

## Stag beetle's battle for survival

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**Abstract:** Abundant in former times Europe's largest beetle is in many areas already extinct or at least a rarity. Serious reasons are expanding human activities including an increasing trend to eliminate decaying trees. By doing so the loss of fundamental life conditions mean the end to certain insect species. The following observations reflect only a few facets out of this beetle's fascinating life.

### Swarming

Stag beetles have been living in Frankonian oak woods (Southern Germany) ever since. They are abundant in Southeast Europe. After eating rotten oak wood in the trunk base for 5 years the larva turns to a pupa. In June of the following year the sun warms the soil and the beetles appear on the surface. The next goal is a sap spot.

Oak sap is sipping where longhorn beetles hatched. In former times especially the big oak longhorn *Cerambyx cerdo* L. caused holes in the oak surface which 'bled' strong enough to feed a whole insect community for days. Only female stag beetles are able to bite through the tough oak bark. Male mandibles are useful for show and rival battles, but not for biting. So a male stag beetle needs a female to survive, regarding food supply (sap) and mating. With a sex rate of 4 to 1 many male stag beetles have a severe problem.

### Courting tree and battle

It takes some time until the beetles - about 3-5 couples and some single males - focus on a certain tree and here on a specific area around the midst of the tree's crown.

Battles start when a new vigorous male appears on the stage. After landing in a safety zone with an approximate radius of 2 meters the newcomer enters the scene on foot. After some impressing gestures the battle starts. It can last for hours if the opponents are rather equal in strength. The author witnessed a fight of 80 minutes



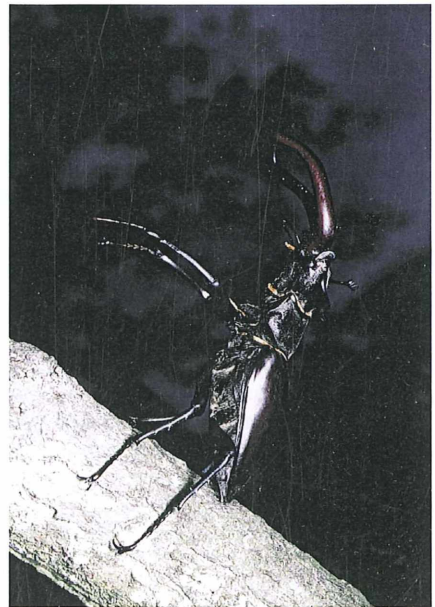
Tafel 3.5

Oben: Auf dem Balkan - und früher auch bei uns sorgten die Austrittslöcher des großen Eichenheldbockes (links) für ergiebige Saftquellen

Links: Eine gerade angeflogene Hornisse wird im Siegesrausch gepackt



Rechts: Typische Droh- und Imponierhaltung des Hirschkäfermännchens, die abgedeutet auch von Weibchen gezeigt wird



Fotos: W. Rummel

until one male succeeded in throwing the opponent from the tree with a sudden lift. The cracking of the Chitin armour can be heard for several meters. The winner remains for several minutes in a victory-pose and then returns to the female.

## Clearing up

While celebrating his victory, every beetle is being pushed off the tree by the winner - even couples. Once the author saw a victorious male fetching a hornet flying by to get some oak sap. The hornet stung and the beetle fell to the ground as if it was dead. Because he could not find the sting hole the author took the male home. Placing the beetle under a water tub, the flowing water helped the male recover. Being taken back the male conquered his former position the next day.

Many battles do not necessarily end with a victory. Sometimes both strugglers fall to the ground while trying to lift the enemy and throw it from the tree. With both components on the ground, a "proper" victory is not possible anymore. But somehow the battle comes to an end and the former rivals climb the tree again. Reaching the former battlefield, they once again find themselves faced with hostile claws of new aggressors. During the battle weaker males often give way to superior ones.

Even an invalid beetle who lost one mandible was seen climbing the tree again after being pushed to the ground. Because his body weight was uneven he followed a spiral track up the stem! 2 days later he lay dead underneath the tree.

## Impressive stand

To express a victorious feeling a stag beetle bends his body, stretches the middle and the hind legs, and lifts his fore legs. The head is held upright with the mandibles wide open, ready to bite (or better pinch) immediately. But if he senses an unknown movement the beetle is discouraged and lets his body slide off the tree and onto the ground. The author is not sure, if this works out facing bigger birds like woodpeckers or owls. The result may depend on their personal experience with stag beetles as prey - or if the beetle is drunken by sap alcohol it could be easier to get it.

## Dangers

Death is luring on forest's floor as well. Especially at dusk or during the night the courting trees are constantly visited by wild bores, hedgehogs, badgers, and others. Lizards are a speciality in Southeast Europe. All enemies eat the soft abdomen of the beetle, leaving hard parts like head, breast, and wings behind. Up to 48 hours the mandibles continue to clasp although all that is left of the body are the breast and the head. Click beetles and other scavenging insects nibble the flesh remnants from the remaining interior.

After bringing his last battle to a glorious end the male stag beetle tries to mate with the female. He stands above her like a cage. Nervously he guards his position against possible threats while she fills her up with sap. From time to time she is blackening the surrounding area with her excrements. The male turns around and around on top of her, testing her perfume which will signal him her agreement for mating. These male movements are stimulating the erogenous zones on her back and on his belly, bringing them into the right mood. Holding a stag beetle in the hand one may want to try to pet these zones mentioned above, and will experience that the beetle will come to a rest.

The following event demonstrates the vigour of hormones: A small male covered with scratches from several battles tried to copulate with a dead female without an abdomen. He tried any position, stopped for a moment, and went on immediately after the female had been touched by the author. The copula itself is not very spectacular. For a short time the female stops drinking, walks some steps away and endures patiently the following procedure.

## Egg laying

Shortly afterwards, in most cases at dusk, the female looks for a suitable tree to lay the eggs. The way can be very dangerous, especially when she flies in the wrong direction namely towards the next village. Year after year the author searched females trapped beneath the street lamps and brought them back to the woods. Immediately after being released they “dived” into the ground next to a root of an old oak. To be able to do so the soil has to be rather dry. Moisture turns the soil into a tough clay, which makes penetrating impossible. So the females have to wait on the surface presenting themselves as “sitting ducks” to possible enemies.

## Dangers after eggs being laid

To protect oak stumps against wild bores the author started covering the place with thistles. This worked out - at least for some days. So a first protection took place. Later in a year the bores' digging may favour stag beetle's development: it makes emerging from the pupa cradle in a depth of one meter much easier. Further, growth of vegetation is suppressed. E.g. beetles could easily be strangled in long grass.

Towards the end of the winter the wild bores visited the beetle's breeding places again. Investigations of the earth clumps showed remnants of at least 5 females. At a neighbouring dead tree relics of 5 males and one female mirrored the typical sex rate, so the bores obviously succeeded in digging up pupa cradles. The pupa appears in September, one month later the beetle hatches and stays in its cradle until June.

The author is alarmed by the fact of increasingly finding dead males. Showing no damage to their bodies, the author assumes they must have died of starvation - even in the beginning of the reproduction time. "Half dead" beetles, picked up from the ground, eagerly take up sugar water out of a soaked cotton wool and soon recover. As the beetle can not smell the sugar one has to push the labellum into the wool. In an extreme case a nearly dead male came back to life within a week and, brought back, entered the courting tree again and rejoined the battle.

Aid in the outdoors is possible by using a moss cushion that holds the sugar water and is being fixed in a twig's fork. Once a sucking male defended "his" moss cushion so fierce that another male passing by let himself fall from the tree. To guarantee a better nourishment the author is debating with foresters to prove the possibility of installing artificial sap sources. A sufficient food supply for the stag beetles is as important to their survival as the construction of breeding heaps for larva's development. The latter become essential where there is a lack of suitable trees and stumps. As trees are being chopped in winter time the remaining stumps contain high amounts of tannins, that have been concentrated by the tree before rejecting its leaves in autumn. These chemicals prevent the growth of certain fungus which are essential for the beetle's larva.

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