The genus *Stylocephalus* comprises 37 species united by the general form of the diamerite and the epimerite proper (Levine, 1988). The genus is known primarily from the Palearctic and Paleotropics. In the Palearctic, *Stylocephalus* species occur in Europe (Léger, 1904; Foerster, 1938; Grell, 1940; Tuzet and Théodoridès, 1951; Tuzet and Ormières, 1955, 1956; Théodoridès, 1955a, 1960a, 1963a; Lipa, 1967; Corbel, 1971), the Mediterranean (Filipponi, 1949, 1951; Théodoridès, 1955a, 1960b, 1982; Ormières, 1967), the Near East (Théodoridès, 1955a, 1955b, 1955c, 1961), and the Far East (Hoshide, 1951, 1958; Théodoridès et al., 1976). In the Paleotropics, *Stylocephalus* species occur on the Indian subcontinent (Misra, 1941, 1942; Théodoridès, 1966; Devdhar and Amoji, 1977; Haldar and Chakraborty, 1979; Patil and Amoji, 1984) and in Southeast Asia (Théodoridès and Desportes, 1966; Théodoridès et al., 1975, 1984) and Africa (Gibbs, 1946; Théodoridès and Pierre, 1961; Théodoridès and Jolivet, 1963, 1982; Théodoridès et al., 1964, 1965) including Madagascar (Théodoridès and Jolivet, 1959) and the Cape Verde Islands (Théodoridès and Jolivet, 1986). In the Neartic 7 *Stylocephalus* species occur (Ellis, 1912a, 1913; Nelson, 1970) including the type species, *Stylocephalus giganteus* Ellis, 1912 that was originally described from an undescribed species of *Eledodes* (Coleoptera: Tenebrionidae: Eledoini) in Colorado (Ellis, 1912a). A single species of *Stylocephalus* is described from the Neotropics (Ellis, 1912b). *Stylocephalus* are known exclusively from tenebrionid beetles and although no stylocephalid has been reported from the Australian or Oceanian regions of the world, neither does the literature indicate a gregarine survey of the tenebrionid beetles in these regions. Thus the distribution of the genus in Australia and Oceania awaits survey and clarification.

During an on-going biotic survey of the gregarine parasites of North American insects, a heretofore unknown gregarine species was discovered in populations of *Trimyitis pruinosa* LeConte, 1851 (Insecta: Coleoptera: Tenebrionidae: Tentryinae: Trimyitini) in the Sandhills region of western Nebraska. The gregarine populations recovered are taxonomically distinct from known gregarine species and represent a new species of *Stylocephalus* Ellis, 1912. The description presented herein utilizes the extended gregarine morphometric set introduced by Clopton (1999), applies these characters only to mature or invariant stages, further develops a standardized discontinuous epimerite character set for the *Stylocephalusidae*, and proposes a new species within the genus *Stylocephalus*.

**MATERIALS AND METHODS**

*Trimyitis pruinosa* LeConte, 1851 adults (n = 69) were collected from beneath cattle dung pats in the loess hills south of Cedar Point Biological Station (CPBS), approximately 1 km southeast of Lake McConaughy, Keith County, Nebraska between 20 July and 4 August 1998 (Fig. 1). Locality coordinates were determined using an Eagle Explorer Global Positioning Satellite locator. Beetles were transported to the laboratory at CPBS, divided into lots of 4-6 individuals each, and held in 100-ml glass culture dishes (Carolina Culture Dishes, Carolina Biological Supply Company, Burlington, North Carolina) with damp filter paper. All beetles were held for at least 6 hr for gametocyct shedding and then either preserved as permanent specimens or examined for gregarine infection within 48 hr of collection. Beetles were eviscerated and their alimentary canals dissected into insect muscle saline (Belton and Grundfest, 1962). Intestines were blotted to remove excess saline and permanent parasite preparations were made using wet smears of gregarines and host gut tissues (Clopton, 1996, 1999). Smears were fixed for 3 min in AFA (ethanol, formalin, and acetic acid), washed and hardened in 70% ethanol (EtOH) for 5 min, and stained with either Semichon's aceto-carmine or Harris hematoxylin and eosin-xylol. Stained specimens were dehydrated in an EtOH series, cleared with xylene, and mounted in Damar balsam.

Gametocytes were extracted from collected feces and transferred into individual wells of a Miniwell® assay plate (Nunclon Miniwell® minitray plate; 60 conical, flat-bottomed, 10-μl wells; Nunclon 439225, Nalge Nunc International Corp., Rochester, New York). Water was added to the margins of the culture plate to provide humidity and the gametocytes were held for maturation and dehiscence. Oocyst structure and dimensions were taken from fresh preparations of oocytes in agar monolayer mounts (Clopton, 1999).

Observations were made using an Olympus B-Max 50 compound microscope with ×20, ×40, and ×100 universal planapochromatic objectives and either phase-contrast condensers or differential interference contrast prisms. Digital photographs were taken with an AGFA

Received 15 April 1999; revised 4 October 1999; accepted 4 October 1999.
clearly differentiated by decreased density of cytoplasm. Protoplomere transversely ovoid to shallowly ovoid. Protoplomere-deutomerite septum clearly marked and constricted. Deutomerite narrowly obovoid to very narrowly obovoid. Nucleus ellipsoid; with a variable number of polysomal endosomes.

Gamont (Figs. 4, 5, 14–17): Protoplomere depressed ovoid to very broadly ovoid, length (PL) 17.2–39.6 (27.3, ±5.2, 29), width (PW) 21.5–51.6 (35.1, ±8.7, 29), PL/PW 0.6–1.0 (0.8, ±0.1, 29), anterior distance to widest point (PLA) 8.4–27.9 (15.4, ±4.4, 29), posterior distance to widest point (PLP) 5.6–22.8 (12.4, ±3.2, 29), PLA/PLP 0.7–2.4 (1.3, ±0.5, 29), PL/PLP 0.3–0.7 (0.5, ±0.1, 29), PL/PW 0.2–0.6 (0.4, ±0.1, 29). Protoplomere–deutomerite septum clearly marked and constricted, width (SW) 21–50.6 (34.6, ±9.1, 29), PW/SW 0.9–1.2 (1.0, ±0.1, 29). Deutomerite often with distinct marginal excrescence or superficial annulation (Figs. 4, 14, 15), narrowly obovoid to very narrowly obovoid, length, (DL) 166.5–608.1 (356.5, ±107.0, 29), maximum width (DWM) 32.1–111.3 (57.6, ±23.4, 29), anterior distance to widest point (DIA) 11.0–80.3 (26.3, ±15.0, 29), posterior distance to widest point (DLP) 145.6–572.4 (331.5, ±104.3, 29), equatorial width (DWE) 18.7–62.1 (35.1, ±12.5, 29), anterior distance to equatorial plane (DLH) 85.6–304.5 (180.1, ±52.4, 29), DWM/DWE 1.3–2.6 (1.6, ±0.3, 29), DLA/DWM 0.3–1.3 (0.5, ±0.2, 29), DLP/DWM 3.3–9.9 (6.1, ±1.7, 29), DLH/DWE 2.8–10.6 (5.4, ±1.6, 29), D Worm/SW 1.2–2.3 (1.6, ±0.3, 29), DWE/SW 0.7–1.3 (1.0, ±0.2, 29). Total length (TL) 186.4–639.6 (381.5, ±110.5, 29). Indices: TL/PL 7.7–23.8 (14.1, ±3.7, 29), DLM/PL 6.9–22.8 (13.2, ±3.7, 29), DWM/PW 1.2–2.5 (1.6, ±0.3, 29), DWE/PW 0.6–1.4 (1.0, ±0.2, 29), TL/DL 1.0–1.1 (1.1, ±0.2, 29). Nucleus ellipsoid, typically abaxial; length (NL) 13.9–42.7 (32.5, ±6.5, 25), width (NW) 8.5–23.8 (18.8, ±4.8, 25), distance to protoplomere–deutomerite septum (NDS) 6.3–143.2 (45.4, ±38.6, 25), NL/NW 1.3–2.9 (1.8, ±0.4, 25); with 0 or 2 polysomal endosomes, diameter (KD) 7.7–16.8 (10.6, ±2.7, 13).

Association: Frontal; isogametic; late and ephemeral; leading directly to syzygy, associated pairs fusing laterally during syzygy; associations, syzygial pairs, and gametocytes located between host ventricular peritrophic membrane and posterior ventricular epithelium. Gamonts in association morphometrically similar to solitary gamonts; epimerite absent.

Gametocytes (Figs. 18–20): White to opalescent in color (Fig. 18), becoming dark brown to black with maturity (Fig. 19); roughly spherical; diameter 179.0–233.0 (205.0, ±18.5, 29); no hyaline coat apparent; gametocyte wall desiccating to become paper-like and slightly papil lamated. Gametocytes mature within 48–72 hr and dehisc with simple rupture of the gametocyte walls. Oocysts are extruded in a coiled chain to form a single, tangled, sticky mass (Fig. 20); episete packet absent, gametocyte residuum present.

Oocysts (Figs. 6, 7, 20, 21): Axially asymmetric, broadly deltoid, gibbous in lateral aspect, slightly keeled in dorsal aspect, very uniform in size and shape; length (OL) 9–10.3 (9.8, ±0.3, 41); height (OH) 7.3–8.7 (7.9, ±0.3, 41); with slight terminal projection or or with shoulders, height (SH) 1.3–2.5 (1.8, ±0.3, 41); with 2 central, spherical residuum, diameter residuum 1.6–2.5 (2.0, ±0.3, 26), diameter residuum 2.1–2.8 (2.0, ±0.3, 22); octozoic, sporozoites resting in tandem, folded around central residuum. Extruded in chains (Fig. 20). Oocysts dark brown under transmitted light, black under reflected light.

Taxonomic summary
Host: Trinymis pruinosa LeConte, 1851 (Insecta: Coleoptera: Tenebrionidae: Tetyrinia: Trinymini).
Symbiotype: One symbiotype specimen is deposited with the Division of Entomology, University of Nebraska State Museum (UNSM), Lincoln, Nebraska. The symbiotype is identified with three labels: a collection label, “NE: Keigh Co.; Cedar Point Biol Stn, N41°12'.25'S, W101°36'.56", 20 July 1998: R. E. Clpton”; an NSF Deposition label, “Clpton: NSF DEB-9705179, NSF PROJECT VOUCHER, REC-9802499”; and a blue UNSM voucher label “RESEARCH PROJECT Voucher Specimen.” Additional voucher specimens (REC980250–REC980253 and REC980333, REC980334) are retained by the author.
Host records: Trinymis pruinosa; adults.
Locality: 25°41'.25'S, W101°36'.56", CPBS, 1 km southeast of Lake McConaughy, Keith County, Nebraska.
Infection site: Trichoplax trophozoites and gamonts were observed along the length of the ventriculus, anterior to the ileum and the attachment of
the Malpighian tubules. Associations primarily located in the ileum. All endogenous life-cycle stages were observed between host ventricular peritrophic membrane and ventricular epithelium. Gametocytes collected from host feces.

Prevalence: 91.3% (63 of 69 beetles examined post mortem).

Specimens deposited: The holotype slide is deposited in the Harold W. Manter Laboratory for Parasitology (HWML), Division of Parasitology, University of Nebraska State Museum, Lincoln, Nebraska. The holotype is a trophozoite on slide HWML 15005 (author's slide REC980476) and is marked by an etched circle. The remaining trophozoites, gamonts, and associations in HWML 15006 (8 slides, author's slides REC980254–REC980257, REC980260, REC980263, REC980264, REC98267) are paratypes Trophozoites, gamonts, and associations on author's slides REC980269, REC980271, REC980274, REC980276a-b, REC980295, REC980298–REC980300, REC980477a-b, and REC980480–REC980482 are paratypes retained by the author.

Etymology: The specific epithet occidentalis (Latin, "of the west") is given to mark the New World distribution of this species.

Remarks

Stylocephalus occidentalis is the first species of Stylocephalus described from the New World Tantyriinae. This gregarine is distinguished from most species in the genus Stylocephalus by overt differences in the form of the epimerite proper. The ovoid epimerite proper of S. occidentalis is shared by only 3 other members of the genus: Stylocephalus conionitis Nelson, 1970, Stylocephalus filiformis Théodoridès, 1959, and Stylocephalus pauliani Théodoridès, 1959, but these taxa are readily distinguished. Gamonts of S. occidentalis range 186.4–639.6, their average length (381.5) less than one-third that reported for S. conionitis (1,105 [Nelson, 1970]) and less than one-fourth that reported for S. filiformis and S. pauliani (1,700 and 1,800, respectively [Théodoridès, 1959]). Stylocephalus occidentalis is further differentiated from S. pauliani by differences in oocyst size that measure 9.7 × 8 and 17 × 12.5, respectively (Théodoridès, 1959). The oocysts of S. conionitis and S. filiformis are unknown.

Two other gregarine taxa were recovered from T. pruinosa but neither in numbers sufficient to permit accurate description nor diagnosis beyond the generic level. Individuals of Protopomagalhaenisia sp. were readily diagnosed by the long, filiform nature of the gamont and the interlocking structure of the primitive–satellite junction (Figs. 22, 23). Individuals of Gregarina sp. were provisionally diagnosed based on the general structure of the gamont, the form of the association, and distinct spherical epimerite (Figs. 24, 25). A more complete diagnosis of this taxon is impossible without data on gametocytes and oocysts that were not recovered. Observed prevalences of Protopomagalhaenisia sp. and Gregarina sp. were 1.4% (1 of 69 beetles examined post mortem) and
11.6% (8 of 69 beetles examined post mortem), respectively. Specimens of *Protomagalhaensia* sp. are found on author’s slide REC980479. Specimens of *Gregarina* sp. are found on author’s slides REC980261, REC980269, REC980274, REC980275, REC980298, REC980480, and REC980481. Additional survey of *T. pruinosa* is warranted to provide complete descriptions and diagnoses of the gregarine assemblage inhabiting this beetle.

ACKNOWLEDGMENTS

I appreciate the use of facilities at the University of Nebraska’s Cedar Point Biological Station, Keith County, Nebraska and I thank the CPBS Director and Assistant Director, John Janovy, Jr. and Mary Batterson, for accommodating my research, students, and family at CPBS. This material is based upon work supported by the National Science Foundation under grant DEB-97-05179.

LITERATURE CITED


