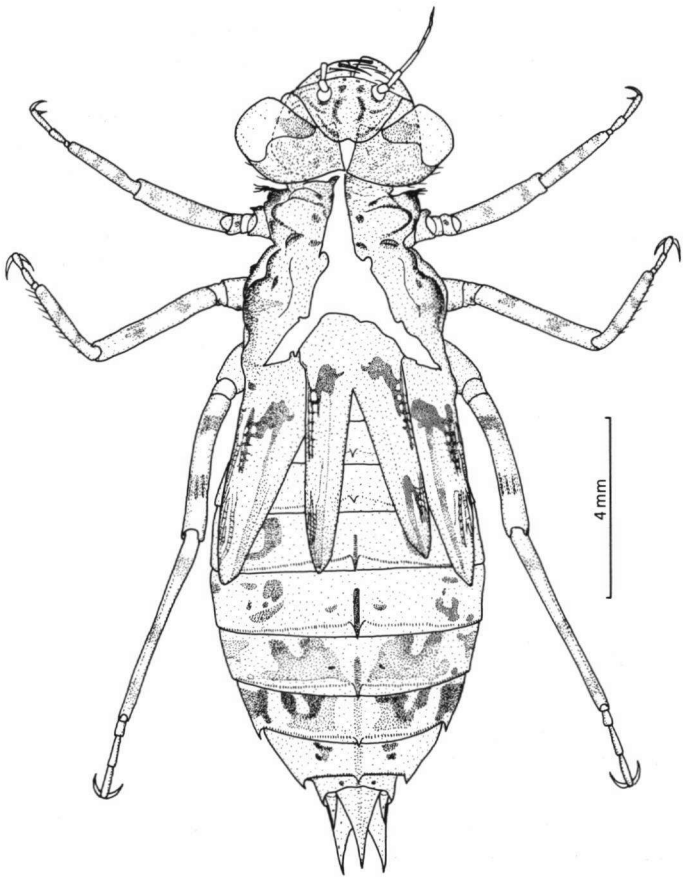

Fig. 7. *Trithemis kirbyi ardens* (Gerst.), ultimate instar larva.

TRITHEMIS KIRBYI ARDENS (GERSTAECKER, 1891)
Figures 7-8

Material. - 3 exuviae, Hoedspruit, E Transvaal, XII-1988; - 1 ♂, Botanic Gardens, Pietermaritzburg, 10-I-1991.

The larva of this species was briefly described by PINHEY (1961) from two females. AGUESSE (1968) only makes brief mention of it, citing PINHEY's (1961) work. It is appropriate to have a more comprehensive description.

DESCRIPTION. - Body length 17.0-18.8 mm, colour light brown, glabrous. Antennae 7- or 8-segmented, the third segment longest, antenna length 2.7-2.9 mm, distance between insertions 1.1-1.2 mm.

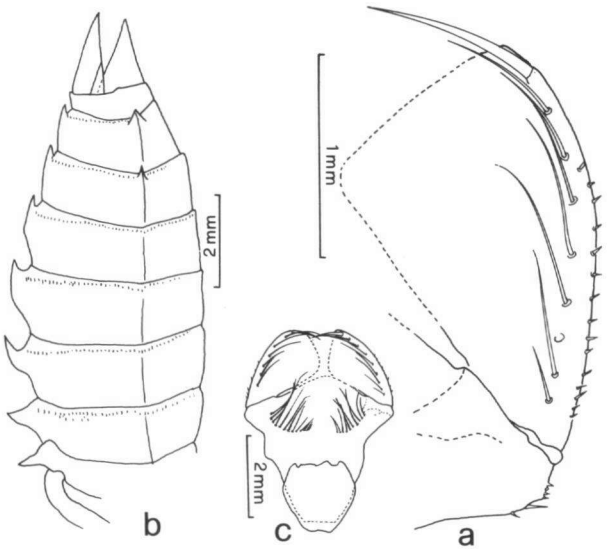

Fig. 8. *Trithemis kirbyi ardens* (Gerst.), ultimate instar larva: (a) abdomen, lateral view; - (b) mask; - (c) palpal setae.

Mask length 4.5-4.8 mm, width 3.3-3.5 mm, articulation between prementum and postmentum at the level of mesocoxae, distal margin of median premental lobe with a central group of two spiniform setae and two lateral groups of 9-13 spiniform setae, regularly spaced. Premental setae 10+11 or 11+11 (6-7 long and four short). Prementum length 3.7-3.9 mm.

Palpus without dark spots, 8-9 crenations on the distal margin, each with groups of 1-4 spiniform setae, 4-6 small spiniform setae present near the articulation with prementum, palpal setae 7 & 7 or 8 & 8 (in the case of 8, with the setae near the prementum articulation short), a marginal line of 11-15 spine-like setae reaching ½ length of the palpus, movable hook slender, a little longer than the palpal setae.

Thoracic setae at leg insertions, very scarce. legs virtually lacking long setae, two dark bands on each femur and 1, 2 or 3 bands on each tibia. Metatibia length 5.0-5.2 mm.

Abdomen length 10.8-11.4 mm, width 5.3-5.8 mm, largest segment S6. Subequal lateral spines on S8 and S9. Distance between tips of lateral spines 4.1-4.4 mm for S8, and 2.4 mm for S9. Dorsal spines on S9-S3, those on S6 the largest. Wing sheaths reaching 1/3-1/2 way across S6. Weak transverse darkish dorsal bands on S10-S7, lightened or broken in the middle area.

Anal pyramid supporting ony a few hair- or spine-like setae. Pyramid in dorsal view much longer than S10-S0, pyramid width 1.4-1.5 mm. Epiproct length 1.9-

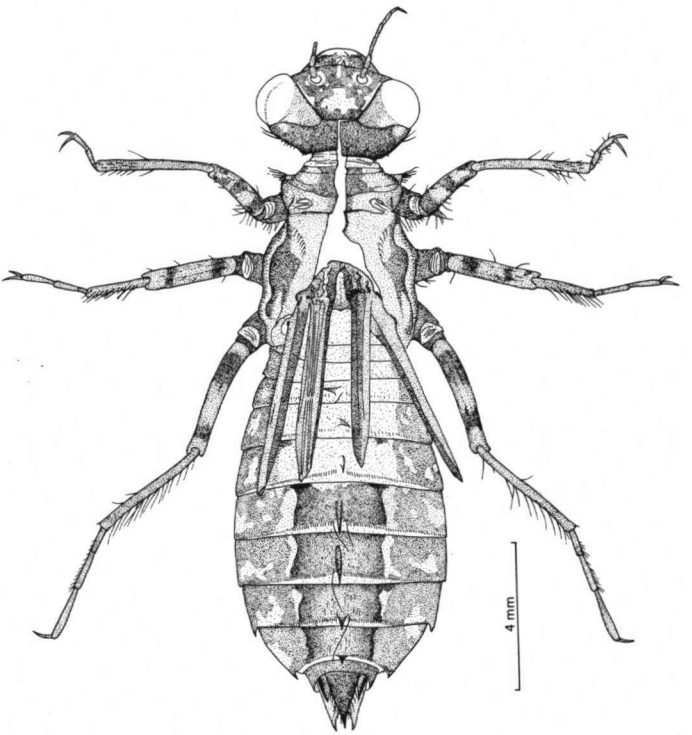

Fig. 9. *Trithemis stictica* (Burm.), ultimate instar larva.

2.0 mm, width 0.9-1.0 mm. Paraprocts as long as epiproct, all with curved apices. Cercus length 0.6-0.7 mm.

TRITHEMIS STICTICA (BURMEISTER, 1839)
Figures 9-10

Material. - 2 ♂, Hilton, Natal, 9-I-1989; - 1 ♂, Lions R., Natal, 15-X-1988; - 1 ♂, Cathedral Peak Hotel grounds, 24-I-1991.

The larva has not been described previously.

DESCRIPTION. - Body length 17-18 mm; colour dark brown, setose. Antennae 7-segmented, the third segment longest (but in one case the fifth), antenna length 2.8-3.0 mm, distance between insertions 1.3 mm.

Mask length 4.6-4.7 mm, width 3.7-3.9 mm, articulation between prementum and postmentum at the level of the mesocoxae, distal margin of median premental lobe with a central group of two spiniform setae and two lateral groups of nine-ten spiniform setae, regularly spaced. Premental setae 9+10 or 10+11 (six or

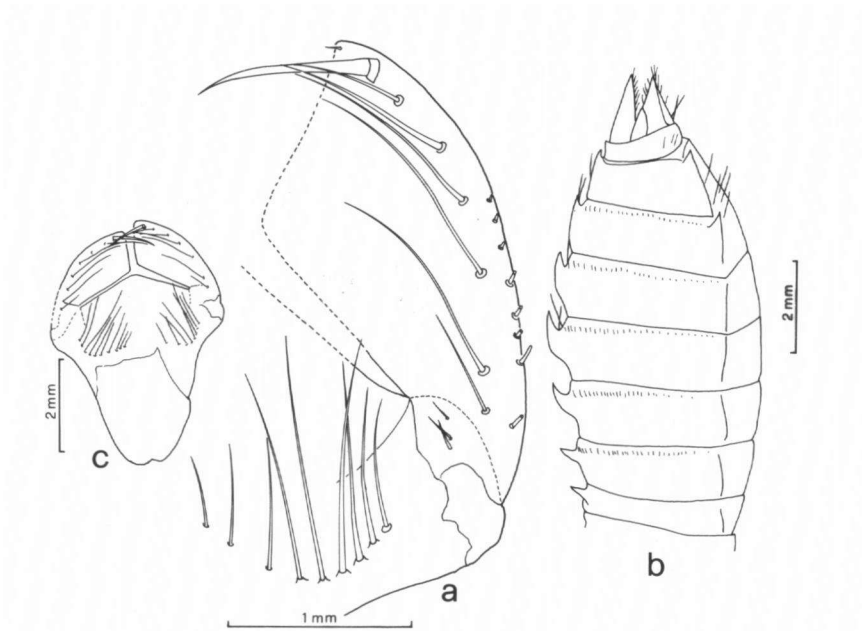

Fig. 10. *Trithemis stictica* (Burm.), ultimate instar larva: (a) mask; - (b) premental and palpal setae; - (c) abdomen, lateral view.

seven long and three or four short). Premental length 3.6-3.7 mm.

Palpus without or with few dark spots, eigth or nine crenations on distal margin, each with groups of 1-4 fine spiniform setae, 3-6 small spiniform setae near the articulation with the prementum, palpal setae 6 & 6, 6 & 7 or 7 & 7, a marginal line of 10-12 ogival setae alternating with needle-like long setae reaching 3/4 of length of palpus, movable hook slender, as long as or a little longer than the palpal setae.

Thorax with tufts of long, soft setae on leg insertions. Legs setose, with several strong brown needle-like setae on each femur and tibia. Two dark bands on each femur, and one or no bands on the tibiae. Metatibia length 5.4-6.0 mm.

Abdomen length 9.4-10.5 mm, width 5.8-6.2 mm, largest segment S6 or S7. Lateral spines on S8 and S9, those on S8 the largest, distance between tips of lateral spines 4.4-4.7 mm for S8 and 2.4-2.6 mm for S9. Dorsal spines on S9-S3, that of S6 the largest, wing sheaths reaching 1/3-1/2 of S6, transverse dark dorsal bands on S10-S6. Some needle-like setae on dorsal surfaces of last abdominal segments.

Anal pyramid with strong brown setae. Pyramid longer in dorsal view than S10 + S9, pyramid width 1.3-1.4 mm. Epiproct length 1.4-1.6 mm, width 0.9 mm. Paraprocts as long as epiproct, all with incurved apex, cercus length 0.6 mm.

SPECIES DETERMINATIONS

Our findings on *Trithemis* larvae support and expand the earlier descriptions. There are however, some discrepancies. For *T.k. ardens,* PINHEY (1961) reported 7-8, all longish, premental setae, and 6 palpal setae. In our specimens, these were 10-11 (6-7 long) and 7-8 respectively. Also, we recorded *T. arteriosa* to have proportionately longer antennae than recorded by PINHEY (1962). We agree on the other, remaining characters, including dorsal markings and cercus length. Therefore, the use of number of setae and antennae length in *Trithemis* species identifications appears limited. A thorough quantitative study is required to establish the extent of this variability.

With the reservations expressed above, a tentative key is proposed below for the higher altitude *Trithemis* spp. of Natal. This is not an exhaustive key for the genus in southern Africa, as the larvae of other, rare, and more tropical species have yet to be discovered. However, it covers the most widespread species. These *Trithemis* larvae are morphologically very similar, and the species descriptions must be used in conjunction with the key.

TENTATIVE KEY FOR FIVE HIGHER ALTITUDE *TRITHEMIS* ULTIMATE INSTAR LARVAE FROM NATAL

1. Abdomen ovoid, with S6 and S7 almost equal in width. Dark transverse dorsal bands on segments S6-S9. Strong, brown, needle-like setae on legs, abdominal segments and anal pyramid. Tufts of hair-like setae at leg insertions ..... ***stictica***
- Abdomen elliptical, with S7 distinctly not as wide as S6. Dark transverse dorsal bands on segments S7-S9. Setae on legs, abdominal segments and anal pyramid not so strong nor so brown. Setae also not needle-like, in particular on the dorsal surface of the abdominal segments. At most, some hair-like setae at leg insertions ..... 2.
2. External surface of palpus with few or without dark spots. Marginal setae of palpus mainly needle--like ..... 3.
- External surface of palpus with dark spots. Marginal setae of palpus mainly ogival-shaped ... 4.
3. Anal pyramid much longer than S9 + S10. Epiproct length about 2 mm ..... ***k. ardens***
- Anal pyramid only a little longer than S9 + S10. Epiproct length not greater than 1.8 mm ..... ***furva***
4. Cercus length about ⅓ of epiproct length ..... ***dorsalis***
- Cercus length more than ⅓ epiproct length ..... ***arteriosa***

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