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Fig. 1: Assuming that the goal post is as wide as the aphid's hind tibia and the ball is roughly as large as the head, the distance y at which the aphid would begin to have difficulties to decide whether the ball is left or right to the goal post can be estimated as $y \approx (x/2)/\tan(\alpha/2)$, where α is the interommatidial angle. This angle and the head and body length were measured on-screen in five winged females of *Lachnus roboris*, using a digital camera that was mounted on a dissecting microscope and attached to a PC.

Can aphids play football?

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Well, it is not very likely. For a start, aphids wouldn't be able to hear the whistle at kick-off, because, as far as we know, they are deaf. Also, aphids can't run very fast – although this might not always be a strict criterion for human football either, at least judged by standards of the ... (insert your most hated club here). Finally, aphids are extremely short-sighted. Their visual acuity is so bad that, when farther away from the goal than roughly 1.5 times their body length, they wouldn't be able to tell whether or not a shot missed the goal (Fig. 1).

However, aphids don't seem to be discouraged by their athletic and sensory shortcomings, since they still can be observed to do one thing that is essential in football: kicking. We noted this behaviour in a large colony of the oak aphid *Lachnus roboris*, a truly giant aphid species (Fig. 2, 3). When an object (e.g. a human finger) is moved close to these aphids, they start kicking their hind legs frantically (although this behaviour could also be called "waving", if you consider them as "fans" rather than "players").

In other aphid species, such kicking and leg-waving behaviour has been linked to defence against predators (Kennedy *et al* 1967; Russel 1972; Henaut *et al* 2000). A particularly interesting example comes from the social bamboo aphid *Pseudoregma spec.*, in which some valiant aphids attack predators by grabbing them and holding on to them. Stern *et al* (1997) observed that many individuals in this species waved their hind legs when predatory wasps passed near and walked over the surface of the colony. Strikingly, leg-wavers were more likely to attack than non-wavers.

An interesting question is if the kicking behaviour is coordinated or instead elicited independently in each individual. (One might sometimes ask similar questions in a football match). In an Asian bee species, the Giant honeybee *Apis dorsata*, coordinated body movements on the hive have been called defence waving (Kastberger *et al*, 1997), or "shimmering behaviour", because to the human observer, the body waves



Fig. 2: With a body length of up to 4.5 mm, the oak aphid *Lachnus roboris* is one of Britain's largest aphid species. The winged female can be easily recognised by the characteristic shading pattern on the wings.

through the bee colony give a shimmering appearance; these waves look indeed like "La Ola" made by fans in a football stadium (Oldroyd and Wongsiri, 2006). Obviously the bees' behaviour serves as a warning signal to animals that are trying to enter or attack the nest. Also, colonies of larvae of the sawfly *Neodiprion sertifer* exhibit a coordinated Mexican wave as defence against birds (Prop 1960).

Examples of similar behaviour – body waving through a colony – can also be found in aphids. Colonies of another large bark feeding aphid species, the enormous *Tuberolachniscus salignus*, have been seen to wave the whole body after stimulation by moving objects close to the colony. And in an unidentified bark feeding aphid, body movements waving through the colony could be observed when the aphids were approached by wasps (observations L.C.). While the wasps were mostly keen to feed on the aphids' honeydew excretions,

some might also pose a direct threat to the aphids and feed on them. Therefore one might ask whether coordinated movements through a colony could appear to predators as coming from a much larger animal that should better be left unattacked. However, it is also possible that the body movements serve as a signal to predators that the aphids are attended by powerful guards: ants.

At present, it remains open whether the kicking and waving behaviour in aphids is coordinated like in some other insects living in colonies. What is relatively certain though is that it does not constitute a ball game.

References

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Fig. 3: Unlike most pest aphid species, *Lachnus roboris* feeds on twigs rather than on leaves. The aphid is visited by ants. The colonies were found in spring 2007 on *Quercus nuttallii* and *Q. imbricaria*, two previously unrecorded host plant species. In late October, sexual morphs appeared and, after mating, the oviparae produced a remarkable number of eggs – an accumulated twig length of 65 cm on one tree was covered in large shiny eggs. In mid March 2008, young fundatrices hatched from the eggs.