

## Insect Fauna of Chestnut Bushes at Paju Area in Korea —Mainly on *Dryocosmus kuriphilus* Yasumatsu—

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파주지역 밤나무숲의 곤충상 연구  
—주로 밤나무혹벌에 대하여—

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### 적 요

경기도 파주지역의 밤나무숲은 밤나무혹벌 (*Dryocosmus kuriphilus* Yasumatsu)이 1965년 이래로 번성하여 막심한 피해를 받고 있으며 벌목되는 나무의 수가 증가 되어가는 실정이다. 저자는 밤나무혹벌의 생물학적 자연구제의 대책을 연구코저 파주군의 법원리, 마장리, 분수리의 3개처와 양주군의 보광사, 벽제리, 2개처에 대하여 밤나무숲의 곤충상을 조사하였다. 전 지역에 대하여 5목 35종의 곤충을 채집하였으며 법원리에서는 해충의 번성이 심하였으나 분수리에서는 작년가지에 많은 밤나무혹벌의 혹이 금년가지에서는 볼수 없어 하나의 회복증상을 발견하고 그 이유로서 법원리는 숲이 고립되어 있으나 분수리는 상수리나무숲으로 잘 둘러싸여 있다는 사실을 지적, 삼림조성에 있어서의 혼합림조성 방식을 제창하였다.

### INTRODUCTION

I have found the chestnut bushes of Kyonggydo, Korea are seriously damaged by chestnut gall wasp, *Dryocosmus kuriphilus* Yasumatsu, in 1965 and ceasingly the trees were withering day by day. The flourish of chestnut gall wasp was first reported by Yasumatsu on Okayama area, Japan in 1941. Research reports on this wasp were administered by Park(1963), Cho(1963), Ko(1966) in Korea and by Fukuda(1950), Ito(1962, 1964, 1965, 1967), Nitto & Shimizu(1954, 1956), Shiraga(1948), Tamura(1959, 1960, 1965, 1967), Torii(1959) and Yasumatsu(1941, 1952, 1955, 1958) in Japan.

Agricultural insecticides, parathion, is effective

to control this wasp. In 1955, Yasumatsu had reported nine effective natural enemies that can be applied to control this gall wasp biologically. *Eupelmus urozonus* Dalman, *Eurytoma rosae* Nees, *Ormyrus sp. A*, *Ormyrus sp. B*, *Megastigmus sp. A*, *Megastigmus sp. B*, *Torymus sp.* are natural enemies that were reported by Ito in 1964.

### MATERIALS AND METHODS

I have administered analytic research on insect fauna for several chestnut bushes at Paju area to affirm the practical applicability of biological control to this gall wasp. I have accomplished analytical investigation of insect fauna at Bobwonri, Majangri, Bunsuri of Paju county and Bokwangsa, Biokjeri of

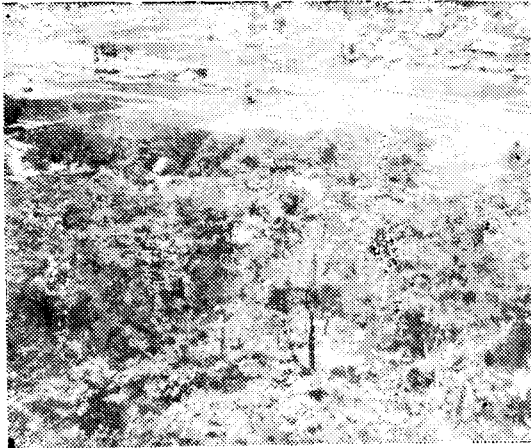


Fig. 1. Whole view of chestnut bush at most seriously damaged Bobwonri.

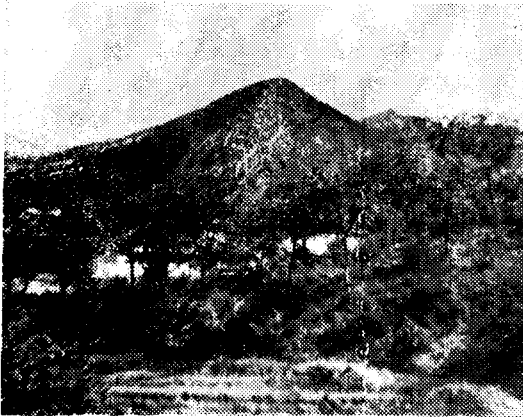


Fig. 2. Side view of chestnut bush at most seriously damaged Bobwonri.



Fig. 3. Damaged individual chestnut tree at Bobwonri.

Yangju county. The period of investigation was from September 1, 1968 to September 30, 1969.

## RESULTS

The chestnut bush at Bobwonri was most seriously damaged by noxious insect parasites among the five investigated areas. It consisted of about 300 individual chestnut trees. The ages of trees were 120 years old to 20 years old. They were mixed at about half each. Main noxious insects were *Dryocosmus kuriphilus* Yasumatsu, *Aletia flavostigma singularis* Butler and *Dictyoploca japonica* Moore. Wasp spread was begun since 1965 and it was increasing in flourish every year in spite of occasional parathion spreading.

The chestnut bush at Bunsuri exhibited wonderful recovery from gall wasp infection. This bush was surrounded by another bush of *Quercus acutissima* Carruthers. And this special circumstance was real characteristics of this area which can be compared to other investigated areas. Here, I have found many gall scars on the last year's branches but I could not find any gall formation on the new branches which were formed this year. I could collect many beneficial insects and one species of natural predator *Ormyrus nigrifemoralis* Yasumatsu that can provide clear explanation to support the extraordinary situation at Bunsuri. The other chestnut bushes at Majangri, Bokwangsa and Biokjeri were slightly damaged by *Dryocosmus kuriphilus* Yasumatsu. I could not find any special characteristics which must be mentioned but it was clear that these areas were also increasing in its damage.

*Dryocosmus kuriphilus* Yasumatsu exhibited maximum population density throughout all areas. At Bobwonri, the number of species of insects found were very few compared to other areas. I think this is the reason why the gall wasp at Bobwonri was most seriously prosperous. I want to indicate another reason of gall wasp prosperity at Bobwonri. The bush of chestnut at Bobwonri is isolated without

**Table 1.** Insect fauna investigated

| Areas      | Insects                             |                                      |  |  | Density |
|------------|-------------------------------------|--------------------------------------|--|--|---------|
|            | Order                               | Family                               | Species  |  |         |
| Bobwonri   | Lepidoptera                         | Noctuidae                            | <i>Aletia flavostigma singularis</i> Butler        | +++                                    |         |
|            |                                     | Saturniidae                          | <i>Dictyoploca japonica</i> Moore                  | +++                                    |         |
|            | Hymenoptera                         | Cynipidae                            | <i>Dryocosmus kuriphilus</i> Yasumatsu             | +++                                    |         |
| Majangri   | Coleoptera                          | Lucanidae                            | <i>Lucanus maculifemoratus</i> Motshulsky          | ++                                     |         |
|            |                                     | Scarabaeidae                         | <i>Gymnopleurus mopsus</i> Pallas                  | -                                      |         |
|            |                                     |                                      | <i>Kolbeus coreanus</i> Kolbe                      | +                                      |         |
|            |                                     |                                      | <i>Xylotrupus dichotomus</i> Linne                 | +                                      |         |
|            | Hymenoptera                         | Cynipidae                            | <i>Dryocosmus kuriphilus</i> Yasumatsu             | +                                      |         |
|            |                                     |                                      | Vespidae   | <i>Vespa crabro</i> Linne              | +       |
|            |                                     |                                      |  | <i>Vespa mandarinia</i> Smith          | +       |
|            |                                     |                                      | <i>Polistes olivaceus</i> De Geer                  | +                                      |         |
|            |                                     | Apidae                               | <i>Bombus ignitus</i> Smith                        | +                                      |         |
|            |                                     |                                      | <i>Nomada ferveus</i> Smith                        | +                                      |         |
|            | Bunsuri                             | Hymenoptera                          | Cynipidae  | <i>Dryocosmus kuriphilus</i> Yasumatsu | +       |
|            |                                     |                                      |  | <i>Andricus inflator</i> Hartig        | +       |
|            |                                     | Ichneumonidae                        | <i>Ophion luteus</i> Linne                         | +                                      |         |
|            |                                     |                                      | Shhecidae  | <i>Sceliphron inflexum</i> Sickmann    | +       |
|            |                                     |                                      | <i>Ammophilia infesta</i> Smith                    | +                                      |         |
|            |                                     | ?                                    | <i>Ormyrus nigriritibialis</i> Yasumatsu           | +                                      |         |
|            |                                     | Apidae                               | <i>Bombus ignitus</i> Smith                        | +                                      |         |
|            |                                     |                                      | <i>Nomada ferveus</i> Smith                        | +                                      |         |
|            |                                     | Vespidae                             | <i>Vespa crabro</i> Linne                          | +                                      |         |
|            |                                     |                                      | <i>Polistes olivaceus</i> De Geer                  | +                                      |         |
| Coleoptera | Cerambycidae                        | <i>Dihammus luxuriosus</i> Bates     | +  |  |         |
|            |                                     | <i>Prionus insularis</i> Motschulsky | +  |  |         |
|            | Coccinellidae                       | <i>Aiolocaria hexaspilota</i> Hope   | +  |  |         |
| Bokwangsa  | Hymenoptera                         | Cynipidae                            | <i>Dryocosmus kuriphilus</i> Yasumatsu             | +++                                    |         |
|            |                                     |                                      | Vespidae   | <i>Vespa mandarinia</i> Smith          | +       |
|            |                                     |                                      | <i>Vespa analis</i> var. <i>crabroformis</i> Smith | +                                      |         |
|            |                                     | Apidae                               | <i>Rygiium flavomarginatum</i> Smith               | +                                      |         |
|            |                                     |                                      | <i>Xylocopa appendiculata circumvolans</i> Smith   | +                                      |         |
|            | Hemiptera                           | Pentatomidae                         | <i>Pentatoma japonicum</i> Distant                 | +                                      |         |
|            |                                     |                                      | <i>Nezara viridula</i> Linne                       | +                                      |         |
|            |                                     |                                      | <i>Rubiconia intermedia</i> Wolff                  | +                                      |         |
|            | Coleoptera                          | Carabidae                            | <i>Carabus dehaani</i> Chaudoir                    | +                                      |         |
|            |                                     |                                      | <i>Carabus koreanus</i> Reitter                    | +                                      |         |
|            |                                     | Cerambycidae                         | <i>Callipogon relictus</i> Semenov                 | +                                      |         |
|            |                                     |                                      | <i>Prionus insularis</i> Motschulsky               | +                                      |         |
| Syrphidae  |                                     | <i>Didea alneti</i> Fallen           | +  |  |         |
|            | <i>Tubifera virgatus</i> Coquillett | +                                    |  |  |         |

|          |             |                                     |  |    |
|----------|-------------|-------------------------------------|--|----|
| Biokjeri | Hymenoptera | Cynipidae                           | <i>Dryocosmus kuriphilus</i> Yasumatsu | ++ |
|          |             | Vespidae                            | <i>Vespa crabro</i> Linne              | +  |
|          |             |                                     | <i>Vespa mandarinia</i> Smith          | +  |
|          |             | Apidae                              | <i>Bombus ignitus</i> Smith            | +  |
|          |             |                                     | <i>Tetralonia mitsukurii</i> Cockerell | +  |
|          | Coleoptera  | Oedemeridae                         | <i>Oedemera lurida</i> Marsh           | +  |
|          |             | Syrphidae                           | <i>Eristaloniya tenax</i> Linne        | +  |
|          |             | <i>Tubifera virgatus</i> Coquillett | +                                      |    |

Notes : +++ very many (over 100 individuals per tree)

++ many (seen at every tree)

+ frequent (found frequently)



Fig. 4. The adult of *Dryocosmus kuriphilus* Yasumatsu,  $\times 50$ .

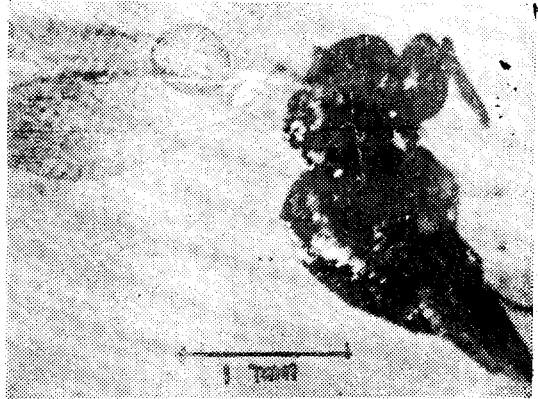


Fig. 6. The adult of *Ormyrus nigrifibialis* Yasumatsu.

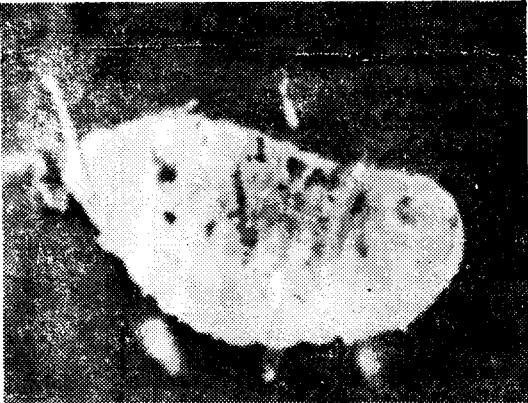


Fig. 5. The egg of *Ormyrus nigrifibialis* Yasumatsu.



Fig. 7. The characteristics of gall wasp damage at Bobwonri. The tree is withering from the top branches.

any protective forest around it. In contrast, the chestnut bush at Bunsuri was covered by good forest of *Quercus acutissima* Carruthers around it.

### DISCUSSION

Major discussion in this paper is to indicate clear reason on the fauna divergence between Bobwonri and Bunsuri. As I noted in Table 1, Bobwonri had only a few species of harmful insects compared to other stations. This was mentioned first as a reason of serious damage to *Castanea crenata* S. et Z. by *Dryocosmus kuriphilus* Yasumatsu. *Aletia flavostigma* Butler, *Dictyoploca japonica* Moore and *Dryocosmus Kuriphilus* Yasumatsu were all strikingly harmful to *Castanea crenata* S. et Z. even though *Dryocosmus kuriphilus* Yasumatsu was most harmful. I would like to indicate one more factor that characterize the Bobwonri case as the bush of *Castanea crenata* S. et Z. was entirely isolated nevertheless the other research areas were mostly surrounded by *Quercus* species. At Bunsuri, it was clear that the bush of *Castanea crenata* S. et Z. was entirely surrounded by a bush of *Quercus acutissima* Carruthers. Theoretical approaches on population dynamics of noxious insects at chestnut bushes are planned to investigate at next step.

### SUMMARY

1. Paju area of Kyonggydo has received serious damages by *Dryocosmus kuriphilus* Yasumatsu in the bushes of *Castanea crenata* S. et Z. since 1965. I have also found the middle parts of whole country of Korea has damaged by this wasp.

2. Bobwonri was the worst case in its damage by *Dryocosmus kuriphilus* Yasumatsu with most prosperous parasite, *Aletia flavostigma singularis* Butler and *Dictyoploca japonica* Moore. I conclude that this is the result of the lack of beneficial insects and isolated bush formation.

3. The chestnut bush at Bunsuri was recovering

from the damage of gall wasp nevertheless it was illustrated big damage at last year's branches. I conclude that this recovering phenomena is closely related with the insect fauna of this area and this characteristic insect fauna was derived from the bush formation which reveals specific bush arrangement that can be illustrated as surrounded by another bush of *Quercus acutissima* Carruthers.

4. As a final conclusion, I recommend mixed bush formation of chestnut tree with *Quercus* species to control insect population dynamics in healthy status.

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