ORIGIN OF SEED GALLS IN EAR COCKLE DISEASE OF WHEAT

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MARCINOWSKI[1] who was the first to study the origin of galls as a result of nematode (*Anguina tritici*) invasion concluded that they may arise from (i) undifferentiated flower buds, (ii) staminate tissues, (iii) carpellate tissues and (iv) tissues lying between stamens and carpel. Subsequent studies have given conflicting accounts of gall formation. Gupta and Swarup[2] reported that in infected spikes the floral initials form the galls but later, Swarup and Gupta[3] concluded that nematodes enter the ovary which forms the gall. Midha and Swarup[4] concluded that 90% of the galls were formed from staminate tissues, 1% from carpellate tissue and 9% from undifferentiated buds. An attempt has, therefore, been made to study the problem of gall formation in wheat afresh, and the results are briefly reported here.

The origin of galls was studied in field with natural infection and also in pot experiments using artificial inoculation. Spikes were collected at different stages and examined under the stereobinocular microscope to identify the structures forming galls. Histopathology of young spikes and also of galls was carried out.

It is observed that maximum gall formation takes place in the middle region in a spike and minimum in the upper region. In a spikelet, the basal florets, numbers 1 and 2, were affected in larger numbers as compared to other florets and the terminal floret number 5 was the least affected[5]. The origin of seed galls was traced to anther, ovary and anther-ovary together. There was no evidence, however, of gall formation from undifferentiated floral primordium and the tissues between the various floral parts. Florets having green galls revealed the occurrence of other persistent structures i.e. stamen, carpel, lodicules etc. Partially converted stamen and ovary into galls were often observed (figures 2, 3). Rarely, the formation of galls from lodicules was recorded. Histopathology of green galls[5], particularly anther galls, showed the occurrence of sporogenous tissue (figure 4). Occasionally, florets were observed having more than one gall and in one floret as many as six galls were obtained within intact lemma and palea.

This study has shown that galls may arise from any part of the floret except lemma and palea but it was anther and ovary which mostly developed into galls. Depending on the reproductive structures forming the galls, these are classified into seven types, namely, (i) single anther gall (figures 2, 3), (ii) double anther gall, (iii) triple anther gall, (iv) ovary gall (figure 1), (v) single anther-ovary gall, (vi) double anther-ovary gall, and (vii) triple anther-ovary gall. The development of more than one type of galls may take place in the same floret. A study of 1257 galls, examined in 30 diseased spikes in pot and field experiments, revealed that the triple anther-ovary galls were the most common, their incidence being as high as 74.6% and the single anther galls were the second dominating category with the incidence of 11.1%. The other categories were represented in low percentages e.g. double anther galls, 0.88%; triple anther galls, 1.35%; ovary galls, 1.19%; single anther-ovary galls, 3.35% and double anther-ovary galls 7.40%.

The distinction between galls of different origins was seen only in the initial stages. Subsequently they all acquired similar structure and at maturity no distinction whatsoever was observed in them. This study has clearly shown that nematode infection takes place in anther and ovary after their differentiation and not in the floret primordium or primordia of various organs.

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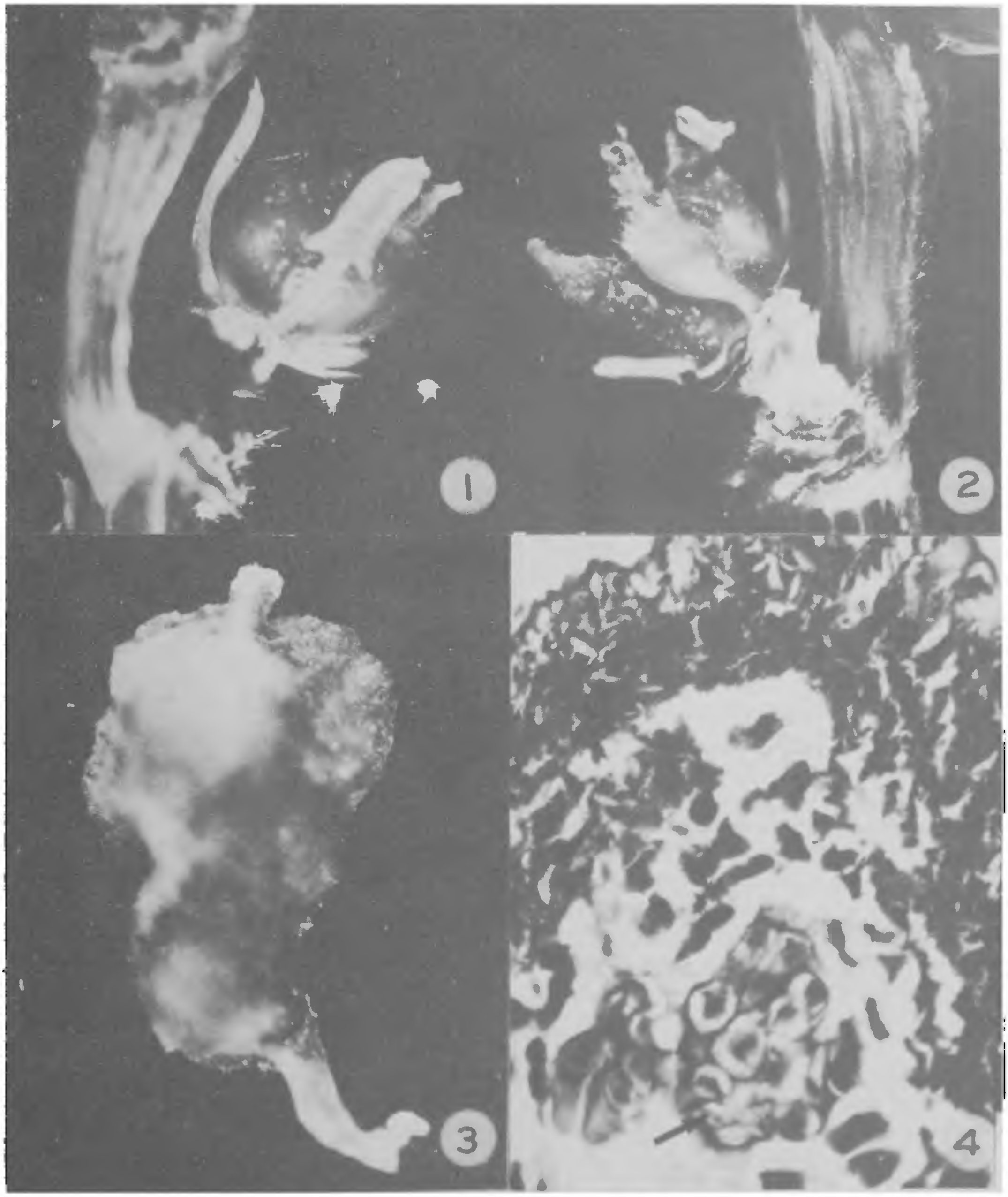

Figures 1–4. 1, 2. Florets showing gall development **(glumes**, lemma and palea removed). **1.** Showing ovary gall. Note the presence of three stamens (×24). **2. Showing** a single anther gall (left) and half ovary forming gall (right), other half is normal. Also note two stamens (×18). **3.** Single anther gall. Note the filament and narrow apical part (×45). **4.** T. S. part of young **green** gall showing wall layers, nematode larvae and degenerating sporogenous tissue (→). (×450).