

LARGE POPLAR LONGHORN, *SAPERDA CARCHARIAS* (L.), AS FOOD FOR WHITE-BACKED WOODPECKER, *DENDROCOPOS LEUCOTOS* (BECHST.)

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SELOSTE:

RUNKOHAAPSANEN, *SAPERDA CARCHARIAS* (L.), VALKOSELKÄTIKAN, *DENDROCOPOS LEUCOTOS* (BECHST.), RAVINTONA

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In a locality in Southern Finland where the white-backed woodpecker, *Dendrocopos leucotos* (Bechst.) was previously breeding we found many conical borings excavated during the winter in young aspens on average 8.1 cm in diameter. Fullgrown larvae of *Saperda carcharias* (L.) (Coleoptera, Cerambycidae) hibernate in pupal chambers constructed about 0.5 m above ground level. Below this chamber the larva has usually prepared an exit hole. After the larva has blocked itself in the pupating chamber it is easy prey for the woodpecker during the whole winter.

There were usually 1-5 conical borings in the same trunk. The number of these borings does not correspond with the amount of larvae eaten, since the woodpecker often made these borings in places from which it could not obtain a prey. The woodpeckers stopped excavating in those cases when the larvae in the galleries were dead.

The exit holes and the conical borings occlude within a few years. The galleries within the tree will not heal and several years later a new larva may utilize them.

In the wintering habitats of the white-backed woodpecker the availability of food could be improved by increasing the amount of *S. carcharias* larvae. This is easily done by encouraging young aspens.

INTRODUCTION

The white-backed woodpecker (*Dendrocopos leucotos* (Bechst.)) is the most scarce woodpecker species in Finland. The present population is most probably only 25, but possibly 40-60 (SARKANEN 1978a) or perhaps 100 breeding pairs (REINIKAINEN 1979). One reason for the decline of white-backed woodpecker numbers in Fennoscandia has been the loss of breeding sites. This it believed to be due to the practice of modern intensive forestry removing dead and unproductive deciduous trees and preventing the growth of new ones (cf. e.g. AHLÉN 1977). The

remaining deciduous woodlands growing on sites previously under shifting cultivation are being planted primarily with spruce (*Picea abies* Karst). In addition open pastures are virtually disappearing, together with the practice of woodland grazing.

The range of the white-backed woodpecker extends from central Europe and Scandinavia eastwards to China, Japan and Kamtchatka (BLUME 1977). In Scandinavia it is found in Southern Norway, mostly in the northern parts of Vestlandet, where there are about 200-400 pairs (ANON. 1978), and in the

central parts of Sweden where about 20 breeding pairs have been counted (AHLÉN 1977, AHLÉN et al. 1978).

BORG and MALMSTRÖM (1975) have pointed out that the survival in Finland of the white-backed woodpecker is threatened. Possible ways of protecting it in Finland have been discussed by ALATALO (1972) and SARKANEN (1974). Since 1978 a special working group of the World Wildlife Fund/Finland has been evaluating effective ways of saving this species in Finland. A similar group has existed in Sweden for several years.

In order to conserve the white-backed woodpecker in Finland its breeding and foraging habitats must be protected. The diet of the white-backed woodpecker is still poorly known. In Sweden it has been found to eat especially wood boring insects. Even during the breeding season not less than 50% of all food items brought to the nest consisted of such insects (AHLÉN et al. 1978). HOGSTAD (1978) studied the foraging habits of the white-backed woodpecker in Norway during the winter. Other reports on the diet of the white-backed woodpecker are to be found in RUGE and WEBER (1974) and BLUME's (1977) monograph on the *Dendrocopos*-woodpeckers. In addition HAARTMAN et al. (1963-72) have summarized the feeding habits of Finnish woodpecker species. They mention that the white-backed wood-

pecker makes deep conical borings which extend to the decaying centre of aspens (*Populus tremula* L.) and goat-willows (*Salix caprea* L.). Ornithologists in Päijät-Häme, southern Finland, confirmed this and later realised the importance of this feeding technique (SINTONEN and TUOMENPURO 1978, REINIKAINEN 1979).

In the present study the large poplar longhorn (*Saperda carcharias* L., Coleoptera, Cerambycidae) was identified as the species which inhabits aspens. To our knowledge this species has not been previously indentified in the diet of the white-backed woodpecker. A few other woodpecker species, especially the greater spotted woodpecker (*Dendrocopos major* L.) have been observed predated on this insect in Czechoslovakia (TICHÝ 1963). This study will review the living habits of the large poplar longhorn, investigate the circumstances in which the white-backed woodpecker may eat it and suggest ways of encouraging the presence of this insect in the habitats of white-backed woodpeckers.

This work has been inspired by the World Wildlife Fund working group in Finland which is attempting to protect the white-backed woodpecker in our country.

Dr. Olli Järvinen has kindly read an earlier draft of the manuscript and Darrell Sequeira B.Sc. Hons. checked the language. The Academy of Finland contributed to the travel expenses.

HABITS OF LARGE POPLAR LONGHORN

Large poplar longhorn is one of the biggest beetles occurring in Finland and ranges as far north as Rovaniemi (KANGAS 1942). The larvae live within the trunks of living aspens but they have occasionally also been found in different species of poplars and willows (see e.g. CRAMER 1954).

Adult large poplar longhorns are active during mid-summer. They eat parts of the leaves of aspens which can be seen to have bitten off holes. Eggs are laid on the rough bark of living aspens. The eggs overwinter (CRAMER 1954, PALM 1959, ŠROT 1962) and hatch the following spring. The larvae eat phloem for a while, under the bark, and later dig deep into the centre of the trunk. This

hole becomes part of the gallery and the opening is used by the larva to eject bitten off chips of trunk. Large poplar longhorn larvae do not digest cellulose (cf. CRAMER op.cit.) but probably consume the contents of cells and sap within the tree. Therefore the larvae can only develop within live trees.

In Scotland RITCHIE (1920) made a detailed study of the construction of the galleries excavated by individual larvae in young aspens. The first tunnel is usually directed downwards towards the center of the tree and sometimes even into the roots. A juvenile larva overwinters at the base of the stem. When older it digs galleries, 10-15 mm in diameter, usually 10-25 cm, but some-

times even higher up the pith. In preparation for its maturation into an imago the larva gnaws a horizontal tunnel which ends in an exit hole made through the bark. From this opening, the larva may discard chips of tree trunk it has removed but often these remain as a plug in the opening. Some larvae do not break through the bark.

By autumn the fully grown larva retires to that part of the gallery which is above the exit hole and constructs a tight plug of chips below itself. Here it overwinters and pupates in early spring. PALM (1959) has found pupae in late June and early July. By mid-summer the insect has reached maturity and crawls out of the trunk.

In young trees the galleries are always found at the base. RITCHIE (1920) observed that the exit holes are usually 10–15 cm and seldom more than 45 cm above ground level. PALM (1959) reported that the large poplar longhorn is found in shoots of aspens up to 20 cm above ground level and SCHNAIDROWA (1961) found that this insect seldom is found more than 60 cm above ground level in poplar plantations, although in exceptional cases it might live at a height of 8 m. TICHÝ (1963) reported that the borings made by woodpeckers to obtain large poplar longhorn larvae in Czechoslovakia averaged 61 cm above ground level.

MATERIAL COLLECTED AND FIELD OBSERVATIONS

In summer 1976 one pair of the white-backed woodpecker was found breeding in an old coppice of birches close to an old cottage in the commune of Heinola mlk, southern Finland. During the early seventies this species had been regularly observed in this area (J. Patomäki). During the winter 1978–79 attention was paid to the trunks of young aspens where there were deep conical borings typical for the feeding technique of the white-backed woodpecker. These borings were found over a large area in the surrounding forests. The authors, however, did not actually see white-backed woodpeckers making conical borings. Others have seen this behaviour in Päijät-Häme (SINTONEN and TUOMENPURO 1978, REINIKAINEN 1979, SINTONEN 1980), and e.g. Mr. TATU

In large trees, however, larvae are found much higher up. In Germany CRAMER (1954) found larvae occurring in abundance at 4 m and he states that they are common up to 16 m. KANGAS (1942) found a large concentration of larvae in an aspen at a height of 4–10 m at Rovaniemi. In this case there were within one vertical meter of the trunk not less than 30 larvae. The galleries are usually short in large trees, about 20–25 cm. The larva later expands the original horizontal entrance tunnel to the gallery into an exit hole (CRAMER 1954).

Larvae which live higher up in the trunk develop in 2 years (KANGAS 1942 and CRAMER 1954) and this is sooner than those larvae living at the base of the trunk which develop in 2–3 years (PALM 1959) in 3 years (ŠROT 1962), in 3–4 years SCHNAIDROWA (1961) or 4 years (RITCHIE 1920).

Both, CRAMER (1954) and SCHNAIDROWA (1961), have observed that woodpeckers predate upon larvae of large poplar longhorn. The results reported by TICHÝ show that most of the borings (98 %) made in order to obtain this insect were made by greater spotted woodpeckers. A few were made by other woodpecker species (*Dendrocopos medius* L., *D. minor* L., *D. syriacus* Hemp. et Ehr. and *Picus viridis* L.).

HOKKANEN (pers. comm.) has seen a male white-backed woodpecker excavating a deep conical boring in a young aspen on April 6th 1980 in the commune of Vehkalahti, south-eastern Finland. Making of deep conical borings is so typical of the white-backed woodpecker that the occurrence of these borings in Päijät-Häme is considered to be an indication of the presence of this species. In Uusimaa and southern Häme M. N. has found *S. carcharias* in young aspens, but no conical borings. Nor have any conical borings been found in Rymättylä, southwestern archipelago of Finland (L. S.).

According to the WWF group, no other woodpecker species have been observed making similar borings (O. JÄRVINEN pers. comm.).

Table 1. The number of deep conical borings and field measurements of their positions in the trunk.
Taulukko 1. Suppiloiden lukumäärät ja niiden sijainti rungossa.

Number of conical borings in the trunk <i>Suppiloita rungossa kpl</i>	Number of exit holes in the trunk <i>Ulostuloreikiä rungossa kpl</i>	Number of trees <i>Puita kpl</i>	Total number of conical borings <i>Suppiloita yht.</i>	Mean height above ground level, cm <i>Keskim. korkeus maasta</i>		Average diameter of tree, cm <i>Puiden keskim. läpimitta, cm</i>
				conical borings <i>Suppilot</i>	exit holes <i>Ulostuloreiät</i>	
1	—	10	10	43.9	—	7.1
1	1	43	43	49.1	34.6	8.0
1	2	1	1	61.1	47.0	15.0
2	—	4	8	45.0	—	7.4
2	1	11	22	45.6	31.1	7.7
2	2	4	8	58.6	43.4	12.6
3	—	1	3	40.0	—	17.0
3	1	3	9	51.1	26.1	6.0
3	2	1	3	52.7	40.0	7.5
4	1	1	4	63.0	28.0	5.5
5	1	1	5	59.6	23.0	8.0
		80	116	49.4	34.4	8.1

During May 1st–2nd 1979, 116 deep conical borings were measured on 80 aspens (Table 1). Only those borings which could be positively identified to have appeared during the previous winter were included. Fresh borings were identified by the presence of chips lying above the leaf litter.

Once a great spotted woodpecker was found making a conical boring or enlarging one made originally by a white-backed woodpecker. On our opinion this boring was rougher and could thus be separated from borings made by white-backed woodpeckers. However, the possibility that some others



Fig. 1. Winter foraging habitat of white-backed woodpecker in Heinola mlk. Phot. 15. 5. 1979 L. Saari.

Kuva 1. Valkoselkätikan talviruokailualueita Heinolan mlk:ssa. Valok. 15. 5. 1979 L. Saari.

species of woodpecker might have done some of the conical borings in the study area cannot be completely excluded.

Measurements were made in 9 different woods. The landscape consists of old swidden sites which is a typical feature in parts of eastern Häme. The luxuriant woods grow on rich soils (OMT, *Oxalis-Myrtillus* Type). Some woods were dominated by a mixture of thin, but high birches and pines and some scattered aspens. Aspens growing below the dominating trees had been thinned out. Most of the conical borings were found in stands where two years earlier the emergent trees had been felled. Conical borings were found in several different places: on the border of fields, in a thicket of aspens amidst a field, and in an area which was clear cut in 1954 and in the coppice thicket thinned out in 1966. A large number of conical borings was found in a coppice cut in the sixties and in an abandoned electric line 200 m long.

At each boring the following measurements

were taken: height of the conical boring above ground level, diameter of the tree at the site of the boring and the distance of the exit holes made by the larvae of *S. carcharias* from ground level. There were usually 1–5 conical borings (Table 1). In some trees there were two exit holes made by large poplar longhorn and in 15 no exit holes could be seen. Only seldom were found aspens with an exit hole made by the beetle but no conical boring made by the woodpecker.

On 15 May 12 dissimilar (see Fig. 1) trunks were taken for laboratory analysis. On 17 July four additional trunks were taken in which there were only galleries made by the large poplar longhorn or borings made by woodpeckers, too. Since we did not want to destroy the habitat chosen by the woodpecker we did not fell more trees. *S. carcharias* larvae were collected on 20 October for measurements of weight from the places where these were to pupate.

THE LOCATION OF THE CONICAL BORINGS

Borings made by woodpeckers were situated in trees which had a diameter (including bark) ranging between 4–17 cm, with an average of 8.1 cm. Fig. 2 shows the distribution of diameter classes.

The average height of conical borings above ground level was 49.4 cm and ranged between 20–75 cm. Since conical borings made only during the winter were studied, it meant that the depth of snow prevented borings from being made nearer ground level. There were, however, some conical borings which were dug lower down the trunk but these were probably made in spring and autumn. These borings were not included in the sample.

The borings were naturally above the exit

hole constructed by the larva. In those cases in which there was one conical boring per exit hole (47 cases) these were situated between 6–35 cm above the exit hole, averaging 14.6 cm. In case there were several borings made above one exit hole the most distant boring could be up to 56 cm above the exit hole. If there were several conical borings in the same tree they were situated between a vertical height of 0–40 cm, on average 9.5 cm. With the exception of a few cases the borings were mostly located on the same side of the trunk. Borings located on different sides of the trunk were often at the same height. Sometimes the borings were so close to each other that they overlapped into a single opening on the surface of the tree (see Fig. 3).

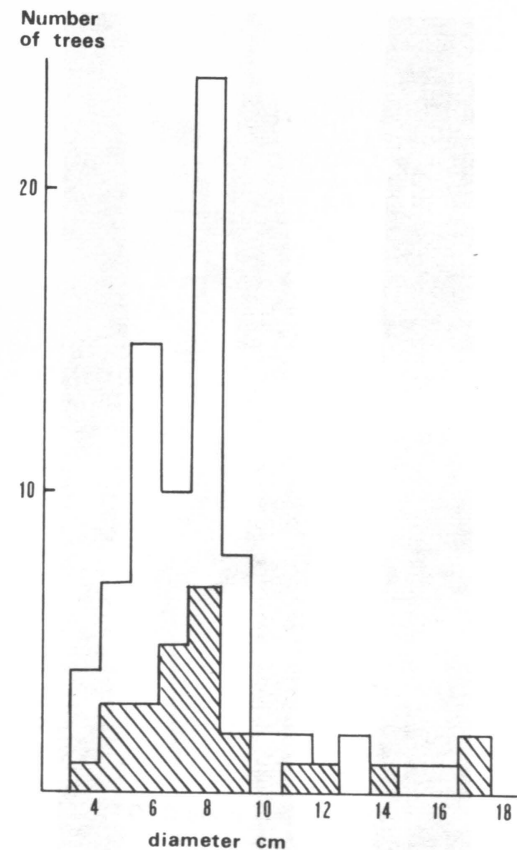


Fig. 2. The diameter of trunks at the conical borings. Shaded areas refer to trees with two or more conical borings.

Kuva 2. Rungon läpimitta suppiloiden kohdalta. Varjostetuissa tapauksissa puussa kaksi tai useampia suppiloita.

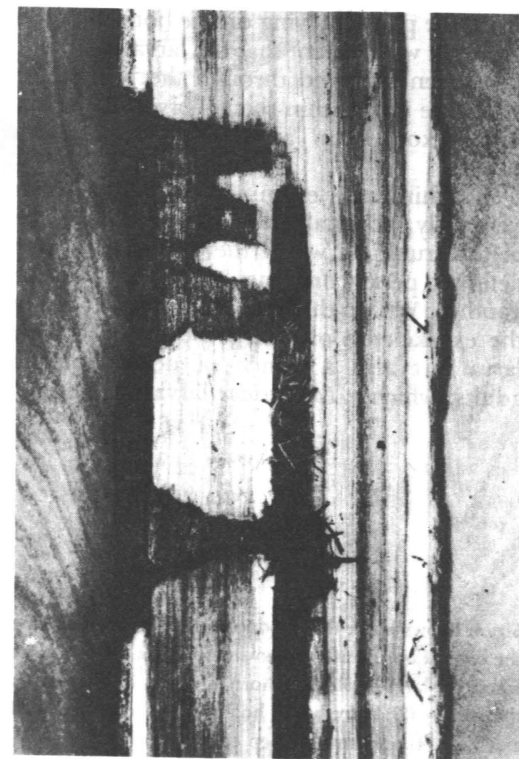


Fig. 3. Four deep conical borings on the same trunk; in the picture from top to bottom: too high, too short, successful and too low. This picture was taken in autumn 1979 which explains why the conical borings are grey.

Kuva 3. Neljä suppiloa samassa rungossa. Kuvassa ylhäältä alas: suppilo tehty liian ylös, liian matalaksi, onnistunut ja liian alas. Kuva otettu syksyllä 1979, mistä syystä suppiloiden reunamat ovat harmaantuneet.

RATE OF PREDATORY SUCCESS

The number of conical borings is not a measure of the amount of larvae eaten because many borings were often located in places where prey could not have been secured. In the material analysed, for example, 19 trees had two borings each, but the presence of exit holes indicated that in only four of these two larvae could have been obtained. In five trees there were three conical borings and in only one of these there had been two exit holes and probably two larvae.

In a few cases which were inspected in the laboratory the woodpeckers had excavated too high or more often too low and in one

case the boring was not deep enough to reach the larva. Two trees, one with four and the other with five deep conical borings were also analysed. Both trees had each contained only one larva and the extra borings were mistakes.

Two trunks had incomplete borings. In one case the bark had been removed from an area equivalent to that of a conical boring and the sapwood had been mined. Within the tree at this location was a larval exoskeleton surrounded by fly pupae (Fig. 4).

In the second case a conical boring, smaller than usual, reached the edge of the gallery.

From the particles lying on the bottom of the boring it was evident that the larva could not have been removed through the boring. At this place too, within the gallery, there was a larval exoskeleton around which were fly pupae.

In a third case, examined on 17 July, there were only two small chippings on the surface of the trunk on which there were also four definite pecks on one spot and two at another. Within the trunk there was not only the exoskeleton of a large poplar longhorn larva but also a bunch of dead dipteran adults, which a *Lonchacidae* larva was eating.

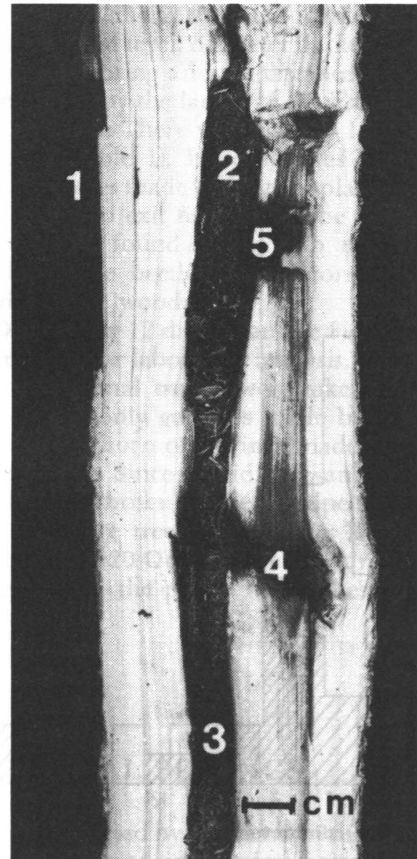


Fig. 4. Shows where the woodpecker had stopped making the conical boring after removing the bark (1); the place where the large poplar longhorn larva was found dead in the gallery (2); a fresh exit hole (3); and old, occluded exit hole (4) and an old deep conical boring (5).

Kuva 4. Tikka on irroittanut kaaman ja keskeyttänyt sitten suppilon teon (1); paikka, josta runkohaapsasen toukka löytyi kuolleena (2); tuore ulostuloreikä (3); vanha kylestynyt ulostuloreikä (4); vanha, kylestynyt suppilo (5).

OCCURRENCE OF LARGE POPLAR LONGHORN

In the study area *S. carcharias* was found only at the base of live aspens which were less than 30 years old. The pattern of the galleries were usually similar to those described by RITCHIE (1920). Fig. 5 is drawn according to the average measurements obtained by us. If the center of the tree was rotten the galleries were tunnelled closer to the surface. If there were several vertical galleries they did not interconnect. Two or more big larvae were never found in the same gallery. This is not surprising in view of their cannibalistic tendencies (see RITCHIE 1920).

The vertical part of the galleries all started from parts of the trunk located below ground level and were quite long. Judging from the location of conical borings the galleries were on average more than 50 cm long and even the exit holes were found at an average height

of 34.4 cm above ground level. Two galleries were as long as 85 cm above ground level and in addition also continued downwards.

The earliest exit hole opened by a larva was observed on 9 August and the next one on 13 August. At the fresh exit holes was a tight plug of chips through which cell sap was flowing down the trunk. There were also cases in which the larva had not completely penetrated the bark at the exit hole even though there were small holes in the bark gnawed thin by the larva.

We have only a few observations on the size of the larvae. On October 20th four larvae found in the pupating chambers were weighed. These larvae had already prepared their exit holes, too. The smaller ones (males?) weighed 0.67, 0.71 and 0.79 g and the biggest one (female?) 1.50 g. Two larvae

wintering at the base of the trunk weighed 0.75 g and 1.18 g.

No pupae were found in trunks split up but on 27 June a newly hatched adult was found. When visiting our study area on 17 July holes bitten by adult large poplar longhorn were found on aspen leaves.

The exit holes and the deep conical borings occlude within a few years (TICHÝ 1962, see also e.g. Fig. 4). Places where borings had been occluded were marked by darkish, vertical stripes on the bark of the tree. The galleries within the trunk do not heal. In some cases a new larva had years later used an old pupating gallery sometimes excavating even further and preparing a new exit hole. It is possible that old galleries contain bacteria, fungi or their excretions which are harmful to the larvae because most of the large poplar longhorn larvae had died within old galleries. In both the fore-mentioned cases in which the woodpecker had not completed boring and in which fly pupae were found around the larvae's exoskeleton, these larvae were found in old pupation galleries.

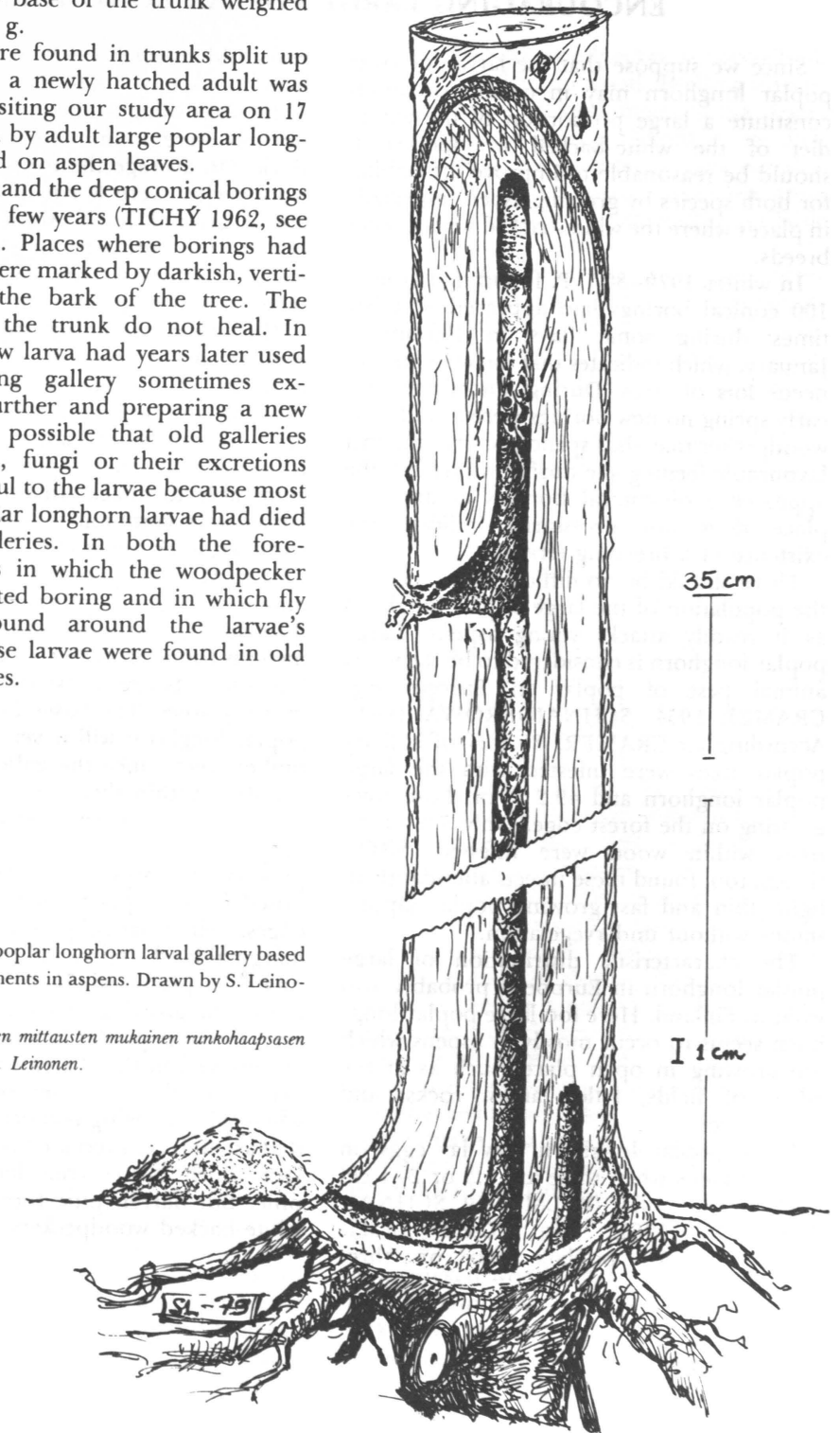


Fig. 5. Typical large poplar longhorn larval gallery based on average measurements in aspens. Drawn by S. Leinonen.

Kuva 5. Keskimääräisten mittausten mukainen runkohaapsasen toukkakäytävä. Piirt. S. Leinonen.

ENCOURAGING LARGE POPLAR LONGHORN

Since we suppose that the larvae of large poplar longhorn may in certain situations constitute a large proportion of the winter diet of the white-backed woodpecker it should be reasonable to improve the habitat for both species by growing aspens especially in places where the white-backed woodpecker breeds.

In winter 1979–80 J. P. found that at least 100 conical borings had appeared at a few times during some days in December–January, which indicates that the woodpecker needs lots of trees. During late winter and early spring no new borings were found. The woodpecker may thus spend a short time in a favourable feeding site during winter but the appearance of conical borings at any one place does not necessarily indicate the existence of a breeding territory.

There should be no difficulties to increase the population of the large poplar longhorn as it readily attacks young aspens. Large poplar longhorn is considered to be the worst animal pest of poplar in Europe (e.g. CRAMER 1954, SCHNAIDEROWA 1961). According to CRAMER, 89.1 % of solitary poplar trees were infested with the large poplar longhorn and 49.2 % of those trees growing on the forest edge. Only 5 % of the trees within wood were infested. ŠROT (1962), too, found these insects abundantly in light, thin and fast growing poplar sapling stands without undervegetation.

The characteristic distribution of large poplar longhorn in Europe is probably also valid in Finland. Here too large poplar longhorn seems to occur mostly in aspens which are growing in open places such as at the edges of fields, felled areas, rocks, and power lines.

Large poplar longhorn may lay eggs on young aspens when these are 1.5 or 2–4 cm thick at root collar (PALM 1959, SCHNAIDEROWA 1961). In Czechoslovakia *Saperda* attacks poplars two or three

years old (ŠROT 1962) and in Scotland it lives in aspens 5–20 years old (RITCHIE 1920). According to the present study conical borings were found already in trees 4 cm thick. On average the trees preferred by the woodpecker were 8 cm in diameter 50 cm above ground level. According to TICHÝ (1963) the greater spotted woodpecker forages in thicker trees, i.e. 8–26 cm in diameter, on average 14.6 cm.

The good sprouting capacity of aspen enables it to restock or regenerate in coppices. The thickets need only to be cleaning thinned and thinned to become open enough for the large poplar longhorn. It seems, too, that injured trees are more vulnerable to attack. In our study area the larvae were common in saplings which had sprouted after being cut.

PALM (1951) noticed that large poplar longhorn prefers saplings injured by moose *Alces alces* (L.). According to ŠROT (1962) this insect is found in both sick and healthy trees, but it lays its eggs most abundantly on well-growing trees. The bases inhabited by large poplar longhorn will never become valuable timber trees, since the galleries and the rot spreading within them destroy the quality of the wood. But these aspens are suitable for paper, firewood or wood chips. For woodpeckers the aspens should preferably be raised in open places such as avenues, field edges, felled areas, power lines and other marginal land. Individual trees could also be raised in places where there are no possibilities of growing economic forests. However, the large poplar longhorn should not be encouraged in those areas, where aspens are being raised for timber or close to areas where pine is being regenerated. It is known that aspen is an alternate host to pine twisting rust which causes considerable damage to pine. But barren pine forests do not attract white-backed woodpeckers.

DISCUSSION

The literature inspected by us indicates that the proportion of large poplar longhorn in the diet of the white-backed woodpecker is poorly known. According to CRAMER (1954), for example, woodpeckers are often known to peck trees inhabited by *Saperda*, and in the 200 trees examined by SCHNAIDEROWA (1961) the woodpeckers had made borings in 62 trees in order to obtain *Saperda carcharias* larvae. The woodpeckers were not however specifically identified in that particular study. TICHÝ (1963) analysed the crop contents of the greater spotted woodpecker and found that even though it was an intense predator on *S. carcharias* larvae there were practically no traces of these larvae in the crops of woodpeckers shot in areas with a great abundance of *S. carcharias*. Two of these woodpeckers containing remains of *Saperda* larvae were shot immediately after boring trunks of aspens.

In feeding experiments it was found out that the non-chitinized parts of larvae were digested in the crop within 1–2 hours and so could not be identified. In TICHÝ's (1963) study area eight species of woodpeckers were observed (including the wryneck *Jynx torquilla* L.) and of these 5 were preying on *S. carcharias* larvae in the trunks of poplars. As already mentioned the greater spotted woodpecker was the most intensive predator on these beetle larvae and the white-backed woodpecker was not observed in that area. Altogether 56 % of the poplars in the study area were inhabited by *Saperda* and the woodpeckers preyed upon 12 % of the larvae.

AHLÉN et al. (1978) stress the importance of wood-dwelling insects in the diet of white-backed woodpeckers but do not mention large poplar longhorn to be a food item. According to AHLÉN et al. (op.cit.) the white-backed woodpecker makes deep conical borings in trees for *Aromia moschata* (L.), *Necydalis major* (L.) and *Leptura (Strangalia) quadrifasciata* L., *Saperda scalaris* (L.) which lives in the phloem of birches and penetrates within the wood to pupate is also mentioned as a food item. In Jyväskylä, central Finland, white-backed woodpeckers brought mainly larvae of *Cossus cossus* L. to their nestlings (MARTIKAINEN and MURTOSAARI 1979). The information now available indicates that

the white-backed woodpecker is specialised, at least in Sweden, on wood-dwelling insects. The availability of local insect fauna determines which species is preferred in the diet. VÖUTE (1952) for example, points out that in winter woodpeckers prefer to predate upon those larvae which are most readily available in the foraging habitat.

It seems that the consensus among ornithologists is that the preference of the white-backed woodpecker for large poplar longhorn larvae is a local phenomenon, which in Finland is concentrated around Päijät-Häme and Southeast Finland. On a local scale learning may play a part in the search for food. In Heinola mlk it is curious that in winter the white-backed woodpecker visits stands of young trees thus differing in behaviour from those observed by other workers. The white-backed woodpecker is generally believed to inhabit over-aged broadleaved stands (cf. e.g. AHLÉN 1977, AHLÉN et al. 1978, ANON. 1978).

In Norway HOGSTAD (1978) noted that the white-backed woodpecker's beak is noticeably longer than that of the greater spotted woodpecker, although both are similar in body size. So the white backed woodpecker is, on average, better adapted to extract larvae living within trees than the greater spotted woodpecker.

REINIKAINEN (1979) estimated that the white-backed woodpecker takes 15–20 min. to obtain one larva of *S. carcharias* and that in one day it may, in theory, obtain about 50 *Saperda* larvae but is more likely to obtain 30 as it must spend time on other activities besides feeding (REINIKAINEN 1979). The larvae have a wet weight of 0.7 to 1.5 g. So the white-backed woodpecker eats about 20 to 45 g/day. Intake of about 30 g insect food per day may be fairly sound estimate since PYNNÖNEN (1939) has reported that a 2 weeks old greater spotted woodpecker eats about 25 g/day. When feeding young the white-backed woodpecker has to increase its foraging effort but it is clear that the white-backed woodpecker is unable to raise a big brood on large poplar longhorn.

Not much attention has been paid to its significance in competition for food resources (cf. e.g. BLUME 1977). In winter

the white-backed woodpeckers in Norway (HOGSTAD 1978), forage for food in different habitats than those observed in Heinola mlk. The birds observed in Norway foraged mostly on birch, less on spruce, least on pine, and grey alder and aspen, although present, were never used. All the white-backed woodpeckers frequented dead trees. Pecking was the most common foraging technique and the other method was bark tearing.

In Sweden, white-backed woodpeckers foraged by: stripping of bark, pecking through bark, picking food items from the surface of trees and deep conical borings. The insect larvae which live several years deep within old deciduous trees made up more than half of the items taken by the white-backed woodpeckers, also when feeding the young. About one fourth of the food search was made on aspens (AHLÉN 1977, AHLÉN et al. 1978).

In the Alps, RUGE and WEBER (1974) found that the white-backed woodpecker preferred especially mountain forests with a great proportion of broad-leaved trees. The white-backed woodpecker often searched its food from decaying stumps and trunks lying on the ground from which it found larvae and beetles. A great proportion of food was obtained by pecking but insects and larvae were also gleaned off twigs. Sometimes the white backed woodpecker caught, for instance, flying adults of *Tipula* species in the manner of flycatchers (*Muscicapa*).

HAARTMAN et al. (1963–72) mention that during the whole year the diet of the white-backed woodpecker consists of insects and their larvae living within decaying trees or stumps of deciduous trees.

The white-backed woodpecker may use different food items and foraging techniques in different parts of its range. The young stands of aspens found important in this study are not mentioned as foraging habitats of white-backed woodpeckers in other parts of Europe.

In winter, the greater spotted woodpecker in Finland feeds primarily on seeds from coniferous trees. Thus it is radically different from the white-backed woodpecker (e.g. PYNNÖNEN 1943). During spring and summer the greater spotted woodpecker in Finland concentrates on searching for insects and their larvae from decaying trees, between

crevices in bark and from foliage. In the absence of snow-cover the greater spotted woodpecker may also visit ant hills. Generally the white-backed and greater spotted woodpecker in Finland do not compete, in winter for the same food resources. The other woodpecker species in Finland are probably even less competitive with the white-backed woodpecker (HAARTMAN et al. 1963–1972). The white-backed woodpecker has thus specialised on eating winter food which other woodpecker species do not use as main food. It hence avoids direct competition with other woodpecker species.

During summer the larvae of large poplar longhorn move swiftly in those parts of the gallery free from chips, and is not consequently available to the woodpecker. Only after the larva has prepared the exit hole in late summer and after it has blocked itself in the pupating chamber by a thick plug of chips it is easy prey during to whole winter.

In spring the white-backed woodpeckers may perhaps also eat those larvae which ascend the trunk, but whose movements might be appreciably slowed down during cold days, as larvae may be inactive at a temperature of + 5.5°C (CRAMER 1954).

In Heinola mlk the larvae had ascended fairly high within the trunk differing thus from the report by e.g. PALM (1959) in which the galleries at the base of the stunted aspens were short. Young larvae living within the trunk below ground level and spending their winter there are presumably not available to the woodpecker.

How does the white-backed woodpecker localise prey? Does the exit hole made by the larva and seen on the trunk help the woodpecker to orientate to those trees which hold larvae in the pupating chamber? In our material 4/5 of the conical borings were in trees where the exit hole was visible. What is the situation in those cases when the larvae have not penetrated the bark at the exit hole? How is the woodpecker able to localise those larvae which are hibernating during the winter frost? Does the tree with galleries sound different when the woodpecker pecks at it? Does the place with a plug of chips or hibernating larva sound distinctive? It seems probable that the woodpecker pecks the trunk to ascertain either the presence of galleries within the trunk or to make the larvae in-

habiting the trunk to move.

RUGE and WEBER (1974) observed that a foraging white-backed woodpecker seems to peck at the trunk at random and then abruptly begins to peck deliberately and vigorously at the spot where it penetrates the trunk to secure the prey. After a few pecks there is always a short pause, during which the woodpecker seems to listen, to ascertain the location of the prey. Clearly, hearing plays a part in securing the prey.

HAARTMAN et al. (1963–72) suggested that the black woodpecker *Dryocopus martius* (L.) may detect the small movements of carpenter ants even below snow.

But how then are the conical borings made in the wrong place to be explained? Cases were also found in which the prey had no chance to escape from its pupating chamber. Usually those borings excavated in vain were made too low in the gallery. It seemed, however, that if the gallery was longer than usual the woodpecker usually made conical borings in vain. Our observations do not, however, allow any definite conclusions on this question. The borings made in vain suggest that hearing the larvae was not always decisive in locating the site of the conical boring.

Our observation of a boring which had been stopped apparently when the woodpecker had discovered that the larva was probably dead and eaten by fly larvae is also interesting. Did the tree sound different or did the prey not react at all prompting the woodpecker to stop trying? A conical boring of normal size would have reached the larva, so in this case the reason could not be the same as that suggested by CRAMER (1954), where the woodpeckers stopped excavating after reaching a depth of a few centimetres if the larvae was too deep within the tree.

It is known that the territory of the white-

backed woodpecker is large (e.g. PYNNÖNEN 1939). In our study area J.P. found a white-backed woodpecker in search of food 1.3 km from the nest site. Does the scarcity of prey animals constrain the white-backed woodpecker to a large territory size? The white-backed woodpecker nests appreciably earlier than the greater spotted (see e.g. SARKANEN 1978 b). Is it a result of the white-backed woodpecker's feeding ecology? The white-backed woodpecker is presumably not as dependent on the arrival of spring and weather conditions as are those woodpeckers which collect their food from the surface of trees or from the foliage. If the large poplar longhorn is the main prey item of the white-backed woodpecker, it should be preyed upon before the adult beetles hatch and leave the tree.

Large poplar longhorn is very suitable as food for the white-backed woodpecker. The larva is big and contains much fat and proteins. Surely the energy obtained from the larva is enough to compensate for the energy required of making one (sometimes even more) conical borings. But how many larvae are required during winter or feeding of the nestlings?

The clutch size of white-backed woodpecker is generally less than that of the greater spotted (see e.g. HAARTMAN et al. 1963–72). Does the large territory and small clutch size indicate scarcity of food? Is making of deep conical borings too laborious during the nestling period? Presumably not since in Sweden a great part of the diet consisted of wood-dwelling insects even during the breeding season (AHLÉN et al 1978). Would it, however, be possible to improve the breeding success of the white-backed woodpecker through artificial feeding? The forementioned focus on some of the questions which we hope will interest future studies on the white-backed woodpecker.

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SELOSTE:

RUNKOHAAPSANEN, *SAPERDA CARCHARIAS* (L.) VALKOSELKÄTIKAN, *DENDROCOPOS LEUCOTOS* (BECHST.) RAVINTONA

Lähinnä metsien rakenteessa tapahtuneen suuren muutoksen seurauksena on valkoselkätikan lukumäärä maassamme voimakkaasti vähentynyt ja sen koko olemassaolo on uhattuna. Päijät-Hämeen lintutieteilijät ovat havainneet valkoselkätikan hakkaavan suppilomaisia koloja nuorten haapojen runkoihin. Tässä tutkimuksessa saaliseläimeksi todetaan runkohaapsasen toukat.

Useampivuotisen yksilökehityksen päätteeksi rungon sisällä elävä toukka kaivaa n. 0.5 m korkeudelle koteloitumisonkalon. Tämän alapuolelle se puhkaisee puun pintaan asti ulottuvan reiän ulostuloaukoksi kehittyvää aikuista varten. Koteloitumisonkalossaan on talvehtiva täysikasvuinen toukka vailla pakenemismahdollisuuksia. Nuoremmat toukat sen sijaan talvehtivat puun työssä lumirajan alapuolella.

Valkoselkätikan todetulla pesimäalueella Heinolan maalaiskunnassa mitattiin tarkemmin talvella haapoihin hakattuja suppilomaisia koloja. Puiden keskimääräinen läpimitta kolojen kohdalta oli 8.1 cm ja ne sijaitsivat rungossa 20–75 cm korkeudella (keskimäärin 49.4 cm). Samassa rungossa saattoi olla 1–5 suppiloa. Suppiloiden lukumäärä ei kuitenkaan kuvaa syötyjen toukkien lukua, sillä monia suppiloita oli tehty saalista tavoittamatta. Tapauksissa, joissa suppilon teko oli jäänyt kesken todettiin kohdalla olleen toukan kuolleen.

Sekä suppilomaiset kolot että ulostuloreiät kylestyvät muutamassa vuodessa. Rungon sisällä olevat käytävät sen sijaan pysyvät aina avoimina. Uusien toukkien todettiin käyttävän myöhemmin jo olemassaolevia koteloitumiskäytäviä hyväkseen.

Valkoselkätikan esiintymisalueilla voitaisiin ajatella runkohaapsasen suosimista. Tämä haavan tuholaisena elävä laji iskeytyy helposti valossa kasvaviin haavan taimiin. Harventamalla haavan vesakkoja tai kasvattamalla

haapaa pellon reunoilla tai muissa varsinaiseen metsänkasvatukseen soveltumattomilla alueilla saataisiin runkohaapsasen määrä lisääntymään. Toukkakäytävät ja niitä seuraava laho tosin pilaavat laadullisesti puun tyven.