Observations on the Life History of Pycnoscelus surinamensis (Linn.), the Intermediate Host of the Chicken Eyeworm in Hawaii

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INTRODUCTION

In beginning a study of the life history of *Oxyspirura mansoni* (Cobbold), the eyeworm of chickens in Hawaii, the author was impressed with the virtual lack of information in the literature concerning the life history and habits of its only known intermediate host, the cockroach, *Pycnoscelus surinamensis* (Linn.). Some observations which have been made on the biology of the roach are herein presented.

SYNONYMY

Blatta surinamensis Linn. (1758 and 1767), *Blatta punctata* Eschscholtz (1822), *Panchlora surinamensis* Guer. (1838), *Pycnoscelus obscurus* Scudd. (1862), *Leucophaea surinamensis* Brunn. (1865), *Blatta indica* Fabr., *Blatta melanocephala* Stoll, *Blatta corticum* Serville, *Panchlora celebesa* Walker, *Panchlora submarginata* Walker, *Panchlora occipitalis* Walker.

DISCUSSION

The Surinam roach is an important insect pest for which no satisfactory biological control yet exists in Hawaii. In certain localities it has become established as a greenhouse pest and has done considerable damage to the bark of roses and lilies. It is also reported to feed upon the roots of the pineapple, the potato tuber, and other plants. It serves as the only known intermediate host of *Oxyspirura mansoni,* a nematode parasite commonly found beneath the nictitating membrane and in the conjunctival sac of domestic fowl and a number of wild birds.

The presence of *Pycnoscelus surinamensis* in the Hawaiian Islands was first reported by Eschscholtz in 1822. Subsequent observations indicate that the roach is widespread, and at the present time it may be found in abundance on Oahu, Kaui, Molokai, Maui, Lanai, Nihoa, Hawaii, Pearl and Hermes Reef, and French Frigate Shoal.

It is thought by some workers to be originally an Oriental species, but today it is considered circumtropical, having been reported from the following localities: Florida, Louisiana, Texas, and Hawaii in the United States; Cuba and Puerto Rico (Rehn, 1903); the Bahama Islands (Morse, 1905, and Hutson, 1938); the Dominican Republic (Caudell, 1914); Trinidad (Bruner, 1906);

Barbados, Martinique, Grenada, St. Vincent, Jamaica, Mexico, Costa Rica, Guiana, and Brazil (North Am. Orthoptera, 1901); Bermuda (Scudder, 1897); Lower Spain, Africa (Senegal), China (Amoy), and the Philippine Islands (North Am. Orthoptera, 1901); Singapore (Ehrhorn, 1916); Java, Sumatra and the Dutch East Indies (Picard, 1929); Japan and Formosa (Kobayashi, 1927); and Australia (Fielding, 1926).

The normal habitat of the roach in Hawaii is in loose, sandy soil, or beneath trash and debris. It is found most commonly in or around chicken batteries and yards, where it subsists chiefly on chicken feces and other organic matter. The soil is literally teeming with the nymphs and adult roachs in such places, and all stages may be readily collected for study. They mostly remain hidden in the soil during the daylight hours, coming out on the surface to feed only at night. The younger nymphs are not nearly so averse to the light as the adults and larger nymphs; in fact, newborn nymphs in the laboratory exhibited a marked positive phototropism during the first several days of life.

When molested in the soil, the nymphs are considerably more active than the adults; all, however, rapidly seek cover. In random collections of adults the females were always found to be more abundant than the males, an observation which verifies the findings of Hebard (1917) and Zappe (1918), neither of whom found a single male in examination of thousands of roaches throughout the United States, Mexico, and the West Indies. Males are quite common here, however, as evidenced by the large number in the Orthoptera collections of the Entomology Department of the University of Hawaii.

The adult female roach is described by Hebard (1917) as follows:

> Form robust, structure rather heavy. Head flattened, eyes well developed. Maxillary palpi short and stout. Pronotum with glabrous surface, showing minute, rather widely spaced pits. Wings transparent except in narrow area of the irregular costal veins and distal portion of anterior field where they are translucent. Styles very short, joints much fused, accuminate tip flattened, dorsal surface weakly convex, ventral surface more strongly convex proximad. This species is easily separated from the other common cockroaches of North America by having the ventral margins of the femora unarmed, or supplied with distal spines. Head shining, blackish-brown; legs brown; tegmina translucent, blackish chestnut brown. Abdomen with dorsal surface dark brown [varies considerably; may be margined with white or dark bands], ventral surface polished, broadly margined with blackish-brown ... [various shades of brown have been observed]. Pronotum shining, blackish-brown, with marginal traces . . . [buff colored] latero-cephalad.

For field identification, the adult male may be distinguished from the female in that its wing covers completely cover the abdomen, while those of the female do not.

The mode of reproduction of *Pycnoscelus surinamensis* was previously unknown; several contradictory concepts being recorded in the literature, all apparently based on inadequate observations. To help clarify this situation, a large number of adult female

roaches were housed individually in the laboratory and periodically examined several times a day. The resultant observations coupled with those made in the normal habitat of the roach are herein presented.

The female Surinam roach forms an egg case about the individual eggs. The ootheca is carried internally during the period of gestation and is deposited or carried externally only under such unusual conditions as are outlined below. Normally reproduction is ovoviviparous, the nymphs hatching within the body of the female. Gravid females have on occasions, however, been observed in the soil with egg cases protruding from the ovipositor. Deposition of the ootheca may also be induced in the laboratory in some instances by excitation of the female. E. W. French reports (personal communication) that one small female deposited an egg case while in confinement and twenty-five days later deposited another. No egg cases thus obtained hatched under laboratory conditions, verifying the results of similar attempts by Zappe (1918).

Birth of living young has been observed a number of times by the author, usually at night or when the gravid female was kept in the darkness. It is accompanied by extreme nervousness on the part of the female, which becomes very excited, strains and distends her ovipositor enormously in attempting to expel the new born nymphs and the remainder of the egg case. She will frequently double up and drag the tip of the abdomen. They have been observed to grasp fragments of the ootheca with the hind limbs to facilitate extrusion. The size of broods born in the laboratory varied from thirty to thirty-six nymphs. On one occasion thirty-six hours elapsed between the birth of the first and last nymphs of a brood.

In *P. surinamensis* the egg case lies in the body of the female with the double row of embryos in a horizontal position, in contrast to the vertical position of the egg case of *Periplaneta americana* (Linn.) and other roaches. When accidentally deposited or dissected from the gravid female, the egg case is light cream in color, turning buff to tan upon exposure to the air. Those observed have not hardened, unlike those of oviparous roaches, and are therefore very susceptible to damage.

The ootheca consists of two rows of alternately spaced segments, each housing an embryonated egg. Between thirty and thirty-six segments have been counted on specimens studied, a range which corresponds to the number of nymphs per brood born in the laboratory. The egg case measures approximately 9 mm. by 3.5 mm. by 2.5 mm. Embryos dissected from the eggs were well advanced in development and their appearance was much the same as that of the new born nymphs described below.

The nymphs when born are a translucent white with orange-brown mandibles and spines, and are approximately 4.5 mm. in length. The head measures 1.1 mm. wide and 0.6 mm. long and the eye spots are darker than the remainder of the head. The

exoskeleton begins to harden upon exposure to the air and in 5 to 6 hours it is a glossy mahogany brown, the ventral surface and legs still remaining translucent. The fragments of the ootheca extruded by the female are usually devoured by the nymphs soon after birth.

SUMMARY

Observations on the habitat, mode of reproduction, and habits of *Pycnoscelus surinamensis,* the intermediate host of the chicken eyeworm in Hawaii, have been presented, with notes on the appearance of the egg case and the new born nymphs.

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