Nysius huttoni

Scientific Name
Nysius huttoni White

Synonyms:

Common Name(s)
Wheat bug, wheat seed bug, New Zealand wheat bug, Nysius bug

Type of Pest
True bug

Taxonomic Position
Class: Insecta, **Order:** Hemiptera, **Family:** Lygaeidae

Reason for Inclusion in Manual
CAPS Target: AHP Prioritized Pest List-2009

Pest Description
Notes on taxonomy: *Nysius huttoni* is an extremely variable species, with three inter-breeding forms based on the extent of wing development (Aukema et al., 2005).

Eggs: Oval, length about three times width; mean length about 0.8 mm, mean width about 0.3 mm. Straw yellow to creamy white; cephalic (head) end more orange when first laid, deep orange when about to hatch (Eyles, 1960).

Nymphs: Generally pale gray to orange (Fig. 1), marked with varying degrees of brown, black, and gray; length from about 0.5 mm in instar I to about 2.0 mm in instar V. Head dark brown to black with longitudinal pale gray to orange stripes. Instars I-IV with pronutum (and wing pads in instars III-IV) dark brown to black; in instar V, pronutum pinkish to gray, variably marked with brown and black, lateral margins and mesal line pale, apex of wing pads and broad U-shaped mark on pronotum black. Dorsal surface of abdomen grayish blue, each segment with transverse row of whitish spots surrounded by narrow red ring. Legs pale brown, spotted with black (Eyles,

Figure 1. Nymph of *N. huttoni*. Photo courtesy of HortNET , The Horticulture and Food Research Institute of New Zealand. www.bugwood.org

1960).

Adults: (Fig. 2) Length 3.5-4.3 mm; width 1.3-1.8 mm. Dorsally clothed with short, appressed, golden to silvery, sericeous pubescence, intermixed with erect, simple setae. Head wider than long, black, mesal area yellow to reddish yellow. Antennae about twice as long as head width, brown to black, 1st segment sometimes yellowish. Pronutum trapeziform, distinctly punctuate, brown, humeral angles and base of meson yellow; scutellum shiny black. Hemelytra brown, variably mottled and spotted with yellow, corial margins uniformly brown, apical margin of each corium bordering the membrane with three dark-brown spots sometimes coalesced into extensive dark area. Membrane nearly clear, cross-hatched with white lines, basal area often fuscous. Undersurface mostly black, abdomen mottled with yellow, coxal clefts yellow. Femora dark brown with apices, dorsal line, and edges broken by yellow, tibiae yellow, tarsi and claws yellow to brown (USDA, 1985).

Figure 2. Adult *N. huttoni*. Photo courtesy of Natasha Wright, Florida Department of Agriculture and Consumer Services, www.bugwood.org

Adults can be divided into three size groups: large (3.5-4.3 mm), medium-sized (3.0-3.8mm), and small (2.3-3.2 mm). All individuals of the large group are long winged or macropterous, but adults in the medium-sized and small groups have three forms ranging from macropterous, sub-bracypterous, to brachypterous (short winged) (Eyless, 1960).

Biology and Ecology

Nysius huttoni usually overwinters as an adult and undergoes reproductive diapause, which is induced by shortening daylengths during the late summer (Farrell and Stufkens, 1993). In lowland agricultural areas, the wheat bug overwinters as an adult under grasses and vegetable debris (Gurr, 1957). Early in the season this pest is associated with weeds, but the bug moves to wheat as most weeds mature and wheat reaches the milk-ripe stage. Adults appear in large numbers during the summer on clover and other plants near wheat crops. *Nysius huttoni* also attacks seedling Brassica crops, which provide the ideal open ground cover. Adults thrive under hot, dry conditions, preferring situations where sunlight reaches the ground. They are seldom found in dense vegetation. Adults hide under clods or debris on the ground when the temperature begins to fall in the evening and become active in the morning when the temperature rises. Rain inhibits activity (Gurr, 1957; USDA, 1985).

Mating occurs during the summer, with a single copulation fertilizing the female for life. One female may deposit singly or in clusters 25-248 eggs, usually in the cracks in the soil (Schaefer and Panizzi, 2000). Females may occasionally deposit eggs on host plants (He and Wang, 2000). Eggs hatch in about 10 days. Nymphs undergo five instars. The complete life cycle takes 50-65 days. There are at least three, possibly four, generations per year in New Zealand and two generations per year in the Netherlands and Belgium (Ferro, 1976; Aukema et al., 2005).

Long day lengths (16:8 and 14:10 h light: dark) promote a continuous lifecycle while short daylengths (12:12 and 10:14 h light: dark) slow up growth and development, promote the pre-mating period, and induce reproductive diapause (He et al., 2004). *N. huttoni* required 638.2, 648.88, and 637.21 degree days for the completion of its lifecycle at 20, 25, and 30 °C, respectively (He et al., 2003).

Symptoms/Signs

The wheat bug is a seed feeder, but may also feed on the foliage. Wheat is most vulnerable to damage at the flowering and grain filling stages of growth (Every et al., 1990). The bug attacks wheat kernels in the water ripe to milky ripe stages of development, piercing the grain and sucking out the juices. Damage usually occurs at field edges (USDA, 1985). When the bug-damaged grain matures, it is characterized by a dark insect-feeding puncture mark surrounded by a pale area on the surface. Some grains shrink to a cuboid shape when much endosperm is removed, presumably from prolonged feeding (Gurr, 1957). Seed germination is not affected by *N. huttoni.*

Because the wheat bug injects an enzyme during feeding, flour from damaged wheat ruins dough during breadmaking. The enzyme splits adjacent protein chains in dough, breaking down the dough structure, suddenly turning it runny and sticky. As few as three to four damaged grains per 1,000 produce flour unsuited for baking (Meredith, 1970).

Nysius huttoni is a particular problem on direct drilled *Brassica* crops. On *Brassica* spp., stems, petioles, and leaves are preferred for feeding. Damage to crucifer seedlings appears throughout the field. A cankerous growth, induced by feeding punctures, rings the stems at the ground level. The girdled seedlings collapse on their own or break in high winds (Gurr, 1957; USDA, 1985).

Nysius huttoni has been reported to reduce seed fill and see quality in white clover.

Pest Importance

The genus *Nysius* occurs in all biogeographic regions of the world, and has many species attacking agricultural and horticultural crops. The New Zealand native bug, *Nysius huttoni*, has a wide host range, including a variety of crops and

weeds. *N. huttoni* is an important pest of wheat and *Brassica* crops. The feeding of *N. huttoni* reduces the weight of grain but more importantly, adversely affects the flour. *N. huttoni* is also a serious pest of young *Brassica* spp.; its feeding eventually leads to seedling death ending in poor crop stands (USDA, 1985). Damage is often severe especially in dry districts and elsewhere in dry years when serious outbreaks occur (Gurr, 1957; USDA, 1985).

The worst outbreak on wheat was recorded in 1970. About 10,000 tons of wheat were damaged by *N. huttoni* (Swallow and Cressey, 1987). According to Ferguson (1994), up to 70% of immature rutabaga (swede) (*B. napus rapifera*) plants were lost through wind breakage after attack by *N. huttoni.*

N. huttoni injects a salivary proteinase into immature wheat kernals while feeding. This proteinase remains in flour made from bug-damaged wheat and, in dough, digests gluten to produce slack, sticky dough and poor quality bread (Every et al., 2005).

Furthermore, *N. huttoni* is often found as a hitchhiking pest in apple packages for export from New Zealand (Birtles et al, 1992; Lay Yee et al., 1997). The high tolerance of late instar nymphs and adults of *N. huttoni* to low temperatures (10 and 15°C) allows the pest to survive lengthy shipment times in infested fruit packages, although the pest could not complete its lifecycle at these temperatures. These features of *N. huttoni* raise major quarantine risks to countries that trade with New Zealand (He et al., 2003).

Known Hosts

Major hosts

Brassica napus (rapeseed, swede), *Brassica napus* var. *napobrassica* (rutabaga, swede), *Brassica oleracea* (broccoli), *Brassica rapa* (turnip), *Brassica* spp. (mustard), *Trifolium dubium* (small hop clover), *Trifolium pratense* (red clover), *Trifolium repens* (white clover), *Trifolium subterraneum* (subterranean clover), *Triticum aestivum* (wheat), and *Triticum* spp. (wheat).

Other hosts:

Aciphylla scott-thomsonii (giant Spaniard speargrass), *Agrostis capillaria* (bent grass), *Avena sativa* (oat), *Bromus* spp. (bromegrass), *Chionochloa rubra* (red tussock), *Hebe salicfolia* (koromiko), *Helianthus annus* (common sunflower), *Hordeum sativum* (barley), *Lactuca* spp. (lettuce), *Lathyrus* spp. (sweet, perennial pea), *Linum* spp. (flax), *Lolium* spp. (ryegrass), *Medicago sativa* (alfalfa), *Pinus radiata* (Monterey pine), *Poa caespitosa* (silver tussock), *Poa colensoi* (blue tussock), *Pyrus pyranica, Secale cereale* (rye), and *Spergularia rubra* (red sandspurry).

Weed hosts:

Anagallis arvensis (scarlet pimpernel), *Achillea millefolium* (common yarrow), *Calandrinia* spp. (redmaid), *Capsella bursa-pastoris* (shepherd's purse), *Cassinia leptophylla* (tauhinu), *Chenopodium album* (common lambs quarters), *Coronopus didymus* (lesser swinecress), *Cytisus scoparius* (scotchbroom), *Hieracium* spp. (hawkweeds), *Nassella trichotoma* (serrated tussock), *Polygonum aviculare* (prostrate

knotweed), *Polygonum maculosa*, *Rumex acetosella* (red sorrel), *Senecio inaequidens*, *Silene gallica* (English catchfly), *Soliva sessilis* (lawn burweed), *Stellaria media* (common chickweed), *Ulex europaeus* (common gorse), and *Verbascum thapsus* (common mullein).

It is also suggested that the presence of mosses (e.g. *Ceratodon, Sphagnum,* and *Polytrichum* spp.) may be crucial for the overwintering period.

Contaminant in:
Actinidia deliciosa (kiwi), *Fragaria* x *ananassa* (strawberry), *Malus domestica* (apple), and *Rubus* spp. (blackberry, raspberry).

Gurr (1957), Ferro (1976) and Scott (1984) suggest that strawberry and raspberry are also attacked but Farrell and Stufkens (1993) consider the presence of adults on strawberries and kiwifruit to be simply a contamination problem. It is stated that it is not a pest of apples although it has been found in consignments (Birtles *et al*., 1992).

Known Vectors (or associated organisms)
Nysius huttoni is not a known vector and does not have any associated organisms.

Known Distribution
Europe: Belgium, Netherlands. **Oceania:** New Zealand

Potential Distribution Within the United States
Nysius huttoni can move as nymphs and adults in commercial shipments of imported fruits and vegetables. In the Netherlands, *N. huttoni* has become extremely abundant raising concerns that this pest may be transported to the United States through trade. *Nysius huttoni* has been intercepted numerous times on plant species not recorded as hosts, which creates additional concern about this pest.

Research in New Zealand indicates that *N. huttoni* could establish in countries that experience temperatures higher than 15°C with a maximum population development occurring at 20°C to 30°C (He et al., 2003). The current distribution of *N. huttoni* in the Netherlands corresponds to U.S. plant hardiness zone 8 (Appendix E), indicating that *N. huttoni* is capable of establishing in areas with an average minimum temperature of -12.2°C (10°F) (NPAG, 2006). Zone 8 include areas of Washington, Oregon, California, Nevada, Arizona, New Mexico, Texas, Louisiana, Arkansas, Mississippi, Alabama, Georgia, Florida, South Carolina, and North Carolina. However, recent finds in Belgium and Netherlands suggest that zones 6 and 7 are also at risk. Zones 6 and 7 include a number of wheat producing states. A recent risk analysis by USDA-APHIS-PPQ-CPHST indicates that most states have areas of moderate risk for *N. huttoni* establishment based on host availability and climate within the continental United States.

Survey

CAPS-Approved Method: Visually inspect wheat kernels during the water ripe to milky ripe stages of development for piercing marks. Damage usually occurs at field edges

Literature-Based Methods:

Visual Survey: Survey is primarily conducted by visual examination of wheat. The bug attacks wheat kernels in the water ripe to milky ripe stages of development, piercing the grain and sucking out the juices, thus surveys should be conducted at this time. Damage usually occurs at field edges (USDA, 1985). Bug damage to mature wheat kernels can be easily recognized as pale, slightly elevated patches, often with one or more black or red dots considered to be the marks of bug stylet punctures, or pitting, blackening, and distortion (especially under the microscope) (Every et al., 1998). In wheat, different cultivars appear to be more susceptible to *N. huttoni* damage. In general, it appears that wheat of high bread quality, such as Otane, Oroua, Domino, and Batten, are less susceptible that poor bread quality wheat varieties, such as Karamu, WE378, ASPS9927, and ASPS9928 (Every et al., 1998).
In the Netherlands, *N. huttoni* is primarily found in areas with sparse vegetation surrounded by bare ground, such as in waste sites and other disturbed locations and not in crop fields. This may be typical of an early introduction and some time should be devoted to these areas. These sites contain an abundance of moss, which has led to speculation that moss may be necessary of overwintering in the Netherlands (NPAG, 2006).

Soil Sampling: The following methods have been utilized when the wheat bug was known to be present to quantify populations. Soil to a depth of 10 mm plus all plant material was removed from each quadrant (8 randomly placed 0.25m^2 quadrants), bagged, and taken to the laboratory (Farrell and Stufkens, 1993). After agitation in a 25% saline solution and removing the floatant, the retained material was examined under a microscope. All wheat bug development stages were identified.

Trapping: A flight trap was set up 1-2 m above the ground. The trap comprised two plates of 3 mm thick Perspex each 200 mm x 800 mm, interlocked to form a cruciform section baffle 800 mm high with four vanes projecting 100 mm from the center line. They were mounted over a 200 mm diameter funnel to receive the catch, opening into a collecting jar containing kerosene (Farrell and Stufkens, 1993). Additionally, wheat bugs flying at approximately 7.5 m above the ground were trapped in an enclosed suction trap equipped with a 300 mm diameter 2800 rpm aerofoil fan.

Key Diagnostics

CAPS-Approved Method: Confirmation of *Nysius huttoni* is by morphological identification. The size and color of *N. huttoni* bugs are extremely variable. The insects resemble many native lygaeids. Identification can be made by careful observation under a microscope by four key characters by a Hemipteran specialist.

Literature-Based Methods: Submit adults for identification in alcohol or mounted dry on triangular points (USDA, 1985).

Screening and identification aids are available at http://caps.ceris.purdue.edu/webfm_send/532 and http://caps.ceris.purdue.edu/webfm_send/533.

Easily Confused Pests

Nysius huttoni can be confused with 12 native *Nysius* species and *Rhypodes cognatus* (present in the United States) and *Nysius vinitor* (not present in United States).

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