

## A New Record of Tarsonemid Mite, *Steneotarsonemus spinki* (Acari, Tarsonemidae) and Its Damage on Rice in Korea

### 한국 미기록 벼먼지응애, *Steneotarsonemus spinki*와 그 피해

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**Abstract** – A tarsonemid mite, *Steneotarsonemus spinki* Smiley 1967, is an important rice pest in major rice producing countries of Thailand, Philippine, China, and Taiwan. *S. spinki* was found first time in Korea from rice grown in environment controlled greenhouse. Rice fed by the mite showed damage symptoms of deformed panicles and inflorescence, lesions on the inner surface of leaf sheath, and browning of rice hulls. Females of *S. spinki* was 263.0  $\mu\text{m}$  (246.5~284.6 $\pm$ 12.2) in body length and 92.4  $\mu\text{m}$  (79.5~104.9 $\pm$ 7.6) in body width. Body was elongate and broadest in region of hysterosoma. Body color was pale brown. Legs were robust except for the legs IV which were typical tarsonemid female legs terminating in a whiplike seta two times the length of the leg. Male of *S. spinki* was 196.5  $\mu\text{m}$  (176.5~222.8 $\pm$ 15.8) in body length and 109.3  $\mu\text{m}$  (98.6~117.7 $\pm$ 6.4) in body width. Anterior ends of apodemes III were extended further than apodemes IV. Femur IV had large inner median lateral flange, and inner anterior and outer median setae were short about equal length. Tarsal claw was stout and curved ventrally.

**Key Words** – Tarsonemidae, *Steneotarsonemus spinki*, Taxonomy, Damage, Rice

**초 록** – 먼지응애류인 벼먼지응애 (新稱, *Steneotarsonemus spinki* Smiley 1967)는 쌀생산국인 태국, 필리핀, 중국, 대만 등에서 쌀의 중요한 해충이다. *S. spinki*가 국내에서 처음으로 환경조절온실에서 재배중인 쌀에서 발견되었다. 응애 피해를 입은 쌀은 이삭에서 기형을 나타내었으며 잎집 내부 표면의 갈변증상, 쌀알의 표면 갈변증상 등을 나타내었다. *S. spinki* 암컷의 체장은 263.0  $\mu\text{m}$  (246.5~284.6 $\pm$ 12.2), 체폭은 92.4  $\mu\text{m}$  (79.5~104.9 $\pm$ 7.6)였으며 전체적인 모양은 난형으로 중앙부위가 가장 폭이 넓었다. 체색은 연한 황색이었다. 다리는 잘 발달되어 있었으며 암컷 제 4각 끝은 채찍모양의 강모로 이루어진 전형적인 먼지응애류의 특징을 가지고 있었다. 수컷 체장은 196.5  $\mu\text{m}$  (176.5~222.8 $\pm$ 15.8), 체폭은 109.3  $\mu\text{m}$  (98.6~117.7 $\pm$ 6.4)였으며 전체적인 모양은 길쭉하고 전동체부 중앙부가 가장 체폭이 넓었다. 내돌기 III은 내돌기 IV보다 전방으로 신장되어 있었다. 제 4각 퇴절은 커다란 안쪽귀가 발달되어 있었으며 안쪽 및 바깥쪽 강모는 같은 길이로 짧게 잘 발달되어 있었다. 부절 발톱은 강하고 복부쪽으로 굽어 있었다.

**검색어** – 먼지응애과, 벼먼지응애, 분류, 피해, 벼

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Among the over 300 tarsonemid species recorded in the world, *Polyphagotarsonemus latus* and *Phytonemus pallidus* are the most important agricultural pests causing severe damages in various crops (Lindquist, 1986). Since the first record of tarsonemid mite, *Polyphagotarsonemus latus*, from fruit trees (Lee, 1965), a total of 16 tarsonemid species has been recorded in Korea (Cho *et al.*, 1993, 1994, 1995; Goo and Cho, 1989). *Tarsonemus* species recorded in Korea are mostly from decaying ornamental and garden trees which are generally thought to be primarily fungivores (Cho *et al.*, 1995, 1996). A few *Tarsonemus* species, such as *T. waitei* Banks, *T. bakeri* Ewing, and *T. smithi* Ewing, are known to be facultative or transitional phytophagous on hosts of agricultural importance (Lindquist, 1978). *Polyphagotarsonemus latus* and *Phytonemus pallidus* are reported as devastating pests especially in horticultural crops including pepper, cucumber, azalea, cyclamen, and gerbera (Cho *et al.*, 1993, 1996; Lee *et al.*, 1992).

Although the rice tarsonemid mite, *Steneotarsonemus spinki* was firstly recorded in Baton Rouge, La., U.S.A., based on the specimens collected on a planthopper, *Sogata orizicola* Muir, in 1960 (Smiley, 1967), it has been recognized as an important rice pest in several Asian countries cultivating rice as a staple food crop, such as Thailand, Philippine, China, and Taiwan (Lindquist, 1986). Larvae and adults of *S. spinki* feed plant tissue and the feeding causes lesion and browning of grains and leaf sheath, but they cannot invade into tissue and grain (Lo and Ho, 1979b). In Guangdong province, China, the damage begins during spike-forming stage of rice in September (Jiang *et al.*, 1994). The damage was correlated with "empty head" sterility and the mites were observed to carry and spread a fungus, *Acrocyllidium oryzae* Sawada, and a mycoplasma-like organism, *Spiroplasma citri* Saglio *et al.*, which causes rice sterility (Chow *et al.*, 1980; Lo and Ho, 1979b).

*S. spinki* was effectively controlled by chlorfensulphide + etofolan, DDVP, and thiophanate (Jiang *et al.*, 1994). Difference in resistance to *S. spinki* was observed among 335 rice varieties and heterozygotic combinations in Guangdong, China (Zhang *et al.*, 1995).

Most *Steneotarsonemus* species have limited host ranges in monocots and *S. spinki* feeds on rice only (Smiley, 1993; Ho and Lo, 1979). Sex ratio is usually female : male = 3 : 1~8 : 1 (Lo and Ho, 1979a; Chow *et al.*, 1980). A female lays about 60 eggs for 10 days and one life cycle is completed within 3~9 days under 30°C and

15~20 days under 20°C (Ho and Lo, 1979).

In Korea, there had been no report on the occurrence of the mite in rice. Recently, rice grown in environment controlled greenhouse at Suwon showed unusual symptoms of deformed panicles and inflorescence, lesions on the inner surface of leaf sheath, and browning of rice hulls. These symptoms were associated with a tarsonemid mite and the description of the mite and its damage symptoms are reported herein.

## Materials and Methods

Rices showing deformed panicles and surface lesion were cut from greenhouse at the National Crop Experiment Station, Suwon, Korea. Mites were picked under stereomicroscope and fixed in 80% alcohol. Permanent slides were prepared using Hoyer's mounting solution (50 g distilled water, 30 g gum arabic, 200 g chloral hydrate, and 20 g glycerin) and morphometric characteristics were examined under differential interference contrast microscope (Nikon Optiphot-2). Drawings were done using drawing tube.

The mites were dehydrated and processed by critical point dryer for scanning electron microscopic observation. Morphological characters were observed and photographed using Hitachi S-2460N scanning electron microscope.

## Results

### Description

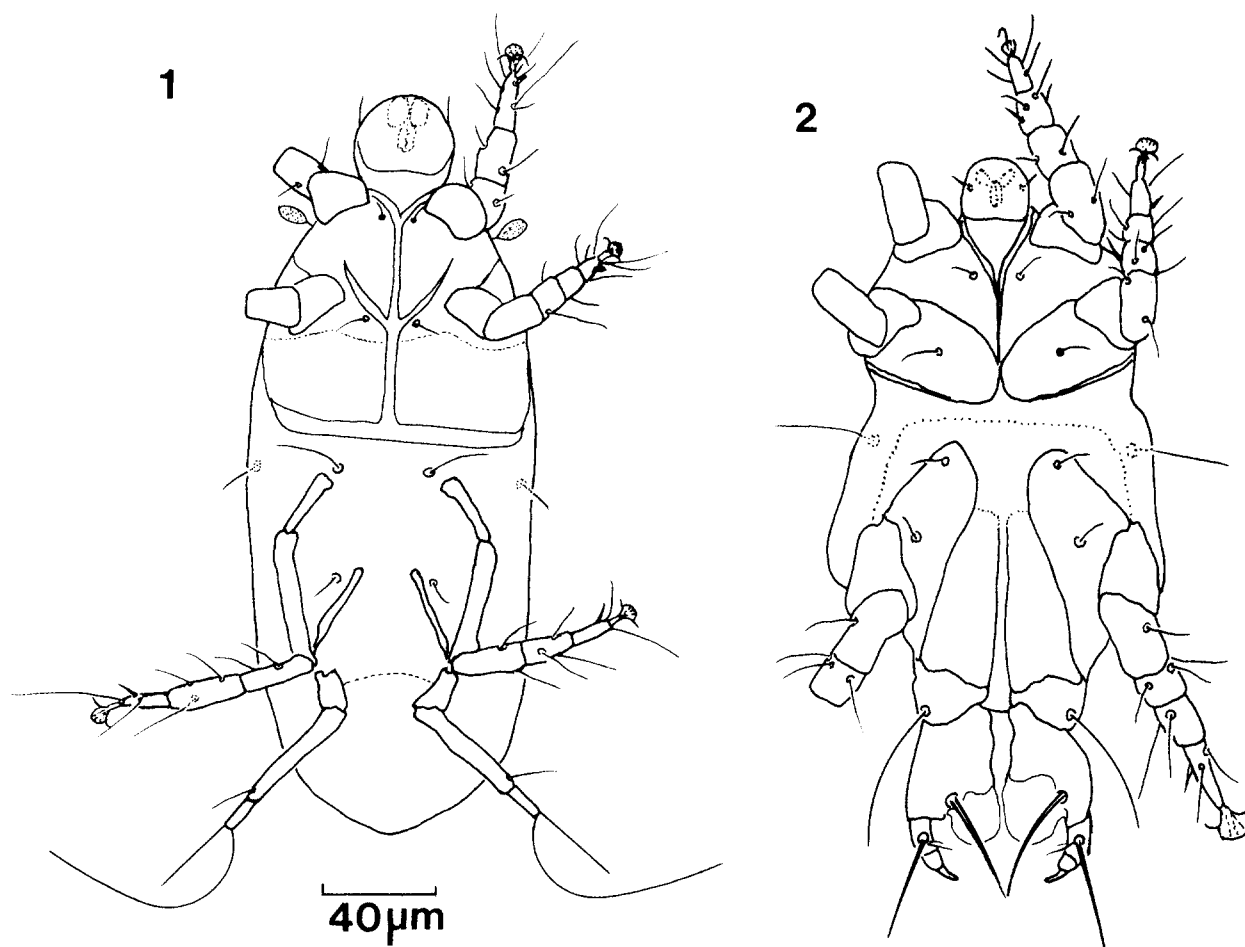
#### *Steneotarsonemus spinki* Smiley 1967

벼먼지응애 (新稱) (Figs. 1-10)

**Materials examined:** 7♀♀, 7♂♂, *Oryza sativa* L. Feb. 24, 1998, Suwon, Korea

**Female:** Body elongate and pale yellow in color. Propodosomal shield trapezoid, with two pairs of setae and pseudostigmatic organs ovoid, bearing small spur-like projections on the surface. Legs I, II, and III robust. Third segment of leg IV rod-like. Fourth segment of leg IV terminates in a pair of short subapical seta and whip-like long apical seta. Other characters similar to the original description (Smiley, 1967).

Measurements (µm): Body length 263.0 (246.5~284.6 ± 12.2), body width 92.4 (79.5~104.9 ± 7.6), leg I except coxa 59.1 (55.7~63.6 ± 2.5), leg II except coxa 57.9



Figs. 1-2 : *Steneotarsonemus spinki*. 1. Ventral view of female. 2. Ventral view of male.

(55.7~60.4±2.0), leg III except coxa 69.5 (63.6~76.3±5.3), leg IV 3rd segment 34.8 (31.8~38.2±2.3), leg IV 4th segment 12.3 (11.1~12.7±0.8), subapical seta of 4th segment 28.4 (27.0~30.2±1.4), apical seta 92.0 (85.9~95.4±3.9).

**Male:** Body elongate and pale yellow in color. Body broadest in anterior region of hysterosoma. Dorsal setae short and stout, slightly dagger-shaped. Apodemes III and IV well developed. Anterior extremities of apodeme IV not extended to the level of apodeme III. Leg IV : Femur with large inner median lateral flange. Inner anterior and outer median setae short and of equal length, posterior inner seta about as long as segment, strong, dagger-shaped. Tibiotarsus short with two tiny inner setae and stout ventrally curved claw. Other characters similar to the original description (Smiley, 1967).

Measurements (µm) : Body length 196.5 (176.5~222.8

±15.8), body width 109.3 (98.6~117.7±6.4), leg I except coxa 73.6 (63.6~82.7±6.5), leg II except coxa 76.1 (63.6~84.3±7.7), leg III except coxa 95.4 (79.5~119.3±13.5), leg IV; coxa width 25.0 (23.9~25.4±0.8), coxa length 21.8 (19.1~23.9±1.5), width at base of femur 20.9 (19.1~22.3±1.4), femur length 31.6 (28.6~36.6±2.8), femur to claw end 24.5 (20.7~28.6±3.0), inner femoral seta 42.5 (36.6~50.9±5.4), tactile seta 38.2 (33.4~42.9±3.4).

**Distribution:** U.S.A., China, Philippines, Taiwan, Thailand, Korea (new record).

#### Damage of *Steneotarsonemus spinki* on rice

Damage symptoms of rice tarsonemid mite are shown in Figs. 11-14. Panicles were deformed and surface of grains turned to brown to dark black. Inner surface of leaf sheath showed browning and decaying symptom

similar to sheath blight disease. Rice hull also showed surface browning symptom. Lots of adults and larvae were observed inside the damaged sheath and surface of rice hulls. In greenhouse condition, several rice varieties including "Dasan", "Ilpum", "Hwasung", "Suwon 441", "Iksan" were damaged by the mite. There was slight difference in degrees of damage among the varieties, however, data were not collected in that aspect.

## Discussion

*Steneotarsonemus spinki* is an important rice pest in several Asian countries (Chow *et al.*, 1980; Lo and Ho, 1979a, b; Zhang *et al.*, 1995). The occurrence of the mite in Korea is the first time in this report. Although the damage was found only in environment controlled greenhouse condition and the mite is mainly distributed in subtropical Asian countries, closer observations are needed on the occurrence of the mite damage in open field rice cultivation. Considering the distribution of the rice tarsonemid mite and occurrence of its damage in subtropical areas, it is assumed that the mite could be introduced from The Philippine by attaching to the rice grains which were reproduced for rice breeding research. To prevent the occurrence of the mite in open field condition, it is necessary to disinfect the seed rice before it is used for rice production. And quarantine inspection should be intensified on the rices imported from other countries especially the South-East Asian countries.

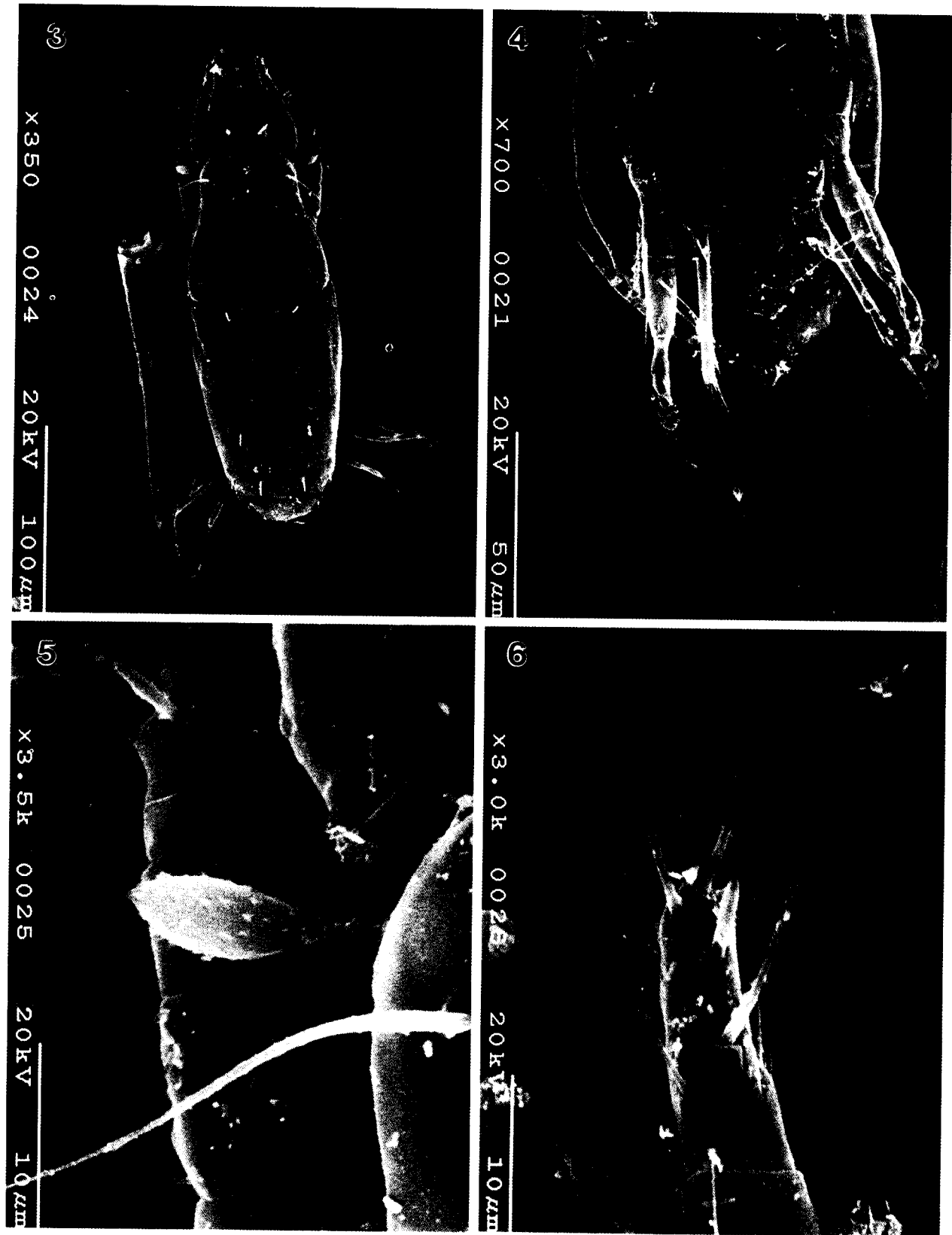
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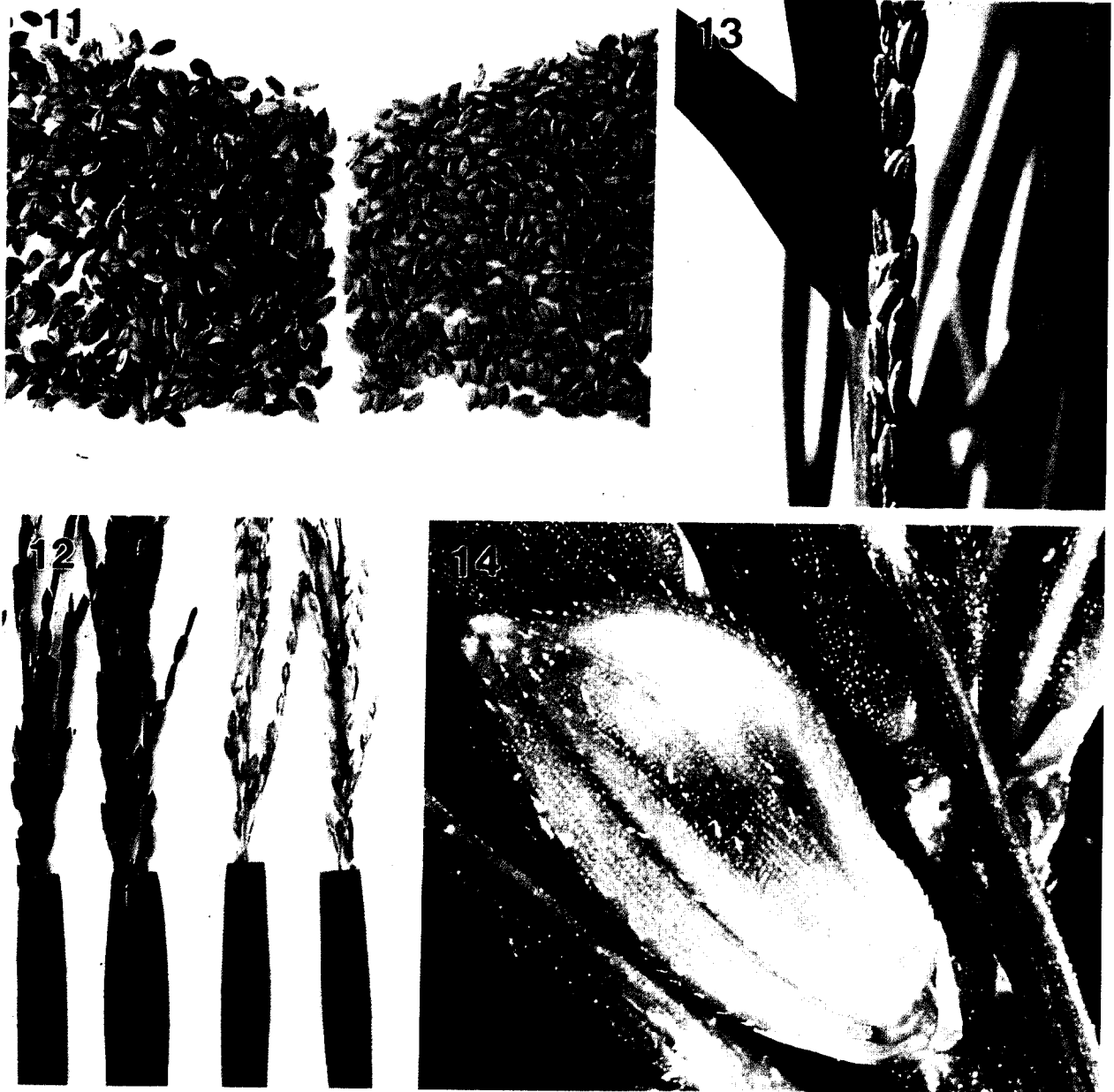
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Figs. 3-6. Scanning electron micrographs of *Steneotarsonemus spinki* female. 3. Dorsal view. 4. Ventral view of leg IV. 5. Pseudostigmatic organ. 6. Tarsus of leg I.



Figs. 7-10. Scanning electron micrographs of *Steneotarsonemus pinki*. 7. Ventral view of male apodemes. 8. Ventral view of male leg IV. 9. Dorsal view of larvae. 10. Egg.



Figs. 11-14. Damage symptoms of rice by *Stenotarsonemus spinki*. 11-12. Damaged grains and sheath (left), healthy (right). 13-14. Damaged grains.