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RESEARCH ARTICLE

SOME BIOLOGICAL FEATURES OF THE CRUSTACEAN TYPOGRAPHER

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Abstract

The article presents bark-eating typographus (Ips typographus), i.e., the big spruce bark-eater, which is one of the most dangerous pests, living mainly on spruce, in most cases on sochi and pine (А.Д. Маслов-2002), rarely on cedar and larch. It settles with high intensity on large and medium-sized fir trees of cool and moist places, high productivity and low frequency, especially in the edges of the forest, where there is relatively good lighting and warmth, on newly cut, cut-broken and weakened trees for various reasons, on branches, on fir-tree residues left in the forest. , in warehouses and wood processing plants, on unpeeled logs, the trunk and bark of which are still raw. This pest is a representative of the Eurybiont group, it is characterized by a wide ecological range of distribution and great plasticity to the conditions of existence. The damage caused by its negative impact is very great from an ecological and economic point of view, therefore a detailed study of the biological features of the pests included in the crustacean family is necessary and necessary, even for the purpose of properly planning the measures to be taken against them. For example, one of the measures to combat the bark-eating typographer is the effective placement of pheromone-based insect repellents, while the natural enemy Rhizophagus (Dendroctonusmicans) gives good results against the large spruce borer (Phizophagusdisparpayk) under laboratory conditions and its settlement in spruce groves inhabited by the borer.

Introduction:-

Internal pests of the trunk and branches of conifers, which belong to the family of bark eaters (Ipinae) and the order of wood-winged beetles, It is divided into three groups: Coleoptera, Hylesinli, and Ipini.

All of them have a lot in common according to their biological characteristics and living conditions, but they differ sharply from each other according to the settlement and damage on different parts of the plant, as well as the external structure, size and shape of the body. Therefore, it is necessary and necessary to study their biological features separately, even in order to properly plan the measures to be taken against them. For example, pheromone-

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based insect traps give good results in the fight against the bark-eating typographer, while this method is unacceptable against the large spruce beetle.

The crustacean typographer is widespread throughout Europe, where there is food and optimal conditions for its existence, as well as in Russia, Mongolia, Kazakhstan, Tajikistan, Turkey, Korea, Japan, America, China and the northern part of Africa, Turkey, Georgia.

According to scientific works in Georgia, various species of crustaceans and M. Sh. The bark-eating typographer was massively distributed at the beginning of the 20th century (П.З. Виноградов-Никитин, Ф.А. Зайцев.), due to the negative impact of which, in 1904, a large number of trees in the spruce forests of Borjomi withered.In 1912-1913, as a result of unsystematic cutting, crustaceans spread massively throughout the territory of Georgia. In 1941-1945, as a result of the mass spread of bark beetles and their negative impact, more than a million trees died in the fir forest surrounding the city of Baghdad (now Mayakovsky).

In laboratory bioassays, the efficacy of the entomopathogenic fungus Beauveria bassiana against the spruce bark beetle, Ips typographus, was tested under various conditions. Four of the tested isolates and the commercial product Boverol® caused 99–100% mortality when tested at a concentration of 1.0×10^7 conidia/ml at 25°C. Using B. bassiana isolate 138 at a concentration of 1.0×10^6, the median survival time (MST) was 6.1 d and significantly longer compared with the MST of 4.2 and 4.0 d at 1.0×10^7 and 1.0×10^8 conidia/ml, respectively. In the next experiment, the beetles were maintained on spruce bark, filter paper or artificial diet during the bioassay with Boverol®, and significant differences in the MST of 3.6, 2.5 and 5.3d, respectively, were noticed. The experiment with Boverol® at different temperatures showed that the beetles lived significantly longer at 15°C (MST 8.7 d) than at 20, 25, 30 and 35°C. At 25°C, the beetles died most rapidly (MST 3.5 d). At different relative humidities (RH) of 40, 70 and 100%, nearly all beetles were dead after treatment with a suspension of Boverol® at 1.0×10^7 conidia/ml. At 40% RH, 49% of the untreated beetles died after 7 d. The best effects were achieved with the following bioassay: beetles were fed for three days on artificial diet, then dipped into a solution of 1.0×10^7 conidia/ml and transferred on a piece of spruce bark in Petri dishes at 25°C and 70% RH (J.Kreutz at all 2004)

Using Porapak Q traps, collected the bark volatiles of six angiosperm trees native to British Columbia: black cottonwood, Populus trichocarpa Torr. & A. Gray (Salicaceae), trembling aspen, P. tremuloidesMichx. (Salicaceae), paper birch, Betula papyrifera Marsh. (Betulaceae), bigleaf maple, Acer macrophyllumPursh (Aceraceae), red alder, Alnus rubra Bong. (Betulaceae), and Sitka alder, A. viridis ssp. sinuata (Regel) Á. Löve& D. Löve (Betulaceae). Utilising coupled gas chromatographic-electroantennographic detection analysis, the captured volatiles were assayed for antennal responses in five species of coniferophagous bark beetles (Coleoptera: Scolytidae), sympatric with most or all of the angiosperm trees: the Douglas-fir beetle, Dendroctonuspseudotsugae Hopkins, the mountain pine beetle, D. ponderosae Hopkins, the spruce beetle, D. rufipennis (Kirby), the western balsam bark beetle, Dryocoetesconfusus Swaine, and the pine engraver, Ips pini (Say). The identities of 25 antennally-active compounds were determined by coupled gas chromatographic-mass spectroscopic analysis, and co-chromatographic comparisons with authentic chemicals. The compounds identified were: hexanal, (E)-2-hexenal, (Z)-3-hexen-1-ol, 1-hexanol, heptanal, α-pinene, frontalin, benzaldehyde, β-pinene, 2-hydroxycyclohexanone, 3-carene, limonene, β-phellandrene, benzyl alcohol, (E)-ocimene, salicylaldehyde, conophthorin, guaiacol, nonanal, methyl salicylate, 4-allylanisole, decanal, thymol methyl ether, (E)-nerolidol, and dendrolasin. A number of these compounds are known semiochemicals that are active in the behaviour of other organisms, including bark beetles, suggesting a high degree of semiochemical parsimony. Antennally-active compounds ranged from seven in A. viridis to 17 in P. trichocarpa. The fewest number of compounds (9) were detected by I. pini and the largest number (24) were detected by D. pseudotsugae. Six compounds excited the antennae of all five species of bark beetles. The large number of antennally-active compounds detected in common by numerous bark beetles and present in common in numerous nonhost trees supports the hypothesis of olfaction-based recognition and avoidance of nonhost angiosperm trees during the process of host selection by coniferophagous bark beetles (Dezene P.W at all 2003)

Materials And Methods:-

The beetle is dark brown, brown, or almost black, shiny, short cylindrical and bushy. At the end of the upper wings, four to four teeth can be seen on the sides of the cart. The second one from the tip is the largest and is enlarged like a button at the end. The middle part of the front of the forehead with a well-defined ridge.

According to different authors, the length of the insect's body is 3.5-5.5 mm. b. N. According to Ogibini (1973), male beetles are 4.81\pm0.005mm long, females 4.83\pm0.005\mm, average 4.2-5.5mm. According to our studies in different environments, adult male beetles reach 5.5 mm in length, and females reach 5.9 mm in length (Fig. 1.)

Fig. 1:- Crustacean typographer.

Fig. 2:- The length of the female is 5.9 mm.

Such a difference in the length of beetles L. Nef (L. Nef 1990) relates the distribution of this harmful insect at different heights above sea level, the speed of tree growth, the density of the pest's settlement on the tree, the content of various substances in the tree and the chemical composition in the soil, which is confirmed by our research.

The egg-

glitter is white, semi-transparent, slightly oval, with a thin mucous membrane. Which is placed by the female on both sides of the uterine passage, in the ovarian chambers, 1 mm apart.

Caterpillar –

(Fig. 1.a) does not have legs, it is yellowish white or white, it is sickle-shaped on the side of the abdomen, the head is well defined, it is dark-yellow in color.

Fig. 3:- Eggs of crustacean typographer.

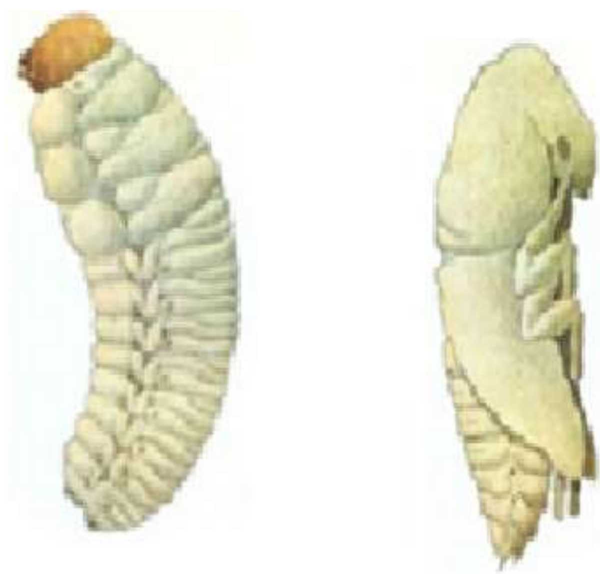

Fig. 4:- Crustacean typograph worm and maggot phase.

The purpose of studying the issue was to determine some biological features of crustacean typographers, such as their development, factors causing and limiting mass reproduction, their negative economic value, and others. For this purpose, we have conducted many years of research, both in the field and in the laboratory.

In order to study the issue in the period 2014-2022, in the western region of Georgia, in particular, in the spruce forests of Adjara, in groves of different altitudes (750-2000m), exposure, steepness of the slope, soil depth, species composition, forest frequency, bonity, moisture content and understory groves, constant and Temporary sample areas, the number of which was proportional to the area of the study area. On average, 2-3 sample areas were allocated per 1000 hectares, and the total length of the routes was 20 kilometers on average. The number of trees present in the sample area and among them to be studied depended on the spread of pests and diseases.

At least 200 trees were studied in the case of a small spread of pest-diseases and a small number of affected trees (up to 10%), in the case of 10% to 20% damage - 100 trees, and in the case of 21% to 40% damage - 50 trees, In case of 41% or more damage - 20 trees.

In the case of pronounced group wilting, counting was done in the foci of pest-diseases and in a 5-meter strip around the foci. In the case of an even distribution of affected trees, while the foci of pests and diseases are not clearly defined, counting was done on diagonal or zigzag-like lines in the entire area of the study area.

The pathological condition of the forest groves was assessed according to the rules accepted in international forest phytopathology and entomology, for Class III woodworms and above:
I – sustainable (healthy) - groves in which the current year's wilting did not exceed the permitted threshold level. Damage caused by pests and diseases was insignificant or not recorded at all.
II – sustainability (viability) is violated - groves where the drying of existing trees exceeded twice the permissible threshold level. Such groves are characterized by group withering of trees, retardation in growth, change of color of needles and leaves. Uneven formation of exercise.
III – loss of stability (viability) - damaged groves, the majority of trees in which were dry or withered.

In order to reveal the density of the population of the pest on the tree, the density of the bark-eating typographer and the bark-eating beetle, the length of the nesting passages, the gradient of withering, production, stock, increase, absolute number total number per pallet (piece/pallet), tree (piece/tree), sample area (ten pieces/sample area) and hectare (thousand pieces/ha);

In addition to the bark-eating typographer (Ips typographus) and the wood crane bark-eater (Ips acuminatusEichn), all kinds of pests were recorded on the bark of the tree, including the large spruce beetle (Dendroctonusmicans), the spruce-breasted beetle (Tetroplumfuscum) and others, as well as entomophagousrhizophagus (Phizophagusdisparpayk). , ant beetle, formicarius (Thanasimusformicarius), neck moth (RaphidiaophiopsisLackum), colossoma (Colossomamacropomum) fly from the Lonchaea family (Lonchaeacollini Hackman) and others, their numbers in percentages, distribution area, population density, development phases, the result of negative effects of the pest , entomophagy efficiency and others.

Results And Discussion:-

The growth and development of the bark-eating typographer (Ips typographus) and the bark-eating beetle (Ips acuminatusEichn), separate phases (egg, caterpillar, pupa, imago) were observed both in the field and in laboratory conditions At temperatures of $-3^0\mathrm{C}-5^0\mathrm{C}-7^0\mathrm{C}-10^0\mathrm{C}$

Nine years of multiple observations in laboratory conditions have shown us that the growth and development of crustacean typographer at 0^0C temperature takes place in all phases, (we did not observe the rock) and their growth rate increases as the temperature increases. Some parts of the worm's body grow faster than others, on the basis of which it can be assumed that the growth of the worm through skin changes depends on the action of environmental conditions, such as temperature, humidity, lighting, nutrition, fluctuations in these conditions, and others. By examining the bark of the model trees left under the snow cover and examining it in detail, we found both caterpillars and grubs, as well as young and adult beetles on the bark.

On standing model fir trees at 1500 and 1800 m above sea level, where the snow cover thickness was greater than 2 m, 80% of the pest was located in the snow cover from the root neck to the height of the trunk 2 m, a small amount of the pest was observed at the height of 2 m above the snow cover.

For the purpose of reducing and destroying the bark eaters and cravings in 2014-2022, the pheromone (Ipsovit, Acuwit) insects (6000 pieces in 2014-2015, 2016-2018-202021-2021-2021) Monitoring, recording and analysis were carried out. (Table No. 1, Fig. No. 1)

Every 8-9 days, insects were removed from the funnels and compared with the previous monitoring results. Dry, withered and damaged trees as a result of the negative impact of typographic bark-eating, as well as cut-broken trees, raw guts and fallen bark were recorded and marked with oil paint. Insects collected from individual quarters and areas of the forest were weighed on an electric milligram scale for comparison with previous monitoring results. **On average, there are 187 pieces of crustaceans with a weight of 1 gram.**

To find out the flight period of the pest, in field conditions in the same area (at an altitude of 750-1000-1200-1500-1800 meters above sea level), in a fixed sample area, with the drying of the snow cover, when the ambient air temperature is still $3^0-5^0-10^0\mathrm{C}$ It fluctuated between 10^0C in signally placed pheromone insect traps. A small number of insects (2-3 pieces) were observed at ambient air temperature of 13^0C flight activation started at 15-16^0C, and constant flight and strong activity took place at temperature of 20-25^{0}C. Therefore, when placing pheromones, it is necessary to pay attention not to the time of year, but to the ambient air temperature. And the most active time of flight and damage lasts from 12:00 to 17:00 in sunny summer weather, while the relatively passive time is morning and evening. Flying in cloudy weather is reduced or completely stopped. They are distinguished by their special pest activity in drought conditions, because they easily settle on trees weakened by lack of water.

We observed the effectiveness of pheromone insect repellants (IPSOVIT, ACUWIT) placed in fir trees inhabited by bark-eating typographers and kentsero bark-eaters. According to our long-term observation (2014-2022), when pheromone insect traps were placed in the forest 5 meters away from the trees inhabited by the pest and the distance between the insect traps was 50 meters, this led to a massive attraction of insects, due to which more trees dried up and group-focal drying occurred, and where Pheromone insect traps were placed at a distance of 100 meters or more from the forest, where the distance between the insect traps did not exceed 50 meters, compared to less trees.

Table 1:-

Quarter	Composition	Abundance	Frequency	Height at the top	Number of insect	2019					2020					2021					2022				
						month																			
						May	June	July	August	all	May	June	July	August	all	May	June	July	August	all	May	June	July	August	all
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
43	96d1ნცb	50	0,5	547	20	320	600	580	280	1780	50	355	321	170	896	25	277	254	44	600	123	986	677	437	2223
3	10ნd	150	0,5	723	17	244	487	305	169	1205	35	280	275	51	641	27	257	219	41	544	111	901	604	371	1987
48	5ნd3ნd4ცჭ	70	0,5	800	13	220	351	254	156	981	12	200	180	20	412	25	243	201	39	508	97	823	685	118	1723
40	10ნd	70	0,5	950	10	200	457	325	131	1113		106	97		288	25	199	167	88	479	57	647	640	287	1631
	all				60	984	1895	1464	736	5079	97	661	873	241	2237	102	976	841	212	2131	388	3357	2606	1213	7564
34	8ნd2ნb	70	0,6	1033	15	60	380	525	148	1100	37	233	227	49	546	31	237	198	63	529	50	584	561	154	1349
39	5ნd3ცჭ2ჩც	70	0,5	1200	15	43	400	340	92	875	25	190	157	35	407	20	237	184	60	501	44	511	445	140	1140
40	10ნd	130	1	1453	15	25	209	130	61	425	20	157	136	30	343	20	194	156	55	425	22	101	89	58	270
	all				45	128	989	995	301	2400	82	580	520	114	1296	71	668	538	178	1455	116	1196	1095	352	2759
76	9ნd1ხჭ	45	0,7	1687	10	20	155	107	47	329	13	56	49	23	141	11	69	56	20	156	41	321	304	63	729
19	7ნd3ხჭ	90	0,6	1765	10	17	97	80	31	225	-	17	13	7	37	4	31	18	8	61	21	287	219	38	565
	all				20	37	252	187	78	554	13	73	62	30	178	15	100	74	28	217	62	608	523	101	1294

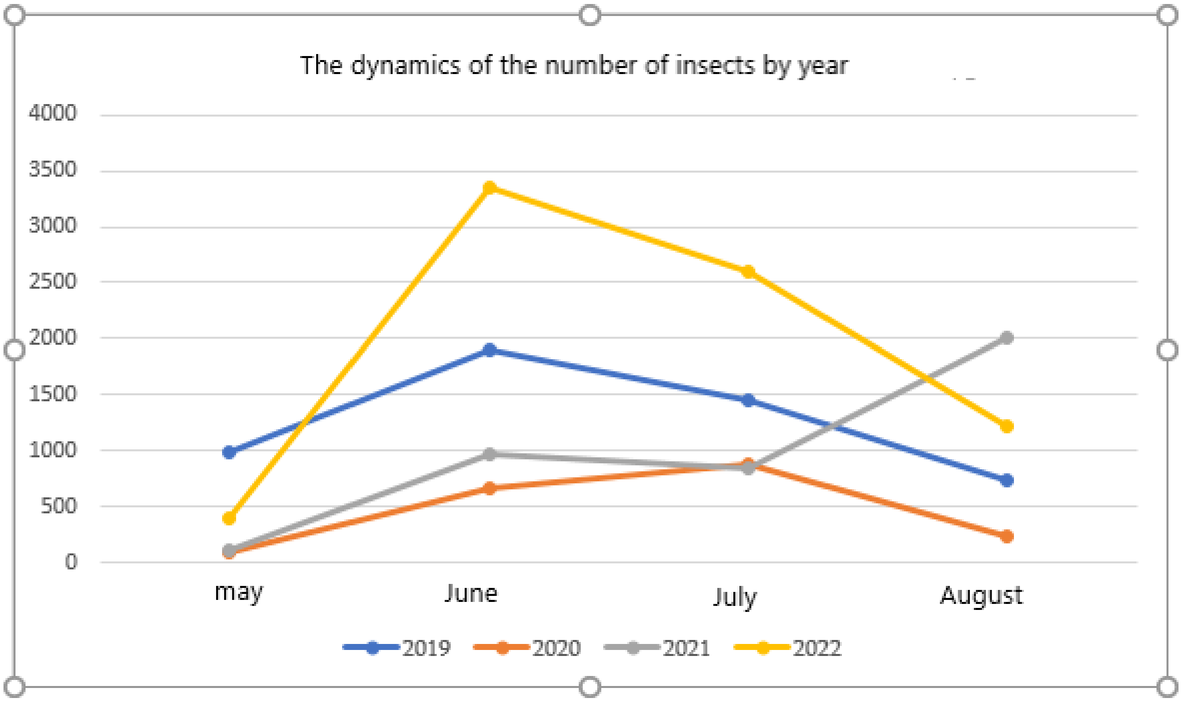

Fig.5:- Thedynamicsofthenumberofinsectsbyyear.

Duringtheflight, maleinsectschoose a treebysmellingthenaturalattractant (lat. Attraho-I am atrect) in the air. He chooses a bark with a smooth surface or a crack in the bark, starts to make an entrance hole (Fig. 3), in a vertical direction, from the bottom up, which is cylindrical in shape and slightly inclined, and under the bark he makes a mating passage, the diameter of which is slightly larger than the size of the insect's body, which Because he only moves forward and throws the rodent back with the help of a cart. At the end of the hole, under the bark, it makes an expanded field or nuptial chamber of about \ 0.41 mm2 (И.Я. Шевырёв)-1 cm2 (А. Д. Маслов-2010) size, where female beetles that are fertilized by only one male gradually accumulate. Then the female beetles start to make passages of different lengths on both sides of the female passage in different directions (Fig. 5) and dig out the ovarian chambers on these passages. According to our data, there are about 5-9 ovarian chambers per 1 cm of the oviduct, and 20-30 chambers on the entire oviduct, where the female lays one egg in each chamber and covers it with flour. A. d. According to Maslov (2010), each female, depending on the length of the passage, lays a minimum of 15 eggs, a maximum of 56 eggs, and an average of 20-25 eggs. N. According to the data of Ogibini (1974), in the case of an average population of bark beetles, the female lays 152-158 eggs. In many cases, the ovarian chambers are empty.

According to various scientific works (Ильинский-1958 и др; Исаев 1967, 1971; Rudinsky, Novak, Švihra-1970; Лебедева и др -2001.), one of the components of the pheromone - methylbutenol - is already present in the rectum of a male woodpecker living on a weakened tree. And during the gnawing of the bark, the second component cis-verbenol is produced, the combination of which is an attractant, which is already mixed with the gnawing of the bark and partially the protein. In the process of working in the bark, the insect expels this gnat from the entrance hole, which emits a specific smell, attracts the bark-eating beetles of both sexes, and they settle en masse on the host tree. At the same time, this, brown, hollow flour, is the first sign of the bark-eating beetle settling on the tree (Fig. 6). In addition to imprinting crustaceans, entomophages are also attracted to the smell of the attractant (Phizophagusdisparpayk, ant beetle, formicarusThanasimusformicarius, hornworm RaphidiaophiopsisLackum, Colossomamacropomum fly from the Lonchaea family, Lonchaeacollini Hackman, and others), which destroy and reduce the number of impressions. Bark eaters, hand prevent their massive reproduction and spread.

Fig. 6:- Entranceholeoftheimprintingcrustacean.

Fig. 7:- Footprints under the bark of the imprinting bark-eater 15.02.2018.

The period of active action of the attractant and the attraction of insects to its specific smell are specified by different authors at different times. V. T. According to Valenta, the active period of the attractant is 12-48 hours after the insect gnaws the bark, on the 5th day its activity drops to 40%, on the 7th day to 30%. N.B. According to Paninina, the active period is 2-5 days, and A. S. According to Isaev, the active period is 18 hours, it begins to decrease on the 5-6th day, and the attraction activity stops after two weeks.

Fig. 8:- Brown hollow flour due to the impact of the printing crustacean.

Fig. 9:- Group wilting of conifers under the influence of a bark beetle.

On the 5th-7th day of settling on the tree, the male bark-eaters slowly start to leave the passages under the bark, their number gradually decreases, and on the 20th day they are no longer present. A. d. According to Maslow, this process lasts 30-45 days.

According to our observations, the egg stage lasts 10-20 days, the caterpillar 20-30 days, and the pupa 7-15 days in different environments. It takes about 35-65 days for the new generation to fully develop. Young beetles continue to feed and gnaw the passages unsystematically for about two weeks in order to mature the genitals. Their exit from the bark and flight depends on the environmental factors, the temperature of the atmosphere must exceed at least $+16-17^0$C.

Even old beetles go through renewal feeding for the entire use of sexual stock. At this time, they stop laying eggs and look for a suitable place for feeding. After restoring the reproductive system, the beetles prepare the so-called eggs repeatedly in the same summer. to the passages of dobils. The population developed from these passages is the Dobil generation.

Long-term observation of permanent sample areas separated at different heights above sea level reveals that many factors determine the density, intensity, and negative impact of typograph bark-eating trees, as a result of which there is a scattered type of single-tree withering, as well as a group-focal type of withering. The speed of drying of trees depends on the size of the tree and the density of their population. They mainly settle on mature, mature (50-150 years) and overripe Christmas trees weakened for various reasons, although they also settle on healthy trees during the period of massive flowering and reproduction. They are particularly harmful during a long drought period, when the soil suffers from a lack of water.

Fig. 10:- Insect traps with pheromone placed in the spruce grove.

Fig. 11:- Print crustaceans removed as a result of one of the monitoring.

Under the bark of the upper tree, the bark-eating typographer hibernates in all phases of its development (egg, caterpillar, beetle of various arthropods). In the fallen spruce bark and in the mineral layer of the soil at a depth of 6-8 cm, only beetles of various arthropods hibernate.

Thus, our research revealed the following:

1. The mass reproduction of the pest is facilitated by high fertility, rapid development, a large number of generations, resistance to climatic factors, biotic factors, incorrect cultivation measures, such as: leaving trees infested with pest-diseases in a cut and uncut state, leaving residues and pest-infested bark on the cut area, Leaving the glands unpeeled, reducing the frequency of the forest and others.
2. 80% of the pest is concentrated in the snow cover from the root neck to the height of 2 m of the stem, and a small amount is above the snow cover. In the 6-8 cm deep layer of the soil and in the fallen bark, where thousands of insects gather at the same time, we are at a distance of 2.5-3.0 m from the trunk of the buzzing tree, which is the best moment to fight against them with a chemical method (insecticides).
3. There are about 5-9 ovarian chambers per 1 cm of the oviduct, and 20-30 chambers on the entire oviduct, where the female lays one egg in each chamber and covers it with fine flour.
4. According to our observations, the egg stage lasts 10-20 days, the larva 20-30 days, and the pupa 7-15 days in different environments. It takes about 35-65 days for the new generation to fully develop.

1. The growth and development of the pest at a temperature of 0^0 C, in all phases (worms, larvae, immature beetles) is taking place, but very slowly. As the temperature increases, their growth rate increases.
2. Typograph crustaceans move very slowly even at a temperature of 0^0 C, but flight and negative activity are not observed, while constant flight and strong activity take place at a temperature of $20-25^{0}$C.
3. It is effective to place pheromone insect killers (IPSOVIT, ACUWIT) outside the forest at a distance of 100 meters, where the distance between the insect killers should not exceed 50 meters, in spruce forests inhabited by the bark-eating typograph and to writebark-eaters.
4. 187 pieces of typograph are crustaceans, the average weight is 1 gram.
5. In different environments, adult male beetles reach 5.5 mm in length, while females reach 5.9 mm in length.

In order to reduce the pest to a minimum, it is necessary to carry out timely and correct forestry complex measures, such as:

1. Placement of signaling pheromone insect traps for timely detection of pests.
2. In order to attract bark eaters and further destroy them, it is necessary to cut down healthy trees in the fall, on which the pest will settle for wintering, which should be peeled in early spring, the bark should be collected and burned, and the area around the tree should be poisoned within a radius of 3 m;
3. It is necessary to place 3-4 pheromone insect repellents per 1 ha in spruce forests inhabited by bark beetles;
4. Based on the monitoring carried out, the type of bark-eating pest should be accurately recorded (Ips acuminatus, two-toothed bark-eater, Pityogenesbiminats, four-toothed bark-eater, Pityogenesquadridens, six-toothed bark-eater, Ips sexdentatus, printing bark-eater, Ips typographus).
5. In areas inhabited by pests, we should encourage the use of entomophagous insects and insectivorous birds as much as possible.
6. The spruces inhabited by the pest should be inspected in detail, the area of distribution, the intensity of the infestation should be recorded, the trees inhabited by the pest should be cut, the trunk should be cleaned from the branches, the trunk and the bark should be peeled, the branches smaller than 8 cm should be closed on the ground, and the branches larger than 8 cm, tree trunks and Pull the bark from the forest. In order to avoid damage to sprouts, it is better to carry out this measure in winter.
7. On the basis of the implemented monitoring, fungi and other types of diseases that contribute to the weakening of spruce groves and the further spread of pests should be registered.

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