

# Keys to Orders and Groups of Insects and Other Arthropods on Ornamentals

*Adapted from North Carolina State University*

Following are four keys, one for adults and three for immature stages. In general, adults are most easily differentiated. However, it is not always easy to tell if a pest that is not winged is mature or immature. The following may help to decide which key to use: (1) If a pest has wings, it is an adult (insect). (2) If a pest is mating, laying eggs, or giving birth to young, it is an adult.

Immature pests (and wingless adults) may not be easy to distinguish; therefore, in keys to immature pests, the pests have been broken down by the portion of the plant infested.

## KEY TO ADULTS

1. Wings present (Fig. 59A to F) - 2

Wingless (Fig. 59G to N) - 10

2. Front pair of wings (the wings that lie on top when folded) partially or completely thickened and leathery (Fig. 60A to C) - 3

Front pair of wings flexible and papery, sometimes clear (Fig. 60D to H) - 5

3. Front pair of wings usually hard, thick, opaque, and lacking veins (Fig. 61A); chewing type (Fig. 61B to D) - **Beetles (Class Insecta, Order Coleoptera)**

Front pair of wings usually leathery, with veins (Fig. 61E); mouthparts chewing type (Fig. 61B to D) or extended into a tube (Fig. 61F) - 4

4. Mouthparts chewing type (Fig. 61B to D); hind legs modified for jumping (Fig. 61E) or front legs modified for digging (Fig. 60B) - **Grasshoppers, crickets, katydids (Class Insecta, Order Orthoptera)**

Mouthparts extended into a tube (Fig. 61F); hind legs usually not modified for jumping - **Bugs (Class Insecta, Order Hemiptera)**

5. Only one pair of wings present, wings usually clear (Fig. 59A); mouthparts adapted for sponging or sucking; second pair of wings represented by small knobs (Figs. 59A, 64A) - **Midges, flies (Class Insecta, Order Diptera)**

Two pairs of wings present (Fig. 59B, C) - 6

6. Wings covered with tiny scales that resemble dust when smudged on one's finger (Fig. 63); mouthparts long, threadlike (Fig. 62A) or absent - **Butterflies, moths, skippers (Class Insecta, Order Lepidoptera)**

Mouthparts chewing type (Fig. 61B to D) or extended into tube (Fig. 61F) - 7

7. Wings held roof-like over body (Fig. 62B) - **8**

Wings held flat over body (not roof-like); mouthparts chewing type (Fig. 61B to D) or extended into a tube or proboscis - **21**

8. Mouthparts chewing type (Fig. 61B to D); wings with network of light, tiny veins evenly covering surface -  
**Lacewings (Class Insecta, Order Neuroptera)**

Mouthparts extended into tube (Fig. 61F) - **9**

9. Body with "honey tubes" or "cornicles;" slow-moving insects; seem to reproduce rapidly (Fig. 65) - **Aphids (Class Insecta, Order Hemiptera, Family Aphididae)**

Body without "honey tubes" - **20**

10. No legs; soft, slimy, sometimes with shell (Fig. 66A, B) - **Slugs, snails (not Arthropods)**

Legs present - **11**

11. More than or fewer than six legs present (Figs. 59H, M, N; 67) - **12**

Six legs usually present (may be reduced/ obscure in many scale insects) (Fig. 59 I, J, L) - **17**

12. Microscopic, often associated with galling or distorted plant growth – **13**

Visible to the unaided eye (with 20-20 vision); damage not usually characterized by galls and distorted growth -**14**

13. Two pairs of legs present; wormlike, usually associated with galls, erineums or chlorosis of host plant (Fig. 67) -  
**Erineum, gall, rust mites (Class Arachnida, Order Acari)**

Four pairs of legs present; oval; females with hind legs threadlike; usually associated with distorted growth (Fig. 68) -  
**Thread-legged mites (Class Arachnida, Order Acari, Family Tarsonemidae)**

14. Four pairs of legs present; usually associated with chlorotic stippling of host plant leaves (Fig. 59H) -**15**

More than four pairs of legs present - **16**

15. Tiny silk "spider webs" on heavily infested plant; chlorotic stippling symptoms developing rapidly; legs arranged somewhat like those of a typical spider; color variable (Fig. 59H) - **Spider mites (Class Arachnida, Order Acari, Family Tetranychidae)**

No silk webbing on heavily infested plants; chlorotic stippling symptoms developing slowly; legs more or less pointing forward and backward; color red (Fig. 69) - **False spider mites (Class Arachnida, Order Acari)**

16. Seven pairs of legs present; oval; sometimes capable of rolling up into a ball (Fig. 59K) - **Sowbugs, pillbugs (Class Crustacea, Order Isopoda)**

Many pairs of legs present; sides straight, long, slender, sometimes coiling into a helix (Fig. 59N) - **Millipedes (Class Diplopoda) or centipedes (Class Chilopoda)**

**17. Body covered by shell-like secretion (Fig. 70) - Scales (Class Insecta, Order Hemiptera)**

No secretion on body - **18**

**18. Body usually naked - 19**

Usually covered with a white, waxy bloom that resembles flour or white, waxy threads (Fig. 59J) - **Mealybugs, woolly aphids, adelgids, soft scales (Class Insecta, Order Hemiptera)**

**19. Mouthparts extended into tube (Fig. 61F); body with "honey tubes" or "cornicles;" mobile (Fig. 59L) - Aphids (Class Insecta, Order Hemiptera, Family Aphididae)**

Mouthparts chewing type (Fig. 61B to D); elbowed antennae and constriction on abdomen (Fig. 85C) - **Ants (Class Insecta, Order Hymenoptera, Family Formicidae)**

**20. White insects (up to 2 mm) that resemble tiny moths; often found on the undersides of host plant leaves, often associated with honeydew and sooty molds; flutter when disturbed (Figs. 60H, 72A) - Whiteflies (Class Insecta, Order Hemiptera, Family Aleyrodidae)**

Slightly larger insects (2 to 10 mm); jump when disturbed (Figs. 71, 73) – **22**

**21. Orange, brown, or black insects (up to 2 mm), slender and spindle shaped; often found in buds, flowers, foliage, or corns; often associated with chlorosis and distorted growth; run or fly when disturbed (Figs. 59B, 72B) - Thrips (Class Insecta, Order Thysanoptera)**

Not as above - **23**

**22. Five to 10 segments in antenna; 2 to 5 mm long (Fig. 73) - Psyllids (Class Insecta, Order Hemiptera, Family Psyllidae)**

Three segments in bristlelike antenna; 2 to 10 mm long (Fig. 71) - **Leafhoppers, planthoppers, spittlebugs (Class Insecta, Order Hemiptera)**

**23. Constriction in abdomen, giving the appearance of a "waist" (Figs. 85B, 85C) - Wasps, ants, bees (Class Insecta, Order Hymenoptera)**

No constriction in abdomen (Fig. 85A) - **Sawflies (Class Insecta, Order Hymenoptera)**

## KEY TO IMMATURE STAGES

### BLOSSOM AND LEAF FEEDERS

1. Chewing mouthparts (Fig. 61B to D) (leaf removed or consumed by pest) - **2**

Mouthparts extended into tube or hairlike structure (Fig. 61F) (leaf may be distorted or discolored, but not consumed by pest) - **7**

2. Insect within leaf mine, leaf gall, inwardly rolled leaf margin, or case made of plant material (Fig. 74A to C) **0- 3**

Pest exposed on leaf - **5**

3. Insect mining within leaf, leaving visible tunnels or leaf blisters (Fig. 74A) - **Leaf-mining caterpillars or maggots (Class Insecta, Order Lepidoptera or Diptera)**

Not as above - **4**

4. Tiny, whitish maggot(s) hidden within curled leaf margins (Fig. 74B) - **Midge maggots (Class Insecta, Order Diptera)**

Pest enclosed in a baglike, silken case enmeshed with pieces of leaves or needles (Fig. 74C) - **Bagworms (Class Insecta, Order Lepidoptera, Family Psychidae)**

5. Slime trail often noticed on damaged portion; soft-bodied, slimy animal, sometimes with helical shell (Figs. 59G; 66A, B) - **Slugs, snails (not Arthropods)**

No slime trail; worm shaped with paired legs - **6**

6. Caterpillar with five to eight pairs of legs (Fig. 75A to B) - **Moth caterpillars (Class Insecta, Order Lepidoptera)**

Caterpillar with more than eight pairs of legs (Fig. 75C) - **Sawfly larvae (Class Insecta, Order Hymenoptera)**

7. Pest mobile, usually with two "honey tubes" or "cornicles" on abdomen (Fig. 76A to E) - **Aphids (Class Insecta, Order Hemiptera, Family Aphididae)**

Mobility variable; no "honey tubes" or "cornicles" on abdomen - **8**

8. Microscopic pest usually associated with distorted plant growth; if not distorted, leaves may be scratched, brown, and/or curled - **9**

Not microscopic, or if microscopic, not associated with above symptoms - **10**

9. Microscopic pest usually associated with distorted plant growth; three pairs of legs (Fig. 77A) - **Thread-legged mites (Class Arachnida, Order Acari, Family Tarsonemidae)**

Microscopic pest that causes leaves to appear scratched, turn brown, and curl; two pairs of legs (Fig. 77B) - **Rust mites (Class Arachnida, Order Acari)**

10. Almost microscopic; three or four pairs of legs; usually associated with very fine webbing, spherical eggs, chlorotic stippling of host plant, and adult spider mites (Fig. 78) - **Spider mites (Class Arachnida, Order Acari, Family Tetranychidae)**

Not as above - 11

11. Very small, active, orange to yellow, spindle-shaped insect; feeding in buds, flowers, and on leaves (Fig. 79A to D) - **Thrips (Class Insecta, Order Thysanoptera)**

Not as above - 12

12. Immobile (except newly hatched crawler stage); body adhering to plant surface so that legs are not visible - 13

Mobile; legs visible - 15

13. Body covered with fluffy or "mealy," white wax secretions; older individuals with waxy strands around periphery (Fig. 80A to E) - **Mealybugs (Class Insecta, Order Hemiptera, Family Pseudococcidae)**

Body not covered by mealy wax - 14

14. Eggs usually laid under body of mother or young born live under mother (Fig. 81A) - **Scales (Class Insecta, Order Hemiptera)**

Eggs inserted into leaf tissue and scattered on lower leaf surface; immatures often associated with whitefly adults (Fig. 81B) - **Whiteflies (Class Insecta, Order Hemiptera, Family Aleyrodidae)**

15. Body covered with white, powdery secretions - 16

Body bare of secretions - 17

16. Slow moving; body coated with floury or "mealy" secretions (Fig. 80A to E) - **Mealybugs (Class Insecta, Order Hemiptera, Family Pseudococcidae)**

Jumping insect covered with white, waxy filaments; associated with small, cicada like adult (Fig.82) - **Psyllids (Class Insecta, Order Hemiptera, Family Psyllidae)**

17. Tiny, black or colorless, spiny nymphs (Fig. 83A, B) - **Lace bugs (Class Insecta, Order Hemiptera, Family Tingidae)**

Nymphs not spiny - 18

18. Jumps when disturbed; body elongate (Fig. 84A) - **Leafhoppers, planthoppers, spittlebugs (Class Insecta, Order Hemiptera)**

Runs when disturbed; body oval in top view (Fig. 84B) - **Plant bugs (Class Insecta, Order Hemiptera, Family Miridae)**

## STEM BORERS AND FEEDERS

1. Pest mobile - 2

Pest immobile (except for first-instar nymph crawler stage) or moves very rarely - 6

2. Oval, round, or pear-shaped pest that may or may not be covered with waxy strands - 3

Wormlike larva with variable number of legs - 5

3. Covered with woolly strands of wax; feeds only on conifers, usually near tips of branches; causes galling and distortion of branches - **Adelgids (Class Insecta, Order Hemiptera, Family Adelgidae)**

Not as above - 4

4. Covered with woolly secretion of wax; may feed on both roots and stems, may cause galls especially on roots - **Woolly and gall-forming aphids (Class Insecta, Order Hemiptera)**

Tiny, flattened insect (crawler); not waxy or pear shaped; no cornicles; found in conjunction with immobile scale insects - **Scale crawlers (Class Insecta, Order Hemiptera)**

5. Body generally cylindrical, with eight pairs of legs; bores in stems - **Moth caterpillars (Class Insecta, Order Lepidoptera)**

Body flattened somewhat; legless or has three pairs of legs; bores in stems - **Beetle larvae (Class Insecta, Order Coleoptera)**

6. Rarely moves once feeding is initiated; covered with cottony, waxy strands; feeds only on conifers, usually near tips of branches; causes galling and distortion of branches - **Adelgids (Class Insecta, Order Hemiptera, Family Adelgidae)**

Body adhering to plant surface so that legs are not visible; eggs usually laid under saclike body of mother or young born live under mother - **Scales (Class Insecta, Order Hemiptera)**

## ROOT FEEDERS

1. Soft-bodied, grublike larva that strips off bark and chews out notches in roots (Fig. 87) - **Weevil larvae (Class Insecta, Order Coleoptera, Family Curculionidae)**

Small insect with heavy, light, or practically nonexistent coat of woolly wax; feeds on stems and roots often causing gall-like swellings on roots - **Woolly and gall-forming aphids (Class Insecta, Order Hemiptera)**