Banasa sordida (Uhler) (Hemiptera: Pentatomidae): Monterey Cypress and Gowen Cypress (*Cupressus macrocarpa, C. goveniana*; Cupressaceae) as Host Plants in Coastal California

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NOTE

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Banasa Stål is a New World pentatomine genus with greatest diversity along the Central American and Andean Cordillera; 11 species occur in the Nearctic Region (Thomas and Yonke 1981). Thomas and Yonke (1981) gave the distribution of *B. sordida* as "entire U.S., northern Mexico and southern Canada." Froeschner (1988) provided U.S. records for Arizona, California, Colorado, District of Columbia, Illinois, Maryland, Massachusetts, New Jersey, New Mexico, Utah, Virginia, and Washington, as well as Canadian records for British Columbia and Ontario. Omitted by Froeschner (1988) were previous records for New York, North Carolina, Ohio (references in McPherson 1980), and Oregon (Thomas and Yonke 1981). Hart's (1919) record of *B. sordida* from Maine might be a *lapsus* for Massachusetts because the latter state was noted to be the sole New England record (Parshley 1917, 1923). New state records, based on specimens in the National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM), are Kentucky (Green County) and Nebraska (Adams and Nemaha counties).

The wide ranges of *B. sordida* and *B. dimidiata* (Say), the only other North American species of the genus with a similarly wide distribution, might suggest that both are commonly collected North American stink bugs whose habits are well known. Although *B. dimidiata* probably qualifies as commonly collected and bionomically well known (Hart 1919, DeCoursey 1963, McPherson 1982, Thomas and Yonke 1981), *B. sordida* does not.

Uhler (1871) described *B. sordida* (as *Atomosira sordida*) without a locality. Van Duzee (1904) stated that Uhler had described the species from Maryland, Massachusetts, and Virginia, even though Uhler (1886) had listed it only from southern states ("S. St."). Van Duzee (1916) summarized the distribution as northern states and Canada and west of the eastern slopes of the Rocky Mountains ("N. & W."). Few or no records of *B. sordida* were available for several state or regional treatments of Pentatomidae. For example, the species was not recorded from Indiana (Blatchley 1926), Missouri (Froeschner 1941), Michigan (McPherson 1970, 1979), and Arkansas (Barton and Lee 1981, Chordas et al. 2005). Van Duzee (1917) listed *B. sordida* from Virginia, but Hoffman (1971) was unable to locate specimens from the state (USNM holdings include three old specimens from Falls Church). *Banasa sordida* recently was collected in Virginia (single specimens from each of two localities), which in view of collecting intensity is thought to reflect the bug's scarcity rather than undercollecting (Hoffman 2005). This pentatomid also is considered uncommon in Illinois (McPherson 1982), is sparsely known in North Carolina (three localities; Brimley 1938, Hoffman 2005) and Ohio (one locality; Furth 1974), and is unrecorded from South Carolina to Florida and west to Texas.

Host plants and habits of *B. sordida* long remained unknown (Blatchley 1926,

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Furth 1974), with collections from weeds (Van Duzee 1916), oak (Ruckes 1937), a sour cherry orchard (Phillips 1951), and soybean (USDA ARS 1964) failing to reveal actual host relationships. Reference, in passing, to the collection of *B. sordida* from Sargent cypress (*Cupressus sargentii* Jeps.) in California (Linsley and Usinger 1936) represented the first association of *B. sordida* with a cupressaceous plant. A firmer relationship with the Cupressaceae was established when Thomas and Yonke (1981) published label data from California specimens, documenting the collection of nymphs and adults from Lawson cypress (*Chamaecyparis lawsoniana* [A. Murray] Parl.). Additional specimen labels indicated that adults have been taken on eastern red cedar (*Juniperus virginiana* L.) in Missouri and *Juniperus* sp. in Oregon, and collected at blacklight among Utah juniper (*J. osteosperma* [Torr.] Little) in Arizona (Thomas and Yonke 1981). Adults also have been taken on *Juniperus* sp. in Nebraska (USNM).

Based on fieldwork in California, we give records of *B. sordida* from two additional species of the cupressaceous genus *Cupressus*: Monterey cypress (*C. macrocarpa* Hartw. ex Gord.) and Gowen cypress (*C. goveniana* Gord.). Both cypresses have populations that are disjunct, small, and relictual. Monterey cypress (Fig. 1) is native to only two locales—Point Lobos and Cypress Point (Del Monte

Figs. 1–4. *Banasa sordida* and its host plant, Monterey cypress (*Cupressus macrocarpa*). 1, Monterey cypress at Point Lobos State Natural Reserve on the central California coast near Carmel. 2–4, *B. sordida*. 2, Fifth instar on cone. 3–4, Adults on cones.

Forest)—on the Monterey Peninsula of California's central coast, but it has been planted extensively and become naturalized along the Pacific Coast. It also has been planted in tropical and warm-temperate areas worldwide. Gowen cypress shows a similarly restricted distribution slightly inland from groves of native Monterey cypress (Wolf 1948, Eckenwalder 1993, Barbour 2007). We use the more familiar generic name *Cupressus*, despite recent studies placing the New World species in *Callitropsis* (Little 2006) or *Hesperocyparis* (Adams et al. 2009), and follow Little (2006) and Adams et al. (2009) in recognizing Gowen cypress (*C. goveniana*) as distinct from *C. pygmaea* (Lemmon) Sarg.

We first encountered *B. sordida* in early April 2011 when nymphs (Fig. 2) and adults (Fig. 3) were observed on closed ovuliferous cones (fruits or strobili) of Monterey cypress planted along the California coast at Ragged Point, San Luis Obispo County. We obtained additional records of the pentatomid from other ornamental plantings of Monterey cypress in April and late July 2011 by tapping clusters of cones over a beating net with a shallow bag and collecting dislodged nymphs (which later were sorted to instar) and adults into plastic vials. The pentatomid's use of native Monterey and Gowen cypresses was documented in July at Point Lobos State Natural Reserve in Monterey County south of Carmel. Voucher material of *B. sordida* has been deposited mainly in the USNM, with four specimens placed in the New Mexico State University Arthropod Museum, Las Cruces.

Nymphs of all instars (n = 79), adults (n = 47), and exuviae (n = ~10) were collected on Monterey and Gowen cypress from Monterey County to southern Santa Barbara County. We regard both cypresses as hosts of *B. sordida*, even though our observations do not satisfy more strict criteria for establishing host use, such as feeding (e.g., Roderick and Percy 2008) and presence of nymphs for multiple years (Nielsen and Hamilton 2009). Fifth instars and adults were observed in early April on developing second-year cones of Monterey cypress in ornamental plantings. Cones used by *B. sordida* generally corresponded with Frankie's (1973) developmental category of 1.5 years. Late-July collections consisted of adults and all five nymphal instars from mature (or nearly mature) second-year cones (Frankie's [1973] 2-year category of cone development), with third through fifth instars more numerous than first and second instars. We did not observe *B. sordida* on earlier-stage, green cones or on the older, often deteriorating, woody cones that persist on trees. Nymphs sometimes were hidden from view in the interior of a cone cluster, and even though their reddish-brown coloration is darker than that of cypress cones, nymphs were not readily apparent on cone surfaces. Adults in April and July were distinctly green and red (Fig. 3) rather than "mottled with green and red" as Thomas and Yonke (1981) noted for many California specimens. A green and red color pattern makes the bugs less conspicuous among cypress cones and foliage (Fig. 4). When adults of *B. sordida* from cypress are killed, the red and green fades so that the coloration fits that described for the species: gray or grayish brown to nearly fuscous (Blatchley 1926, Thomas and Yonke 1981, Hoffman 2005).

Banasa sordida has been found on species of *Chamaecyparis*, *Cupressus*, and *Juniperus*, genera that belong to a cupressaceous group with similar development of ovuliferous cones (Farjon 2005), and might specialize on the Cupressaceae. Along the California coast, this pentatomid was common on Monterey

cypress in ornamental plantings and also was found on native Gowen and Monterey cypress on the Monterey Peninsula where the bugs would be exposed to maritime fog, salt spray, and wind. Four North American congeners also are known from cupressaceous hosts: *B. euchlora* Stål, *B. grisea* Ruckes, *B. packardi* Stål, and *B. tumidifrons* Thomas and Yonke (Thomas and Yonke 1981).

The occurrence of *B. sordida* on native Monterey and Gowen cypress in "ecologic islands" (Schoenherr 1995) in the Monterey Bay area where plant endemism is common (Griffin 1978, Schoenherr 1995) and on the serpentine-endemic Sargent cypress (Linsley and Usinger 1936, Eckenwalder 1993), coupled with the bug's wide range and extent of intraspecific variation (Thomas and Yonke 1981), suggests the possibility of a cryptic-species complex. Studies, however, have not been conducted on *Banasa* to test that hypothesis.

Specimens examined (all collected in 2011 by B.A.K. & A.G.W.; numbers for each nymphal instar are indicated as Arabic numerals, followed by a dash and Roman numerals indicating instars)—CALIFORNIA: Monterey Co., Point Lobos State Natural Reserve, Cypress Grove Trail, 36°31.249–260′N 121°57.041–089′W, 29 July, 1♂, 1–I, 5–II ex native *Cupressus macrocarpa*; Point Lobos State Natural Reserve, Lobos Ranch, 36°30.597′N 121°55.808′W, 29 July, 3♂, 5♀, 2–III, 1–IV ex native *C. goveniana*; Rt. 1 S of jct. with Struve Rd. N of Moss Landing, 36°49.302′N 121°47.062′W, 28 July, 1♂, 1–I, 4–II, 5–III, 11–IV, 11–V ex planted *C. macrocarpa*; Seaside, NE of Rt. 1 exit 404, 36°37.780′N 121°50.190′W, 9 April, 12♂, 14♀, 6–V & 28 July, 1–II, 2–III, 3–IV, 4–V ex planted *C. macrocarpa*; Neeson Rd. SE of Marina, 36°41.2′N 121°46.6′W, 28 July, 1–V ex planted *C. macrocarpa*. San Luis Obispo Co., Rt. 1, Cambria, 35°34.680′N 121°06.841′W, 8 April, 1♂, 1–V ex planted *C. macrocarpa*; Rt. 1, Ragged Point, 35°46.826′N 121°19.922′W, 7 April, 4♂, 3♀, 3–V ex planted *C. macrocarpa*; San Luis Obispo, 35°14.875′N 120°40.319′W, 30 July, 1♂, 3–II, 3–III, 2–IV, 7–V ex planted *C. macrocarpa*. Santa Barbara Co., Rt. 1 exit 113 E of Naples, 34°26.606′N 119°57.297′W, 30 July, 1♂, 1♀, 1–II, 1–III ex planted *C. macrocarpa*.

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