

Bionomics and Distribution of *Stethorus caseyi* Gordon & Chapin (Coleoptera: Coccinellidae), with Description of the Mature Larva

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Abstract. The larva of *Stethorus caseyi* Gordon & Chapin is described. This species was collected at several sites on the Texas High Plains, where it was found feeding upon colonies of tetranychid spider mites on corn, *Zea mays* L. The mature (fourth instar) larva is described and illustrated. A diagnosis is provided, separating the larva of *S. caseyi* from that of the two other *Stethorus* species (*Stethorus nigripes* Kapur and *Stethorus histrio* Chazeau) collected in the same geographical and ecological area. A discussion of the geographic range of *S. caseyi* is presented, especially in comparison with the two other introduced species with which it is sympatric in West Texas.

Introduction

The coccinellid genus *Stethorus* Weise is atypical among ladybird beetles for several reasons, the most significant of which is the prey preference of these beetles. Although the habits of all species have not been documented, it seems there is uniform preference of these beetles for spider mites (Acari:Tetranychidae), many of which are economically important. Various species of *Stethorus* have been studied and/or used in biological control of spider mites on various crops (e.g. Readshaw 1975, Field 1979, Hoy and Smith 1982, Congdon et al. 1993). Recently, we documented the presence of two species of *Stethorus* (*Stethorus nigripes* Kapur and *Stethorus histrio* Chazeau) in fields of corn, *Zea mays* L., in the Texas Panhandle (Pollock and Michels 2002, 2003). Both species were introduced to North America, although the exact route they took to the United States, and Texas specifically, is unknown. A third species, *Stethorus caseyi* Gordon & Chapin, was also collected from corn fields in the study area, although it was always less abundant than *S. nigripes*. It is likely, however, that *S. caseyi* is important in its ability to feed on large numbers of the Banks grass mite, *Oligonychus pratensis* (Banks), in corn fields.

Among the three species of *Stethorus* collected in northern Texas, larvae of two of them are adequately described and/or illustrated: *S. nigripes* [Britton and Lee 1972 (as *Stethorus loxtoni*), Houston 1980] and *S. histrio* (Britton and Lee 1972, Gordon and Anderson 1979, Houston 1980). No published descriptions or illustrations exist for larvae of *S. caseyi*; these are presented for the first time in this paper, the purposes of which are to document the distribution of *S. caseyi* in Texas and to provide the first detailed description of the mature larva of this species.

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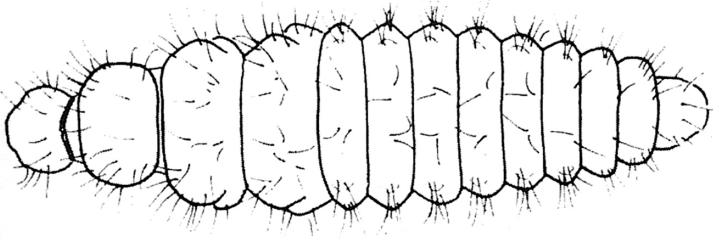
Results and Discussion

The type locality for *S. caseyi* is Devils River, Val Verde Co., TX. Other records by Gordon and Chapin (1983) indicate that *S. caseyi* is restricted to southwestern USA (AZ, NM, TX, UT) and adjoining northern Mexico (Sonora). In the summer of 2000, during a survey of *Stethorus* species in the Texas Panhandle, many corn fields were found to be infested with Banks grass mite with corresponding large numbers of *S. nigripes*. Larvae of *S. nigripes* are small, pinkish, and without conspicuous setation; adults are very small, with black bodies and appendages. In a field near Groom, Carson Co., TX, a larger *Stethorus* adult with yellow appendages was collected and identified as *S. caseyi*. This prompted a search for the corresponding larva, several of which were eventually discovered feeding within a large colony of mites on the underside of a corn leaf. Additional adults and larvae of *S. caseyi* subsequently were collected from several other corn fields in Carson, Castro and Potter Counties, Texas. These new records represent the northernmost and easternmost records for *S. caseyi*. Whenever adults and/or larvae of *S. caseyi* were encountered, they were found in association with either *S. nigripes* or *S. histrio*, although always in much lower numbers than either of the other two species. Adults were brought into the laboratory for rearing in order to get associated larvae of all instars, and to obtain data on food preferences, longevity, and other aspects of their life history. Of particular interest was their feeding behavior, because this could have possible biological control implications. *Stethorus caseyi* larvae in all four instars were observed to feed upon eggs, larvae, nymphs and adults of Banks grass mite.

The following description is based on a series of four mature (fourth instar) larvae, collected from colonies of Banks grass mite in a corn field near Groom, Carson County, TX. Specific identification of the larvae was based initially on adults associated with larvae in the field, and then on subsequently reared and associated life stages. For ease of comparison and for consistency, the organization of the description of *S. caseyi* and the characters discussed therein is based on that of *S. histrio* by Gordon and Anderson (1979).

Body (Fig. 1) elongate, relatively narrow, widest at metathorax; length 1.93-2.52 mm (average = 2.23 mm); entire dorsal surface of larva darkly pigmented, appearing greyish to black in life. Head (Fig. 2) subquadrate, distinctly wider than long, lateral margins of head capsule slightly arcuate; head covered by sparse, but elongate, stout setae, narrowed before apices; 1 large dorsal, and 1 large ventral stemma, directed anteriorly; single smaller stemma posterad of two larger stemmata [the smaller stemmata thought by Putman (1955: 507) to be "possibly functionless"]. Antennae rather inconspicuous, with single, broad, very short segment; antenna bearing elongate, tapering, sensillum, distinctly longer than 1st antennomere. Labrum with anterior margin arcuate, rounded laterally. Mandibles relatively small, symmetrical and falcate, internal groove present; apices unidentate; base of mandible with broad molar process with prostheca; posterolateral corner of mandible with very long, stout seta. Maxilla with fused cardo, stipes and palpifer; maxillary palpi distinct, relatively elongate, with three articles; 3rd palpomere conical, slightly longer than lengths of palpomeres 1 and 2 combined. Labium fused, with 2-segmented palpi, distal palpomere fusiform. Prothorax moderately transverse, rounded at sides; anterior and lateral margins with long, dark setae; setae not noticeably abruptly narrowed distally (c.f. *S. histrio*); disc of prothorax with mixture of short and long setae, with subquadrate, more darkly pigmented regions, separated by ecdysial line. Meso- and metathorax distinctly transverse, each with transverse, more darkly pigmented sclerite, narrowest medially and widened laterally; each sclerite ringed peripherally with long, dark setae; pleura of meso- and metathorax with small pigmented area, with 3-4 long setae; most of pleural regions and entire venter of thoracic segments light in color, not distinctly sclerotized; coxal articulating areas distinctly sclerotized. Thoracic spiracle small, rounded, inconspicuous. Legs relatively short, stout,

very sparsely clothed with scattered short setae; coxae elongate, somewhat conical, with single, elongate lateral seta; femur and tibia subequal in length; tarsungulus relatively short, with basal cleft, surrounded distally by group of elongate and distally spatulate setae. Abdomen elongate, dorsum of segments 1-7 each with 6 somewhat tuberculate, pigmented areas (strumae); strumae approximately of equal area, each with 2-4 elongate setae and 0-2 shorter, inconspicuous setae; dorsum of abdominal segments uniformly, darkly pigmented, not pigmented in pleural and ventral regions; venter of abdominal segments with single elongate seta on each side; abdominal segment 8 relatively narrower and more elongate than 1-7, struma more poorly defined; segment 9 without struma, with 2 transverse rows of relatively short setae. Abdominal spiracles small, circular, similar in size and shape to thoracic spiracle.



1



2



3

FIG. 1. 1, *Stethorus caseyi*, habitus of mature larva, scale bar = 0.5 mm; 2, *Stethorus caseyi*, larval head capsule, scale bar = 0.1 mm; 3, *Stethorus caseyi*, larval head capsule, detail, scale bar = 0.05 mm

Live larvae of *S. caseyi* are easily distinguished from those of *S. nigripes* and *S. histrio*, with which they were collected in several corn fields in West Texas during the summer of 2000. The most diagnostic characters for *S. caseyi* in the field are the larger size, very dark coloration, and conspicuous setation. Fourth-instar larvae of *S. nigripes* and *S.*

histrion are smaller on average than larvae of *S. caseyi*. Also, live larvae of *S. nigripes* are pinkish-grey, and larvae of *S. histrion* are very light grey. The darkly pigmented tergal sclerites on the meso- and metathorax are sharply delimited and highly contrasted against the light thoracic cuticle in *S. nigripes* and *S. histrion*. Also, the shapes of these tergites seem to be diagnostic for these two species (see Britton and Lee 1972, Gordon and Anderson 1979). The more darkly colored regions on the thoracic tergites of *S. caseyi* larvae are more diffuse in shape, and because of the dark ground color of the dorsum of the body, they are not as contrasting as in the previous two species. According to Gordon and Chapin (1983), *S. caseyi* belongs to the subgenus *Stethorus*, while *S. nigripes* and *S. histrion* are members of the subgenus *Parastethorus* Pang and Mao. These subgeneric taxa were based on adult characters. Once larvae of additional *Stethorus* species are described, larval features may corroborate this subgeneric classification.

None of the three species we collected was reported by Gordon (1985) to be in the Texas Panhandle. However, interest in *Stethorus* has often been restricted to perennial rather than ephemeral cropping systems, and therefore it follows that little research or survey work on *Stethorus* has been done in the Great Plains region of the United States. These studies (Pollock and Michels 2002, 2003) are the first to describe the species diversity of *Stethorus* in this region. Finding *S. histrion* and *S. nigripes* during this research, along with the relative rarity of *S. caseyi* may lead one to ask if *S. caseyi* was at one time the dominant *Stethorus* species in the Texas Panhandle, and if the former two species have had an impact on *S. caseyi*. Studies on other coccinellid species have shown that introductions of exotic species can displace native species. Examples include the seven-spotted ladybeetle, *Coccinella septempunctata* L., in Utah displacing native *Hippodamia* and *Coccinella* species from alfalfa, *Medicago sativa* L., (Evans 2004). Cormier et al. (2000) recorded a significant reduction in the native species *Coccinella trifasciata* L. and two-spotted ladybeetles, *Adalia bipunctata* (L.), in Nova Scotia after the introduction of seven-spotted ladybeetle, *Propylea quatuordecimpunctata* (L.) and *Hippodamia (Adonia) variegata* (Goeze). A review of potential displacements of native by exotic coccinellid species can be found in Obrycki et al. (2000).

Because no historical records exist for the *Stethorus* species in the Texas Panhandle, significant conclusions cannot be drawn about possible displacement of *S. caseyi* by the two introduced species. Surveys for all three species farther north and west in the Great Plains region may give insights about the distribution and abundance of *S. caseyi* before the arrival of *S. histrion* and *S. nigripes* in the Texas Panhandle, depending on the current distribution of the two exotics. According to Gordon (1985), *S. punctum* (LeConte) is the most widely distributed *Stethorus* species in North America, consisting of two subspecies with western (*S. p. punctum*) and eastern (*S. p. picipes* Casey) distributions, respectively. Again depending on the current distribution of *S. histrion* and *S. nigripes*, it may be possible to determine if the distribution of *S. punctum* also has been affected by the exotic species.

Speculations about the distribution of *Stethorus* species in the Great Plains point out the general lack of good historical records for this genus and the need to document more exact distributions. *Stethorus* can be an important biocontrol agent for tetranychid mites on corn and other ephemeral field crops (e.g., Hoy and Smith 1982). However, until the distribution and species diversity of these lady beetles are better understood, including detailed ecological studies, their potential as biocontrol agents will not be realized.

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