

**HARMONIA AXYRIDIS (PALLAS), THE THIRD SPECIES OF THE
GENUS TO BE FOUND IN THE UNITED STATES
(COLEOPTERA: COCCINELLIDAE)**

J. B. CHAPIN AND V. A. BROU

(JBC) Department of Entomology, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, Louisiana 70803-1710; (VAB) 74320 Jack Loyd Road, Abita Springs, Louisiana 70420.

Abstract.—*Harmonia axyridis* (Pallas), an Old World Coccinellini, is reported as established in southeastern Louisiana. A few specimens were also collected in eastern Mississippi. The species is described, illustrated, and compared to *H. dimidiata* (F.) and *H. quadripunctata* (Pontopiddian).

Key Words: Coleoptera, Coccinellidae, *Harmonia*

A lady beetle, not previously known to be established in the United States, was collected near Abita Springs, St. Tammany Parish, and in other southeastern Louisiana parishes. A few specimens were also collected in eastern Mississippi. *Harmonia axyridis* (Pallas) occurs in southern Siberia, Manchuria, China, Formosa, Korea, Japan, Ryukyu Islands, and the Bonin Islands (Dobzhansky 1933, Timberlake 1943, Chapin 1965, Iablokoff-Khnzorian 1982). Specimens of this species were released in California in 1916, 1964, and 1965 (Gordon 1985) and in Nova Scotia, Connecticut, District of Columbia, Delaware, Georgia, Louisiana, Maine, Maryland, Mississippi, Ohio, Pennsylvania, and Washington from 1978 to 1982 (Gordon 1985, P. W. Schaefer, pers. comm.). Specimens were also released in Connecticut in 1985 during a study of the potential of *H. axyridis* to control *Matsucoccus resinosae* Bean and Godwin (McClure 1987).

Japan was the country of origin of the specimens released in Louisiana and Mississippi. A single release of 32 specimens

was made in Shreveport, Bossier [sic] Parish, on August 24, 1979, and eight releases of 3781 specimens were made in Leland and Stoneville in Washington County, Mississippi, from July 12 to October 23, 1980 (P. W. Schaefer, pers. comm.). There were no subsequent reports that this species had become established.

***Harmonia axyridis* (Pallas)**

Figs. 1-6

Diagnosis.—Form oval, convex. Head straw-yellow, immaculate, with two longitudinal rows of faint spots, or with black spot on clypeus sometimes extending onto labrum and head. Antennae and mouthparts yellow-brown, sometimes tinged with black. Pronotum straw-yellow with four black spots and usually a faint mark above scutellum, or lateral spots joined to form two curved lines or an M-shaped mark extending to anterior margin, occasionally center of pronotum black. Scutellum straw-yellow. Elytra yellow-orange, each elytron in fully maculate individuals with faint mark

behind scutellum, two spots at one-fifth, three spots in semicircle at two-fifths, three spots at three-fifths, and one spot at four-fifths, these black spots variously reduced or absent; each elytron usually with transverse plica anterior to apex (Fig. 1). Ventral surface yellow-orange to black, hypomeron, epimera, epipleura, and lateral abdominal margins paler. Intercostal process of prosternum with carinae. Legs yellow-brown varying to black with posterior side of middle and hind legs and tarsi paler. Length, 4.81–7.47 mm; width, 3.90–5.89 mm.

Locality data. — The majority of the more than 1000 specimens were collected by V. A. Brou at his home located 4.2 miles north-east of Abita Springs (Sec. 24, T6, SR12E) using six light traps of varying wattages, ranging from 60–2500 watts per trap. Usually a combination of ultraviolet light sources were used on the traps, including fluorescent blacklights and high intensity discharge lamps, e.g. mercury vapor. The traps operated from dusk to dawn and were controlled by photoelectric cells. Specimens first appeared on July 20, August 8 and 20, October 22, and November 17 in 1988. No specimens were seen previously even though the light traps had been operating 365 nights per year since 1982 at this same location. In 1989, specimens were taken on January 26 and from March 19 to December 27. In 1990, they were collected on January 13 and 22 and from February 2 through September 16 and were present through December. Larvae and adults were collected on crabapple trees infested with *Aphis spiraecola* Patch in May. This species is now the most common lady beetle at this site. Additional specimens were collected in July 1990, by the senior author and V. L. Moseley on crapemyrtles infested with *Tinocallis kahowaluokalani* (Kirkaldy) in the following southeastern parishes: Jefferson (Metairie), Orleans (New Orleans), St. Helena (Greensburg), St. Tammany (Covington, Folsom), Tangipahoa (Hammond), and Washington (Franklinton). The following specimens were

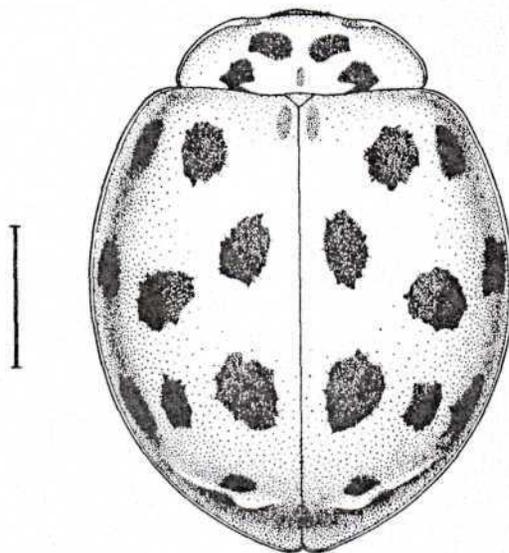


Fig. 1. *Harmonia axyridis*, habitus; scale bar = 2 mm.

collected in Mississippi counties: 1, Calhoun (5.5 miles north of Vardaman, black-light trap in sweetpotato field), August 9, 1990, James Jarrett; 3, Harrison (T5S, R13W, Sec. 1, old field habitat on senescent *Erigeron*), November 15, 1990, T. C. Lockley; 1, Panola (2 miles south of Crenshaw), October 6, 1990, S. Jones (student collection) (MSU).

Comments. — The variability of the color pattern has led to the description of more than 100 forms (see Korschefsky 1932 for synonymy). Twenty-four of these patterns were portrayed by Ayala (1978). Only the pale forms are found in Louisiana and Mississippi, including *frigida* Mulsant, *novemdecimsignata* Falderman, and *succinea* Hope which are more common in the Maritime Province of Russia, Korea, Manchuria, and China. In southwestern Siberia, black forms with one to several pale spots predominate (Dobzhansky 1933). In Japan, the percentage of the pale form, *succinea*, decreases gradually from northeast to southwest while one of the dark forms, *conspicua*, increases conversely; two other dark forms do not show such a gradient (Komai 1956). Iablo-

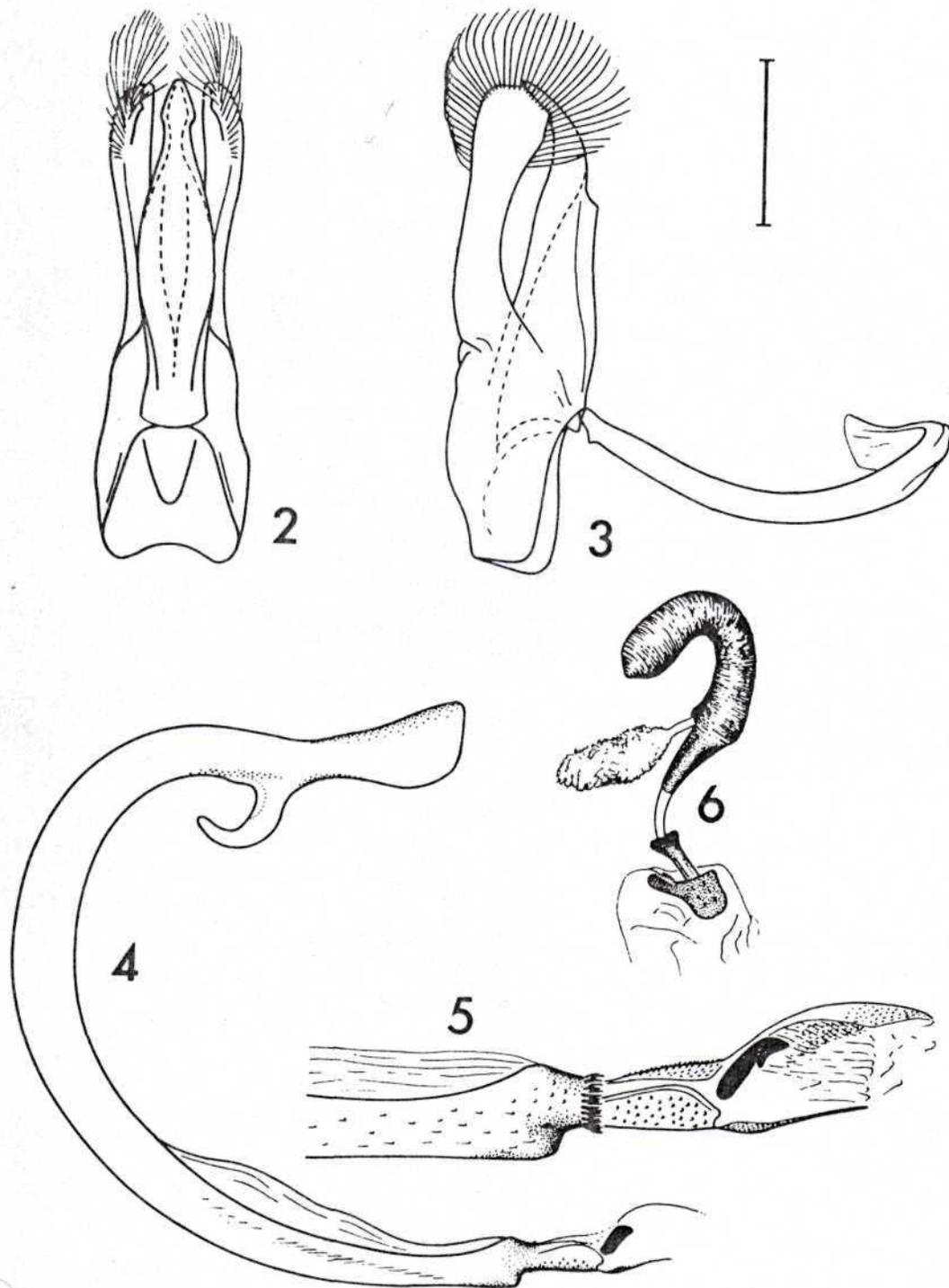
koff-Khnzorian (1982) summarized the information known about this species, some of which is included in Hodek (1973). Some of this data, including the host information given below, may refer to *H. yedoensis* (Takizawa), a closely related species that occurs in China, Korea, Japan, Ryukyu, and Taiwan.

Two other species of *Harmonia* occur in the U.S. *Harmonia dimidiata* (F.) was introduced from China into California and then to Florida in 1926 where it became established (Gordon 1985). *Harmonia quadripunctata* (Pontopiddian), which may have been accidentally introduced, was reported from New Jersey and New York and has been in the U.S. since 1924 (Vandenberg 1990). Specimens of *H. axyridis* are broadly oval; the pronotal pattern consists of four to five black spots, two curved lines, an M-shaped mark, or the center of the pronotum is black; in addition to the spot behind the scutellum, each elytron has nine black spots arranged in a 2,3,3,1 pattern, or the spots are variously reduced or absent; and a transverse plica, which is lacking in the other two species, is usually present near the elytral apex. *Harmonia quadripunctata* is more elongate in shape with 11 punctiform black spots on the pronotum, one or two pairs sometimes faint or absent; the elytron is immaculate or has a pair of elongate black marks at the lateral margin on either side of the mid-line (Vandenberg 1990); and the prosternal carinae, present in the other two species, are absent (Iablokoff-Khnzorian 1982). Specimens of *H. dimidiata* are round and very convex with a bilobed black spot at the base of the pronotum and seven black spots arranged in a 1,3,2,1 pattern on each elytron.

With the addition of two more species of *Harmonia* to our fauna, the key to the genera of Coccinellini (Gordon 1985, p. 681) needs to be modified as follows:

- | | | |
|---------|--|---------------------------|
| 9(6). | Apex of each middle and hind tibia without spurs | 10 |
| - | Apex of each middle and hind tibia with 2 spurs (Fig. 626a) | 12 |
| 10(9). | Postcoxal line on first abdominal segment with oblique dividing line | 11 |
| - | Postcoxal line on first abdominal segment without oblique dividing line | |
| | <i>Mulsantina</i> Weise | |
| 11(10). | Prosternal carinae ending at anterior coxal margin | <i>Neoharmonia</i> Crotch |
| - | Prosternal carinae extending anterior to the anterior coxal margin or absent | <i>Harmonia</i> Mulsant |
| 12(9). | Prosternum strongly convex medially, protuberant at apex (Fig. 614b); mesosternum deeply emarginate for reception of sternal process | <i>Anatis</i> Mulsant |
| - | Prosternum normally rounded, not protuberant at apex; mesosternum truncate or weakly emarginate for reception of prosternal process | 13 |
| 13(12). | Postcoxal line on first abdominal sternum complete, of the <i>Pullus</i> type (Fig. 637a) | <i>Adalia</i> Mulsant |
| - | Postcoxal line on first abdominal sternum incomplete, of the <i>Diomus</i> or <i>Nephus</i> type (Figs. 634b, 682a) | 14 |
| 14(13). | Elytron yellow with black sutural margin and 4 black spots (Fig. 672g), spots often somewhat coalesced; pronotal hypomeron with shallow fovea; Oriental genus, one species possibly established in Florida | <i>Coelophora</i> Mulsant |
| - | Elytron with color pattern not resembling that of <i>Coelophora</i> ; pronotal hypomeron without shallow fovea; North American or European genera | 15 |
| 15(14). | Tarsal claw with median tooth (Fig. 626a) | <i>Myzia</i> LeConte |
| - | Tarsal claw with subquadrate basal tooth (Fig. 664b) | 16 |
| 16(15). | Pronotal surface polished, shiny, not alutaceous between punctures .. | <i>Calvia</i> Mulsant |
| - | Pronotal surface alutaceous, often dull, not polished | 17 |
| 17(16). | Pronotum black with large, subtrapezoidal or triangular white spot on each anterolateral angle (Fig. 643g) (apical margin of pronotum sometimes narrowly pale) | <i>Coccinella</i> L. |
| - | Pronotum not as above | 18 |
| 18(17). | Postcoxal line on first abdominal sternum with oblique dividing line | <i>Olla</i> Casey |
| - | Postcoxal line on first abdominal sternum without oblique dividing line | 19 |
| 19(18). | Apex of mesosternum notched for reception of prosternal process; European genus, one species presently established in | |

th
 ... 12
 ... 11
 ...
 Weise
 ...
 Crotch
 to
 ...
 fulsant
 ly,
 er-
 of
 fulsant
 o-
 ite
 of
 ... 13
 m
 (a)
 fulsant
 m
 pe
 ... 14
 in
 en
 te-
 is,
 da
 fulsant
 ng
 on
 an
 ... 15
 (a)
 Conte
 th
 ... 16
 u-
 fulsant
 ot
 ... 17
 be-
 ch
 cal
 /ly
 ella L.
 ... 18
 im
 Casey
 im
 ... 19
 p-
 ge-
 in



Figs. 2-6. *Harmonia axyridis*, male and female genitalia. Figs. 2, 3, ventral and lateral views of phallobase without and with trabses. Figs. 4, 5, entire siphon and enlarged view of distal end. Fig. 6, spermathecal capsule, sperm duct and infundibulum.

southeastern Canada, Vermont, and New York¹ *Propylaea* Mulsant
 - Apex of mesosternum truncate; occurring over most of North America from southern Canada to Mexico *Cycloneda* Crotch

Koebele's field notes (Timberlake 1943) indicated that *H. axyridis* was common in Japan on various aphid-infested trees, such as maple, walnut, and willow, and also on rose. It fed on *Lachnus* sp. on *Podocarpus* and *Kermaphis pini* (Koch) [= *Pineus pini* (Koch)] on pine in Japan, on *Lachnus* sp. on *Pinus sinensis* at Hongkong, China, and was collected on *Lachnus* infested pine in Formosa. Iablokoff-Khnzorian (1982) also stated that it was arboreal, that it was found on rosaceous arborescents and also on oak and other trees, and that it was chiefly an aphid feeder although it fed on *Icerya purchasi* Maskell (Margarodidae), *Phenacoccus pergandei* Cockerell (Pseudococcidae) and *Anomoneura mori* Schwarz (Psyllidae), at least in the laboratory. Preferred aphid hosts given by Iablokoff-Khnzorian (1982), some of which were listed by Hodek (1973), are as follows: *Acyrtosiphon pisum* (Harris), *Amphorophora oleracea* v.d. Goot [= *Hyperomyzus carduellinus* (Theobald)], *Aphis pomi* De Geer, *Cinara laricicola* (Börner) [= *C. cuneomaculata* (del Guercio)] (?), *C. todocola* (Inouye) (?), *Cryptosiphum gallarum* (Kaltenbach) [= *C. artemisiae* Buckton], *Eriosoma lanigerum* (Hausmann), *Hyalopterus pruni* (Geoffrey), *Macrosiphum rosae ibarae* Matsumura, *Megoura viciae japonica* (Matsumura) [= *Uroleucon giganteum* Matsumura], *Myzus malisucta* Matsumura [= *Ovatus malisuctus* (Matsumura)], *M. persicae* (Sulzer), *Neophyllaphis podocarpi* Takahashi, *Nippolachnus piri* Matsumura, *Periphyllus californiensis* (Shinji), *Rhopalosiphum pseudobrassicae* Davis [= *Lipaphis erysimi* (Kaltenbach)], *R. prunifoliae* Shinji [= *Capitophorus prunifoliae* (Shinji)],

¹ Dysart, R. J. 1988. J. New York Entomol. Soc. 96: 119-121.

Toxoptera piricola Matsumura [= *Schizaphis piricola* (Matsumura)]. Yasumatsu and Watanabe (1964) listed 13 hosts including *Cinara kochi* Inouye, *Hyalopterus pinni* Matsumura, and *Chrysomela vicintipunctata* Scopoli. Fuyuan and Dongxi (1989) reported the control of *Nesticoccus sinensis* Tang (Pseudococcidae) and *Rhizococcus transversus* (Eriococcidae) after coccinellids, predominately *H. axyridis* and *H. obscuroidesignata* (Liu-Chung-Lo), were attracted to aphid-infested rape interplanted in the bamboo forest.

ACKNOWLEDGMENTS

The authors wish to thank R. D. Gordon, USDA Systematic Entomology Laboratory, Washington, D.C., for confirming the identification of *H. axyridis*; M. B. Stoetzel, USDA Systematic Entomology Laboratory, Beltsville, Md., for identifying *A. spiraeicola*; Terence Schiefer, Mississippi State University (MSU), Starkville, Miss., for permission to use the label data on the Mississippi specimens; K. A. Westphal for the illustrations; V. L. Moseley, D. A. Rider, and L. H. Rolston, Louisiana State University, and P. W. Schaeffer, USDA Beneficial Insects Research Laboratory, for reviewing earlier drafts of this manuscript. Approved for publication by the Director of the Louisiana Agricultural Experiment Station as manuscript number 90-17-4432.

LITERATURE CITED

- Ayala, F. J. 1978. The mechanisms of evolution. *Scientific American* 239: 56-69.
 Chapin, E. A. 1965. Coccinellidae. In *Insects of Micronesia*. Coleoptera. Bernice P. Bishop Museum, Honolulu, Hawaii 16: 189-254.
 Dobzhansky, T. 1933. Geographical variation in ladybeetles. *The American Naturalist* 67: 97-126.
 Fuyuan, X. and W. Dongxi. 1989. Control of bamboo scale insects by intercropping rape in the bamboo forest to attract coccinellid beetles. *Chinese Journal of Biological Control* 5: 117-119.
 Gordon, R. D. 1985. The Coccinellidae (Coleoptera) of America north of Mexico. *Journal of the New York Entomological Society* 93: 1-912.
 Hodek, I. 1973. *Biology of Coccinellidae*. Academia,

Schiza-
tsu and
 cluding
s pinni
tipunc-
 989) *re-*
sinensis
ococcus
occinel-
l H. ob-
attract-
 d in the

- Czechoslovak Academy of Sciences, Prague. 260 pp.
- Iablokoff-Khnzorian, S. M. 1982. Les Coccinelles Coléoptères-Coccinellidae, Tribu Coccinellini des Régions Paléarctique et Orientale. Société Nouvelle des Editions Boubée, Paris. 568 pp.
- Komai, T. 1956. Genetics of ladybeetles, pp. 155-188. In Demerec, A., ed., Advances in Genetics. Vol. 8. Academic Press, New York.
- Korschefsky, R. 1932. Coccinellidae II, pp. 224-659. In Junk-Schenkling. Coleopterorum Catalogus, pars 120. Junk, Berlin.
- McClure, M. S. 1987. Potential of the Asian predator, *Harmonia axyridis* Pallas (Coleoptera: Coccinellidae), to control *Matsucoccus resinosae* Bean and Godwin (Homoptera: Margarodidae) in the United States. Environmental Entomology 16: 224-230.
- Timberlake, P. H. 1943. The Coccinellidae or ladybeetles of the Koebele collection—Part I. Hawaiian Planters' Record 47: 1-67.
- Vandenberg, N. J. 1990. First North American records for *Harmonia quadripunctata* (Pontopidian) (Coleoptera: Coccinellidae); a lady beetle native to the Palearctic. Proceedings of the Entomological Society of Washington 92: 407-410.
- Yasumatsu, K. and C. Watanabe. 1964. A Tentative Catalogue of Insect Natural Enemies Of Injurious Insects in Japan. Part I. Parasite-Predator Host Catalogue. Kyushu University, Fukuoka, Japan. 166 pp.

Gordon,
 oratory,
 he iden-
 stoetzel,
 oratory,
spirae-
 pi State
 iss., for
 the Mis-
 l for the
 .. Rider,
 ite Uni-
 A Bene-
 , for re-
 uscript.
 Director
 eriment
 17-4432.

lution. Sci-

ects of Mi-
 Museum,

on in lady-
 17-126.
 of bamboo
 re bamboo
 inese Jour-

(Coleoptera)
 of the New
 l.
 Academia,